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TAX AVERSION, OPTIMAL TAX RATES, AND INDEXATION

Roger N. Waud

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ABSTRACT

Taking account of the costs of tax evasion and avoidance activity together with the government's costs of tax enforcement it is shown that the optimal point on a stylized Laffer curve is located on the positively sloped region, not at the maximum point of the curve. The analysis eschews the usual supply-side-type rationale for the Laffer curve and shows that such a curve can arise solely as a consequence of the optimizing tax aversion activity of a utility maximizing economic agent. The analysis further implies that indexation to inflation may be warranted by considerations of economic efficiency.

Roger N. Waud
Department of Economics
Gardner Hall
CB#3305
University of
North Carolina,
Chapel Hill
Chapel Hill, NC 27514

Tax evasion, the illegal underreporting of income, is now recognized to be significant and growing in a number of industrialized economies.[1] It encompasses understatement and deception about income producing activities that are reported on tax returns, as well as the non-reporting of income producing activities in the so-called "underground economy." Tax avoidance, the legal use of tax loopholes, has long been a common practice afforded by a myriad of tax laws. Both tax avoidance and tax evasion activity, which we lump together under the term tax aversion, occasion real resource costs. An accounting of the costs to society of running a tax system should include the cost of tax aversion activity as well as the government's cost of tax enforcement. Recognizing both kinds of costs, one of the main purposes of this paper is to present an analysis that indicates that the optimal point on a stylized Laffer curve occurs on the positively sloped region--not at the maximum point of the curve. While concern regarding the possibility of being on the negatively sloped region of a Laffer curve is not misplaced, our analysis suggests that such concern should properly extend to the positively sloped region above the optimal point as well. Given this result, our analysis suggests that indexation to inflation of a marginally progressive income tax structure may be warranted by considerations of economic efficiency.

Our analysis eschews the usual supply-side-type rationale for the Laffer curve which is variously based on the incentive effects of tax rates on total output and tax revenue, typically by way of the labor-leisure and/or saving and investment-capital accumulation decisions.[2] Rather we show that a Laffer curve can arise solely as a consequence of the optimizing tax aversion behavior of a utility maximizing economic agent. That is, changing tax rates yield a Laffer curve even when the economic agent's total income from all activities is assumed constant, or in other words, even when the usual tax effects on the labor-leisure decision are ignored. At the appropriate point we will indicate why recognition of the usual effects does not modify our conclusions in any substantive way.

In section I we show how the relationship between the statutory tax rate and optimizing tax aversion behavior gives rise to an expected tax rate. Section II examines the determination of the optimal level of tax enforcement and the optimal tax rate, and considers the nature of the deadweight losses that can arise when the statutory tax rate is set too high. Section III shows how a marginally progressive income tax structure and inflation can generate such losses. Section IV concludes with a comparison of the relative merits of two alternative strategies for avoiding these losses: periodic discretionary tax cuts, and income tax indexation. Section V summarizes and concludes the paper.

I. Tax Aversion Behavior and the Expected Tax Rate

The ensuing analysis focuses on the utility maximizing representative economic agent who engages in tax aversion, which encompasses both tax avoidance and evasion behavior Tax aversion has associated costs such as, for instance, the use of the agent's own time to investigate and carry out aversion activities, and/or the hiring of expert advice and assistance provided by accountants and tax attorneys. The extent to which the optimizing economic agent finds it worthwhile to engage in tax aversion is assumed to depend on the relationship between the statutory tax rate, the costs of tax aversion, the probability that tax evasion will be detected (not avoidance, which is legal), and the fine if detected.[3]

I.a The Effect of Tax Rates on Tax Aversion

The literature on the theoretical analysis of tax evasion within an expected utility framework is fairly extensive; that on tax avoidance is less so.[4] A case can be made that the two activities should be analyzed jointly. Cross and Shaw (1982) have argued that a joint analysis is called for because of the possibilities of substitutability and complementarity. For instance, any reduction in the probability of detection of tax evasion or in the penalty for evasion will raise the rate of return on evasion relative to that on avoidance activity. Similarly, any increase in the availability of avoidance loopholes will likely increase avoidance relative to evasion activity. Furthermore, Cross and Shaw point out that because certain evasion (avoidance) activities can affect the marginal cost of avoidance (evasion) activities, the costs of engaging in evasion and avoidance should be modeled as interdependent. For instance, an accountant or attorney paid to advise on tax avoidance might provide information on tax evasion possibilities, unwittingly or otherwise.

In Cross and Shaw's analysis of tax aversion expected utility depends on both tax avoidance and tax evasion activities with their interdependent costs to the taxpayer represented by a joint cost function. Assume that income Y is the agent's total income from all activities, earned in both the underground and above ground economy, in both legal and illegal activities. Given a proportional income tax rate τ, assuming declining absolute risk aversion, and that total income Y is exogenous, expected utility is

$$(1)\quad E(U) = (1-p)U(V) + pU(X)$$

where the net income of the taxpayer if evasion is not detected is

$$(2)\quad V = Y(1-\tau) + (e_1Y + e_2Y)\tau - C(e_1Y,\ e_2Y)$$

while if evasion is detected it is

$$(3)\quad X = Y(1-\tau) + \tau e_1Y + \tau e_2Y(1-F) - C(e_1Y,\ e_2Y)$$

where $0 < p, \tau, e_1, e_2 < 1$; $F > 1$; $C_1, C_2, C_{11}, C_{22} > 0$ and $C_{12} < 0$; where p is the probability of detection, e_1 and e_2 are the portions of income avoiding and evading tax respectively,[5] F is the fine imposed if evasion is detected, and the joint cost function $C(\cdot,\cdot)$ specifies complementarity between avoidance and evasion activity--$C_{12} < 0$.[6] Within this framework it can be shown (see Cross and Shaw (1982) for details) that

(4) $$\frac{\partial \theta_1}{\partial \tau}, \quad \frac{\partial \theta_2}{\partial \tau} \gtrless 0$$

(5) $$\frac{\partial \theta_1}{\partial F}, \quad \frac{\partial \theta_2}{\partial F} < 0$$

(6) $$\frac{\partial \theta_1}{\partial p}, \quad \frac{\partial \theta_2}{\partial p} < 0$$

Interestingly enough, the effects of a tax rate change on tax avoidance and tax evasion activity cannot be signed unambiguously. However it can be shown (see Cross and Shaw, p. 41) that if $\frac{\partial \theta_2}{\partial \tau} > 0$ then $\frac{\partial \theta_1}{\partial \tau} > 0$ because in that case an increase (decrease) in the tax rate τ increases (reduces) tax evasion activity which in turn lowers (raises) the marginal cost of tax avoidance and causes an increase (reduction) in avoidance activity. This result is of interest in view of some recent empirical findings by Clotfelter (1983) and Slemrod (1985).[7] Using over 47,000 individual U.S. tax returns for 1969 Clotfelter estimates the elasticity of tax evasion with respect to marginal tax rates to be significantly positive. Using over 23,000 U.S. tax returns for 1977 Slemrod has difficulty separating income from tax rate effects and concludes (p. 238) "simply that the tendency for tax evasion increases for higher income, higher tax rate households." Hence in the analysis to follow it will be assumed that $\frac{\partial \theta_2}{\partial \tau} > 0$, and given that $\frac{\partial \theta_2}{\partial \tau} > 0$ implies $\frac{\partial \theta_1}{\partial \tau} > 0$ in the theoretical framework described above, it will also be assumed that $\frac{\partial \theta_1}{\partial \tau} > 0$ in the ensuing analysis.

I.b The Tax Rate-Expected Tax Rate Relationship

The fraction of income that escapes taxation due to tax aversion activity equals $\theta_1 + \theta_2$. Hence $\phi \equiv 1 - \theta_1 - \theta_2$ is the fraction of income not subject to tax aversion. The expected tax revenue from the representative economic agent is given by

$$\tau Y(1-p)\phi + \tau Y p[\phi + \theta_2 F] = \tau \theta Y$$

where $\theta \equiv [(1 - \theta_1 - \theta_2) + p\theta_2 F]$ is obviously a function of τ, F, and p, noting that θ_1 and θ_2 are functions of τ, F, and p as described above. Hence the tax aversion behavior of the representative economic agent is defined by a tax aversion function $\theta(\tau, F, p)$, such that $\theta_\tau < 0$, θ_F, $\theta_p > 0$, given that $\frac{\partial \theta_1}{\partial F}$, $\frac{\partial \theta_2}{\partial F}$, $\frac{\partial \theta_1}{\partial p}$, $\frac{\partial \theta_2}{\partial p} < 0$, and assuming that $\frac{\partial \theta_1}{\partial \tau}$, $\frac{\partial \theta_2}{\partial \tau} > 0$, and that $(pF - 1) < 0$; $\theta(\tau, F, p)$ is a decreasing function of τ such that $0 \leq \theta(\tau, F, p) \leq 1$.[8]

The product of the statutory tax rate τ and the tax aversion function defines the <u>expected tax rate</u>

(7) $T \equiv \tau\theta(\tau, F, p)$.

It is the fraction of income[9] the government expects to collect in tax revenue from the economic agent engaged in the optimal amount of tax aversion for given levels of the statutory tax rate τ, the fine F imposed if tax evasion is detected, and the probability p of detection. In general, for any tax aversion function $\theta(\tau, F, p)$ there is some level of the statutory tax rate τ which yields a maximum expected tax rate, given the values of F and p. At that value of τ

$$(8) \quad \frac{\partial T}{\partial \tau} = (\theta(\tau, F, p) + \tau\theta_\tau) = 0$$

while at any lower value $(\theta(\tau, F, p) + \tau\theta_\tau) > 0$, and at any higher value $(\theta(\tau, F, p) + \tau\theta_\tau) < 0$.[10] For example, for given levels of F and p the relationship between τ and $\tau\theta(\tau, F, p)$ is represented by a curve such as Om1 in Figure 1. The maximum expected tax rate $\tau_m\theta(\tau_m, F, p)$ occurs at the statutory tax rate τ_m where (8) holds. The tax rate-expected tax rate relationship Om1 may be termed the Laffer curve for the economic agent, given F and p.

II. The Optimal Level of Tax Enforcement and the Optimal Tax Rate

The shape and position of the Laffer curve in Figure 1 and hence the specific value of τ which gives the maximum expected tax rate is a function of the government's tax enforcement variables--the fine F and the probability of detection p of tax evasion. An increase in F and/or p shifts the curve upward, such as from Om1 to On1 since from (7)

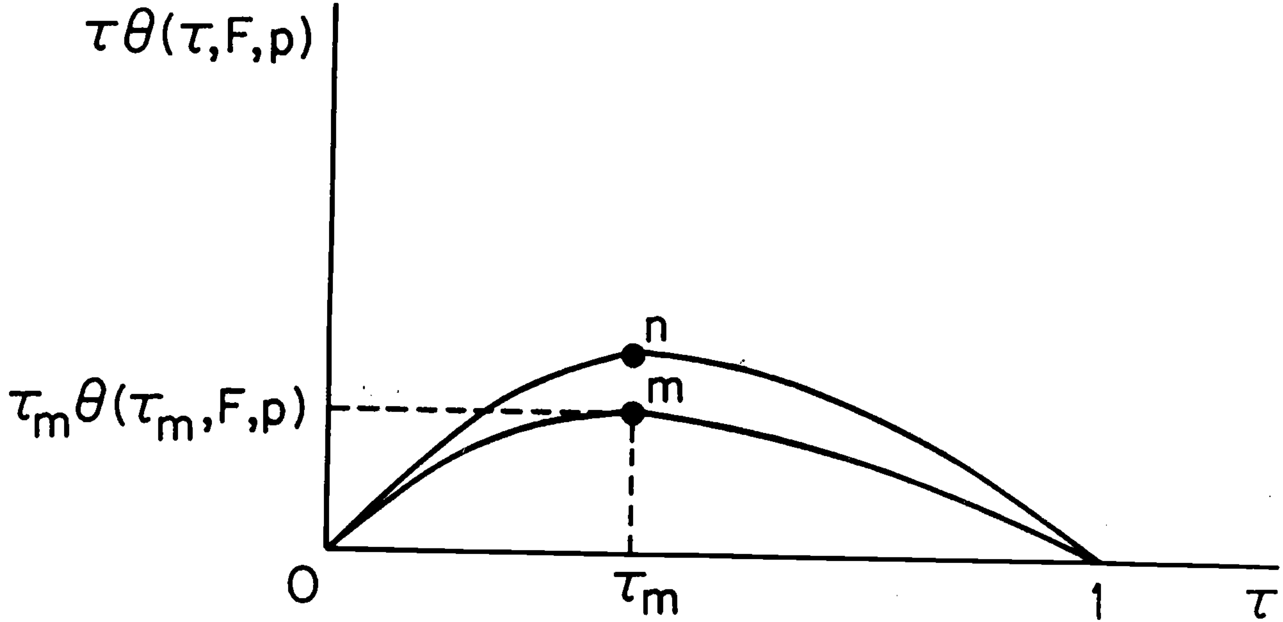

Figure 1

(9) $\frac{\partial T}{\partial F} = \tau e_F > 0$

and

(10) $\frac{\partial T}{\partial p} = \tau e_p > 0.$

The optimal setting of the tax enforcement variables F and p as well as the optimal setting of the statutory tax rate τ depends on the government's desired expected tax rate, since it is the expected tax rate that determines the amount of tax revenue the government expects to collect from the representative economic agent.

II.a Optimal τ, F, and p Given the Desired Expected Tax Rate

Here we make the following assumption: the government first decides on the level of its total spending on all activities, aside from tax enforcement expenditure, and then determines the level of the expected tax rate desired to finance such spending.[11] The process and objectives which determine the government's total spending are, like the level of its desired expected tax rate, simply taken as given for the purposes of this analysis.

Given the objective of establishing the desired expected tax rate, what is the optimal level of government spending on tax enforcement activity, per the representative economic agent, and the optimal setting of the statutory tax rate? From society's perspective, it is that setting of F, p, and τ which minimizes the total of the government's tax enforcement cost per representative economic agent <u>plus</u> the cost of tax aversion activity incurred by the representative economic agent (the $C(\cdot,\cdot)$ function in equations (2) and (3)), since the latter cost, like the former, uses up resources otherwise available to society. The government's enforcement cost per representative economic agent may be represented by the function $g(F, p)$ where g_F, g_p, g_{FF}, g_{pp} > 0, reflecting the assumptions that such costs rises at an increasing rate with F, the fine imposed on tax evaders, and p, the probability that an evader will be detected. Larger fines are likely to involve the government in more litigation and lengthier court contestations, while raising the probability of detection requires the employment of more tax agents and an increase in the frequency and/or intensity of tax audits. The representative economic agent's tax aversion cost function $C(\cdot,\cdot)$ can be written, using the results (4), (5), and (6), as

$$C(\tau, F, p) = C[\theta_1,(\tau, F, p), \theta_2(\tau, F, p)]$$

where

$$C_\tau = C_1\theta_{1\tau} + C_2\theta_{2\tau} > 0$$

$$C_F = C_1\theta_{1F} + C_2\theta_{2F} < 0$$

$$C_p = C_1\theta_{1p} + C_2\theta_{2p} < 0.$$

The setting of τ, F, and p which minimizes the sum of tax enforcement plus tax aversion costs per representative economic agent, subject to achieving a desired expected tax rate, is obtained from the Lagrange function

$$(11)\quad L = g(F, p) + C(\tau, F, p) + \lambda[K-\tau\theta(\tau, F, p)]$$

where λ is the Lagrange multiplier, K is the given desired level of the expected tax rate, and all other variables are as defined before.[12] Differentiating (11) with respect to τ, F, and p, the first order conditions are

$$(12)\quad L_F = g_F + C_F - \lambda\tau\theta_F = 0$$

$$(13)\quad L_p = g_p + C_p - \lambda\tau\theta_p = 0$$

$$(14)\quad L_\tau = C_\tau - \lambda\ [\theta(\tau, F, p) + \tau\theta_\tau] = 0$$

$$(15)\quad L_\lambda = K - \tau\theta(\tau, F, p) = 0$$

From (12), (13), and (14) we have that

$$(16)\quad [\theta(\tau, F, p) + \tau\theta_\tau] = \frac{C_\tau\tau\theta_F}{g_F+C_F} = \frac{C_\tau\tau\theta_p}{g_p+C_p} \gtrless 0$$

given that g_F, g_p, θ_F, θ_p, $C_\tau > 0$ and C_F, $C_p < 0$.

The interpretation of (16) is facilitated by Figure 2 where the horizontal line at K represents the desired level of the expected tax rate. It intersects the economic agent's Laffer curve at points a and b. The slope of the Laffer curve, given by the left side of (16) (see (8)), is positive at point a and corresponds to a cost (tax enforcement plus tax aversion cost) minimizing position when $|g_F| > |C_F|$ and $|g_p| > |C_p|$ in (16). At point b the slope of the Laffer curve is negative and corresponds to a situation where $|g_F| < |C_F|$ and $|g_p| < |C_p|$. Point b cannot be a minimum cost position however. For consider what happens to costs ($g(F,p) + C(\tau, F, p)$ in (11)) given F and p, which determine the position of the Laffer curve, if at point b the statutory tax rate τ is reduced below τ_b. The only cost affected is the cost of tax aversion $C(\tau, F, p)$ because τ doesn't appear in $g(F, p)$. Since $C_\tau > 0$ the cost of tax aversion is reduced when τ is lowered, and the same expected tax rate K can be realized at a lower statutory tax rate τ_a, corresponding to point a on the positively sloped portion of the Laffer curve.

It should be emphasized that a narrower cost accounting--say from the tax collector's perspective--would ignore the cost of tax aversion activity to the economic agent represented by the $C(\tau, F, p)$ function. Given this narrower perspective, $C(\tau, F, p)$ is dropped from (11), and it must be true from (14) that the optimal setting of τ occurs where the slope of the Laffer curve, given by $[\theta(\tau, F, p) + \tau\theta_\tau]$, equals zero. In that case the optimal τ corresponds to the highest point on the Laffer curve, and at this point the curve

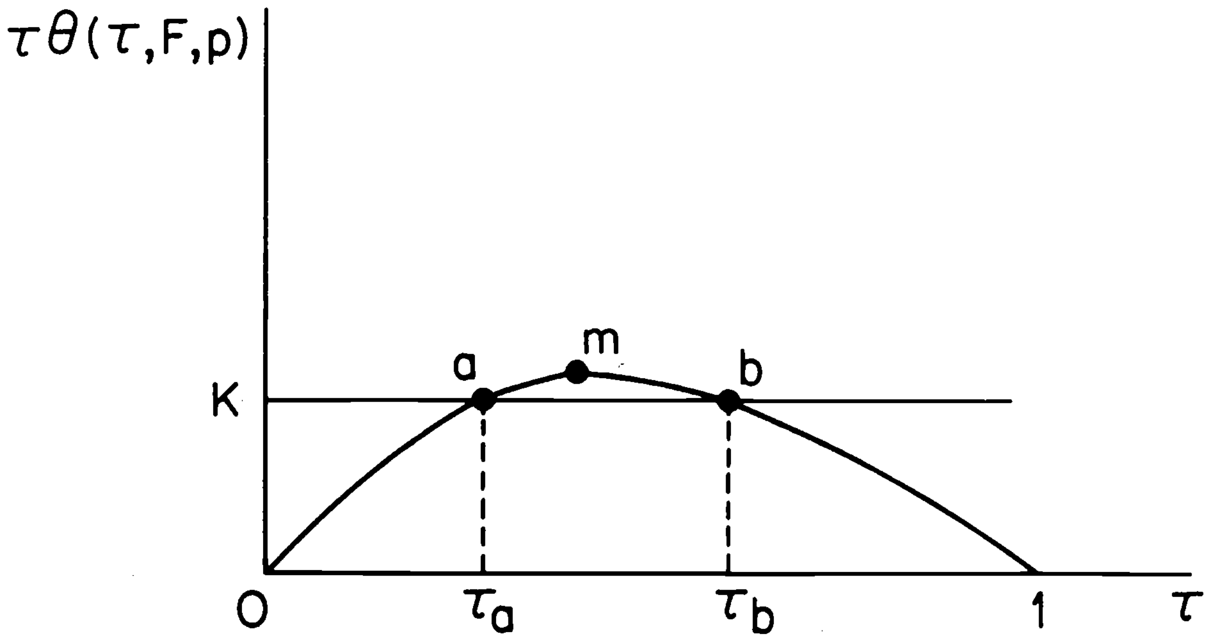

Figure 2

would be tangent to the K line representing the desired expected tax rate, the position of the curve of course determined by the optimal setting of F and p. By contrast, for a complete cost accounting from society's perspective it is necessary to take account of both the government's cost of enforcing the tax code on the representative economic agent, and the cost of the agent's tax aversion activity; then the optimal setting of the statutory tax rate will correspond to a point on the positively-sloped region of the representative economic agent's Laffer curve.

Note that these results derive solely from tax aversion behavior since our analysis has completely ignored the tax effects on the labor-leisure decision and hence on Y, which has been assumed constant. However our conclusions are not affected in any substantive way when we allow Y to be affected by τ, F, and p.[13]

II.b The Maximum Optimal Expected Tax Rate

We have examined the optimal setting of τ, F, and p given a desired level of the expected tax rate. But what is the maximum expected tax rate that can be achieved optimally? Does the maximum expected tax rate that can be achieved optimally lie along the positively sloped region of the representative economic agent's Laffer curve, or does it occur at the maximum point?

To answer this question we need to determine the maximum expected tax rate net of tax enforcement and tax aversion costs that can be imposed on the representative economic agent. The expected tax rate minus enforcement and aversion costs is given by

(17) $M = \tau\theta(\tau, F, p) - g(F, p) - C(\tau, F, p)$

where all variables are as defined before. Differentiating (17) with respect to F, p, and τ gives

$$M_F = \tau\theta_F - g_F - C_F = 0$$

or

(18) $\tau\theta_F = g_F + C_F$

and

$$M_p = \tau\theta_p - g_p - C_p = 0$$

or

(19) $\tau\theta_p = g_p + C_p$

and

$$M_\tau = \theta(\tau, F, p) + \tau\theta_\tau - C_\tau = 0$$

or

(20) $\theta(\tau, F, p) + \tau\theta_\tau = C_\tau > 0.$

According to (18) and (19) the maximum expected tax rate that can be achieved optimally occurs when tax enforcement effort, implemented by increasing F and p, has been carried to the point where the expected marginal tax revenue, $\tau\theta_F$ and $\tau\theta_p$, equals the marginal cost of tax enforcement plus the marginal cost of tax aversion activity--$(g_F + C_F)$ for F and $(g_p + C_p)$ for p. Recalling that g_F, $g_p > 0$ and C_F, $C_p < 0$, when $|g_F| > |C_F|$ and $|g_p| > |C_p|$ the level of τ required for (18) and (19) to hold must satisfy

(20). But observe in (20) that $(\theta(\tau, F, p) + \tau\theta_\tau) > 0$, since $C_\tau > 0$, so that the setting of τ that gives the maximum expected tax rate that can be achieved optimally must lie along the positively sloped region of the Laffer curve, such as at point a in Figure 3.

As the curve indicates, it is possible to have a higher expected tax rate than that at point a simply by setting the statutory tax rate higher than τ_a. But the additional tax aversion cost (since $C_\tau > 0$) required to achieve it would be greater than the additional expected tax revenue it would generate. Note that if tax aversion costs are ignored, so that only the narrower cost accounting of the tax collector's perspective obtains, then $C(\tau, F, p)$ is dropped from (17) and the apparent "optimal" setting of τ corresponds to the maximum point m on the Laffer curve in Figure 3, since $(\theta(\tau, F, p) + \tau\theta_\tau)$ then equals zero by (20).

Finally, consider the case where $|g_F| < |C_F|$ and $|g_p| < |C_p|$. Then the marginal costs of increasing F and p, the right-hand sides of (18) and (19), are negative--government enforcement costs increase less than tax aversion costs decline. This suggests that the government step up enforcement until the probability p of detection of tax evasion equals 1, and/or increase the fine F until tax evasion activity is completely discouraged. If $C_{12} < 0$ (for the cost function $C(\cdot,\cdot)$ in (2) and (3)) is sufficiently negative tax avoidance (a legal activity, not an object of detection or fine) could also be eliminated. Then the Laffer curve would be the 45° line in Figure 3--the expected tax rate

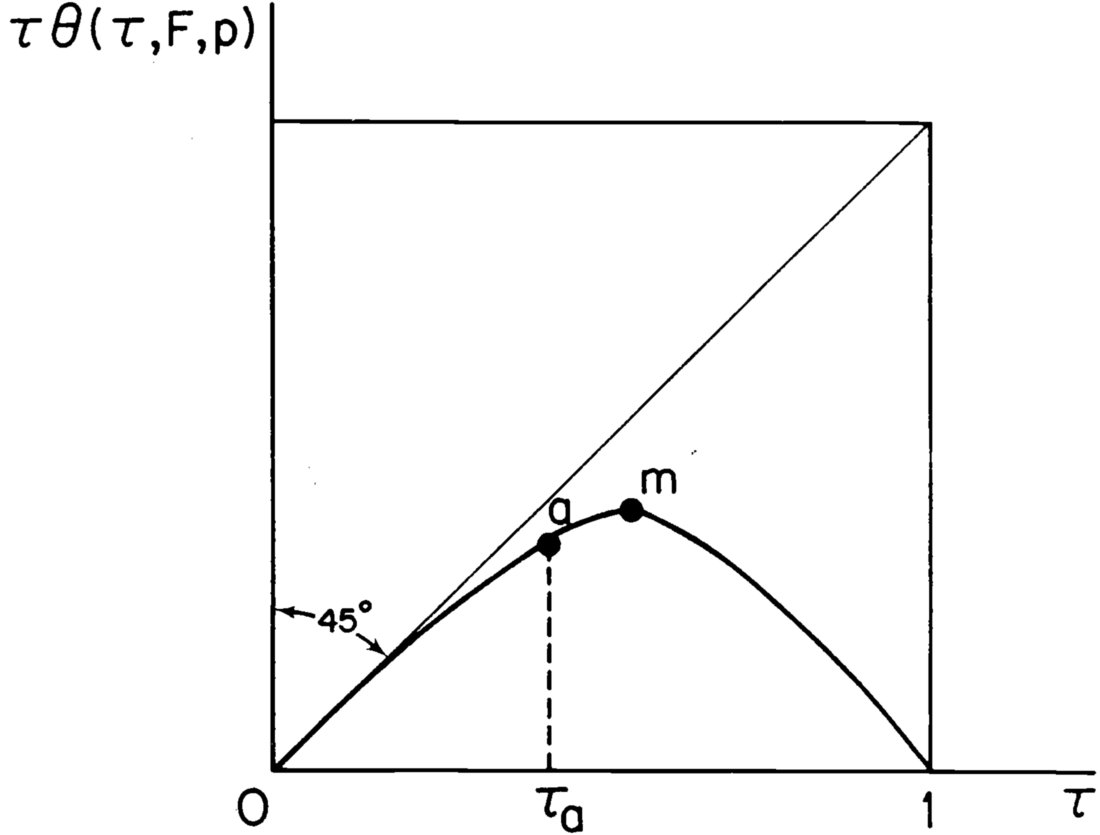

Figure 3

would equal the statutory tax for all levels of τ. On the other hand, if the jointness of costs of tax avoidance and tax evasion is weak or non-existent ($C_{12} = 0$) then the Laffer curve would lie somewhere between the 45° line and the curve passing through point a in Figure 3.

Generally, it is not a government's objective to establish the maximum optimal expected tax rate. Rather government expenditure levels determined by other objectives will dictate the need for a given desired level of the expected tax rate and the optimal setting of τ, F, and p to satisfy equations (12)-(15), as previously discussed. However, what if the government expenditure levels dictated by these other objectives are so high that the given expected tax rate required to finance them exceeds the maximum optimal expected tax rate? Then we have the ingredients for a structural deficit--a situation where government expenditures outstrip the capacity to finance them with tax revenue.

II.c Overshooting the Optimal Tax Rate: A Deadweight Loss

In the ensuing discussion we will use the term "optimal tax rate" to refer to that value of the statutory tax rate given by equations (12)-(15), the equations which give the optimal values of τ, F, and p for a given desired level of the expected tax rate.

For example, in Figure 2 suppose τ_a is the optimal value of the statutory tax rate and that F_a and p_a are the optimal settings of F and p for achieving the given desired expected tax rate K =

$\tau_a\theta(\tau_a, F_a, p_a)$; Om1 is the representative agent's Laffer curve determined by F_a and p_a, and a point a on Om1 corresponds to the optimal tax rate τ_a. Note that given F_a and p_a the desired expected tax rate K also can be achieved by setting the statutory tax rate equal to τ_b corresponding to point b on Om1, giving $\tau_b\theta(\tau_b, F_a, p_a) = \tau_a\theta(\tau_a, F_a, p_a)$. However, τ_b is not optimal because it gives rise to a deadweight loss to society due to the larger tax aversion cost occasioned by τ_b relative to that which occurs at τ_a, since $C_\tau > 0$.

There are many other possible Laffer curves in Figure 2 (not shown) corresponding to other levels of F and p, and hence many other settings of τ which would give the expected tax rate K. But none of them are optimal--they do not satisfy equations (12)-(15). None-the-less it is true that, just like the optimal curve Om1, each of these Laffer curves has two points--one on positively sloped region and one along the negative slope--corresponding to the two levels of the statutory tax rate that yield the expected tax rate K. By the same argument as for the optimal curve Om1, <u>the lower level of τ occasions less resource expenditure on tax aversion than the higher one</u>. Given the desired level of the expected tax rate, for <u>any</u> Laffer curve, whether optimal by equations (12)-(15) or not, we will refer to the lower level of τ which yields the desired expected tax rate as the <u>critical</u> tax rate. Optimal tax rates are a subset of critical tax rates. We use such terminology in order to recognize that there are many possible levels of tax enforcement that are not optimal but yet admit the possibility of attaining a given desired level of the expected tax rate; therefore there are many possible Laffer curves, each with its associated critical tax rate.

In sum, for any given F and p and desired level of the expected tax rate, whenever the statutory tax rate exceeds the critical tax rate society suffers a deadweight loss--nobody gains --because by reducing the statutory tax rate to the critical level the economic agent is induced to expend fewer resources on tax aversion activity. Moreover, whatever the expected tax rate levels attainable on the Laffer curve associated with the given F and p, such expected tax rates can always be attained with lower tax aversion costs to society by use of statutory tax rates corresponding to the positively, as opposed to negatively, sloped region of the curve.

III. The Critical Tax Rate and Inflation

Assume now that the tax structure is marginally progressive and that tax brackets are defined according to nominal income levels. Also assume that the statutory tax rate τ is a weighted average of the progressively higher tax rates associated with successively higher income brackets, each bracket's tax rate weighted by the percent of the representative economic agent's nominal income in that bracket. Given such a tax structure, as is well known, inflation will push the representative economic agent into successively higher tax brackets, effectively subjecting an evergrowing portion of the agent's income to higher tax rates.

Because of this phenomenon, popularly known as bracket-creep, an ever-increasing average income tax rate τ is imposed on the agent.[14]

Such inflation generated bracket creep increases τ along the horizontal axes in Figures 1-3. The upper limit on τ of course is the statutory tax rate prevailing in the highest income tax bracket of the marginally progressive tax structure; once reached, τ will cease rising despite continuing inflation. The crucial concern, however, is the possibility that such bracket creep can push τ past the critical tax rate and ultimately onto the negatively sloped region of the Laffer curve. This likelihood of course depends on the degree of marginal progressivity of the tax structure as well as the position of the prevailing Laffer curve.

IV. Discretionary Tax Cuts versus Income Tax Indexation

One way to keep bracket creep from driving τ onto the negatively sloped region of the agent's Laffer curve is by discretionary reduction of marginally progressive tax rates whenever bracket creep pushes τ above the critical tax rate. While such cuts could in principle maintain τ at the critical or even optimal level, given an optimal level of tax enforcement (i.e., optimal levels of F and p), in practice inflation-generated bracket creep operates continuously to push τ above either a critical or an optimal level while discretionary tax cuts are typically infrequent and subject to the pressures of politics. Hence even if τ is periodically moved back to a critical or an optimal level by discretionary tax cuts, bracket creep will assure that τ is almost continuously above such levels and that society incurs the associated deadweight loss due to resource expenditure on tax aversion activity.

As an alternative to discretionary tax cuts, suppose the tax brackets defined according to nominal income levels in the marginally progressive income tax structure are linked to real income levels. This can be achieved by indexing the bracket-defining nominal income levels to the inflation rate. In principle such <u>income tax indexing would allow establishment of the optimal level of tax enforcement in conjunction with continuous maintenance of the optimal tax rate because it would prevent bracket creep from driving</u> τ <u>beyond the optimal tax rate</u>.

In reality, policymakers don't know the optimal level of tax enforcement and hence the optimal level of τ. They don't even know the relationship between a desired expected tax rate and the critical tax rate needed to achieve it when government tax enforcement expenditures are not optimal. Nonetheless, whatever the level of tax enforcement it is still desirable to avoid positions along the negatively sloped region of the associated Laffer curve. At a practical level then, it can be argued that income tax indexing will prevent bracket creep from pushing τ past the peak of the agent's Laffer curve, or if already past it, at least prevent further increases in the deadweight loss associated with movement down the negatively-sloped region of the curve.

V. Conclusion

It has been shown that due to tax aversion behavior there is associated with any statutory tax rate a corresponding lower expected tax rate, defined as the fraction of a dollar of income that the government expects to collect in tax revenue. Because tax aversion behavior depends on the level of the statutory tax rate there is some optimal level of tax enforcement (some optimal setting of F and p) and the statutory tax rate τ for any given level of the expected tax rate desired by the government. The optimal statutory tax rate corresponds to a point on the positively sloped region of the economic agent's Laffer curve. Furthermore, there is an upper limit on the level of the expected tax rate that the government can achieve optimally, and it too corresponds to a point on the positively sloped region of a Laffer curve.

Given a desired level of the expected tax rate (assumed less than or equal to the upper limit) and the associated optimal setting of the statutory tax rate, society suffers deadweight losses if the statutory tax rate is set higher than the optimal level. Given a marginally progressive tax structure, such deadweight losses are particularly likely when there is inflation. It may be argued that such losses are best avoided by indexing the marginally progressive tax structure to inflation rather than by periodically cutting statutory tax rates.

Finally, from an efficiency standpoint, the proper question is not is the statutory tax rate above the point where the Laffer curve's slope becomes negative? Rather is the statutory tax rate above the lower rate corresponding to the optimum point on the positively sloped region of the curve?

Footnotes

1. See Simon and Witte, Witte, and the recent U.S. Internal Revenue Service report on this subject; also note the extensive citations to research in the area cited by these authors. In these studies, tax evasion refers to income taxes individuals and corporations should pay but do not, encompassing income earned from both legal and illegal activity.
2. See, for instance, Bender (1984), Fullerton (1982), Shaller (1983), Stuart (1981), and Yuncker (1986).
3. Before proceeding one might well ask about the real-world magnitude of tax evasion. The latest IRS report estimates that $90.5 billion of federal income tax was lost in the United States in 1981 due to unreported incomes, an amount approximately equal to 22 percent of total federal corporate and personal income taxes actually collected in 1981; $81.5 billion was due to unreported legal income and another $9.0 billion due to unreported income earned in illegal activities. Witte summarized findings in several countries and reports that in general the Scandinavian countries, West Germany, and the United Kingdom have unrecorded economic activity (therefore untaxable) comparable to that of the United States where such activity amounted to approximately 12 percent of national income in 1979; such activity was estimated to equal 20-25 percent of

GNP in Italy, while for Belgium and France it was estimated to be somewhere between the estimates for the U.S. and Italy.

4. Analysis focusing on tax evasion has origins in the expected utility analysis of Allingham and Sandmo (1972): see, for example, Srinvasan (1973), Yitzhaki (1974), McCaleb (1976), Weiss (1976), Andersen (1977), Pencavel (1979), Christiansen (1980), Isachsen and Strom (1980), Cowell (1981), Sandmo (1981), and Usher (1986). An expected utility analysis of tax avoidance may be found in Kane and Valentini (1975) and Kane (1976).

5. Note that the shifting between taxed and untaxed activities by the agent is in the analysis by virtue of the choice variables θ_1 and θ_2, the portions of income avoiding and evading tax respectively.

6. The amounts of income avoiding and evading tax are respectively denoted A and E by Cross and Shaw where in terms of our notation $A \equiv \theta_1 Y$ and $E \equiv \theta_2 Y$. We express avoidance and evasion in terms of the fractions θ_1 and θ_2 in order to expedite the ensuing analysis and our use of the concept of the expected tax rate.

7. Some experimental evidence that there is a positive relationship between tax rates and tax evasion has been provided by Friedland, Maital, and Rutenberg (1978).

8. Noting that

$$\theta_\tau = -\frac{\partial\theta_1}{\partial\tau} + (pF-1)\frac{\partial\theta_2}{\partial\tau}$$

it follows that a sufficient condition for $\theta_\tau < 0$ is that $pF < 1$. If the expected fine, pF, for tax avoidance is large enough, so that $pF > 1$, then there will be no tax aversion. In that case $\theta = 1$ for all τ. The condition $pF < 1$ also assures that $\theta_F > 0$.

9. Since the representative economic agent's income Y is a constant exogenous variable, Y is dropped from the ensuing discussing. Whenever the expected tax rate is mentioned it is the case that the statement could be taken to refer to the tax revenue expected to be collected from the representative economic agent since that revenue equals the agent's income Y multiplied by the expected tax rate $\tau\theta(\tau, F, p)$. We will consider the implications of allowing Y to vary below.

10. $\tau\theta(\tau, F, p)$ achieves a maximum when $\theta(\tau, F, p) + \tau\theta_\tau = 0$ only if $2\theta_\tau + \tau\theta_{\tau\tau} < 0$; a sufficient condition for this to occur is that $\theta_{\tau\tau} < 0$, given $\theta_\tau < 0$.

11. We don't mean to imply that this is a realistic assumption about the way the government actually operates. It may finance its spending in part by taxation and in part by bond financing or money creation, and it may be that its choice of how much to

spend is in part dependent on concern about the implied size of the taxation and possible deficit financing required.

12. It can be argued that the desired expected tax rate K should be a function of F and p to the extent that there is concern to finance the government's tax enforcement efforts with tax revenue. Entering the desired tax rate $K(F, p)$, K_F, $K_p > 0$ doesn't affect the analysis in any substantive way.

13. Allowing for such effects by explicitly recognizing Y in the analysis (recall that its presence has been ignored since it was assumed given) and interpreting K in (11) as the level of tax revenue T (equals $\tau\theta(\tau, F, p)Y$) the government desires to collect from the representative economic agent, optimization (analogous to (12)-(15)) yields

$$(16') \quad [\theta(\tau, F, p)Y + Y\tau\theta_\tau + \tau\theta(\tau, F, p)\frac{\partial Y}{\partial \tau} = \frac{C_\tau[\tau\theta_F + \tau\theta\frac{\partial Y}{\partial F}]}{g_F + C_F} = \frac{C_\tau[\tau\theta_p + \tau\theta\frac{\partial Y}{\partial p}]}{g_p + C_p} < 0$$

Again by the same argument as was made for (16) in conjunction with Figure 2 to establish the minimum cost position, the left side of (16'), which is the slope of the Laffer curve, is positive at point a in Figure 2 and again corresponds to the minimum cost position, no matter what is assumed about the signs of $\frac{\partial Y}{\partial \tau}$, $\frac{\partial Y}{\partial F}$, or $\frac{\partial Y}{\partial p}$. It is also readily evident from the analogue to (14), which is

$$(14') \quad L_\tau = C_\tau - \lambda[\theta(\tau, F, p) + \tau\theta_\tau + \tau\theta(\tau, F, p) \frac{\partial Y}{\partial \tau}] = 0$$

that in the case of the narrower perspective of the tax collector where $C(\tau, F, p)$ is ignored, so that C_τ doesn't appear in (14'), the optimal setting of τ still occurs where the slope of the Laffer curve (the bracketed expression in (14')) equals zero.

14. When Cross and Shaw (1982) amend the model of equations (1)-(3) to specify a marginally progressive tax structure the ambiguity in (4) remains, not surprisingly. We continue to assume that $\theta_{1\tau}$, $\theta_{2\tau} > 0$ and hence that $\theta_\tau > 0$.

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