Tax-Base Enforcement and Leviathan:

On the Allocation of Tax Enforcement Effort[1]

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ABSTRACT

Agencies charged with collecting tax revenue and enforcing the tax code generally use information provided by taxpayers to decide whether or not to subject individual returns to a variety of review procedures. One consequence of such conditional screening efforts is the creation of incentives for strategic income reporting by individuals who wish to avoid the inconvenience and penalties associated with audits. Insofar as taxpayers exhibit different degrees of risk aversion, individuals in identical fiscal circumstances will report different income levels and, consequently, pay different taxes according to their degree of risk aversion. Some individuals will overpay, while others underpay their legitimate tax obligations.

Another consequence of differences in taxpayer risk aversion is that a tax agency may allocate its enforcement effort in a manner that systematically takes account of those differences. How differences in taxpayer risk aversion affects enforcement activities varies with the institutional environment in which the tax agency operates. Three models, the Leviathan model and two related enforcement models, are developed and tested in this paper. The evidence suggests that risk aversion affects both taxpayer behavior and the allocation of audit efforts by the Internal Revenue Service of the United States, although not in the manner predicted by the Leviathan model.

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I. Introduction

This paper explores some implications of the differences in taxpayer risk aversion. An implication of differences in taxpayer risk aversion is that the effective tax base faced by taxpayers depends partly on the tax laws adopted by legislation and partly on the enforcement efforts of the tax agency charged with enforcing the tax law. In this, the tax code is similar to other laws and regulations. Without enforcement, little revenue would be generated by a given tax code. Without uniform enforcement, the pattern of effective taxes faced by taxpayers may differ substantially. However, without adjustments that take account of differences in taxpayer risk aversion, the burden of taxation will differ among individuals in otherwise similar circumstances. The overall burden and the distribution of tax burden generated by a tax system is partly determined by the manner in which tax law is policed. The first part of the paper demonstrates that relatively risk-averse taxpayers are more inclined to pay their taxes than less risk-averse individuals in a setting where all tax payers face the same audit rates.

The pattern of tax enforcement effort that will be adopted by the tax agency, clearly, depends upon the institutional setting in which the responsible agency operates. Different patterns of rewards and costs will indirectly generate different "agency objective functions" by defining different patterns of constraints. In a well functioning democracy, the institutional environment tends to favor policies in the interest of the median voter, and both the tax code and the pattern of enforcement tend to be those that minimize median tax burden and the overall excess burden of the tax system in order to allow the median taxpayer-voters to secure public services at fiscally attractive prices, (Buchanan,1967, Ch. 11, Hettich and Winer 1999, Ch. 5). In less than ideally competitive democracies, both the tax code and the pattern of tax enforcement may diverge from those which best advance the median or average voter's interests.

The nature of the policies that are finally implemented in less than perfectly competitive democracies is partly a matter of the procedures used to make policy (Buchanan and Tullock, 1962), and partly imperfections in the control devices used by the electorate. For example, the tax system is an area of policy that is prone to cyclic majorities, in which case agenda control rather than median voter interests might largely determine tax policies at the

margin. In such a setting ,a constitutional rule that required an equitable system of taxation *and enforcement* might simultaneously advance equity while making democratic governance more efficient, Buchanan and Congleton, 1998, Ch. 8. On the other hand, fiscal agency problems can arise from various informational and computational limitations of voters (Buchanan, 1967 Ch. 10) given the constitutional constraints under which fiscal decisions are made (Buchanan and Brennan, 1980). Even under the best of circumstances rationally ignorant voters may make errors (Congleton, 2001) and voter interests in public policy may well be less rational than the best that can be imagined (Caplan, 2001). To the extent that imperfect monitoring by voters allows interest groups inside or outside government to influence public policies at the margin, the "government" may have an interest in maximizing the revenues that can be generated from a given tax base and tax code. Buchanan and Brennan refer to such tax revenue maximizing governments as "Leviathan."

The two extremes of median voter and Leviathan governance have implications for taxation and for tax enforcement. Niskanan's (1971) model of bureaucrat incentives can be used to characterize how any elected government may implicitly provide an agency with an objective functions. Niskanen argues that the internal incentives within government tend to cause most bureaucrats to act as budget maximizers. Governments may, therefore, use conditional budgets to induce the bureaucracy to advance their objectives (Weingast and Moran, 1983). For example, if government seeks additional revenue, the future budgets of the tax agency can be based upon the tax revenue produced by the tax enforcement agency. Insofar as additional tax revenues lead to larger budgets (or discretionary budgets), the agency will tend to behave as a revenue maximizer, at least at the margins controlled by the agency. On the other hand, if electoral feedback implies the government should promote the median voter's interests, budget increases can be provided for agencies that have advanced the median voter's interests and decreases for those that have ignored or harmed median interests. In this case, the tax bureaucracy will attempt to provide the enforcement agenda preferred by the median voter. To the extent that the tax code is in the median voter's interests, the pattern of enforcement preferred by the median voter will attempt to assure that the tax code is in fact backed up by effective enforcement. The second part of this paper

explores how differences in taxpayer risk aversion will affect the allocation of tax-enforcing efforts by the tax agency in such political environments.

Clearly, a broad range of tax code enforcement regimes are possible within democratic governments. In a worst-case setting, where voters know little about the true costs of government services or range of services provided, the tax agency may act as Leviathan's agent and attempt to squeeze the maximum tax revenue out of the existing tax code. In a best-case setting, where voters are relatively well-informed and competition for office is intense, the tax agency may act as the median voter's agent and attempt to assure that the majority's tax objectives are advanced at least cost. Which pattern of incentives operates in a given political setting is an empirical question. It turns out that variation in the extent of taxpayer risk aversion provides a possible method by which Leviathan and two tax code enforcement regimes can be distinguished from one another. The third section of this paper attempts to empirically distinguish between three tax enforcement regimes using published data from the Internal Revenue Service.

II. Risk Aversion and Tax Payments with Uncertain Enforcement

Consider a taxpayer of the sort long studied in the tax evasion literature (Allingham and Sandmo, 1972). Suppose that the typical taxpayer has an indirect utility function, U, defined over after-tax income, Y-T.

$$U = u(Y-T) \tag{1}$$

Suppose also that that the tax base is complex, as suggested by Hettich and Winer, so that a taxpayer's legitimate tax obligations varies widely with the details of his or her income. To simplify, let L be the legitimate exclusion of a particular taxpayer's personal income, Y, and that the tax payment owed is:

$$T = t\,(Y - L) \tag{1}$$

where T is an increasing function of taxable income, T-L.

Assume that the tax agency has responsibility to monitor the actual exclusions claimed by tax payers, and audits taxpayer tax returns at rate, P, which is conditioned on various

taxpayer characteristics. Because taxpayer circumstances vary considerably, no single taxpayer's legitimate exclusion can be determined by the tax collecting agency prior to the audit. The tax agency consequently has to rely on criteria not directly linked to individual circumstances when deciding which returns should be most thoroughly audited. Here, the obvious characteristics are announced gross income Y and the extent to which exclusion, E, declared by the taxpayer exceeds some "normal exclusion," N, that is to say, P= p(Y, E - N).

Taxpayers who are found to have underpaid their taxes by excluding more than their legitimate amount, L, will pay a fine that is proportional to the over exclusion, F = f(E-L), if audited. The taxpayer pays no fine if no overexclusion is discovered by the audit, F = 0 if E < E*, but still bears the opportunity cost of the audit itself. The cost of participating in an audit can be approximated as *a*Y where Y is annual income of the taxpayer being audited and *a* is the time that an audit takes to conclude.

The typical taxpayer's decision to report taxable income to the tax authority can now be modeled as a conventional expected-utility-maximizing choice.

$$U^e = (1-P)\, U^o + P\, U^A \tag{2}$$

where

$$U^o = u(Y - t(Y-E)) \quad \text{and} \quad U^A = u\,(Y - t(Y-E) - aY - f\,(E-L)\,)$$

Differentiating with respect to E, gathering terms, and setting the result equal to zero yields:

$$U^e_E = P_E\,(U^A - U^o\,) + P(\,U^A_E - U^0_E\,) + U^o_E = 0, \tag{3}$$

The second order condition for equation 3 is:

$$U^e_{EE} = P_{EE}\,(U^A - U^o\,) + 2\,P_E\,(U^A_E - U^o_E\,) + (1-P)U^o_{EE} + P\,U^A_{EE} < 0, \tag{4}$$

which is satisfied when the utility function is concave ($U_E > 0$, and $U_{EE} < 0$), the probability of audit rises at an increasing rate as exclusions increase ($P_E > 0$ and $P_{EE} > 0$) and when there is an effective penalty system in place ($U^A_E < U^o_E$).[2]

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[2] Given concavity, it may be surprising that $P(\,U^A_E - U^o_E\,) < 0$. P is clearly positive. Recall that both U^A_E and U^o_E depends on the tax and fine schedules as well as taxpayer risk aversion.

$$U^A_E = U^A_Y\,(-T_E - F_E) \quad \text{and} \quad U^0_E = U^0_Y\,(-T_E)$$

Insofar as exclusions reduce taxes, $T_E < 0$. Consequently, $U^0_Y\,(-T_E) > 0$. If the fine schedule is an effective deterrent, the fine imposed on underpayments must increase faster than tax savings, $F_E > -T_E > 0$, which implies that $(-T_E - F_E) < 0$, and, thus, $U^A_E = U^A_Y\,(-T_E - F_E) < 0$. An effective fine schedule is sufficient to make $P(\,U^A_E - U^o_E\,) < 0$.

The first two terms in equation 3 can be regarded as the marginal cost of additional exclusions and the last term regarded as the marginal benefit realized from additional exclusions. All rational taxpayers will exclude at the level that sets their marginal expected costs equal to their marginal expected benefits in utility terms. A risk- neutral taxpayer will equate the expected marginal increase in fines equal to the marginal tax savings, $PF_E + P_E(F+ aY) = -T_E = T_Y$. The exclusion declared by risk-averse taxpayers *excludes somewhat less* than this amount because such tax payers are willing to pay an" insurance premium" to reduce their risk of audit. Other things being equal, the insurance premium increases with the extent of taxpayer risk aversion, because the difference between the marginal utilities associated with different levels of income increases with increases in concavity.[3]

The first order condition together with the implicit function theorem imply that the exclusion reported by a typical taxpayer can be represented as:

$$E^* = e (Y, N, L, t, a, F) \quad (5)$$

The exclusion reported by a typical tax payer depends on his or her gross income, the audit threshold, the tax schedule specified in legislation, the opportunity cost of being audited, and the marginal fine imposed on illegal exclusions. The shape of this function also depends in part on the degree of taxpayer risk aversion.

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[3] Substituting for U^A_E and U^0_E and rearranging terms allows equation 3 to be written as:

$$U^e_E = U^0_Y T_Y - PF_E U^A_Y + P_E(U^A-U^0) = 0 \quad (3b)$$

Recall that (U^A-U^0) is approximately $DY\, U^0_Y = -FU^0_Y$ and that U^A_Y, similarly, is approximately $U^0_Y - DY\, U^0_{YY} = U^0_Y - FU^0_{YY}$ which allows equation 3b to be rewritten as:

$$U^e_E = U^0_Y T_Y - PF_E(U^0_Y - FU^0_{YY}) + P_E(-FU^0_Y) = 0 \quad (3c)$$

Dividing by U^0_Y yields:

$$U^e_E/U^0_Y = T_Y - P_EF - PF_E (1 - FU^0_{YY}/U^0_Y) = 0 \quad (3d)$$

Recall that the Arrow-Pratt measure of risk aversion is $R = -U_{YY}/U_Y$. Consequently equation 3d can be written as:

$$T_Y - P_EF - PF_E (1 + FR^0) = 0 \quad \text{at } E^* \quad (3e)$$

Note that if the taxpayer is risk neutral, E* satisfies $T_Y = P_EF + PF_E$, that is to say, a risk averse taxpayer choose the exclusion such that the marginal increase in tax savings from further exclusions equals the increased expected penalty associated with that exclusion. Note also that the subjective marginal cost of exclusions rises with risk aversion and the level of fines associated with (E*-L) so that E* will satisfy: $T_Y = P_EF + PF_E (1 + FR^0)$.

The effect of changes in the audit procedures of the tax-enforcing agency on taxpayer behavior can now be assessed by differentiating equation 5 with respect to the effect of the tax-enforcing agency's exclusion threshold N on taxpayer exclusions:

$$E^*_N = [\, P_{EN} (U^A - U^o) + P_N (U^A_E - U^o_E)] / [- U^e_{EE}\,] > 0 \qquad (6)$$

The second order condition is assumed to hold for the range of interest, $[- U^e_{EE}\,] > 0$, consequently, the qualitative effect of a change in the exclusionary threshold is determined by the numerator of equation 6.

The *qualitative* effect of relaxing the "audit trigger" is unabiguously positive insofar as this change in auditing procedures reduces audit rates for the class of taxpayers of interest. A decrease in audit rates implies that $P_N < 0$, and also implies that the marginal probability of being audited for marginal exclusions declines, $P_{EN} < 0$. The utility realized if audited necessarily below that realized when not audited, $U^A < U^o$, as noted above, and an effective fine schedule implies that $(U^A_E - U^o_E) < 0$. Consequently, both terms in the numerator are positive. Exclusions tend to increase as audit thresholds increase.

The *quantitative* effect of a reduced prospect of audit on taxpayer exclusions varies with taxpayer risk aversion. There are two affects of a decrease in audit rates on risk-averse taxpayers: there is an effect on the financial costs/benefit calculation made by risk neutral tax payers plus an additional adjustment to the insurance premium previously paid by risk-averse taxpayers. The insurance premium can now be safely reduced, which implies that relatively risk averse tax payers make relatively larger adjustments to their reported income than made by relatively less risk averse taxpayers. As taxpayers become more risk averse, the initial insurance premium becomes larger, and so does the marginal rate at which they reduce that premium as risks decline.[4]

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[4] The effect of relaxing the audit threshold on taxpayer exclusions is perhaps more direct in the formulation in note 3 above. Recall that at E* the marginal tax reduction from additional exclusions is set equal to the marginal cost of increased expected fines where the latter is affected by risk aversion.

$$0 = T_Y - [P_E F + P F_E (\, 1 + FR^0)] \equiv H \qquad (3e)$$

Note that changes in the audit rate generated by a higher threshold affect only the "marginal cost" side of the condition characterizing E*. P_E and P both fall as N increases, thus the expected

In cases where the audit trigger is tightened and audit rates increase, the logic is reversed, and relatively risk-averse tax-payers will reduce their exclusions by more than their relatively less risk-averse fellow taxpayers. Although both risk neutral and moderately risk-averse individuals behave *qualitatively* in the same way when audit rates decline, $E^*_N < 0$, their *quantitative* responses to changes in audit rates differ systematically. A risk-averse taxpayer will report more income than a risk neutral taxpayer in otherwise identical circumstances, and also tends to respond more to increases in audit rates: $E^{rn}*_N < E^{ra}*_N < 0$. Risk aversion, thus, affects the extent of the effective tax base for a given audit rate, and also the manner in which the actual tax base changes with changes in audit procedures.

III. Tax Enforcement Strategies and Tax Receipts

We now attempt to determine whether the distribution of taxpayer risk aversion will affect the pattern of tax enforcement and thereby the pattern of taxpayer payments under several assumptions about tax-base enforcement. The manner in which risk aversion affects tax agency audit activities differs according to the institutional environment in which the tax agency operates. Three possible agency objective functions are analyzed: (i) the case where the tax agency attempts to maximize tax revenue, (ii) the case where the tax agency attempts to minimize the extent of aggregate illegal tax exclusions, and (iii) the case where the enforcement agency attempts to detect and punish those who substantially violate the tax code. In all three of these cases, the audit rates of similar taxpayers who differ only with respect to their risk aversion tend to differ, although in each case the agency's allocation of tax-enforcing effort varies across agency objective functions. Other objective functions are also possible, but these three are most consistant with the political extremes of interest group and median voter dominated polities.[5]

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marginal cost of anticipated fines falls as well. Note that the extent to which those marginal costs fall increases with R and with F.

More formally the effect of risk aversion on adjustment rates is evident in $E^*_N = H_N/-H_E =$

$$\frac{-[P_{EN}F + P_N F_E(1 + FR^0)]}{-\{T_{YY} - [P_{EE}F + P_E F_N + (P_E F_N + PF_{EE})(1 + FR^0) + PF_E(F_E R^0 + FR^0_E)]\}} > 0$$

[5] For example, discriminating among taxpayers may be rulled out. In settings where political and legal setting require an equitable distribution of enforcement effort, clearly the tax agency would

It bears noting that the "maximize tax revenue" and "minimize illegal exclusion" agency objective functions have very similar implications for tax-base enforcement. To see this, suppose that there are two groups of taxpayers who are identical in all respects except for their degree of risk aversion. Suppose that there are N^{rn} relativley less risk-averse tax payers and N^{ra} relatively more risk averse taxpayers in the group of interest. If the tax rate for individuals in this class is t, the total tax revenue, T, paid by this class of tax payers is:

$$T = N^{rn} (Y - E^{rn})t + N^{ra} (Y - E^{ra})t \quad (7)$$

Suppose that the tax agency controls only the audit rules. The tax rate and the fine schedules are assumed to be set by the legislature. Suppose that each audit costs the agency C dollars and that the agency has budget B for audit purposes. The feasible range of audits is $(A^{rn} + A^{ra})C = B$, where A^{rn} and A^{ra}, are the number of audits performed in each group. The probability of audit facing each group of taxpayers can be manipulated by adjusting audit thresholds and is simply the number of audits performed in each group divided by the numbers of returns submitted by those groups.

An agency interested in maximizing tax revenue would allocate its resources such that:

$$t (N^{rn} E^{rn}_A - N^{ra} E^{ra}_A) = 0,$$

which can be written as:

$$N^{rn} E^{rn}_A = N^{ra} E^{ra}_A \quad (8)$$

or

$$N^{rn}/N^{ra} = E^{ra}_A / E^{rn}_A$$

Equation 8 demonstrates that the audit rates of a revenue maximizing tax agency are set such that the marginal increase in tax revenue generated is equal among groups of taxpayers. In cases where the size of the two groups is equal, the number of audits will be the same only in the case in which both groups are *equally responsive* to changes in the probability of audit. The analysis above demonstrates that this will not be the case for risk neutral and risk-averse

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ignore differences in taxpayer risk aversion. In this case, every taxpayer would have the same probability of audit, as often assumed in the literature on tax evasion, and the tax burden imposed on taxpayers in similar fiscal circumstances according to their preferences for risk, as indicated above.

taxpayers. In general risk-averse tax payers are more responsive to increases in the probability of audit than are risk neutral tax payers. Consequently, other things being equal, *a revenue-maximizing tax agency will devote relatively more resources to auditing the returns of relatively risk-averse groups* than to less risk averse groups of taxpayers.

Now consider a tax agency that minimizes aggregate illegal exclusions. Illegal exclusions occur when $E^* > L$, where E^* is as characterized above in equation 5. The total under reported taxable income, $\mathcal{L}$, from two classes of taxpayers is:

$$\mathcal{L} = N^{rn} (E^{rn} - L) + N^{ra} (E^{ra} - L), \tag{9}$$

which is minimized when resources are allocated among the relevant groups so that:

$$N^{rn} E^{rn}_A = N^{ra} E^{ra}_A \tag{10}$$

In cases where both groups of taxpayers under report their taxable income, the same allocation of audit resources minimizes total under payments and maximizes tax receipts.

As long as essentially all taxpayers underreport their taxable income, differences in these two agency objective functions do not reveal themselves. However, these two types of tax agencies do differ in their treatment of honest taxpayers. Once the lawful level of exclusions is reached, illegal withholdings fall to zero, and no further audits are warranted to encourage tax compliance. An tax agency that attempts to minimize unlawful exclusion would never audit at a rate greater than required to achieve $E^* = L$. However, Leviathan would target such taxpayers with additional audit efforts insofar as they can be induced to *overpay* their taxes at a relatively low cost. In such cases, the revenue maximizing tax agency will subject the most risk averse (honest) taxpayers to greater audit rates than would be imposed by an agency that minimizes aggregate illegal exclusions (tax evasion)..

The difference between a law-enforcing tax agency and Leviathan is more obvious when the goal of a tax-enforcement agency is to *punish illegal behavior* rather than to minimizing total illegal exclusions. The audit activities of an "evasion punishing" agency are targeted at the taxpayers who are most prone to over exclude their income from the tax base. Consequently, an evasion-punishing tax agency will target the most audit resources at the least risk-averse classes of taxpayers and the least resource to the most risk-averse taxpayers. The analysis above implies that risk-averse taxpayers tend to report fewer exclusions than risk

neutral taxpayers, $E^{rn} > E^{ra}$, other things being equal. This pattern of audits is *exactly the opposite of that adopted by a tax-revenue maximizing enforcement agency*. The most risk-averse persons are the taxpayers least likely to have violated the tax law, although they are also the taxpayers who are most responsive to changes in audit rates.

Table 1 summarizes the predicted pattern of enforcement effort for these three institutional environments when there are three class of risk averse taxpayers. Leviathan's tax agency would target the most resources at taxpayers who are most sensitive to the probability audit, and the least resources at those who are least sensitive to the probability of audit. An enforcement agency that attempts to minimize aggregate illegal exclusions would allocate its efforts in a similar pattern for all taxpayers that underreport their income but it may devote fewer resources to the most risk-averse taxpayer groups, who are likely to obey by the tax law. A crime punishing agency subjects the least risk-averse taxpayers to the most audits, because these are those most likely to have substantially violated the tax law.

Table 1
The Allocation of Audit Effort
(For a Given Enforcement Budget)

	Most Risk Averse Taxpayers	Moderately Risk Averse Taxpayers	Least Risk Averse Taxpayers
Maximize Induced Tax Receipts	High	Medium	Low
Minimize (Aggregate) Illegal Exclusions	Low	High	Medium
Punish Maximal Tax Evasion	Low	Medium	High

IV. Law Enforcement or Leviathan? Some Evidence from the Internal Revenue Service of the United States

The above analysis suggests that these three institutional environments can be distinguished from one another if the risk aversion of taxpayers can be identified. It is clear that the Internal Revenue Service discriminates among taxpayer groups, but it is less clear whether it discriminate according to taxpayer risk aversion. For example, taxpayers with

larger incomes are subject to relatively greater audit rates than taxpayers with low income. Holding income constant, taxpayers who submit returns that include schedule S (small businesses) and schedule F (small farmers) are audited at different rates than those whose earned income can be tabulated on schedule 1040.[6] Unfortunately for our purposes, the IRS reports include no direct tabulations of audit rates by degree of taxpayer risk aversion. However, if risk aversion plays a role in career choices, as postulated by Frank Knight (1971) and affirmed by the work of Orazem and Mattila (1991), we can use type of return as a proxy for taxpayer risk aversion.

Knight argues that entrepreneurs differ from ordinary persons in that they are more willing to accept risks. The Knightian hypothesis, thus, implies that individuals who lack business income tend to be more risk averse than those with business income. As a first approximation, taxpayers filling personal returns without schedules S or F can be regarded as more risk averse, on average, than those who file returns that include S or F schedules. Moreover, businesses also differ with respect to the level of risk involved. For example, it is clear that farming is a relatively safe business in the contemporary setting. Farming risks are reduced by a large number of government programs that effectively bound the losses faced by farmers. Moreover, farmers can use a well-developed futures markets to manage any residual risk during the annual crop cycle in a manner that is largely unavailable for other industries. (There are no organized futures markets for new computer software, automobiles, law suits, consulting services, or retail sales.) These safety nets and market devices for shedding risk suggest that farmers--those filing schedule F--may be regarded as more risk averse than those filing schedule S, other things being equal.[7]

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[6] The Internal Revenue Service publishes a report each year that summarizes its tax collection activities for the previous year. The audit and penalty data used below are assembled from twenty years of those annual reports. A subset of this *IRS* data set is also tabulated in the *Statistical Abstract of the United States*: *2000*. See table 546.

[7] Evidence of the risk of various businesses is provided in table 877 of the *Statistical Abstract of the United States: 2000,* which tabulates business failure rates by industry for five years. For the years listed, the average failure rate for all businesses was 80.1 whereas the failure rate for agriculture forestry and fishing was 77.4 per 10,000 firms. The farming sector had an average debt-equity ratio of around 19% (table 1111) while those of other business sectors (in partnerships) were generally well above 30%.

If this characterization of average risk aversion is correct, the above model of tax reporting suggests that we should observe that ordinary 1040 taxpayers "overexclude" less than farmers who "overexclude" less than nonfarm proprietors and partnerships. Table 2 reports data on recommended tax and penalties from audits of individual tax returns assembled from the annual reports of the IRS for the 1981 - 2000 period. Note that, with only one exception, the rank order of penalties and taxes assessed after audit conform with the model's predictions under this rank order of risk aversion. The average penalties and additional tax recommended by the IRS following an audit are larger for 1040 taxpayers than for schedule F filers, who are charged less than those filing schedule C.

Table 2
Average Penalty and Tax Recommended after Audit
(nominal)

Year	Number of Returns Filed	Average Refund	Nonbusiness Returns Examined with TPI between $25K and $50K	Schedule C Business Returns Examined with TGR between $25K and $100K	Schedule F Business Returns Examined with TGR under $100K
1981	166,528	0	805	2,258	1,296
1982	170,369	1,009	853	2,566	2,031
1983	171,174	1,169	976	3,770	1,677
1984	172,512	1,086	1258	4,224	1,764
1985	178,219	1,077	1361	4,977	1,929
1986	188,017	1,212	1608	5,332	2,718
1987	193,156	1,200	1704	5,685	2,442
1988	194,305	1,138	1774	4,986	2,131
1989	190,567	1,133	1895	5,445	2,236
1990	201,715	1,168	2768	6,113	2,890
1991	203,713	1,199	3551	7,888	3,815
1992	204,075	1,267	2919	6,802	2,592
1993	207,423	1,230	3107	6,575	2,056
1994	204,975	1,267	2739	6,519	2,527
1995	205,747	1,351	1730	6,238	2,408
1996	208,938	1,485	1958	5,463	2,115
1997	216,510	1,578	3470	6,263	2,318
1998	224,453	1,716	2798	5,964	2,875
1999	224,305	1,941	2456	5,401	3,042
2000	226,130	2,075	2926	5,120	2,702
Average		*1,308*	*2,133*	*5,379***	*2,378*
Standard		*299.488*	*844.049*	*1332.679*	*544.399*

* Farm returns between 25k and 100k

Given recognizable differences in taxpayer risk aversion, the analysis suggests that the pattern of audits will vary systematically, although the effect of taxpayer risk aversion on the pattern differs according to the institutional structure in which the tax-enforcement agency operates. Some rough evidence of targeting according to risk aversion is presented below in table 3. Table 3 summarizes audit rates reported by the IRS in its annual reports covering the years 1981 through 2000 for roughly comparable pretax income levels. The audit rates included are for taxpayers reporting only a 1040 and those including schedules C or schedule F. Note that the pattern of audit rates for these taxpayer classes is consistent with the "punish the tax evader" model of tax enforcement. 1040 taxpayers are audited at lower rates than farmers who are audited at lower rates than business men and women.

Table 3
Audit Rates

Year	Nonbusiness Returns Examined with TPI between $25K and $50K	Schedule C Business Returns Examined with TGR between $25K and $100K	Schedule F Business Returns (Farms) Examined with TGR under $100K	
1981	3.170	3.980	2.620	*
1982	2.900	3.970	2.150	*
1983	2.610	3.280	2.020	*
1984	2.050	2.560	1.850	*
1985	2.020	2.550	1.780	*
1986	1.640	2.240	1.140	*
1987	1.400	2.010	1.130	*
1988	1.210	2.120	0.950	*
1989	1.000	1.920	0.870	
1990	0.740	1.860	1.300	
1991	0.640	1.850	1.300	
1992	0.590	1.990	1.080	
1993	0.580	2.410	1.060	
1994	0.530	3.010	1.160	
1995	0.900	3.080	1.230	
1996	0.950	2.850	1.590	
1997	0.700	2.570	1.280	
1998	0.580	1.820	0.930	
1999	0.360	1.300	0.680	
2000	0.210	0.930	0.350	
Average	1.239	2.415	1.324	
St. Deviation	0.854	0.768	0.525	

* Farm returns between 25k and 100k

The analysis above suggests that more than risk aversion affects tax agency audit decisions. Equations 5 and 10 imply that audit rates vary across taxpayers according to economic circumstances (income, Yi), personal characteristics (risk aversion, Ri) and institutional setting. These effects can be represented in a linear form as:

$$A_{it} = \Sigma\, a_i R_i + \Sigma\, b_i Y_i + \Sigma\, c_i I_i + u_{it} \qquad (11)$$

To estimate this audit function, data on audit rates and income ranges for 1040, schedule-C, and schedule-F filers were collected from individual annual reports f the IRS for the 1981 - 2000 tax years. In order to use conventional statistical methods, it was necessary to map reported income ranges into income levels, as is often the case for work based on aggregate data reported by the government. Taxpayer-income levels are approximated as the midpoints of the ranges characterized for the bounded ranges, and as the lower bound of income levels for the unbounded maximal range.[8] Minor changes in the institutional environment are proxied by the political party of the president in office and by general trends (year).

Table 4 reports estimate of the audit schedule used by the IRS for the 1981-2000 period. Column one characterizes an estimated audit schedule based only on differences in income. Table 3 indicated that audit rates tend to increase as income increases, and this is clearly evident in the estimated audit schedule. Columns two and three report estimates of the manner in employment-based risk aversion affects agency audit efforts. Table 3 also suggests that business and farm returns are treated differently, and these estimates affirm those differences. Columns 2 and 3 report least-squares and Tobit estimates of the effects of employment-based risk aversion on the audit rates implemented by the IRS. Note that the coefficient estimates are all similar in magnitude, but the Tobit regression yields a somewhat better fit than the least-squares estimate. As predicted the taxpayers in different risk classes are treated differently by the IRS. The effect of business income is consistent with the "punish tax evasion" model of the tax agency. Business returns are subject to higher audit rates, for a given income level. However, the effect of farm income is consistent with that model only if farmers are generally *more* risk averse than ordinary 1040 taxpayers.

Columns 4 and 5 report audit schedule estimates augmented by variables that account for modest changes in the political environment faced by the IRS. The IRS is part

[8] An exception to this mapping procedure from ranges into numbers was made for cases where the unbounded range changed through time. For example, in 1989 the highest category reported for non-business income taxpayers was changed from 50 to 100 thousand dollars. In this case, rather than 50 a number somewhat closer to 100 (here 90) was used to make the income thresholds comparable. The use of two such changes somewhat improved the fit of the regression estimates reported in table 4 without significantly changing coefficient magnitudes.

Other methods of dealing with the unbounded range, for example, using the average income of the top 5% of the income distribution, were also tried, but did not yield results materially different from those reported in Table 4.

of the executive branch and can be subject to presidential directives of various sorts, thus the party affiliation of the president is included as an explanatory variable along with year which proxies general social and political trends in the column 4 estimates. Column 5 uses a more general but less informative approach to capture variation in the institutional setting faced by the IRS. The column t estimates includes 19 year-fixed-affect variables (binary) to account for year- to-year changes in the political environment. Both these augmented audit schedules are broadly similar to the previous estimates. Modest changes in institutional incentives do affect audit rates, but do so in a manner that does not affect the magnitude, sign, or significance of the income and risk-category variables.

The model of taxpayer exclusions developed above also implies that exclusions vary systematically with audit rates and taxpayer characteristics. IRS recoveries from taxpayers after audit provides indirect evidence of the exclusions claimed by classes of the taxpayers insofar as uncollected taxes and penalties vary with exclusions as noted above in table 2. This relationship can not be estimated directly, because the audit rates faced by taxpayers in the present model are endogenous. A simultaneous equation method of estimation is necessary to avoid bias. (Simultaneous equation methods are not required for the tax-agency equations because the model assumes a Stackelberg relationship between the tax agency and taxpayers.) Column 6 reports an estimate of the relationship between audit rates and exclusions using average penalties and taxes recommended after audit to approximate exclusions.[9] The estimates use the 2-stage least squares method. The instrument used for audit rates is from the model reported in column 5. Similar results were obtained using more sophisticated techniques. (For example, the generalized method of moments yields a somewhat better fit and somewhat greater significance for the estimated coefficients.)

Note that audit rates have the anticipated effect on exclusions. Exclusions fall as audit rates increase, other things being equal. Moreover, although the signs of the estimated effects of business returns (schedule C) and farm returns (schedule F) are consistent with the audit rate estimates insofar as average penalties and tax revenues generated from audits of

[9] To the extent that the IRS is able to distinguish among taxpayers within the groups tabulated in their annual reports, the average penalties and taxes collected post audit will tend to be higher than the average of all taxpayers within the groups of interest. However, the effects of changes in audit rates on reported income should be qualitatively similar for the group as a whole.

business returns exceed those of farmers and ordinary taxpayers, the coefficients are no longer significantly different from zero at conventional levels. One interpretation of this result is that the pattern of audits has approximately equalized expected recoveries among risk classes, other things being equal. However, the audit schedule has evidently not fully equalized anticipated penalties across all categories of taxpayers insofar as the sign on income remains statistically significant. Penalties remain larger for relatively rich than relatively poor taxpayers under the current pattern of audits.

Table 4
Audit Rate Regressions

	Audit Rate 1981-2000 LS	Audit Rate 1981-2000 LS	Audit Rate 1981-2000 Tobit	Audit Rate 1981-2000 LS	Audit Rate 1981-2000 LS	Ave Penalty 1981-2000 2SLS
	(I)	(II)	(III)	(IV)	(V)	(VI)
C	1.026 (5.12)***	0.843 (3.26)***	0.865 (3.70)***	336.243 (6.042)***	-0.679 (1.54)	1600.382 (1.59)
Gross Income TPI/TGI	0.024 (8.60)***	0.276 (8.31)***	0.025 (9.62)***	0.0266 (11.22)***	0.0264 (11.22)***	188.967 (11.04)***
Schedule C		0.381 (1.46)	0.597 (2.46)**	0.591 (2.702)***	0.592 (2.76)**	1345.897 (1.38)
Schedule F		-0.736 (2.53)**	-0.546 (-2.03)**	-0.564 (-2.35)**	-0.560 (-2.36)**	-1753.575 (1.65)*
Republican President				-1.139 (-3.28)***		
Year				-0.168 (-5.69)***	(fixed effects years 81-99)	
Audit Rate						-1930.292 (3.54)
R-square	0.349	0.382	0.439	0.570	0.633	0.590
F-statistic	73.89***	28.05***	--	35.58***	9.19***	52.15***
Log Likelihood	-233.090	-207.900	-222.640	-203.960	-192.842	--
Number of Observations	140	140	140	140	140	140

All data are from the annual report of the IRS.
*** designates significance at the .01 level, ** at the .05 level and * at the 0.1 level.

Overall, the estimated audit schedules are consistent with the "punish tax evaders" model of the tax agency. The estimates of column 6 are consistent with significant farmer risk aversion insofar as penalties and additional taxes imposed on those reporting farm income tends to be smaller than that of ordinary taxpayers for a given income and pattern of audit rates. If one accepts the hypothesis that farmers are generally even more risk averse than ordinary taxpayers, as a group they should be, and are, subject to lower audit rates. Other hypotheses may also account for much of the observed pattern of audits, but the Leviathan model does not. A tax-revenue maximizing agency will focus more effort on relatively risk-averse taxpayers than on relatively less risk-avese taxpayers, which is a pattern

of enforcement that is clearly not in evidence within the data set assembled for the present study.

V. Conclusion

The worst-case Leviathan scenario is unlikely to arise in states where elections determine policy. Taxpayer fears are clearly less present in the voting booth than in the enforcement agency's office, so it is clear that politicians who promise a less fearsome pattern of tax enforcement with a broader legal tax base will receive more votes than those promising very tough tax enforcement on a somewhat narrower tax base, if voters are risk averse. On the other hand, if tax-revenue maximizing tendencies are present anywhere within a democratic system, they are most likely to be present at the level of the tax enforcement agency. Even the median voter has an interest in squeezing additional tax revenue from the lawful tax base. Additional revenue can reduce the median voter's tax burden or fund additional government services.

The data assembled for this study suggest that the modern IRS of the United States is more of an evasion-punishing agency than a revenue-maximizing agency. This conclusion is limited to the sample period in which data were assembled and for the country examined. Among modern industrialized democracies, the United States is noteworthy for its relatively low tax burden, consequently, the U. S. is among the least likely places to find clear evidence of tax revenue-maximizing behavior. Such behavior may be more likely to be present in democracies with far greater tax burdens or in dictatorial regimes where rulers have clear private incentives to maximize the pecuniary value of high office. In other times or in other places the Leviathan model may perform better as a model of policy formation, but exploring these possibilities are left for future research.

That Leviathan is not evident in the contemporary United States does not mean that the Leviathan model is irrelevant for the U. S.. The behavior of the tax agency reflects electoral demands, and the data suggest that those demands have managed to hold revenue-maximizing tendencies in check. To the extent that political demands are influenced by the powerful ideas of economists, it is surely possible that the Leviathan model developed by Buchanan and Brennan in the late 1970's played a significant role in the political debates that

gave rise to the present incentive structure for the IRS. The very success of some ideas in politics may negate their predictions about government policies in practice.

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