

GAME THEORY AND THE RATIONAL TAX EVADER*

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Sticking to his built-in bias toward rationality, how can the economist explain tax evasion?

He may at first nudge think that government and "Machiavellian Man" (i.e., the taxpayer who pays or evades taxes strictly on the grounds of minimizing his costs regardless of any moral compunctions)¹ are involved in a zero-sum game. If one gains the other loses and vice versa, that is, the government takes money from the taxpayer; if he pays, he loses a certain something; if he evades, the taxpayer gains a certain something or loses an uncertain something else depending on how often he is caught.

Let us play a simple zero-sum game between the government (which we shall label "C" designating "collector" of revenues and the determinant of the "columns" in our game matrix) and the taxpayer (whom we shall label "R" to designate that he plays the "rows" in our game, the "R" also perhaps standing for "rationalizer" in determining if he should pay the tax (row₁) or should evade it (row₂).

*) I am indebted to association and discussion with Afghan tax collectors, payers and evaders during 15 months in 1959-60 spent as a tax consultant in Afghanistan and as lecturer in Public Finance at Kabul University-- I thank Otto Eckstein and Richard Bird, both at Harvard, for their comments.

1) This assumption might not be altogether ridiculous: cf. Robert Keatley, "Italian Paradox," **Wall Street Journal**, February 18, 1963, p. 16: "A Jesuit priest recently argued in a magazine article that taxpayers should deliberately understate their income because government officials don't believe honest claims anyway."

In the first game the taxable base (say income) is \$10,000. The rational taxpayer/evader has the choice of paying or evading taxes on any or all of his total tax base; the government has the choice, for example, of setting rates of 80 per cent or 20 per cent. We assume a fixed "enforcement probability" (p) of the government catching evaders at .20, i.e., one chance out of five. If caught, the tax evader must pay F : his taxes plus a fixed fine of say \$ 5,000 (half the tax base). The rational taxpayer/evader decides to evade if it will minimize his tax burden, i.e., if $pF < rBT$ with r being the rate and BT the tax base. The government sets the rate here at either 80 or 20 per cent, whichever will maximize its total revenue².

Our game of one "typical" taxpayer is an either/or proposition: either he pays or evades. We assume the game is a continuing one so that in this case the evader is caught once every five times, but that the probability of future demises remains the same (as perhaps analogous to overloaded trucks being caught for weight violations on state highways with the trucking company continuing to overload trucks as it may still be cheaper to pay fines than to keep down the weight, assuming the fines not become progressive and assuming they do not begin to hang truck drivers). "P," as seen by each taxpayer/evader, remains the same at all rates, assuming fixed enforcement effort by government.

In the following matrix, the government maximizes its tax revenues by always selecting the higher rate (80 per cent), while the taxpayer/evader minimizes his losses by always evading regardless of the rate chosen; the response to play C_1 by the government is the taxpayer/evader's R_2 . The revenue to the government is shown in the northeast corner of each box, while the costs to the taxpayer/evader are shown in the southwest corner of each box. The game "solution" is in box C_1R_2 . This game is strictly competitive with high rates met by high evasion practices and with one's gains being the other's losses.

2) In the general case involving many taxpayers, tax revenues may be maximized by either raising or lowering existing tax rates to the point where the base-rate elasticity ($\Sigma r = (dBR/dr) (r/BR)$ where BR is the base reported) equals unity. For example, where the function $p = p(r)$ is linear, say $p = 1-r$, revenue is maximized ($\Sigma r = 1$) when $\Sigma r = (BT - BR)/BR = (1-p)/p$; that is, when $r = p$. See diagram A where p (which in the general case is BR/BT) is measured along the horizontal axis. The constant of course need not necessarily be 1.

As a more generalized solution to the zero-sum Game 1, the fine (F) would not be fixed as in our illustration but would be a function of the tax liability (T) which is equal to rBT , i.e., $F = f(rBT)$. As in many cases this function is a simple linear one such as having to pay twice the tax if one is caught, therefore one might say $F = frBT$ with f being 2 in this instance. Substituting $frBT$ in our original inequality $pF < rBT$ telling the taxpayer/evader when to evade, we get $pf < 1$ which is applicable *regardless of the rate*. In a simple example when f happens to be 2 and p is .2 (i.e., the chance of getting caught being one out of five), the decision would be to evade since .4 is less than unity. The government would in this case have to set the fine (including the tax liability) at five times the tax liability in order to make the taxpayer/evader indifferent as to his behavior; or else, to obtain the same results the government would have to increase the chance of being caught to every other time if it kept the fine at the same level. In the real world (particularly the less developed part of it) the latter course of action might be far easier than the former.

This Game 1 (the "competitive zero-sum game") may represent how some governments and taxpayers view taxation: as a struggle over funds with one side losing, the other winning. In certain countries rates are set high (say on certain imports or high marginal income brackets)

nor the function linear for all values in order for the following example to be of use.

This, of course, is based on the proposition that the probability (p) of collecting tax is, *ceteris paribus*, inversely related to the tax rate; or, in alternate form, assuming a constant tax base (BT), the base reported (BR) is inversely related to the tax rate (r) applied to the tax base (BT).

Note : Sigma notations denote elasticities.

with the response of much evasion and substantial miscarriage of horizontal equity. The "solution" in this type of game is not altogether satisfactory: high rates and much evasion result in discredited tax systems, disincentives, weak patterns of taxpayer voluntary compliance to taxes in general, horizontal inequities, and the diversion of scarce resources by the government to enforce its high rates and by the taxpayer to evade them.

GAME 1

"The Competitive Zero-sum Game"

Government

		$r = 80\%$		$r = 20\%$	
		c_1		c_2	
Taxpayer	PAYS	R_1	8000	2000	
			-8000	-2000	
	EVADES	R_2	2600	1400	
			-2600	-1400	

$BT = 10,000$ $p = .2$ $F = rBT + 5000$
 C_1R_2 result: $pF = .2 (.8(10,000) + 5000) = 2600$
 Government picks C_1 ; taxpayer/evader picks R_2 .

However, even though Game 1 may be pictured in the minds of some governments and taxpayers, there are other considerations that drastically alter the nature of the game.

When the costs of enforcement and evasion are brought into the game, it may become a "cooperative variable-sum game" whereby both players may come out better than the C_1R_2 position (high rates and much evasion).

The taxpayer really faces a choice of rBT (paying the tax) versus evading *plus* the costs (K) of evading ($pF + K$), i.e., he may have to

set up special sets of books, bribe officials, smuggle goods, worry and waste managerial time on the problem.

The government really faces a choice of $\Sigma (r_1 B T F_1 - C_1 + p e F_1 (1 - P_1))$, $\Sigma (r_2 B T P_2 - C_2 + p e F_2 (1 - P_2))$, ..., $\Sigma (r_n B T P_n - C_n + p e F_n (1 - P_n))$ in determining which set of tax rates, enforcement costs (C) and fines will maximize tax revenues, if this is the goal we limit ourselves to. The expression $(1 - P)$ indicates the share of the tax base undergoing "attempted evasion" with P being the ratio of the tax base reported (BR) to the total tax base (BT) in the identity $T = r B T P$. Here in our illustrative game of government and one rational taxpayer/evader it is a choice between the tax being paid (rBT) or not (the government then collecting $(p F - C)$).

In this second game let us keep the base (\$10,000) and choice of rates (80 and 20 per cent) the same. To maintain the same probability of catching tax evaders at one-fifth, let us assume that at the 80 per cent rate with a greater payoff for successful evasion the cost per taxpayer is \$ 1,000 while for the lower rate (20 per cent) it is only \$500 (absolutely fewer try to evade, fewer are caught, tried, sentenced, fined, etc.).³ Much less time and money is spent by the government, police and courts on the fewer evaders who find it worthwhile to evade at the lower rate. We assume that the fine (F) remains the same (rBT + \$5,000).

The person who chooses to evade also has costs; we assume $k = \$1,000$, i.e., extra accounting, legal, managerial, bribery and other costs.

Now the matrix looks different:

In the southwestern box, for example, the government's income is $p F_1 - C_1$ where $F_1 = r_1 B T + 5,000 = (.8) (10,000) + 5,000$; thus $p F_1 = 2,600$ and with C_1 equal to 1,000 the net income for government is \$1,600. In the same box the tax evader (being caught once every five times) loses in fines an *average* of \$2,600 per time plus the \$1,000 per time in evasion costs (that makes it possible for him to get by four-fifths of the time), or a total of \$3,600. The point of indifference between paying and evading is at $r = .25$, i.e., this is the rate when $r B T = p F + K$.

3) Changing the cost to maintain a given "p" is of course similar to monopolistic competition theory whereby altering selling costs (advertising) may maintain a given level of sales, thus making costs rather than sales the independent variable.

In a generalized form when the fine and evasion costs are some proportion of the tax base the break-even point is $I = (pf + k)/r$ as $F = fBT$ and $K = kBT$. Thus in Game 2 with the tax base and p being held constant, variation in the tax rate becomes the sole determinant of the taxpayer/evader's response.

GAME 2

"The Cooperative Variable-sum Game"

		Government	
		C_1 $r = 80\%$	C_2 $r = 20\%$
Taxpayer	PAYS R_1	8000 -8000	2000 -2000
	EVADES R_2	1600 -3600	900 -2400

$$BT = 10,000 \quad p_e = .2 \quad F = rBT + 5000$$

This second game is "cooperative" as well as "variable sum" reflecting the dead loss from society's unproductive use of resources in trying to enforce and evade high tax rates which provide strong incentives for such evasion. The optimum location from the interests of government and taxpayers is box C_2R_1 , the northeastern box with our representative taxpayer paying low taxes. In this case both "cooperate" by seemingly picking their low taxes: the government "plays" low rate and the taxpayer does not evade. Game I the government always optimized by evading regardless of the government's first move. In the "cooperative" case *both* lose at C_1R_2 (the high-rate-evaded "solution" of the "competitive" case) and *both* gain at C_2R_1 (or at least the government achieves the "second best" of four possible locations). In terms of growth this means less resources are spent on evasion and enforcement-penalizing systems.

A General Model

It is perhaps more common for governments to set F as a function of the tax liability, e.g., $F = frBT$; as we include the evaded tax (rBT) as a part of the total payment from the caught evader, f is always greater than unity. Evasion costs (K) and the government's enforcement effort (C) are more likely related to the size of the tax base itself; variations in the tax rate may not affect the cost of maintaining different sets of books or adding extra staff to the government tax collection agency, thus we hold $K = kBT$ and $C = cBT$.

The game in general terms for any series of rates from minimal ones (rm) to very high ones (rh) becomes:

Collector

$rh \dots \dots \dots rm$

Rationalizer Pays : $(-rhB, rhB) \dots (-rmB, rmB)$

Evades : $(-rhB [(pf + k)/rh], rhB [(pf-c)/rh]) \dots (-rmB [(pf + k)/rm], rmB [(pf-c)/rm])$

The rationalizing taxpayer/evader is better off to pay his taxes when $(1 - k)/r < pf$ while the government collector prefers taxes to fines when $pf < (1 + c)/r$.

This results in three possible cases for different values of pf : Case 1 (R evades, C wants tax), Case 2 (R pays tax, C wants fine), Case 3 (R pays tax, C wants tax). The first two cases represent conflict of interest and throws us back into the zero-sum jungle of Game 1. Case 3 on the other hand is one of concert of interest: both are better off doing what is better for both.

Case 1 : $(1 - k)/r > pf < (1 + c)/r$ (R evades, C wants tax)

Case 2 : $(1 - k)/r < pf > (1 + c)/r$ (R pays, C wants fine)

Case 3 : $(1 - k)/r < pf < (1 + c)/r$ (R pays, C wants tax)

There is a pf greater than $(1 - k)/r$ and less than $(1 + c)/r$ which makes the game cooperative and provides a satisfactory solution to both players. The smaller r becomes, the greater the range is to attain a "cooperative" pf . To achieve this solution government may operate on p , f and r with k and c being more or less fixed.

Looking at this solution from the view of selecting an acceptable r , we must have an r greater than $c/(pf-1)$ and less than $k/(1-pf)$ for values of pf less than 1 which is the general case. For most countries, especially less developed ones, p is probably much less than .5 and f is seldom as high as 2. If pf happens to equal unity, then r must be less than k but greater than c ; for pf is of greater than unity, the taxpayers always pays but the government would prefer the tax to collecting fines only if $r > c/(pf - 1)$. Thus for government to keep its Machiavellian rationalizers honest, it must either establish a pf greater than $(1 - k)/r$ for any given r or for any given pf it must set r below $k/(1 - pf)$ than $(1 - k)/r$ for any given r or for any given pf it must set r below $k/(1 - pf)$. Changing pf may well be difficult with p being tougher to alter than f which tends to be a widely unexploited weapon in financing development via the tax system. Thus for countries where administrative incapacity prevents raising p and political timidity inhibits boosting fines (not to mention jail terms), the recourse may well be to selecting tax rates that are equal to fall below $k/(1-pf)$.

Implications

How relevant and useful can this game be? In the United States, for example, f is 1.5 for cases involving fraud with intent to evade the tax. This would require a p of up to two-thirds (assuming k/r is rather small) to invoke tax payments from the Machiavellian rationalizers among us. This seems to be a rather high p for anyone except very high taxpayers who might expect an audit every year. It might also partly explain why so much evasion does occur, especially where the p would be generally much lower than two-thirds, e.g., interest, dividend and entrepreneurial (including farm) income. In the absence of effective withholding in these areas (thus raising p), what does the model suggest? A system of variable fines could be envisaged which would relate to the suspected p 's in each area. For example, raising the fine for fraudulent evasion of taxes on interest income from 50 per cent to 200 per cent would cut the "required" p in half. Such a widely-announced discriminatory (in the economist's sense) fine might be far simpler and less costly than requiring millions of information returns. Even though the political feasibility of a set of discriminatory fines (based on equating $p f$ to unity) might be highly dubious, such a tool might be worth considering for the enforcement kit of less developed countries where the cost and/or possibility of "unearned income" (typically having a low p with consequently much

evasion) were not stout-hearted enough to squelch such a plan. In the broader sense of horizontal equity among different types of income, variable fines may be one device to equate the P ratios (BR/BT) among factor income.

On the other hand where both p and f are institutionally rigid, the recourse must be to set r below $k/(1 - pf)$ if a concert of interest is preferred to the game warfare inherent in the Game 1 "high rate — much evasion" dilemma.

CONCLUSION

This exercise can point up certain facets of the tax reform problem (if both government and the taxpayer/evader are "rationalizers"):

(1) It supports the proposition that the reported tax bases (BR) are inversely related to tax rates. Not all taxpayers see the same chance of being caught (p) nor are equally Machiavellian, but as the rate (r) rises above different break-even points $[k/(1-pf)]$ for different taxpayers, it is not surprising that P (i.e., BR/BT) falls. As an old Afghan tax evader immortalized, "There's a little bit of Machiavelli in us all."

(2) If government and taxpayers view the "tax game" as competitive and zero-sum, then one may "rationally" expect the government to push for high rates and taxpayers to evade. This be an illusory optimum for both.

(3) If government and taxpayers consider *all costs* involved (those of evasion and enforcement) and are able to signal their moves effectively (via low tax rates and taxpayer compliance) then one may "rationally" expect the government and taxpayers to reach a *true* optimum in what is, in fact, a cooperative variable-sum game.

(4) Government may be able to change the rules of the game (raising "fines" and/or the probability of catching evaders) thus making possible higher tax rates at which the rational tax evader is indifferent to paying or evading taxes.

Is this simple analysis realistic?

Many people in less developed lands (as well as in some developed ones) do, in fact, view taxes as a "game". Beating the government out of taxes in some places has become almost as respectable (and fun) as church bingo. For less developed lands the gross horizontal inequities involved in widespread evasion (especially by the rich) are

coupled with serious losses in potential revenues⁴. One obvious policy implication from point (4) above is that a *combined* program of realistic rates *with* a serious attempt at enforcement with stiffer penalties and maybe a few "show trials" for demonstration effects may have a regenerative impact on taxpayer morality, may enhance respect for the government revenue system, and — which may be the primary concern — increase government revenues. Recently Chile has switched tax strategies by prosecuting evaders, an enforcement technique previously regarded as unthinkable in playing the tax game in Latin America.

Let me close with an example of juggling rates and enforcement techniques found in customs administration. George J. Eder, Executive Director, Bolivian Monetary Stabilization Council in 1956/57⁵, tells me of this example (documented in a letter to ICA, Washington, of April 15, 1957): of some 102,000 Swiss watches that entered Bolivia in 1955 (Swiss figures) only 378 actually passed through customs (with duties of 200-300 per cent). This was typical for many imports. When tariffs were cut to 20-50 per cent rates on a number of items, revenues were increased substantially — so much so that the well-organized smuggling operation was virtually driven out of business. At this point the "Bolivian Smugglers' Guild" appealed to the government to raise tariff duties sufficiently so they could get back into business and alleviate the unemployment of the Guild's many members. The government did⁶.

4) In India, for example, "the difference between the income originally reported and that disclosed later to the Department (was) on the average, as much as 600 per cent." (My underscoring.) See the **Report of the Taxation Enquiry Commission, 1953-54**, New Delhi, 1955, vol. II, p. 189. In Argentina, Banco Central, statisticians estimated that in 1956 income tax revenues would have been increased by 109 per cent if all taxable income had been reported; see S. S. Surrey and O. Oldman, "Report of a Preliminary Survey of the Tax System of Argentina," **Public Finance**, vol. XVI (1961), No. 2, p. 176.

See also Walter Wurfel, (Washington) **Evening Star**, March 6, 1963: "But the old Latin American game of tax evasion is still the rule. About 9,000 persons paid income taxes in El Salvador last year. The number of others who should have filed returns is estimated at between 9,000 and 27,000."

5) Now Research Associate, Harvard Law School International Program in Taxation, and a neditor of the World Tax Series.

6) For other telling tales of government-tax evader relations see my article, "Certainty as Criterion: Taxation of Foreign Investment in Afghanistan," **National Tax Journal**, June, 1962.
