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THE EFFECT OF TAX AND AUDIT RATES ON COMPLIANCE WITH THE FEDERAL INCOME TAX, 1977-85

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ABSTRACT

This paper develops a game-theoretic model of the effects of state and federal income tax rates and audit rates on compliance with the federal income tax. Using data drawn primarily from the *Annual Reports of the Commissioner of Internal Revenue* for the years 1977-85, we find empirical confirmation of the model's prediction that increases in the tax rates increase compliance. We also investigate the overall performance of the federal revenue collection process and find that the entire IRS estimate of the increase in individual noncompliance during 1977-85 is more than accounted for by the decrease in auditing over the same period.

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1. INTRODUCTION

Although there is much that is admitted to be mysterious about the tax compliance process, at least one thing tax policy analysts seem to know for sure: lowering income tax rates induces greater compliance. This "fact" served as an important justification for the dramatic reduction of the top marginal rate from 50 to 28 percent by the Tax Reform Act of 1986, and has been routinely advanced in policy debates by all manner of experts. To take but two typical examples, economists Henry Aaron and Harvey Galper in their recent analysis of tax reform advance only two factors affecting tax compliance, marginal tax rates and complexity, stating that "the increase in the typical marginal tax rate has made tax avoidance increasingly profitable.[1] A different sort of expert, then Commissioner of Internal Revenue, Roscoe L. Egger, Jr., testifying on the President's tax reform proposals, told the Congress:

> "I believe, personally, that there is a very definite mindset on the part of many taxpayers that when the rates reach a particular level, they are going to try to find ways around it, whereas [with] the reduction in those rates, more and more of that particular group feel that it is not worth it.[2]

Commonplace as they are, assertions such as these seem supported more by wishful thinking than by either solid theory or hard fact. Indeed, early theoretical work by economists generated ambiguous predictions about the effects of tax rate changes on compliance, while more recent theoretical work that includes the IRS as an interactive participant in the tax collection process suggests that increasing tax rates will actually *increase* compliance (Graetz, Reinganum and Wilde, 1986). Empirical evidence on the issue is quite limited and largely unreliable (as discussed in Dubin, Graetz and Wilde, 1987). Although we shall report here several empirical findings of interest and discuss their policy implications, the basic purpose of this paper is to provide new evidence regarding the relationship between tax and audit rates and federal income tax compliance.

Our theoretical analysis builds on the game-theoretic model due to Graetz, Reinganum and Wilde (1986), subsequently generalized in Reinganum and Wilde (1986), which includes the tax enforcement agency as strategic participant in the revenue collection process. Our empirical analysis, based upon state-level data taken mostly from *The Annual Reports of the Commissioner of Internal Revenue*, confirms the theoretical prediction of the game-theoretic model that *increases* in tax rates *increase* compliance. This emerges from our analysis of the effect of state tax rates on compliance and from testing the effects on compliance of inflation, which has been directly related to federal tax rate increases through so-called bracket creep.[3] For example, in the years 1971-81, a period of relatively stable federal income tax rates coupled with substantial inflation, the average tax

bracket of individual taxpayers rose from 24.0 to 32.1 percent.

In addition, the time-series nature of our data allows us to investigate the overall performance of the federal revenue collection process during the last decade. Given it's significance in the debates over the 1986 tax reform, we explore, in particular, the relationship between audit rates and tax collections by asking what would have happened to total IRS collections from individuals had the audit rate remained constant at its 1977 level over the period 1977-85. We estimate that total IRS collections would have risen by 47.43 billion dollars in 1985, had the audit rate remained constant at its 1977 level, a figure which in fact exceeds the most current IRS estimate of the fall in compliance during the same period—33.8 billion dollars per year by 1985. Although changes in collections during the last decade necessarily reflect a variety of other factors—notably including the dramatic increases in third-party information reporting and in the IRS's ability to match such information to tax return submissions, as well as the substantial new and increased penalties enacted by Congress in 1981 and 1982—this finding confirms the prominence of audit rates in the tax compliance process. Our estimates imply that the entire estimated increase in individual noncompliance during 1977-85 is more than accounted for by the decrease in auditing over the same period, other things equal. These results have obvious and important policy implications, and generally confirm an economic approach to tax noncompliance: taxpayers do seem to respond rationally, even predictably, to the nature of the tax lottery confronting them. Notwithstanding the vocal claims of commentators to the contrary, the integrity of the tax system does not seem to have been seriously at risk due to massive shifts in taxpayers' behavior during this time.[4]

We are not only able to estimate the total decrease in IRS collections from individuals due to the fall in audit rates over the period 1977-85, but we are also able to separate that estimate into an amount attributable to the lost additional tax and penalties that would have been collected directly from audits and an amount attributable to general deterrence effects (the decrease in collections from taxpayers, whether or not they are audited, who have reported less taxes due in response to the decreased likelihood of audit).

The remainder of this paper is organized as follows. Section 2 describes the theoretical analysis that yields our prediction of a positive relationship between tax rates and compliance, including the linkage between federal compliance and state tax rates, by developing a game-theoretic model that includes both state and federal tax agencies. Section 3 then describes our data and estimation procedures. Section 4 presents our results on the relationship of state tax rates and inflation rates to federal tax compliance for the years 1977-85, and summarizes other empirical results of general interest, including our findings regarding the effect of audit rates on individual tax collections. Section 5 concludes by discussing the policy implications of these results.

2. THEORETICAL PERSPECTIVE

The modern economic theory of tax compliance began with Gary Becker's 1968 article on the economics of crime. In addition to the basic notion that crime could be explained as a rational decision based on factors such as probabilities of detection and conviction, punishment levels, attitudes towards risk, and the like, the most important aspect of Becker's work was his model of criminal behavior, which treated the enforcement and judicial systems as exogenous. A substantial theoretical literature devoted to taxpayer behavior developed in the Becker tradition, beginning a few

years later with the publication of papers by Allingham and Sandmo (1972) and Srinivasan (1973). The consensus of this literature is that increasing the probability of audit or the penalty rate for underreporting tax liabilities will unambiguously reduce noncompliance, but that little else can be said conclusively regarding the effects on noncompliance of other factors such as income or, especially, tax rates (see, in particular, Yitzhaki, 1974, or more generally, reviews by Witte and Woodbury, 1983; and Cowell, 1985). That this class of models to fails yield an unambiguous prediction regarding the effects of tax rates on noncompliance is noteworthy since, as we have suggested, one of the most widely held "facts" of tax compliance is that lowering tax rates will stimulate increased compliance.

The problem with models developed in the Becker tradition is that they ignore elements of the revenue collection process that need to be incorporated into any reasonable empirical specification of a compliance model. In particular, if audit rates and punishment levels are included as explanatory variables, some account must be taken of their potential endogeneity.[5] From a theoretical point of view, endogenizing audit rates requires formulating a positive model of IRS behavior and integrating it with a positive model of taxpayer behavior.

A game-theoretic model which includes both the IRS and taxpayers was introduced in Graetz, Reinganum and Wilde (1986) and subsequently generalized in Reinganum and Wilde (1986). In these models the IRS is assumed to set audit rates to maximize expected total revenue net of audit costs, taking as given the reporting strategies of taxpayers. In other words, the IRS is assumed not to be able to precommit to particular audit strategies. Tax rates and penalty rates are fixed exogenously. Graetz, Reiganum and Wilde predict, in equilibrium, a positive relationship between tax rates and compliance. This seemingly counterintuitive result has a natural economic explanation. An increase in the tax rate increases the gains to underreporting income, but it also increases the expected costs of underreporting income in two ways. First, an increase in the tax rate increases the penalty for underreporting since fines are typically proportional to unpaid tax. Second, an increase in the tax rate increases the incentives of the IRS to audit since, for a given level of underreporting, it increases the total tax and penalty collected given an audit. On balance—at least in the model analyzed by Graetz, Reinganum and Wilde—the costs of noncompliance associated with an increase in the tax rate outweigh the benefits, so that an increase in the tax rate increases compliance. We will refer to this effect as the GRW hypothesis.

That federal tax rates might be positively related to compliance is an important possibility, but, because of its counterintuitive nature, one which requires empirical verification. Moreover, it is strongly suggestive of other testible relationships that have important policy consequences. In particular, it raises the question whether state income tax rates have a systematic effect on federal compliance levels. The existence of such a linkage is not obvious, but the question is especially important given the recent efforts of state and federal agencies to coordinate their enforcement activities.

Forty-three of the fifty states currently have income taxes. In all these states there is substantial overlap between the information relevant for federal and state income tax computations. Direct federal-state relationships are common, and, in fact, many states now "piggy-back" their income taxes on the federal tax law. Taxpayers can be expected to coordinate their reports of relevant tax items, including, for example, income and deductions, on their federal and state income

tax returns, and they likely will perceive there to be a connection between the probability of audit for state and federal tax underreporting. Moreover, both state and federal returns are filed subject to the threat of penalties for perjury as well as for tax fraud. Taxpayers will rightly expect therefore that inconsistencies in their reporting between federal and state returns will increase the risks of imposition of the harsher penalties for tax noncompliance that depend on the government's ability to prove that the taxpayer's understatements were willful.[6] It is, therefore, reasonable to assume that a strong correlation will exist between taxpayers' underreporting on federal and state returns.

There is also a direct linkage between the activities of state and federal audit agencies. Congress and state legislatures have explicitly provided for exchanges of otherwise confidential tax return and other tax information between the states and the IRS "to increase tax revenues and taxpayer compliance and reduce duplicate resource expenditures."[7] District directors of the IRS are instructed to be personally involved in this state-federal cooperative program and to serve as liaison with state tax authorities. The IRS Manual explicitly directs the use of data available from state agencies "wherever possible." Tax returns and information reports are "exchanged on a continuing basis," including magnetic tape data from the IRS's individual master file.[8] In fact, third party information reporting for both state and federal purposes may now be accomplished by a single filing with the IRS of data in a magnetic media format. Although at the beginning of the Coordination of Tax Information program information typically travelled in one direction—from the federal to state agencies—in recent years, the flow of information from the states to the IRS has been of dramatically increasing importance. In addition, disclosure of federal tax return information to state lawyers pursuing tax cases is now governed by the same standards that apply to IRS disclosures to attorneys of the federal Department of Justice.

Agreements on the exchange of tax information also explicitly provide that state tax enforcement agencies and the IRS "will develop cooperative return selection and examination programs" to avoid duplicative efforts.[9] The IRS and cooperating states now routinely, for example, synchronize certain audit decisions. Currently 49 states and the District of Columbia have agreements on the coordination of tax information and audits with the IRS.

The model which follows incorporates into the basic game-theoretic model introduced by Graetz, Reinganum and Wilde state, as well as federal, tax agencies and coordinated state and federal reporting strategies by taxpayers. A relationship between state tax rates and federal compliance emerges that is similar to that of the original GRW hypothesis, viz., that an increase in state tax rates increases compliance at the federal level.

In this model income takes one of two values, I_L or I_H, where $I_L < I_H$. The probability of high income is q. Denote $I_H - I_L$ by Δ. For simplicity assume taxpayers are risk neutral, and all act strategically; that is, whenever a taxpayer has high income, he reports low income on both his state and federal returns with probability β, where β is set to maximize expected net income, allowing for tax rates, audit probabilities and penalty rates.

To describe the problems facing the state and federal tax agencies we introduce the following notation:

p_i = probability of agency i audit given a report of I_L, $i = s, f$;

q_{ij} = probability of agency i audit given agency j audit, $i \neq j$; $i, j = s, f$;

t_i = proportional tax rate, $i = s, f$;

π_i = penalty rate applied proportionally to evaded tax, $i = s, f$; and

c_i = cost of agency i audit, $i = s, f$.

Tax agencies only audit low income reports. They want to maximize net expected revenue. Given β_s, we have for the state tax agency that

$$R_s(p_s) = t_s I_L + [p_s + (1 - p_s) q_{sf} p_f] \sigma t_s (1 + \pi_s) \Delta - p_s c_s \ , \tag{1}$$

where $\sigma = \beta q / (1 - q + \beta q)$.

In other words, σ is the probability that a low income report comes from a high income taxpayer who has underreported.

The definition of expected state revenue net of audit costs given in (1) assumes the cost of a state audit is zero when it occurs because of a recommendation by the federal tax agency. This assumption is stronger than necessary (what is required is that federal cooperation lowers state audit costs, viz. that it be less than c_s) but it is analytically convenient. It is also implicit in (1) that the federal tax agency only recommends audits to the state tax agency when it actually finds a taxpayer whom it believes to have attempted to understate his federal taxes.

For the federal tax agency we have an analogous revenue function:

$$R_f(p_f) = t_f I_L + [p_f + (1 - p_f) q_{fs} p_s] \sigma t_f (1 + \pi_f) \Delta - p_f c_f \ , \tag{2}$$

The taxpayer minimizes net expected tax payments to the two agencies. Since the taxpayer underreports on both returns or neither, we have:

$$\begin{aligned} T(\beta) = (t_s + t_f) I_H + \beta \Delta \{ & \pi_f t_f [p_f + p_s (1 - p_f) q_{fs}] + \pi_s t_s [p_s + p_f (1 - p_s) q_{fs}] \\ & - t_f (1 - p_f)(1 - p_s q_{fs}) - t_s (1 - p_s)(1 - p_f q_{sf}) \} \ . \end{aligned} \tag{3}$$

Equations (1), (2), and (3) are linear in p_s, p_f, and β, respectively. In order to guarantee an interior equilibrium (one in which $0 < p_s, p_f, \beta < 1$) certain conditions must be met. For example, if c_s and c_f are large enough then the Nash Equilibrium is $p_s = 0 = p_f$ and $\beta = 1$. Assuming the relevant conditions hold, we find p_s^*, p_f^*, and β^* by differentiating (1), (2), and (3), setting the results equal to

zero, and solving. The relevant derivatives are:

$$\partial R_s/\partial p_s = (1 - p_f q_{sf})\Delta(1 + \pi_s)t_s\sigma - c_s \; ; \tag{4}$$

$$\partial R_f/\partial p_f = (1 - p_s q_{fs})\Delta(1 + \pi_f)t_f\sigma - c_f \; ; \tag{5}$$

$$\partial T/\partial\beta = \Delta\{\pi_f t_f [p_f + p_s(1 - p_f)q_{fs}] + \pi_s t_s [p_s + p_f(1 - p_s)q_{sf}] - t_f(1 - p_f)(1 - p_s q_{fs}) - t_s(1 - p_s)(1 - p_f q_{sf}) \, . \tag{6}$$

Interior values of p_s^*, p_f^*, and β^* are given by setting (4), (5) and (6) equal to zero and solving the resulting three equations. It is not possible to obtain closed-form solutions, but we can still do comparative statistics.

Totally differentiating (4) and (5) and simplifying gives, respectively,

$$-q_{sf} t_s\sigma(dp_f) + (1 - p_f q_{sf})\sigma(dt_s) + (1 - p_f q_{sf})t_s\sigma'(d\beta) = 0 \; ; \text{ and} \tag{7}$$

$$-q_{fs}\sigma(dp_s) + (1 - p_s q_{fs})\sigma'(d\beta) = 0 \, , \tag{8}$$

where $\sigma' = d\sigma/d\beta$. Differentiating (6) and simplifying gives

$$\begin{aligned}&[(1 + \pi_f)t_f(1 - p_s q_{fs}) + (1 + \pi_s)t_s(1 - p_s)q_{sf}](dp_f)\\ &\quad + [(1 + \pi_s)t_s(1 - p_f q_{sf}) + (1 + \pi_f)t_f(1 - p_f)q_{fs}](dp_s)\\ &\quad + \{\pi_s[p_s + p_f(1 - p_s)q_{sf}] - (1 - p_s)(1 - p_f q_{sf})\}(dt_s) = 0 \, .\end{aligned} \tag{9}$$

Equations (7), (8) and (9) can be written in the form

$$\begin{bmatrix} 0 & x_{12} & x_{13} \\ x_{21} & 0 & x_{23} \\ x_{31} & x_{32} & 0 \end{bmatrix} \begin{bmatrix} dp_f/dt_s \\ dp_s/dt_s \\ d\beta/dt_s \end{bmatrix} = \begin{bmatrix} 0 \\ y_2 \\ y_3 \end{bmatrix} \tag{10}$$

where

$$x_{12} = -q_{fs}\sigma$$

$$x_{13} = (1 - p_s q_{fs})\sigma'$$

$$x_{21} = -q_{sf} t_s\sigma$$

$$x_{23} = (1 - p_f q_{sf})t_s\sigma'$$

$$x_{31} = (1 + \pi_f)t_f(1 - p_s q_{fs}) + (1 + \pi_s)t_s(1 - p_s)q_{sf}$$

$$x_{32} = (1 + \pi_s)t_s(1 - p_f q_{sf}) + (1 + \pi_f)t_f(1 - p_f)q_{fs}$$

$$y_2 = -(1 - p_f q_{sf})\sigma$$

$$y_3 = -\{\pi_s [p_s + p_f (1 - p_s) q_{sf}] - (1 - p_s)(1 - p_f q_{sf})\} .$$

Denote the determinant of the X matrix in (10) by D. Then

$$D = x_{12}x_{23}x_{31} + x_{13}x_{21}x_{32} < 0 ,$$

and

$$X^{-1} = \frac{1}{D} \begin{bmatrix} -x_{23}x_{32} & x_{13}x_{32} & x_{12}x_{23} \\ x_{23}x_{31} & -x_{31}x_{13} & x_{13}x_{21} \\ x_{32}x_{21} & x_{12}x_{31} & -x_{12}x_{21} \end{bmatrix} \tag{11}$$

But

$$\begin{bmatrix} dp_f/dt_s \\ dp_s/dt_s \\ d\beta/dt_s \end{bmatrix} = X^{-1} \begin{bmatrix} 0 \\ y_2 \\ y_3 \end{bmatrix} \tag{12}$$

so that

$$\frac{d\beta}{dt_s} = \frac{1}{D}(x_{12}x_{31}y_2 - x_{12}x_{21}y_3) = (x_{12}/D)(x_{31}y_2 - x_{21}y_3) . \tag{13}$$

Now $D < 0$ and $x_{12} < 0$ so $sgn(d\beta/dt_s) = sgn(x_{31}y_2 - x_{21}y_3)$. But

$$x_{31}y_2 - x_{21}y_3 = -\sigma\{(1 - p_f q_{sf})[(1 + \pi_f)t_f(1 - p_s q_{fs}) + \pi_s t_s (1 - p_s) q_{sf}]$$
$$+ q_{sf} t_s [p_s + p_f (1 - p_s) q_{sf}]\} < 0 . \tag{14}$$

Therefore $d\beta/dt_s < 0$; as state tax rates rise, compliance with the tax laws (both federal and state) rises.

We also get from (11) and (12) that $sgn(dp_s/dt_s) = sgn(d\beta/dt_s) < 0$. Thus as state tax rates rise, the state audit rate falls. This is made possible by the increase in compliance. Finally, dp_f/dt_s, the effect of increases in state tax rates on federal auditing, is ambiguous since the decrease in state auditing encourages more federal auditing but the increase in federal compliance discourages it.

The crucial new result in our model is that as long as there is a linkage between the likelihood of audit at the state and federal levels, an increase in the state tax rate increases compliance at the federal level. This occurs for precisely the same reasons as those which explain the GRW hypothesis. Thus, besides being of independent interest, if we can demonstrate that compliance with the federal income tax increases with increases in state income taxes, we will have provided indirect

support for the GRW hypothesis. Direct support can be provided by an observed positive relationship between compliance and the rate of inflation; an uncompensated increase in the price level pushes individuals into higher and higher tax brackets without increasing their real income, and is thus equivalent to an increase in the federal income tax rate. We next test for a positive relationship between compliance and inflation, and for the state tax rate effect.

3. EMPIRICAL ANALYSIS

Our empirical analysis focuses on estimation of the relationships between state and federal tax rates and compliance with the federal income tax. We specify a model in which compliance depends on tax rates, the audit rate, per capita income, and other socio-economic variables. We also examine a similar equation which relates total individual collections per return to these factors. We test for a state tax rate effect using the actual average state income tax rate, and for a federal tax rate effect using the inflation rate. Increases in the inflation rate proxy increases in federal taxes since they have pushed taxpayers into higher tax bracket without increasing real income, as discussed in section 2.[10]

A. Data

Our data is drawn from a variety of sources, but the core of our analysis depends on the *Annual Report of the Commissioner of Internal Revenue* for the years 1977-85. These reports include district level data on Internal Revenue Service collections, number of returns filed, amount and number of refunds, number of examinations, total additional tax and penalty recommended after examination, and budgets. The data is further broken down by "class of tax"—individual, corporate, estate, gift, etc., and IRS district. For most states, the whole state is one district. Until 1984 California, Illinois, Ohio, Pennsylvania and Texas each had two districts and New York had four. In 1984 another district was added to Texas and three were added to California. In these cases we aggregate district level data from the annual reports to the state level. All of this data is reported for the government fiscal year, which runs from October 1 to September 30 during 1977-85.

The focus of our present analysis is on compliance with the individual income tax. This tax class includes returns with schedule C or F present (non-farm business or farm) but varies as to whether partnership returns are included. Given the importance of tax shelter investments for tax compliance in the years relevant here, and the reporting of tax shelter losses on partnership returns as well as on Schedules C and E of individual returns, we add partnership returns to individual returns whenever the annual reports do not do so.

Keeping this in mind, we use the following eight primary variables from the annual reports: (1) total collections from individual income and employment taxes;[11] (2) total refunds to individuals; (3) total tax returns filed;[12] (4) number of individual income tax returns filed; (5) number of excise tax returns filed; (6) number of individual income tax returns examined; (7) additional tax and penalties recommended after examination for individual income tax returns; and (8) costs incurred by the Internal Revenue Service.[13]

Using these eight primary variables, we construct eight secondary variables which are those actually used in our analysis. The first three of these are measures of noncompliance.

BANG: total additional tax and penalty recommended after examination for individual returns,

per million individual returns examined, in 1972 dollars.

PBANG: total additional tax and penalty recommended after examination, as a percentage of total collections, for individual returns, per million individual returns examined.

NBANG: total additional tax and penalty recommended after examination, as a percentage of total collections, for individual returns, normalized by the audit rate for individual returns.

BANG is perhaps the most natural of these measures of noncompliance; it is simply the average return per audit. There is, however, an abundance of evidence that suggests that the IRS often uses percentage compliance as an implicit equity criterion. We therefore define two additional measures of noncompliance which are based on the aggregate percentage return from auditing—*PBANG* normalizes total additional tax and penalty as a percentage of total collections by the total number of audits and *NBANG* normalizes it by the audit rate. Other things equal, we interpret an increase in any of these measures as reflecting an increase in noncompliance. The remaining variables constructed from the data published in the *Annual Report of the Commissioner of Internal Revenue* are:

ICR: total collections from individual income and employment taxes divided by the number of individual income tax returns, in 1972 dollars—individual collections per return.

IAR: total individual income tax returns examined as a percentage of the total individual income tax returns filed—the individual audit rate.

BPR: the total costs incurred divided by the total returns filed, in 1972 dollars—budget per return;

PIRF: the total number of individual tax returns filed divided by the total number of returns filed—percent individual returns filed; and

PEXF: the total number of excise tax returns filed divided by the total number of returns files—percent excise returns filed.

We also use a number of socio-economic variables taken from a variety of these sources, and a time trend. These are all reported by calendar year.

STAXR: total state income tax paid as a percentage of total state income—the average state income tax rate,

PERED: percent of the adult population with at least a high school education;

PEROLD: percent of the population over 45;

UR: the unemployment rate;

PICAP: per capita income, in 1972 dollars;

PICAP2: per capita income squared, in 1972 dollars;

PMAN: percent of the workforce employed in manufacturing;

PI: percent inflation (measured by changes in the the consumer price index), common for all states in given year; and

TIME: a pure time trend.

Total state income taxes are taken from *State Government Tax Collections*, 1977-1985, published by the U.S. Department of Commerce. We divide this variable by total state income to get the average state tax rate. But constructing a state tax rate variable in this fashion introduces potential endogeneity. Therefore we use the maximum statutory marginal tax rate, taken from *Significant Features of Fiscal Federalism*, 1977-1985, published by the U.S. Advisory Commission

on Intergovernmental Relations, as an instrument. The latter is clearly exogenous as it represents the top rate for each individual and therefore is not behaviorally determined. Furthermore, it should be highly correlated with the average state tax rate. Indeed, reduced form equations for the state tax rate verify a strong correlation between maximum marginal state income tax rates and measured average state income tax rates. Allowing for the endogeneity of state income tax rates in this way did not affect our estimations (i.e., the appropriate specification tests failed to detect the presence of endogeneity). We thus treat the average state income tax rate as exogenous in the final specifications reported below in 3(B).

The mean values of these variables and their standard deviations are displayed by year in Table 1. The actual values by state by year of *BANG*, *ICR*, *IAR*, *BPR* and *STAXR* are given in the appendix.

B. Estimation

We pool state level data for the years 1977 to 1985 and estimate *BANG*, *PBANG*, *NBANG* and *ICR* as functions of one-year lagged values of *IAR*, *STAXR*, *PERED*, *PEROLD*, *UR*, *PICAP*, *PICAP2*, *PMAN*, *PI* and *TIME* for the years 1978-1985. The estimation is complicated by two considerations that need to be addressed simultaneously. First, as we have discussed, it is likely that the one-year lagged audit rate, *IAR(-1)*, is correlated with the unobservable factors that affect compliance and collections per return. To account for this potential endogeneity we instrument *IAR(-1)* with *BPR*, *PIRF* and *PEXF*. Second, the pooled time series cross-section data may contain a random state effect that induces dependent observations over time. To account for the presence of an unobserved random effect we form the optimally weighted average of between and within group estimates to obtain the so-called random effects estimator. The weighting factor is calculated by a transformation of the estimated standard errors provided by the between and within group estimators. Given the potential endogeneity of the audit rate we use instrumental variables to obtain consistant estimates of the error components. Transformation of the data into Gauss-Markov form then allows us to test for the presence of endogeneity and to construct consistent and efficient estimates of the parameters.[14]

GLS estimation of this type provides more than a gain in efficiency. Not adjusting for random effects, if present, may lead to incorrect inferences regarding endogeneity and the apparent insignificance of some structural effects. In fact, inspection of the residuals obtained using instrumental variables indicates a correlative pattern suggestive of an unobserved individual specific effect.

GLS estimates were obtained by subtracting a fraction θ of the mean value of each variable by state from each observation of that variable within that state. The constant θ is a function of the error variances consistently estimated in the between and within group estimators, with adjustments made for degrees of freedom. For the audit equation, $\theta = 0.269$ while for the collections equation $\theta = 0.715$. In the noncompliance equations, estimates of the error components reveal that the variance of the individual specific effect was negligible in comparison with the non-individual specific variation, so that it was appropriate to set $\theta = 0$ in these models.

Table 2 gives results for the noncompliance equations. In each of these, specification tests due to Hausman (1978) indicate endogeneity of the audit rate. The test statistics were 7.2, 39.6 and 25.9

TABLE 1

Mean Values of Variables by Year
(Standard errors in parenthesis)

	1977	1978	1979	1980	1981	1982	1983	1984	1985
BANG	.66	.66	.71	.70	.83	.96	1.17	1.43	1.58
	(.38)	(.23)	(.22)	(.28)	(.29)	(.31)	(.38)	(.55)	(.77)
PBANG	.59	.58	.56	.57	.59	.62	.74	.90	1.13
	(.70)	(.70)	(.61)	(.72)	(.65)	(.65)	(.77)	(1.04)	(2.25)
NBANG	.41	.42	.41	.42	.46	.53	.65	.79	.85
	(.18)	(.22)	(.16)	(.24)	(.22)	(.22)	(.22)	(.31)	(.55)
IAR	1.90	1.80	1.68	1.68	1.55	1.42	1.38	1.24	1.16
	(.66)	(.59)	(.58)	(.58)	(.46)	(.35)	(.38)	(.38)	(.37)
STAXR	1.66	1.65	1.66	1.61	1.58	1.63	1.70	1.80	1.87
	(1.16)	(1.08)	(1.05)	(1.04)	(1.06)	(1.12)	(1.16)	(1.17)	(1.19)
ICR	1.98	2.03	2.11	2.14	2.26	2.28	2.21	2.24	2.31
	(.75)	(.65)	(.66)	(.68)	(.75)	(.75)	(.73)	(.77)	(.77)
PERED	.67	.67	.67	.67	.68	.68	.67	.68	*
	(.073)	(.074)	(.075)	(.076)	(.077)	(.078)	(.080)	(.081)	
PEROLD	.44	.43	.43	.42	.42	.41	.41	.41	*
	(.039)	(.038)	(.038)	(.041)	(.040)	(.040)	(.045)	(.038)	
UR	.066	.057	.055	.068	.073	.093	.093	.073	*
	(.016)	(.015)	(.014)	(.016)	(.019)	(.023)	(.025)	(.022)	
PICAP	4.82	5.03	5.14	5.14	5.24	5.20	5.28	5.54	*
	(.69)	(.66)	(.65)	(.73)	(.73)	(.80)	(.81)	(.81)	
PMAN	.22	.21	.21	.21	.20	.19	.19	.19	*
	(.089)	(.087)	(.085)	(.082)	(.082)	(.079)	(.077)	(.077)	
PI	.075	.070	.090	.10	.087	.059	.037	.032	*
	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	
BPR	.0050	.0050	.0047	.0045	.0044	.0044	.0048	.0048	*
	(.0013)	(.0014)	(.0014)	(.0014)	(.0012)	(.0012)	(.0013)	(.0014)	
PIRF	.64	.64	.65	.66	.66	.66	.66	.66	*
	(.031)	(.026)	(.027)	(.027)	(.025)	(.026)	(.024)	(.026)	
PEXF	.0090	.0087	.0093	.0079	.0086	.0097	.0088	.0062	*
	(.0040)	(.0037)	(.0040)	(.0031)	(.0037)	(.0034)	(.0037)	(.0031)	

* 1985 values of these variables are not used in the current analysis.

TABLE 2

Instrumental Variables Estimates: *BANG*, *PBANG*, *NBANG*[*]

Independent variable	Dependent variable *BANG*	*PBANG*	*NBANG*
ONE	-14.76	-17.77	-4.9
	(-6.59)	(-2.86)	(-3.64)
IAR(-1)	.59	1.47	.21
	(5.02)	(4.51)	(3.01)
STAXR	-7.75	-.17	-5.83
	(-3.61)	(-2.88)	(-4.49)
PERED(-1)	-.31	4.89	.10
	(-.77)	(4.32)	(.42)
PEROLD(-1)	1.89	-.75	.80
	(2.48)	(-.35)	(1.73)
UR(-1)	.10	-8.61	-3.50
	(9.23)	(-2.73)	(-5.10)
PICAP(-1)	.68	-1.88	-.35
	(2.00)	(-1.98)	(-1.68)
PICAP2(-1)	-5.32	.12	1.93
	(-1.67)	(1.32)	(1.00)
PMAN(-1)	.78	.38	-0.42
	(1.75)	(.31)	(-1.55)
PI(-1)	-5.88	-7.05	-3.20
	(-4.57)	(-1.97)	(-4.10)
TIME	.15	.26	7.87
	(7.65)	(4.65)	(6.48)
Number of observations	400	400	400
Standard error of regression	.44	1.21	.26

[*] *t*-statistics are in parenthesis.

for *BANG, PBANG*, and *NBANG*, respectively, each of which well exceeds the standard significance level for a chi-squared with one degree of freedom (3.8).

Our results on individual collections per return are presented in Table 3. For comparison, both IV and IV-GLS estimates are included, but our subsequent discussion of results is based on the latter. (The chi-squared statistic for endogeneity of *IAR(-1)* in this case was 8.6.) Finally, we present in Table 4 the OLS and GLS estimates of the reduced form for the audit rate equation.

4. *RESULTS*

In this section we summarize and discuss briefly the results given in Tables 2, 3 and 4. The first two of these, concerning the relationships between tax rates and noncompliance, confirm the theoretical model developed in section 2 of this paper. In particular, tax rates, measured either by *STAXR* or *PI*, are positively related both to compliance and collections per return. A more detailed discussion of these and other results follows.

a) *State Tax Rates:* An increase in the average state income tax rate significantly decreases federal noncompliance according to all three measures. Furthermore, it has a significant positive effect on collections per return—a 10 percent increase in the average state income tax rate would have yielded approximately $26 per return at the federal level, measured in 1985 dollars, notwithstanding the deductibility (by taxpayers who itemize deductions) of state income taxes in computing federal income tax.

b) *Inflation Rates:* Like an increase in the state income tax rate, an increase in the rate of inflation decreases noncompliance by all three measures, and significantly so in each case. It also results in a statistically significant increase in collections per return (notably in the IV-GLS estimation but *not* in the IV estimation). A ten percent increase in the rate of inflation would have yielded approximately $27 per return at the federal level, measured in 1985 dollars.

c) *Audit Rates:* The audit rate is endogenous in all of the noncompliance equations and the collections per return equation. As expected, it is influenced significantly by the budget per return, with respect to which it is increasing. Also as expected, it is decreasing in the percent employed in manufacturing. Surprisingly, perhaps, it is independent of income. Finally, it is increasing in the rate of inflation.

We find in all of our noncompliance equations a positive and very significant coefficient on *IAR(-1)*: in equilibrium there is a negative relationship between the audit rate and compliance (recall that *BANG*, *PBANG* and *NBANG* are measures of *noncompliance*). This is because the IRS concentrates its audit activities where it believes compliance is the lowest—what we have elsewhere called the "yield effect" (Dubin and Wilde, 1986). In this case, even if a deterrent effect of audits is present, the yield effect dominates it.[15]

But a deterrent effect of audits may still be present. If so, it would make sense to include *IAR(-1)* in a collections per return equation. Indeed, our estimation confirms that higher audit rates are associated with higher collections per return: on average, for the period 1977-85, a ten percent increase in the audit rate would have generated additional revenue on the order of $87 per return (in 1985 dollars). This is much more than can be accounted for by the increased additional tax and penalty collected as the direct result of the additional audit; i.e., our estimates include a *general* deterrence effect as well as a *specific* yield effect (see section 4(g) below).

TABLE 3

Estimates of *ICR*: IV and IV+GLS*

Independent variable	IV	IV+GLS
ONE	-10.41	-6.59
	(-4.40)	(-4.15)
IAR(-1)	.39	.24
	(3.11)	(2.45)
STAXR	9.78	6.61
	(4.31)	(2.65)
PERED(-1)	-.80	.38
	(-1.85)	(.75)
PEROLD(-1)	1.86	3.02
	(2.30)	(3.14)
UR(-1)	1.97	1.75
	(1.64)	(2.36)
PICAP(-1)	2.69	.81
	(7.46)	(3.20)
PICAP2(-1)	-.18	-1.90
	(-5.42)	(-.85)
PMAN(-1)	2.94	2.73
	(6.25)	(5.48)
PI(-1)	1.02	1.72
	(.75)	(2.98)
TIME	1.96	2.47
	(.92)	(1.68)
Number of observations	400	400
Standard error of regression	.46	.19

* *t*-statistics are in parenthesis.

TABLE 4

Reduced Form Estimates of *IAR(-1)*: OLS and GLS*

Independent variable	*OLS*	*GLS*
ONE	8.45	5.60
	(6.19)	(5.79)
STAXR	-1.80	-1.56
	(-1.06)	(-.82)
PERED(-1)	.31	.19
	(.85)	(.48)
PEROLD(-1)	-1.02	-1.37
	(-1.64)	(-2.01)
UR(-1)	.55	.71
	(.60)	(.80)
PICAP(-1)	-.69	-.35
	(-2.63)	(-1.33)
PICAP2(-1)	5.63	2.55
	(2.33)	(1.06)
PMAN(-1)	-1.51	-1.43
	(-5.07)	(-4.27)
PI(-1)	3.10	2.97
	(2.98)	(3.31)
TIME	-6.62	-6.84
	(-5.38)	(-6.03)
BPR(-1)	2.17	2.22
	(10.80)	(10.48)
PIRF(-1)	-.18	.11
	(-.20)	(.11)
PEXF(-1)	-4.81	1.26
	(-.80)	(.20)
Number of observations	400	400
Corrected R-squared	.61	.59
Standard error of regression	.34	.29

* *t*-statistics are in parenthesis.

d) *Income:* As pointed out above, changes in per capita income have no effect on audit rates. They do, however, have interesting effects on noncompliance. In particular, both *percentage* noncompliance measures (*PBANG* and *NBANG*) decrease with increases in per capita income. But *absolute* noncompliance (*BANG*) increases with increases in per capita income. These results are consistent so long as the elasticity of absolute noncompliance with respect to per capita income is less than one. In fact, it ranges from below one to above one in our data set, and has a value of .66 at the mean.

Increases in per capita income increase collections per return but at a decreasing rate (this effect is so predictable it amounts to a consistency check). Significantly, though, the elasticity of collections per return with respect to per capita income, evaluated at its mean, is 1.95, much more than can be accounted for by increasing marginal tax rates alone.

e) *Other Variables:* The effects of our other socio-economic variables are mixed. The education variable has virtually no effects (except on *PBANG*). An increase in the age variable increases both collections per return and absolute noncompliance, has no effect on percentage noncompliance, and decreases the audit rate. An increase in the unemployment rate increases absolute noncompliance but decreases both measures of percentage noncompliance. It also increases collections per return. It appears this variable may be proxying some regional factors, or, perhaps, has effects analogous to per capita income since it affects the number of low-income filers. Percent employed in manufacturing has no effect on any of the measures of noncompliance, but is positively related to collections per return and negatively related to the audit rate.

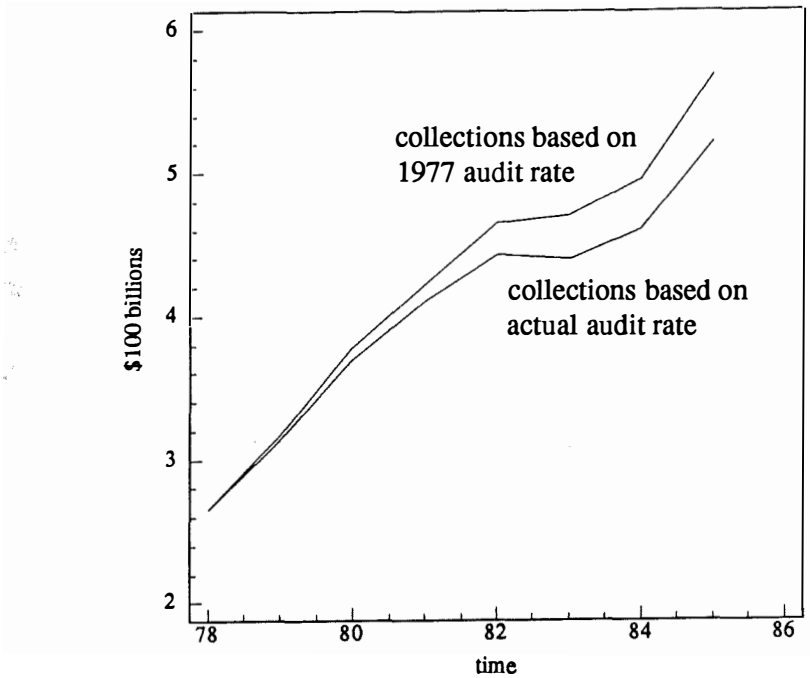
f) *Intertemporal Effects of Declining Audit Rates:* We have conducted some experiments based on our estimates which examine the intertemporal effects of declining audit rates. Using the IV-GLS estimates from Table 3, we have calculated for each year the predicted value of total collections from individual returns that would have been realized had the audit rate remained constant at its 1977 level. These are reported in Figure 1 in comparison to the predicted value of total collections from individual returns given the actual audit rate. By 1985 we estimate that maintaining the audit rate at its 1977 level would have reduced the compliance gap by 20.79 billion 1972 dollars, or 47.43 billion 1985 dollars.[16]

g) *Specific versus General Deterrance:* One of the unique aspects of our study is that it allows us to isolate and estimate the general deterrance aspect of audits. To do this, we first subtract the additional taxes and penalties resulting from IRS examinations from total IRS collections, for each state and each year. We again subtract refunds from this figure and divide by the number of individual returns filed to get a new collections per return variable which does not include the revenue generated by the examinations process. We then repeat our IV-GLS estimation using this as the dependent variable, and calculate a predicted value for the increase in total individual collections for 1985 that would have resulted from holding audit rates at their 1977 levels. This value, $43.46 billion, is 93% of our original estimate, which included the additional tax and penalty resulting from IRS examinations. Thus it represents the *general* deterrance effect of the increase in audit rates.

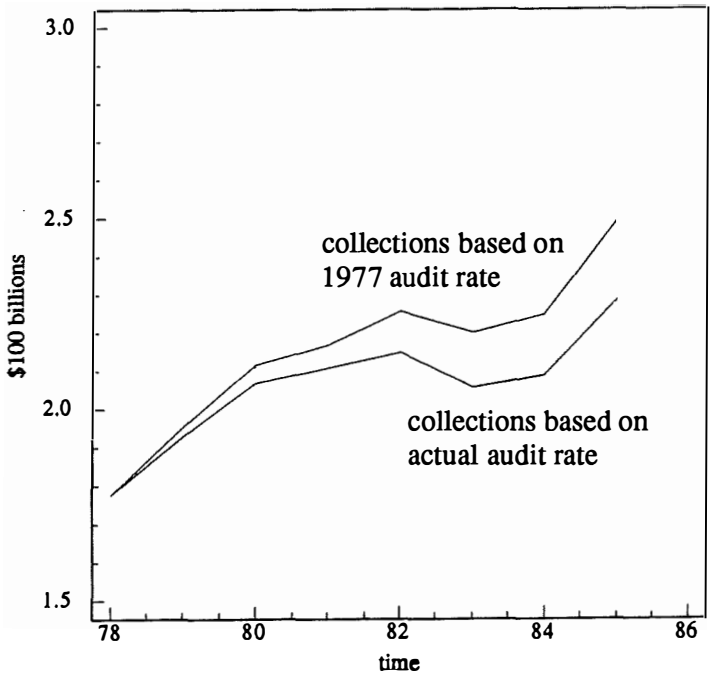
FIGURE 1

Predicted Effects of Declining Audit Rates
on Individual Collections, 1978-85

(*current dollars*)



(*1972 dollars*)



5. POLICY IMPLICATIONS

a) *Tax Rates and Compliance:* Both our theoretical analysis and our empirical findings suggest a *positive* relationship between tax rates and tax compliance; increased tax rates increase compliance. Although there is some empirical evidence that reaches an opposite conclusion[17] and our inferences regarding the effects of changes in federal tax rates are based primarily on the effects of changes in the inflation rate, at a *minimum*, our results counsel extreme caution in urging or adopting policy recommendations on the assumption that increased compliance will automatically accompany tax rate reductions. Notwithstanding the conflict of our findings with the common perception that lowering tax rates will stimulate compliance, we have here adduced strong evidence suggesting precisely the contrary.

b) *Federal-State Relationships:* We have demonstrated an impressive theoretical and empirical relationship between state and federal tax policies and tax enforcement. Our work not only points to the union of state and federal tax administration in improving the efficacy of tax administration at both levels of government, but also suggests the potential existence of a wide range of hitherto unexamined federal and state tax policy connections. These state-federal interrelationships cry out for greater research and policy attention. The federal-state linkages that we have found here confirm the importance of considering the impact of federal policy change on the states and vice versa.

c) *Audit Rates and Compliance:* Our results corroborate the central role of audit rates in compliance process. The impact of the decade-long fall in audit rates on tax collections is serious indeed. The budgetary practice of routinely including IRS audit personnel within a general political philosophy limiting the desired size of government agencies, as has been the practice of the Reagan administration, is enormously costly. Additional dollars spent on tax audits would appear to have tremendous marginal productivity even now, notwithstanding the fact that the federal revenue collection process seems extremely stable over time.

The Senate's version of the 1986 Tax Reform Act would have created a special Tax Administration Trust Fund to ensure increases in IRS enforcement budgets in future years. This proposal was explicitly intended to redress Senators' concerns that the audit rate had fallen by half during the prior decade. The Senate Finance Committee's Report estimated that this trust fund would have produced 17.6 billion dollars of additional revenues in the five fiscal years 1987-1991. These estimates were greeted skeptically and the proposal was not included in the 1986 Act as finally enacted. Our results here confirm the Senate's general intuitions, if not their precise estimates. Further efforts seem warranted to develop legal or institutional mechanisms to protect IRS audit capacity. It has not only been ironic, but also foolhardy in the extreme, to cut back on such an obviously effective compliance tool as audits at the same time as Congress has been giving the IRS a wide range of new procedural, information gathering, and penalty tools to attack what has been widely described as apocalyptic noncompliance.[18]

d) *Taxpayer Attitudes and Compliance:* Our findings suggest that the widespread claims asserting a major role in the increases in federal tax noncompliance in recent years of taxpayer attitudes toward government in general or the tax system in particular may well be overstated. Both our theoretical analysis and our empirical findings convey instead a systematic, and ultimately more calculating, rational explanation for why noncompliance is up.

APPENDIX

TABLE A.1
BANG

State	1977	1978	1979	1980	1981	1982	1983	1984	1985
New York	0.67	0.79	0.77	0.60	1.04	0.94	1.61	1.88	1.91
Maine	0.38	0.55	0.47	0.51	0.54	0.55	0.64	1.08	0.99
Massachusetts	0.92	0.63	1.03	0.61	0.71	0.95	1.43	1.31	1.14
Vermont	0.33	0.72	0.46	0.49	0.49	0.59	0.53	0.68	0.73
Connecticut	0.41	0.55	0.63	0.47	0.83	0.84	1.74	1.48	1.34
New Hampshire	0.47	0.49	0.88	0.74	1.07	0.66	1.06	1.09	1.72
Rhode Island	0.38	0.76	0.68	0.92	1.81	1.16	1.28	1.41	1.83
Maryland	0.61	0.63	0.64	0.59	0.77	0.97	1.45	1.46	1.26
New Jersey	0.83	0.50	0.61	0.43	0.79	1.03	1.15	1.64	1.70
Pennsylvania	0.63	0.78	0.78	0.80	0.93	1.30	1.47	1.23	1.34
Virginia	0.53	0.64	0.69	0.68	0.72	1.19	1.19	1.26	1.79
Delaware	2.96	0.73	0.63	1.29	0.76	0.67	0.86	0.76	0.77
Georgia	0.55	0.46	0.67	0.60	0.81	0.93	0.99	1.84	1.68
Alabama	0.53	0.56	0.48	0.52	0.47	0.72	0.88	0.86	1.24
South Carolina	0.50	0.49	0.54	0.40	0.53	1.13	1.12	0.80	0.82
North Carolina	0.46	0.56	0.58	0.63	0.60	0.65	0.75	0.83	0.87
Mississippi	0.54	1.08	0.56	0.55	1.22	0.68	0.62	0.93	1.09
Florida	0.81	0.92	1.17	1.09	1.50	2.16	2.15	3.37	2.69
Tennessee	0.61	0.94	0.71	0.56	0.61	0.89	0.68	1.54	1.57
Ohio	0.78	0.65	0.66	0.60	0.63	0.82	0.73	1.16	1.30
Michigan	0.59	0.52	0.72	0.58	0.62	0.78	1.17	1.38	1.90
Indiana	0.58	0.91	0.73	0.77	0.69	1.65	1.29	1.84	1.45
Kentucky	0.63	0.75	0.80	1.51	0.73	0.94	1.28	0.87	0.87
West Virginia	0.96	0.96	0.90	1.59	1.30	1.19	0.97	0.96	1.05
South Dakota	0.55	0.37	0.62	0.44	0.48	0.53	0.87	0.88	0.69
Illinois	0.69	0.65	0.62	0.73	0.96	1.03	1.40	2.42	2.63
Iowa	0.72	0.49	0.61	0.61	0.79	0.76	1.00	1.26	1.21
North Dakota	0.51	0.56	0.56	0.44	0.52	0.68	0.76	0.84	0.70
Wisconsin	0.42	0.50	0.60	0.59	0.73	0.79	0.74	1.17	1.88
Nebraska	0.69	0.50	0.71	0.56	1.05	0.82	0.91	1.41	1.55
Missouri	0.50	0.61	0.72	0.76	0.97	0.99	1.59	2.13	2.10
Minnesota	0.70	0.48	0.54	0.55	0.78	0.74	1.01	0.97	1.08
New Mexico	0.32	0.49	0.58	0.45	0.52	0.57	0.84	0.80	0.93
Texas	0.76	0.75	0.81	0.82	1.12	1.18	2.46	2.02	3.03
Wyoming	0.57	0.71	0.84	1.44	0.94	1.02	1.20	1.70	5.14
Colorado	0.72	0.49	0.64	0.55	0.61	0.86	1.03	2.37	1.36
Arkansas	0.78	0.98	0.68	0.45	0.67	0.56	0.79	1.50	1.03
Louisiana	0.51	0.49	0.68	0.80	0.74	0.87	1.11	1.31	1.60
Oklahoma	0.65	0.87	0.92	0.65	0.96	1.06	1.18	1.44	1.52
Kansas	0.69	0.53	0.65	0.78	0.72	0.99	1.20	1.20	1.10
Alaska	0.63	0.49	0.74	0.71	1.55	1.74	1.90	2.90	3.03
Idaho	0.47	0.53	0.75	0.54	0.69	0.94	1.20	1.22	1.69
Montana	0.47	0.70	0.54	0.95	0.64	1.02	1.08	1.21	1.58
Hawaii	0.60	0.49	0.50	0.57	0.66	0.92	0.96	1.27	1.22
California	0.44	0.45	0.52	0.53	0.81	0.70	1.50	1.84	1.98
Arizona	0.49	0.55	0.74	0.56	0.67	1.20	1.35	2.01	1.41
Oregon	0.62	0.72	0.71	0.58	0.90	1.26	1.25	1.36	1.56
Nevada	1.16	1.73	1.84	1.13	1.18	1.39	1.58	1.98	2.81
Utah	1.13	0.54	0.66	0.67	1.06	1.07	1.23	1.27	1.65
Washington	0.71	0.80	0.86	0.57	0.78	0.95	1.13	1.09	1.36

TABLE A.2
ICR

State	1977	1978	1979	1980	1981	1982	1983	1984	1985
New York	3.07	3.26	3.28	3.49	3.70	3.77	3.75	3.87	3.83
Maine	1.29	1.29	1.32	1.34	1.46	1.43	1.42	1.42	1.47
Massachusetts	2.09	2.18	2.26	2.39	2.60	2.67	2.69	2.80	2.96
Vermont	1.24	1.17	1.34	1.34	1.43	1.48	1.74	1.50	1.60
Connecticut	3.63	2.75	2.93	3.22	4.68	4.36	3.89	3.92	4.03
New Hampshire	1.47	1.57	1.65	1.68	1.84	1.92	1.93	1.97	2.06
Rhode Island	1.83	2.29	2.26	2.25	2.41	2.35	2.19	2.26	2.40
Maryland	2.71	2.94	3.07	3.04	3.30	3.29	3.36	3.58	3.57
New Jersey	3.95	2.72	2.59	2.61	2.47	2.59	2.62	2.87	3.19
Pennsylvania	2.16	2.66	2.65	2.71	2.80	2.73	2.57	2.62	2.69
Virginia	1.53	1.62	1.70	1.72	1.80	1.83	1.85	1.93	2.05
Delaware	3.48	3.87	3.86	3.97	3.16	4.05	4.07	4.24	4.32
Georgia	1.53	1.70	1.75	1.82	1.93	1.88	1.95	2.06	2.19
Alabama	1.43	1.54	1.59	1.57	1.65	1.64	1.64	1.62	1.70
South Carolina	1.24	1.35	1.42	1.43	1.48	1.48	1.45	1.47	1.50
North Carolina	1.53	1.57	1.64	1.66	1.69	1.67	1.68	1.74	1.78
Mississippi	1.05	1.08	1.13	1.12	1.17	1.39	1.19	1.18	1.19
Florida	1.86	1.66	1.78	1.84	1.99	1.93	1.94	2.00	2.07
Tennessee	3.29	1.51	1.58	1.60	1.53	1.71	1.80	1.85	2.07
Ohio	2.53	2.70	2.94	2.73	2.92	2.86	2.77	2.84	2.89
Michigan	2.21	3.12	3.43	3.17	3.27	3.16	3.11	3.41	3.58
Indiana	1.69	2.30	2.31	2.28	2.43	2.43	2.43	2.48	2.53
Kentucky	1.43	1.54	1.58	1.58	1.59	1.61	1.55	1.56	1.64
West Virginia	1.34	1.36	1.40	1.41	1.42	1.49	1.36	1.32	1.38
South Dakota	1.25	1.24	1.31	1.29	1.33	1.35	1.34	1.37	1.35
Illinois	3.96	3.18	3.15	3.26	3.54	3.34	3.19	3.25	3.32
Iowa	1.62	1.63	1.71	1.71	1.74	1.69	1.61	1.59	1.62
North Dakota	1.48	1.44	1.55	1.52	1.75	1.72	1.60	1.54	1.58
Wisconsin	1.85	2.06	2.13	2.15	2.22	2.18	2.05	2.07	2.13
Nebraska	1.88	2.09	2.33	2.34	2.43	2.44	2.40	2.39	2.37
Missouri	2.41	2.79	2.91	2.98	3.09	3.06	3.13	3.09	3.20
Minnesota	2.64	2.81	3.00	3.09	3.21	3.27	3.27	3.28	3.43
New Mexico	1.18	1.33	1.37	1.39	1.44	1.50	1.45	1.44	1.54
Texas	2.32	2.28	2.54	2.49	2.73	2.77	2.63	2.64	2.75
Wyoming	1.47	1.60	1.70	1.79	1.85	1.86	1.60	1.56	1.57
Colorado	1.74	2.92	3.00	3.04	3.28	3.45	3.35	3.20	2.87
Arkansas	1.22	1.27	1.31	1.30	1.35	1.38	1.40	1.46	1.52
Louisiana	1.62	1.86	1.92	2.04	2.21	2.23	2.04	2.00	1.99
Oklahoma	1.72	1.94	2.06	2.44	2.85	2.85	2.47	2.39	2.48
Kansas	1.58	1.93	2.06	2.17	2.27	2.18	2.12	2.20	2.25
Alaska	3.14	2.68	2.54	2.55	2.85	2.97	2.93	2.75	2.79
Idaho	1.73	1.95	1.97	2.00	2.13	2.08	1.95	1.94	1.97
Montana	1.27	1.29	1.35	1.36	1.41	1.52	1.40	1.33	1.35
Hawaii	1.80	1.79	1.82	1.89	1.91	1.82	1.75	1.73	1.76
California	2.31	2.34	2.40	2.54	2.60	2.61	2.57	2.63	2.76
Arizona	1.46	1.66	1.75	1.75	1.76	1.72	1.66	1.73	1.86
Oregon	2.52	1.84	1.99	1.76	2.17	1.98	1.85	1.88	1.95
Nevada	1.90	2.11	2.23	2.25	2.20	2.12	2.04	2.07	2.23
Utah	1.46	1.59	1.65	1.66	1.74	1.71	1.72	1.76	2.06
Washington	1.92	2.14	2.32	2.33	2.40	2.34	2.23	2.21	2.16

TABLE A.3
IAR

State	1977	1978	1979	1980	1981	1982	1983	1984	1985
New York	3.10	2.39	2.24	2.23	2.00	1.63	1.59	1.31	1.29
Maine	1.64	1.30	0.99	1.00	0.92	1.15	1.10	0.83	0.81
Massachusetts	1.48	1.40	1.27	1.40	1.42	1.13	0.90	0.71	0.71
Vermont	2.35	1.84	1.63	1.62	1.27	1.00	1.12	1.14	1.04
Connecticut	1.70	1.22	1.50	1.63	1.40	1.28	1.09	1.23	1.13
New Hampshire	2.28	1.65	1.16	0.99	0.82	0.88	0.96	0.79	0.55
Rhode Island	1.46	1.00	1.05	0.92	0.89	1.08	1.35	1.16	0.74
Maryland	2.16	1.86	1.83	1.84	1.73	1.27	1.15	1.01	1.13
New Jersey	1.85	2.04	1.89	1.85	1.51	1.56	1.53	1.34	1.07
Pennsylvania	1.40	1.54	1.46	1.18	1.20	0.99	0.88	0.81	0.79
Virginia	1.53	1.56	1.57	1.54	1.50	1.23	1.14	0.92	0.94
Delaware	1.34	1.54	1.46	1.59	1.77	1.52	1.31	1.33	1.17
Georgia	2.43	2.41	2.02	1.99	1.62	1.50	1.38	1.23	1.06
Alabama	1.67	2.10	2.26	1.90	1.69	1.58	1.42	1.11	0.98
South Carolina	1.65	1.51	1.56	1.48	1.28	1.08	1.13	0.98	0.95
North Carolina	1.88	1.67	1.59	1.41	1.28	1.24	1.19	1.02	0.92
Mississippi	2.30	2.34	2.20	2.19	1.87	1.49	1.45	1.28	1.35
Florida	2.15	2.12	1.97	1.93	1.61	1.43	1.40	1.38	1.14
Tennessee	1.56	1.50	1.39	1.45	1.61	1.42	1.38	1.16	1.07
Ohio	1.29	1.18	1.12	1.11	1.15	1.11	1.15	0.93	0.90
Michigan	1.55	1.70	1.54	1.37	1.36	1.19	1.11	0.91	0.91
Indiana	1.27	1.12	1.14	0.92	0.84	0.84	0.98	0.70	0.63
Kentucky	1.60	1.35	1.20	1.10	1.25	1.14	1.13	0.85	0.72
West Virginia	1.06	1.09	0.97	0.81	0.97	0.94	1.04	0.95	0.85
South Dakota	2.09	2.01	1.34	1.62	1.77	1.86	1.57	1.41	1.07
Illinois	2.01	1.77	1.66	1.58	1.59	1.40	1.26	1.00	0.91
Iowa	1.46	1.56	1.46	1.53	1.51	1.35	1.14	0.89	0.86
North Dakota	1.59	1.53	1.30	1.84	1.96	1.70	2.05	1.67	1.42
Wisconsin	1.47	1.31	1.01	1.07	0.99	0.91	1.05	0.83	0.73
Nebraska	1.62	1.72	1.46	1.57	1.37	1.62	1.16	1.18	1.03
Missouri	1.78	1.74	1.51	1.34	1.37	1.23	1.10	0.97	0.95
Minnesota	1.68	1.89	1.71	1.61	1.42	1.63	1.43	1.17	1.05
New Mexico	1.62	1.39	1.42	1.65	1.50	1.57	1.39	1.44	1.29
Texas	1.71	1.74	1.59	1.47	1.17	1.18	1.23	1.18	1.33
Wyoming	1.57	1.66	1.56	1.99	1.69	1.76	2.24	1.94	1.67
Colorado	1.81	1.82	1.33	1.69	1.69	1.46	1.45	1.38	1.40
Arkansas	1.66	1.63	1.55	1.51	1.33	1.34	1.31	1.30	1.09
Louisiana	1.63	1.70	1.63	2.04	1.78	1.49	1.28	1.31	1.45
Oklahoma	1.95	1.86	1.57	1.54	1.23	1.15	1.16	1.21	1.41
Kansas	1.89	2.00	1.53	1.56	1.36	1.26	1.16	1.16	1.20
Alaska	3.87	3.61	3.81	4.05	3.14	2.59	2.46	2.43	2.35
Idaho	1.69	1.70	2.02	1.89	1.95	1.58	1.70	1.59	1.56
Montana	1.92	1.54	1.81	1.54	1.68	1.79	1.55	1.37	1.15
Hawaii	1.85	2.09	2.04	2.26	1.87	1.54	1.49	1.39	1.59
California	3.41	3.22	3.26	3.06	2.33	2.05	1.97	1.61	1.70
Arizona	2.52	2.32	2.25	2.23	2.17	1.67	1.61	1.45	1.70
Oregon	1.23	1.15	1.18	1.20	1.28	1.34	1.41	1.36	1.36
Nevada	4.68	4.16	3.51	3.20	2.92	2.44	2.73	2.49	2.22
Utah	1.96	1.96	2.06	2.00	1.91	1.70	1.64	1.97	1.47
Washington	1.47	1.54	1.49	1.59	1.50	1.57	1.43	1.41	1.40

TABLE A.4
BPR

State	1977	1978	1979	1980	1981	1982	1983	1984	1985
New York	0.76	0.71	0.68	0.65	0.63	0.62	0.65	0.65	0.62
Maine	0.49	0.45	0.41	0.38	0.37	0.38	0.38	0.37	0.34
Massachusetts	0.56	0.56	0.54	0.53	0.51	0.49	0.51	0.48	0.48
Vermont	0.56	0.53	0.47	0.45	0.42	0.40	0.42	0.42	0.40
Connecticut	0.47	0.45	0.45	0.41	0.43	0.44	0.47	0.48	0.46
New Hampshire	0.51	0.47	0.41	0.39	0.37	0.38	0.40	0.38	0.36
Rhode Island	0.65	0.64	0.57	0.55	0.52	0.51	0.51	0.46	0.44
Maryland	0.54	0.53	0.50	0.48	0.50	0.49	0.54	0.55	0.54
New Jersey	0.56	0.58	0.51	0.48	0.47	0.47	0.49	0.48	0.46
Pennsylvania	0.48	0.48	0.44	0.41	0.40	0.39	0.42	0.42	0.41
Virginia	0.40	0.38	0.36	0.34	0.32	0.33	0.35	0.34	0.33
Delaware	0.57	0.65	0.59	0.58	0.56	0.54	0.57	0.60	0.54
Georgia	0.53	0.55	0.53	0.52	0.53	0.52	0.59	0.61	0.63
Alabama	0.37	0.38	0.37	0.36	0.35	0.35	0.37	0.37	0.34
South Carolina	0.34	0.34	0.31	0.29	0.27	0.24	0.28	0.29	0.27
North Carolina	0.37	0.37	0.36	0.33	0.32	0.31	0.32	0.34	0.31
Mississippi	0.42	0.41	0.39	0.36	0.35	0.34	0.35	0.39	0.36
Florida	0.47	0.47	0.44	0.40	0.37	0.35	0.40	0.42	0.41
Tennessee	0.36	0.36	0.35	0.33	0.36	0.36	0.41	0.47	0.44
Ohio	0.46	0.45	0.44	0.41	0.42	0.42	0.48	0.49	0.48
Michigan	0.47	0.46	0.44	0.42	0.41	0.41	0.46	0.45	0.42
Indiana	0.38	0.38	0.37	0.35	0.34	0.35	0.40	0.42	0.39
Kentucky	0.40	0.41	0.40	0.37	0.37	0.36	0.40	0.38	0.36
West Virginia	0.45	0.43	0.44	0.42	0.40	0.40	0.44	0.45	0.42
South Dakota	0.48	0.46	0.42	0.43	0.43	0.42	0.43	0.41	0.39
Illinois	0.55	0.52	0.52	0.51	0.52	0.52	0.57	0.57	0.56
Iowa	0.36	0.37	0.37	0.36	0.34	0.33	0.34	0.33	0.33
North Dakota	0.43	0.45	0.39	0.42	0.41	0.40	0.42	0.41	0.41
Wisconsin	0.35	0.34	0.33	0.32	0.31	0.31	0.33	0.32	0.32
Nebraska	0.44	0.47	0.44	0.43	0.41	0.38	0.41	0.40	0.39
Missouri	0.56	0.54	0.52	0.50	0.48	0.48	0.49	0.49	0.49
Minnesota	0.46	0.49	0.48	0.46	0.44	0.43	0.42	0.42	0.42
New Mexico	0.48	0.47	0.43	0.40	0.38	0.38	0.40	0.39	0.36
Texas	0.53	0.52	0.50	0.49	0.50	0.50	0.58	0.63	0.62
Wyoming	0.59	0.58	0.50	0.46	0.47	0.49	0.64	0.63	0.60
Colorado	0.49	0.51	0.48	0.45	0.44	0.44	0.51	0.58	0.62
Arkansas	0.45	0.44	0.43	0.40	0.40	0.40	0.43	0.43	0.39
Louisiana	0.45	0.46	0.45	0.42	0.39	0.40	0.44	0.45	0.42
Oklahoma	0.54	0.53	0.50	0.46	0.44	0.43	0.49	0.52	0.50
Kansas	0.42	0.44	0.44	0.42	0.39	0.40	0.43	0.42	0.41
Alaska	1.00	1.12	1.19	1.21	1.05	0.99	1.07	1.06	1.05
Idaho	0.52	0.53	0.52	0.49	0.49	0.47	0.53	0.51	0.48
Montana	0.46	0.46	0.45	0.41	0.39	0.38	0.43	0.43	0.40
Hawaii	0.56	0.56	0.58	0.55	0.52	0.52	0.57	0.58	0.54
California	0.51	0.50	0.47	0.47	0.46	0.47	0.55	0.61	0.58
Arizona	0.47	0.48	0.45	0.42	0.39	0.38	0.44	0.43	0.42
Oregon	0.39	0.37	0.37	0.34	0.39	0.40	0.46	0.45	0.43
Nevada	1.02	0.98	0.89	0.83	0.74	0.76	0.85	0.89	0.84
Utah	0.44	0.45	0.43	0.41	0.41	0.42	0.50	0.54	0.49
Washington	0.44	0.45	0.43	0.41	0.40	0.41	0.48	0.50	0.48

TABLE A.5
STAXR

State	1977	1978	1979	1980	1981	1982	1983	1984	1985
New York	3.39	3.10	3.17	3.20	3.27	3.69	3.60	3.74	4.01
Maine	1.23	1.50	1.47	1.59	1.78	2.03	2.08	2.12	2.33
Massachusetts	2.87	3.10	3.22	3.15	3.18	3.33	3.23	3.31	3.62
Vermont	2.52	2.12	2.33	2.11	2.20	2.28	2.22	2.31	2.45
Connecticut	0.24	0.28	0.27	0.28	0.29	0.32	0.38	0.54	0.55
New Hampshire	0.13	0.15	0.13	0.12	0.13	0.15	0.15	0.17	0.19
Rhode Island	1.66	1.60	2.01	1.72	1.95	2.09	2.35	2.31	2.21
Maryland	2.71	2.70	2.24	2.64	2.08	2.76	2.74	2.77	2.95
New Jersey	1.22	1.21	1.23	1.24	1.27	1.34	1.38	1.54	1.63
Pennsylvania	1.44	1.47	1.55	1.49	1.52	1.53	1.50	1.73	1.70
Virginia	2.04	2.25	2.17	2.19	2.26	2.37	2.30	2.39	2.56
Delaware	3.77	3.86	3.91	3.87	3.85	4.08	4.08	4.10	4.22
Georgia	1.65	1.90	1.91	1.98	2.06	2.19	2.25	2.19	2.49
Alabama	1.28	1.37	1.39	1.37	1.60	1.41	1.52	1.56	1.72
South Carolina	1.81	1.95	2.03	2.18	2.22	2.36	2.40	2.39	2.47
North Carolina	2.41	2.32	2.42	2.56	2.51	2.67	2.60	2.69	2.95
Mississippi	1.11	1.16	1.29	0.90	1.03	0.85	0.95	1.13	1.09
Florida	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tennessee	0.09	0.09	0.08	0.09	0.09	0.11	0.12	0.11	0.12
Ohio	0.82	0.93	0.93	1.02	1.01	1.08	1.64	1.88	2.03
Michigan	2.07	2.20	2.29	2.07	1.99	2.13	2.47	2.98	2.59
Indiana	1.31	1.31	1.27	1.13	1.21	1.37	1.42	1.87	1.92
Kentucky	1.66	1.70	1.77	1.80	1.84	1.83	1.86	1.84	1.95
West Virginia	1.50	1.53	1.56	1.66	1.64	1.79	1.73	2.06	2.54
South Dakota	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Illinois	1.63	1.63	1.59	1.58	1.54	1.61	1.54	1.87	1.59
Iowa	3.13	2.16	2.25	2.21	2.28	2.30	2.34	2.23	2.26
North Dakota	1.36	1.45	0.98	0.93	0.89	0.49	0.44	0.86	0.86
Wisconsin	3.60	3.76	3.48	3.22	3.46	3.28	3.23	3.72	3.31
Nebraska	1.63	1.51	1.60	1.65	1.23	1.34	1.56	1.55	1.57
Missouri	1.23	1.24	1.36	1.38	1.37	1.51	1.61	1.49	1.67
Minnesota	3.42	3.45	3.55	3.16	3.16	3.36	4.01	4.20	3.92
New Mexico	0.38	0.59	0.77	0.46	0.62	0.12	0.12	0.51	0.56
Texas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wyoming	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Colorado	1.83	1.77	1.85	1.59	1.32	1.46	1.63	1.75	2.01
Arkansas	1.40	1.51	1.55	1.92	1.69	1.83	1.87	1.89	1.99
Louisiana	0.58	0.74	0.81	0.69	0.45	0.49	0.50	0.84	1.05
Oklahoma	1.23	1.27	1.41	1.31	1.56	1.78	1.79	1.70	1.81
Kansas	1.27	1.29	1.40	1.43	1.59	1.62	1.81	1.75	1.80
Alaska	4.87	3.37	2.55	1.94	0.12	0.02	0.02	0.01	0.01
Idaho	2.24	2.31	2.15	2.07	2.17	2.54	2.38	2.25	2.46
Montana	2.43	2.24	2.42	1.98	1.88	1.89	1.87	2.03	2.09
Hawaii	3.04	3.11	3.13	3.16	3.07	2.45	2.80	3.05	3.14
California	2.11	2.37	2.12	2.49	2.25	2.40	2.29	2.51	2.83
Arizona	1.29	1.30	1.33	1.20	1.34	1.51	1.52	1.49	1.66
Oregon	3.42	3.62	3.62	3.54	3.77	3.53	4.13	3.92	4.07
Nevada	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utah	2.14	2.18	2.32	2.35	2.33	2.40	2.38	2.40	2.59
Washington	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

FOOTNOTES

1. Aaron and Galper (1985, page 42). Consider also, for example, Thomas Vitez, quoted in the *Wall Street Journal*, April 10, 1984: "The principal reason [for the growing compliance gap] is that inflation is pushing people into higher and higher tax brackets and increasing the pressure to cheat," or Alfred Blumenstein (1983): "Reducing the benefits [of tax evasion] means finding ways to reduce the marginal rate." See generally Graetz and Wilde (1986).

2. Testimony by Roscoe L. Egger in U. S. Congress (1985, page 197). See also pages 186 and 209 where the Commissioner speculates that the increase in revenue from taxpayers in higher income tax brackets following the 1981 reduction in the top rate from 70 to 50 percent was due to greater compliance by persons in those brackets.

3. A recent cross-section study due to Cox (1986), raises the issue of the effect of state income taxes on federal income tax compliance. Using 1979 TCMP data, but controlling only for income, he finds no systematic evidence of an effect of state tax rates on compliance. Crane and Nourzad (1986) attempt to analyze the effect of inflation on aggregate tax evasion over the period 1947-81, concluding that increases in the inflation rate or the marginal tax rate increased tax evasion. Their measure of tax evasion is based on the difference between the Adjusted Gross Income estimate derived by the Bureau of Economic Analysis and that reported by the IRS, their measure of the fine rate is the ratio of additional taxes and penalties assessed by the IRS to the amount of tax evaded, and their measure of true income is the same BEA estimate of adjusted gross income used to construct their measure of tax evasion. Their estimation allows for the simultaniety introduced by the construction of the latter, but not audit rates, fines, or marginal tax rates, the last of which is constructed using a technique similar to that of Clotfelter (1983). It is therefore unlikely that their results are reliable. See also note 17, below.

4. For example, Vitez (1983, pp. 191) has remarked that: "the dramatic deterioration in compliance levels witnessed thus far, if not reversed quickly and forcefully, will gain further momentum and eventually erode, beyond repair, the integrity of our present income tax system."

5. This is a point which the empirical literature on crime, in contexts other than tax law, has taken into account (see, e.g., Pyle, 1983), but in the empirical literature on tax compliance has either been ignored (e.g., Witte and Woodbury, 1985) or improperly dealt with (e.g., Clotfelter, 1983).

6. Persons who willfully violate the tax laws, may be subject to criminal prosecution. The most frequently used criminal provisions in the Code are § 7201, which provides that willfully attempting to evade or defeat any tax is a felony punishable by a fine of up to $100,000 ($500,000 for a corporation) or imprisonment for a maximum of five years, or both; § 7203, which provides that willful failure to file a return, supply required information, keep required records, or pay tax due is a misdemeanor punishable by a maximum fine of $25,000 ($100,000

for a corporation) and by imprisonment for a maximum of one year; and § 7206, which makes it a felony punishable by a maximum fine of $100,000 ($500,000 for a corporation) and by imprisonment for a maximum of three years to file a return that the taxpayer does not believe to be true and correct as to every material matter. Section 7201 requires the government to prove a substantial tax deficiency, but §§ 7203 and 7206 do not.

7. Internal Revenue Service, Manual, *Disclosure of Information Handbook*, § (33) 00.

8. Internal Revenue Service, Manual, *Disclosure of Information Handbook* § (33) 42.2.

9. Id. at Exhibit (33) 00-1, Section 5.1 (Draft Agreement on Coordination of Tax Administration).

10. We have constructed an average marginal tax rate variable for the aggregate U.S. using the procedures described by Barro and Sahasakul (1983). The Internal Revenue Service publishes in *Statistics of Income* and *Statistics of Income Bulletin* tables which classify the number of returns by highest marginal tax rate on each return for the aggregate U.S. (state-level breakdowns of this data are not available). We weight each marginal rate by the percentage of returns in that class. The outcome ranges from 18.69 to 21.81 percent in the years 1977-85, and takes on common values for all states in a given year. It was insignificant in all our models and therefore dropped in the final specifications reported below in section 3(B).

11. This variable includes any additional tax and penalty collected as the result of examinations.

12. Prior to 1981 virtually all nonprofit organizations filed in Delaware. Starting in 1981 they began to file in the district of primary activity. We have therefore subtracted nonprofit returns filed from total returns filed (the former amounts to less than 2 percent of the latter). Also, prior to 1981 "declarations of estimated tax" were recorded as one entry per year for any taxpayer filing a declaration of estimated tax in any quarter. Starting in 1981 each quarterly form was counted as one entry, increasing the number of declarations of estimated tax by approximately a factor of four. We have adjusted "total returns filed" for 1981-85 to account for this.

13. We have ignored the approximately one to two percent of "examinations" that take place at seven "regional service centers," each of which covers six to eight states. Thus "number of returns examined," "additional tax and penalty," and "costs" include only the district level figures from the annual reports. Also, Tables 9 and 10, covering "number of returns examined" and "additional tax and penalty," were discovered to have their headings reversed in the 1981 *Annual Report of the Commissioner of Internal Revenue.*

14. Within-group estimation or equivalently fixed-effects does not account for variation across states and is therefore not fully efficient. This last point notwithstanding, we have performed specification tests on the fixed-effects models and have detected the continued presence of endogeneous audit rates. This suggests that at least some portion of the endogeneity of the

audit effect is due to its correlation with the unobserved non-individual specific error. This precludes the use of other estimation methods which might seem to be appropriate in this context, including, for example, that suggested by Hausman and Taylor (1981).

15. The theoretical model of section 2 yields an ambiguous prediction regarding the effect of inflation (i.e., higher tax rates) on auditing. That we see a positive coefficient on *PI* in the *IAR(-1)* regression, however, is consistent with the fact that with respect to audits, the yield effect dominates the deterrent effect in our noncompliance regressions: in other words, the IRS seems to be optimizing better than taxpayers.

16. To put this 47.43 billion dollar figure into perspective, it should be kept in mind that the average audit rate fell from 1.9 percent to 1.24 percent over this period, and the gain in revenue from holding it constant at its 1977 level amounts to 8.6 percent of total individual collections in 1985 (net of refunds). The standard error of this estimate is 19.39.

17. Using individual return data and the results of actual IRS audits conducted as part of the 1979 IRS Taxpayer Compliance Measurement Program (TCMP), Clotfelter (1983) attempts to explain underreported income as a function of effective marginal tax rates, after-tax income, wages as a proportion of adjusted gross income, interest and individuals as a proportion of adjusted gross income, and several socio-economic variables. But Clotfelter ignores audit rates because of potential simultaneity problems, and constructs a measure of the effective marginal tax rate, based on taxpayer return characteristics and the relevant marginal state income tax rate, which is both *ad hoc* and itself potentially endogenous. Thus, even though Clotfelter finds a negative relationship between his measure of the effective marginal tax rate and compliance, we regard his results as far from conclusive.

    Alexander and Feinstein (1986), using 1982 TCMP data, also find negative effects of marginal tax rates on compliance. Tax rates enter in their model through the probability of detection. Their equation for the latter is assumed to be independent of their compliance equation, which leads them to estimate a recursive rather than simultaneous system. Their approach is therefore analogous to treating audit rates exogenously and therefore suffers the same criticism of the earlier aggregate studies. In addition, Alexander and Feinstein's analysis ignores the role of state taxation which we have demonstrated here to be an important determinant of Federal compliance.

18. Even though the Tax Administration Trust Fund was not included in the 1986 Tax Reform Act, it now appears IRS enforcement efforts are on the rise. In fact, the IRS recently has projected an audit rate of 1.47 percent for fiscal year 1987, based on the employment of an additional 2,500 auditors (*L.A. Times*, April 16, 1987).

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