

Criminal Investigation Enforcement Activities and Taxpayer Noncompliance

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This article tests empirically whether measurable activities of the IRS Criminal Investigation Division (CI) affect taxpayer compliance. The analysis is based on a state-level cross-section for the time period 1988 through 2001. First, it finds that CI activities have a measurable and significant effect on voluntary compliance. Second, it concludes that the mix of sentenced cases (for tax and money laundering violations) is not a significant determinant of tax compliance. Third, it finds that incarceration and probation (rather than fines) have the most influence on taxpayers. Simulations using the estimated models show that the direct effect of doubling the audit rate on assessed tax collections (reported amounts and additional taxes and penalties) is \$21.7 billion. Doubling CI tax and money laundering sentences is forecast to increase assessed collections by \$16.0 billion. It estimates the general deterrence or spillover effects from either audit or CI activities to be approximately 95 percent.

Keywords: *tax evasion; personal income tax; panel data, econometrics*

1. Introduction

Recent estimates from the Internal Revenue Service (IRS; 2006) indicate that the annual tax gap (i.e., the difference between taxes owed and taxes paid on a timely basis) was \$345 billion for tax year 2001. Of this amount, IRS enforcement activities and late payments recovered about \$55 billion, leaving a net tax gap of \$290 billion. According to the IRS, roughly \$197 billion of the tax gap was attributable to individual taxpayers, nearly triple the level estimated in 1985.¹ Although the tax gap has grown, the IRS's ability to audit and enforce the tax code has diminished. For instance, in 2002, the IRS had roughly 13,000 revenue and tax agents devoted to examination, a decrease from the 18,000 agents

employed in 1995. Next to these numbers, the Criminal Investigations Division of the IRS (CI) appears small. In 1970, CI had approximately 2,500 agents; by 1998, the number of CI agents had increased to 3,000 agents. Due to the increases in the tax gap, it is important to reassess the role played by examination in taxpayers' voluntary compliance and to ascertain what effect CI investigations play in general deterrence.

The empirical approach used in this article follows Dubin, Graetz, and Wilde (hereafter, DGW; 1987, 1990b). The DGW method can determine both specific and general deterrence effects of CI activities, as well as the effects of audit rates on taxpayer compliance. Although the general deterrence effects provided by audits have been widely acknowledged, the IRS has never reported the "spillover" benefits of audits. Spillover benefits are the increase in collections from taxpayers, whether or not they are audited, who report more taxes in response to an increased likelihood of an audit. DGW's principal innovation was to directly estimate taxes due rather than first attempting to construct a noncompliance measure and then extrapolating from noncompliance to revenue. The empirical analysis in DGW was based on two econometric models that were both estimated using a state-level, time-series, cross-section data set for the years 1977-1987, with various measures of compliance specified as a function of audit rates and socioeconomic factors.

The current study's purpose is to answer several basic questions. First, does CI have a measurable effect on voluntary compliance, which includes both civil and criminal tax laws? Second, if CI does have a measurable effect on voluntary compliance, what mix of CI investigations has the greatest influence on voluntary compliance? (CI investigates two broad categories of cases: tax violations and money laundering violations.) A subsidiary inquiry is whether either or both types of cases have an effect on voluntary compliance with the tax laws. Third, do convictions that result in prison sentences affect compliance differently from cases that result in probation?

Author's Note: This research was sponsored in part by the IRS under the project "IRS Criminal Investigation Research: Empirical Analysis of the Impact of CI Activities on Taxpayer Compliance," TIRNO-00-D-0039. James Lin (Pacific Economics Group) provided excellent research assistance. The author thanks Patrick Travers (operations research analyst in CI Research), Peggy Opeka (program analyst in CI Research), Debbie King (director of CI Research), Alan Plumley (economist and technical advisor in IRS Office of Research), Mark Matthews (IRS deputy commissioner for services and enforcement), Colleen McGuire (senior associate, ICF Consulting), as well as seminar participants at the IRS Research Conference. The useful comments of the discussant John Scholz are gratefully acknowledged, as well as the helpful suggestions of the referees and the editor at *Public Finance Review*.

In this article, I empirically test whether CI's measurable activities affect taxpayer compliance.² I extend the original DGW analysis (based on the period 1977-1987) to include factors that measure CI activity. The time period covered in the new model spans from 1988 to 2001. I reach several conclusions. First, CI activities have a measurable effect on voluntary compliance. I find statistically significant results from my measure of CI sentenced cases on general tax deterrence. Second, I conclude that the mix of sentenced cases (for tax and money laundering violations) is not a significant determinant of tax compliance. Attention from the media often plays an important role in disseminating information to the public. In the case of the annual tax gap, the significant magnitude of general deterrence implies that the media play a large role in fostering tax compliance. Finally, I find that incarceration and probation (rather than fines) have the most influence on taxpayers. I also perform simulations to determine the direct revenue (spillover) effect of audits and CI activities. I find that the direct effect of doubling the audit rate on assessed tax collections (reported amounts and additional taxes and penalties) is \$21.7 billion. Further, doubling CI tax and money laundering sentences could increase assessed collections by \$16.0 billion. I estimate the spillover effects from both audit and CI activities to be approximately 95 percent. Doubling the audit rate or CI sentenced cases produced similar increases in total collections.

The remainder of the article is organized as follows. In section 2, I review the empirical tax evasion literature. In section 3, I discuss the process of criminal investigations and potential influences on taxpayer compliance. In section 4, I discuss the methodology, model specification, and econometric issues. Section 5 presents the data, theory, and estimation results. Section 6 presents the results of several simulations, and section 7 offers some conclusions.

2. Literature Review

As discussed by Andreoni, Erard, and Feinstein (1998), and Slemrod and Yitzhaki (2002), the IRS has made few data sources that can be used to study tax compliance available to researchers. With respect to nonexperimental and nonsurvey data for the United States, there continue to be limited data. There are essentially two data sources. The first data source is the Taxpayer Compliance Measurement Program (TCMP) data. These data have been analyzed by Dubin and Wilde (1988), Witte and Woodbury (1985), and Beron, Tauchen, and Witte (1993) for tax year 1969. These

papers were important empirical studies on audit effects and compliance because they demonstrated the endogeneity of audit rates and positive compliance effects from audits in certain audit classes. Subsequently, Dubin et al. (1992) used the 1979 TCMP data to study tax return preparation decisions by taxpayers. Recently, Mete (2002) combined TCMP surveys conducted by the IRS for several tax years to study the interaction among taxpayers, the IRS, and political ideology.

The second data source is based on time-series cross-sectional information available by state and year. Measures of audit activity, taxes assessed, and taxes collected are taken from the annual reports of the commissioner of the IRS. For instance, DGW (1990b) used IRS audit data and taxpayer information measured at the state level throughout a ten-year period to analyze taxpayer noncompliance. Ali, Cecil, and Knoblett (2001) also relied on data taken from the annual reports. Their analysis was based on annual data from 1980 through 1995 (i.e., sixteen observations at the national level). Giles and Caragata (2001) presented an aggregate analysis similar to that of DGW (1990b). Their study analyzed the ratio of the hidden economy to GDP and the ratio of tax revenues to GDP.³

Plumley (1996) extended the analysis in DGW (1990b). His time-series cross-section analysis covered the period from 1982 to 1991, whereas the DGW study used data from 1977 to 1987. Importantly, Plumley was the first to show that CI activities (measured as criminal convictions obtained per million people) were significant and positively related to compliance.⁴ Few studies, however, have focused on the role of criminal investigation enforcement and taxpayer noncompliance.

3. IRS Criminal Investigations

The main role of the IRS Criminal Investigation Division is to investigate alleged violations of the tax and money laundering statutes. CI has focused its activities for some time on narrowing the tax gap. Tax gap investigations include both tax and money laundering cases that involve tax issues. Tax gap investigations normally do not include illegal activity associated with narcotics investigations.⁵ CI tax investigations are so-called *legal source* tax crimes because they encompass all cases involving tax violations in which the income derives from legal activity, including questionable refund schemes, return preparer cases, excise tax cases, employment tax cases, and frivolous filers and nonfilers. CI also investigates *illegal source* financial crimes and narcotics-related financial crimes.

The CI is literally the IRS's criminal investigation arm and is the only federal agency with the power to investigate potential criminal violations of the U.S. Tax Code. CI's tax cases sometimes result from referrals by the IRS's civil arm. During an audit or tax investigation, a case might be referred to the CI for criminal investigation.⁶ Audits are not, however, the sole source for tax-related cases. CI may investigate a tax case resulting from a special agent's work in the field, from a referral from another agency (e.g., the FBI, Customs, or U.S. Attorney or DOJ), from informants, as part of the grand jury process, or as a result of refund fraud-related activity.

Although the IRS can investigate and audit tax returns and recommend civil penalties, CI has the exclusive responsibility and authority to investigate tax fraud and to recommend prosecution for willful and egregious tax code violations. CI's role as a tax crimes agency expanded in 1970 under the Bank Secrecy Act (BSA) and has been further expanded during the last thirty years to include narcotics investigations and money laundering violations. Money laundering cases often result from the record-keeping requirements established in the BSA.⁷

Money laundering activity and tax activity can be closely related. Money laundering activity (i.e., activity involving illegal income sources) is often a precursor to tax evasion. As such, it is sometimes difficult to determine whether a case is primarily tax related. CI has been able to classify its cases in terms of whether they are primarily related to tax or money laundering. CI has further classified cases according to whether they are both tax and money laundering cases, tax cases only, money laundering cases only, or neither. For this study, I treat any case with a tax-related component as a tax case and any case with a money laundering component as a money laundering case.⁸

A criminal investigation case proceeds in several steps. Generally, cases subject to investigation are either recommended for prosecution or dropped. If a case is recommended for prosecution, then the U.S. Department of Justice (DOJ) or U.S. attorney may proceed with the case, and the U.S. attorney either issues an indictment or declines to prosecute. Indicted individuals may be acquitted, have their case dismissed, or be convicted. If a conviction is obtained, then the individual is sentenced. In this study, I analyze CI activities from the perspective of cases recommended for prosecution and from the perspective of successfully prosecuted cases in which the defendant was sentenced. Cases recommended for prosecution represent the outcomes of the CI procedures and protocols. The DOJ may or may not process these cases, depending on the nature of the case or resource constraints at the DOJ. In most cases in which there is an

indictment, defendants will be found guilty and will be sentenced. The impact on compliance can be experienced whenever publicity is received. This may include the coverage of an issued search warrant, an indictment, a plea, or a conviction. Media coverage acts as a form of indirect contact with the general public and provides the greatest amount of exposure for CI activities.

4. Model Specification and Econometric Issues

As discussed above, this study updates and extends DGW (1990b) to examine the role of CI activities on taxpayer noncompliance. The DGW empirical analysis was based on three models that were estimated using a state-level, time-series cross-section. One model specified reported taxes per return filed as a function of audit rates and a variety of socioeconomic control variables. The second model used assessed taxes per return (combining reported taxes with additional taxes and penalties) as the dependent variable. The final model specified returns filed per capita as a function of the same variables. DGW selected explanatory variables for this system of equations based on two considerations: the size of the tax base and taxpayers' compliance behavior. Clearly, some factors affect both the tax base and taxpayer compliance. In general, this effect may lead to ambiguous predictions for the a priori signs of some regression coefficients. Taxpayers confront three options: to file a return and report honestly, to file a return and underreport taxes, or not to file a return. Deterrence theory maintains that factors that either reduce the benefit or increase the costs of filing a return and underreporting taxes will increase the likelihood of selecting one of the other options. Variables related to compliance behavior either reflect opportunities to evade (e.g., more educated or savvy taxpayers) or the enforcement activity of the IRS (e.g., examination and criminal prosecution). With respect to variables that relate to the tax base, any change that increases the tax base (e.g., shifting taxpayers above minimum reporting requirements or into higher tax brackets) will increase reported taxes and the number of returns filed. In addition to updating the DGW models, a specific objective of this study is to augment the list of compliance factors to measure the nature and extent of CI activities.

Individuals face a complex decision process with respect to criminal activity. An individual may be deterred from tax evasion, money laundering, or other criminal acts based on the likelihood of being caught. This deterrence possibility has been the empirical paradigm of modern criminal

analysis. In this approach, a potential criminal may be deterred from committing a crime due to the high probability of being caught and the sufficiently severe penalties that follow. Of course, not all individuals are rational actors with respect to the crimes they commit. A rational calculus applied to crime and punishment is, however, a benchmark test and provides policy makers with justification for increasing enforcement levels or changing the enforcement mix. Ultimately, the manner in which individuals respond is an empirical matter. Thus, I assume that individuals consider the likelihood that they will be detected and punished.

With respect to civil audit examination, a measure such as the audit rate may be significant to a potential tax evader because it measures the probability that the taxpayer will be subjected to an audit. In the current setting, the natural analogue to the audit rate is the rate at which CI investigations commence or the rate at which CI recommends prosecution. Prosecution rates are, in fact, quite small for individual taxpayers. These prosecution rates may be orders of magnitude smaller than the individual audit rate. A compounding factor is that not all cases recommended for prosecution lead to indictments, and not all indictments lead to sentencing. In contrast, the audit rate leads to an audit whether or not there is recommendation for a change in the taxpayer's liability. Focusing on sentenced cases produces an exposure measure closer to the audit rate but results in a factor that, in relative magnitude to the population at large, is quite small. In addition, as a matter of general deterrence, individuals are likely to respond to the probability of detection. The question remains as to how they learn the rates at which they are likely to be caught. Attention from the media would seem to be the most likely forum through which taxpayers become aware of the likelihood that their crimes will be detected. Therefore, successfully prosecuted and sentenced cases that receive some media attention would appear to be most relevant to the question raised above. Finally, taxpayers may be concerned only with sentences that result in incarceration or probation as compared to monetary fines. Thus, the subset of sentenced cases that result in nonmonetary fines may be relevant.

Taxpayers may respond to the probability of an audit in a rational calculus that affects their decision to file a tax return or the degree to which they file an honest and correct return. This theory is known as deterrence theory in the literature. It has also been persuasively argued that taxpayers may react to the actions of other taxpayers, especially as those actions concern notions of fairness and support for their decisions to voluntarily comply with the law. This theory of taxpayer behavior is known as

assurance theory (Roth, Scholz, and Witte 1989; Scholz 1998; Scholz and Lubell 1998a, 1998b). Models of conformity and social dynamics (Durlauf and Young 2001) postulate that the utility of a given decision may in part be determined by the expected actions of others. Models of social dynamics bridge the deterrence and assurance theories of taxpayer compliance. Manski (1993, 1995), however, has shown that for linear models with aggregate data, there is an inherent identification problem that may not allow the theoretical issue to be resolved empirically.⁹

As an empirical matter, many nonexclusive measures of CI enforcement activity could have significance. Among the choices are separating tax and money laundering cases, separating media cases from nonmedia cases, and the sentencing mix. With three types of CI cases (tax, money laundering, and other) and of media (*yes* versus *no*, or type of coverage), and at least three sentencing outcomes, variables that can measure CI activities quickly expand relative to the years and geographic locations available for analysis. My approach simplifies the relevant set of CI factors as much as possible while considering specifications and models that would allow a full picture to emerge. The final econometric models include variables for the total number of CI tax and money laundering sentences, the percentage of tax and money laundering sentences that do not receive prison or probation outcomes, and the percentage of CI sentenced cases that are related to tax and money laundering.

Three econometric issues deserve further discussion. First, I focus on CI cases that ultimately receive sentences because the fraction of all cases that CI recommends for prosecution and that are eventually sentenced is quite large and has been growing for some time.¹⁰ Second, I treat CI activities as exogenous on both theoretical and empirical grounds. CI activity is largely a result of cases discovered and selected for examination that arise independently of tax gap or noncompliance issues. Therefore, it is reasonable to treat CI factors exogenously in the reporting and filing econometric equations. In addition, Hausman specification tests for endogeneity of the CI enforcement factors did not reveal endogenous behavior.¹¹

Finally, there is the issue of model dynamics. The model of DGW (1990b) is a steady-state equilibrium relationship that assumes that all effects are in long-run equilibrium. As audit rates change, however, taxpayers can change their behavior and modify their reported taxes due. It may appear reasonable to assume that reported taxes in a given year react to audit rates that prevail in that year (or in the year prior, as DGW specified). The typical IRS audit cycle may not, however, initiate an audit for several years following the filing of a tax return. Taxpayers, in this situation, must react to their

expectation of future audit rate levels. Alternatively, the additional taxes and penalties reported in a given tax year may, to some degree, depend on the audits of tax returns from previous years. Hence, additional taxes and penalties may be a function of past audit rate levels. Finally, taxpayers may change their reported taxes to continuously adjust to a new target level. Among some taxpayers, there may be the perception that a rapid or discontinuous change in behavior may be a signal to the IRS of an existing or current tax problem. This group may adjust its reported taxes based on a mixture of taxes reported in the previous year and the optimal level of taxes due based on existing or current conditions.

The DGW model may be written as follows:

$$Y_{it} = X_{it}\beta + Z_{it}\gamma + \varepsilon_{it} \quad (1)$$

where

Y_{it} = reported taxes at time t and for state i

X_{it} = endogenous factors (audit rates) measured at time t and for state i

Z_{it} = exogenous factors (tax rates, family size, age distribution, etc.) measured at time t and for state i

ε_{it} = random (unobserved) component of the model β and γ unknown coefficient vectors to be estimated.

DGW (1990b) estimated this panel data structure using state-level and time-series data. They assumed that audit rates were endogenous and further assumed a random error components structure for ε_{it} with $\varepsilon_{it} = \mu_i + \xi_{it}$, where μ_i is a random effect specific to the state and ξ_{it} is a random effect that is time and state specific. This error structure leads to temporal correlation of the observations for each state (due to the persistent and random μ_i) and is optimally estimated using generalized least squares. It is possible to generalize this structure by introducing a Koyck-Nerlove partial adjustment. In this case, equation (1) becomes

$$Y_{it} = \lambda Y_{it-1} + X_{it}\beta + Z_{it}\gamma + \varepsilon_{it} \quad (2)$$

Although equation (2) permits richer dynamics, its estimation is complicated by the endogeneity of Y_{it-1} in the equation. Ordinary least squares estimates are inconsistent, in the panel context, when lagged values are included. The lagged variables are correlated with the current values of the residuals ε_{it} as they are determined in part by the random component μ_i (e.g., μ_i determines Y_{it} and Y_{it-1} to the same degree). This situation is similar to the problem of estimating a nonpanel dynamic model when the

residuals are autoregressive. A consistent estimator transforms the equation of interest (2) by first differencing and then using instrumental variables. In this study, I generalize the model of DGW using the model of Anderson and Hsiao (1981); see also Anderson and Hsiao (1982), Arellano (1989), and Arellano and Bond (1991).¹² The empirical results indicate that a short-term dynamic is most likely at work, with the majority of adjustment occurring within two to three years after a change in tax policy. Interestingly, this period of time for adjustment and audit expectation formation naturally corresponds to the audit cycle itself.¹³

5. Data, Theory, and Empirical Results

The DGW analysis was based on data reported in the annual report of the commissioner of internal revenue for the years 1977-1987. These reports include district-level data on IRS collections, number of returns filed, amount and number of refunds, number of examinations, total additional tax and penalties recommended after examination, and budgets. As discussed further below, the DGW econometric models were not structurally stable for time periods before and after 1988. In addition, many of the key CI compliance factors were not available for the period prior to 1988. Thus, the data used in this study are a compilation of annual tax enforcement, criminal investigation, and socioeconomic for each U.S. state from 1988 to 2001.¹⁴ I discuss the data used in this study in the following order: dependent variables, the IRS audit rate, instrumental variables used for consistent estimation of the audit effect, CI enforcement factors, and socioeconomic control variables.

5.1. Dependent Variables

The dependent variables are (1) assessed liability per return (*ALR*): reported individual income tax plus additional tax and penalty recommended after examination divided by the number of individual income tax returns filed, in 1972 dollars; (2) reported taxes per return (*RTR*): reported individual income tax divided by the number of individual tax returns filed, in 1972 dollars; and (3) returns per capita (*RCAP*): reported total individual income tax returns filed divided by total population. The average values for these factors are shown in table 1. Generally, returns filed per capita rose only slightly in this period, whereas assessed and reported taxes per individual return filed rose steadily.

Table 1
IRS Data Means Table (by year)

Time	Variable	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
ALR	Assessed income tax liability per individual returns filed (real 1972 dollars in thousands)	1.3237	1.3219	1.3414	1.2661	1.3171	1.3492	1.3794	1.4423	1.5307	1.5419	1.6054	1.7001	1.7881	1.6103
BPR	Budget per return	0.0050	0.0056	0.0054	0.0055	0.0056	0.0055	0.0051	0.0043	0.0059	0.0044	0.0042	0.0040	0.0038	0.0040
DIR_EXAM	Direct examination time	0.4113	0.4796	0.5045	0.4945	0.5075	0.4942	0.4955	0.4920	0.5281	0.5414	0.4954	0.4438	0.3951	0.3689
FAMSIZ	Family size (household per capita)	0.3690	0.3712	0.3698	0.3712	0.3729	0.3717	0.3707	0.3729	0.3750	0.3759	0.3769	0.3832	0.3794	0.3805
FRMFAM	Farms per household	0.0132	0.0130	0.0128	0.0125	0.0123	0.0126	0.0124	0.0123	0.0122	0.0121	0.0120	0.0119	0.0115	0.0114
IAR2	Audit rate	0.8260	0.8024	0.6630	0.6565	0.6575	0.6644	0.7347	0.6686	0.5936	0.5804	0.4240	0.2802	0.1814	0.1453
M_TOT	% of total sent related to money laundering	0.0438	0.0382	0.0968	0.2153	0.2773	0.3409	0.3269	0.3380	0.3245	0.3565	0.3829	0.3981	0.3713	0.3715
MNEL_M	% of money laundering sent neither to prison nor on probation	0.0498	0.0299	0.0361	0.0369	0.0211	0.0172	0.0082	0.0058	0.0065	0.0137	0.0026	0.0008	0.0025	0.0056
PER65	R of population older than 65	0.1220	0.1233	0.1245	0.1254	0.1261	0.1268	0.1270	0.1274	0.1275	0.1273	0.1271	0.1268	0.1254	0.1254
PERED	% of adults with a high school diploma	0.6750	0.7775	0.7629	0.7935	0.7935	0.8134	0.8191	0.8284	0.8288	0.8315	0.8397	0.8472	0.8548	0.8532
PICAP	Personal income per capita	6.3051	6.4846	6.5244	6.4449	6.5718	6.5938	6.7295	6.8278	7.0119	7.1812	7.5278	7.6773	7.9734	8.0826
PMAN	% of employed persons in manufacturing	0.1561	0.1542	0.1521	0.1480	0.1453	0.1438	0.1423	0.1416	0.1391	0.1382	0.1375	0.1344	0.1304	0.1252
PSEVR	% of employed persons in service	0.2110	0.2187	0.2260	0.2303	0.2366	0.2422	0.2468	0.2538	0.2602	0.2664	0.2731	0.2803	0.2823	0.2853
PWELFAM	% of families on welfare	3.5723	3.5669	3.7808	4.1465	4.3705	4.1813	4.4054	4.1064	3.7413	3.2288	2.4384	2.0238	1.7598	1.6771
RCAP	Individual income tax returns filed per capita * 1,000	0.4630	0.4651	0.4666	0.4665	0.4604	0.4603	0.4637	0.4689	0.4754	0.4776	0.4814	0.4738	0.4773	0.4771
RTR	Reported income tax liability per individual returns filed (real 1972 dollars in thousands)	1.3120	1.3108	1.3288	1.2537	1.3047	1.3366	1.3667	1.4310	1.5172	1.5323	1.5991	1.6955	1.7846	1.6061
STAXR	State tax rate	3.9934	4.0200	4.0782	4.2448	4.3870	4.3930	4.4156	4.4302	4.4506	4.4806	4.5504	4.5416	4.5542	4.5096
T_TOT	% of total sent related to tax	0.8057	0.7724	0.7374	0.6445	0.6202	0.5263	0.5218	0.5046	0.5802	0.4728	0.5418	0.4879	0.5154	0.4825
TNEL_T	% of tax sent neither to prison nor on probation	0.0295	0.0236	0.0310	0.0471	0.0240	0.0191	0.0086	0.0147	0.0279	0.0088	0.0081	0.0074	0.0273	0.0047
TOTTM	Total sentences (tax and money laundering only)	40.08	37.28	39.54	46.90	44.58	50.88	52.76	44.52	46.40	48.34	50.60	42.14	40.38	34.64
UI	Unemployment rate	0.0549	0.0515	0.0545	0.0646	0.0686	0.0632	0.0563	0.0519	0.0515	0.0471	0.0434	0.0411	0.0389	0.0453

Source: Author

5.2. IRS Enforcement Factors

The audit rate is defined as individual audit rate (*IAR2*)—reported total individual income tax returns examined divided by total individual income tax returns filed—and is treated endogenously.¹⁵ The dramatic decline in the individual audit rate (*IAR2*) between 1977 and 1987 was followed by an equally staggering decline during the subsequent twenty years. Indeed, audit rates fell from 1.88 percent in 1977 to 0.83 percent in 1988. The decline continued through the end of the analysis period, until the individual audit rate was less than 0.15 percent in 2001.¹⁶ Meanwhile, individual returns filed per capita (*RCAP*) grew steadily throughout the twenty-five-year period by 20 percent, or 0.8 percent per annum, but has grown only modestly during the past decade. As a compliance factor, the audit rate is expected to be positively related to tax reporting and return filing because an increase in the likelihood of apprehension lowers the net benefit of filing a fraudulent return. It is, however, theoretically and empirically fundamental that the audit rate be treated endogenously in the system of equations. Consistent estimation of the audit affect requires good instruments that are correlated with the audit rate but plausibly uncorrelated with taxpayer compliance.

5.3. Instrumental Variables

I extended the budget per return variable (*BPR*)—reported total IRS budget divided by total returns filed, used in the DGW study—and added a new instrument. The IRS published the IRS budget per individual return filed until 1999. The budget (in real 1972 dollars) reached its peak of \$5.62 per return in 1989. This growth was likely a consequence of the Tax Reform Act of 1986 (TRA).¹⁷ The budget per return subsequently underwent a significant decline, however, dropping to \$3.96 per return by 2001.¹⁸

The IRS provided a measure of the total available resources devoted to examinations (*DIR_EXAM* [direct examination]: percentage of all examiners' time allocated to direct examination of the returns).¹⁹ This percentage further refines the budget variable described above; it should be highly correlated with audit activity but nevertheless is exogenously set by the IRS in any fiscal period as it corresponds to the planned examination activity.²⁰ Beginning in 1980 with a state average of 64.4 percent, the direct examination percentage fell to 41.1 percent by 1988. Although the percentage of time devoted to examinations rose somewhat through 1997 (to 54.1 percent), the pattern from 1997 to 2001 had been to reduce direct examination time (measured at 36.9 percent in 2001).

5.4. CI Enforcement Factors

CI provided detailed information about sentenced cases and cases recommended for prosecution, including media coverage and sentence type (typically, probation or prison).²¹ The sentence counts were first broken down by the crime committed and then further distinguished using the sentence's punishment (prison or probation). My analysis begins with those CI cases that were sentenced.²² Sentenced cases can arise as a result of a pure tax investigation, a pure money laundering investigation, a combination of both tax and money laundering investigations, or something not related to either tax or money laundering.²³ Finally, sentenced cases may have received recommendations for prison, probation, or some other fine or penalty.

Total CI sentenced cases ranged between 2,133 and 3,157 during the period from 1988 to 2001. There is, however, some evidence of a recent decline in the total cases that CI has sentenced. For instance, tax cases of this type have declined fairly steadily from 1988 to 2001 from 1,876 cases per annum in 1988 to 899 cases in 2001. Conversely, money laundering cases have risen from 132 cases per year in 1988 to a high of 1,170 cases per annum in 1994. There are approximately 900 such cases conducted per year at present. Total CI cases related to tax or money laundering (*TOTM*) ranged from 35 to 53 per year per state, as shown in table 1.

On a percentage basis, these patterns are quite dramatic. The number of CI tax cases as a percentage of total CI cases (*T_TOT*) fell from 80.6 percent in 1988 to 48.3 percent in 2001. Meanwhile, money laundering cases rose from just 4.4 percent of all CI cases (*M_TOT*) to 37.2 percent by 2001.²⁴ With respect to the way cases are disposed, tax cases that received prison sentences averaged 1,037 per annum from 1989 to 1998. After 1998, there was a decline to 726 cases per annum in 2001. The number of tax cases that received probation fluctuated around 1,300 cases per annum from 1988 to 1998. In 2001, the amount declined to 811 cases per annum. Money laundering cases receiving prison sentences increased dramatically from 80 cases per annum in 1988 to 1,041 cases per annum in 1994. There was an average of 863 cases per annum in the subsequent years from 1995 to 2001, with 785 cases per annum in 2001. Money laundering cases receiving probation followed a very similar pattern, rising from 68 cases per annum in 1988 to 727 cases per annum by 2001.

Dramatic increases in prison sentences are evident when comparing the number of cases receiving prison sentences to the number of returns examined. The prison sentence rate is, however, still more than 100 times smaller than the audit examination rate for individuals.²⁵ The percentage of

CI tax cases not receiving prison or probation (*TNEI_T*) has generally declined in the 1988 through 2001 period. In 1988, roughly 3 percent of tax cases received fines of some sort (rather than prison or probation sentences), and this rate declined to less than 0.5 percent by 2001. The percentage of money laundering cases receiving neither prison nor probation outcomes (*MNEI_M*) showed similar declines in this period.²⁶

5.5. Socioeconomic Factors

I follow DGW by constructing several socioeconomic explanatory variables, all reported on a calendar year basis: average state income tax rate (*STAXR*): total state individual income tax paid as a percentage of total state personal income; *PERED*: percentage of the adult population with at least a high school education; *PER65*: percentage of the adult population older than sixty-five; *UI*: the unemployment rate; *PICAP*: income per capita, in 1972 dollars; *PMAN*: percentage of the workforce employed in manufacturing; *PSERV*: percentage of the workforce employed in the service industry; *FRMFAM*: farms per household; *FAMSIZ*: households per capita; and *PWELFAM*: percentage of all households on welfare. These explanatory factors are assumed to be exogenous, and appear as control variables in both the filing and collections equations. The variables primarily related to the tax base are *PER65*, *FAMSIZ*, and *PWELFAM*. The variables related to both the tax base and taxpayers' compliance behavior are *UI*, *PICAP*, and *STAXR*. The variables primarily related to the taxpayers' compliance behavior are *PERED*, *PMAN*, *PSERV*, and *FRMFAM*. The effects of these variables are somewhat ambiguous. For example, an increase in *PER65* may be correlated with larger deductions, causing reported taxes to fall. Conversely, simplification in the types of income categories for those older than sixty-five (*PER65*) may raise compliance and reported taxes. An increase in the percentage of households on welfare should increase reported taxes per return because it effectively eliminates a portion of the lower tail of the income distribution. Meanwhile, increases in *FAMSIZ* (households per capita) are associated with fewer opportunities for deductions, leading to higher reported taxes. Conversely, increases in *FAMSIZ* may be associated with simplified returns and greater tax compliance. Increases in *UI* and *STAXR* are expected to cause reported taxes to fall, because the former leads to lower taxable income whereas the latter increases deductions. Increases in *PICAP* are expected to increase reported tax collections. Finally, the percentage of the population with a high school education (*PERED*) is thought to be positively associated with tax noncompliance (lower reported tax)

because the educated are better equipped to play the tax lottery. Increases in farms or individuals in service industries were argued to be positively associated with tax noncompliance in DGW. Changes in tax law and major shifts in employment patterns, however, make these arguments less germane to the 1988-2001 period.²⁷

Most of the explanatory factors appeared to continue the trends discussed in DGW. First, the percentage of families on welfare (*PWELFAM*) rose to a peak of 4.4 percent in 1994 but declined to 1.68 percent by 2001. This decline may have been due to welfare reform enacted in the Personal Responsibility and Work Opportunity Reconciliation Act of 1996 (PRA). Welfare cases necessarily fell when fewer individuals qualified for welfare under the PRA. In addition, the number of farms per household (*FRMFAM*) continued to show a decline during the analysis period, reflecting fewer farms in the United States and a larger number of households. Unemployment (*UI*) has generally declined, with the exception of the recession that took place during the early 1990s and the increase in unemployment that occurred in 2001. Personal income in real terms (*PICAP*) rose steadily from 1988 through 2001. From the early 1980s forward, the state tax rate (*STAXR*) grew fairly steadily from 3.99 to 4.51 percent. The percentage of the population older than sixty-five (*PER65*) showed a relatively modest growth during the period. The percentage of employed individuals in manufacturing (*PMAN*) declined from just higher than 15.6 percent in 1988 to roughly 12.5 percent by 2001. The percentage of employed individuals in service industries (*PSERV*) increased from 21.1 percent in 1988 to nearly 28.5 percent in 2001. This pattern continues the trends described in the original DGW study. The importance of manufacturing and service industry employees may have changed, however, because compliance and collections associated with these sectors have shifted since the original 1977-1986 study of DGW.

5.6. Empirical Results

The original DGW model used data for the years 1977-1986. Adding data for later years more than doubled the observations. The overall explanatory power of the model fell, however, in the period spanning from 1988 to 2001. This change, coupled with changes in the signs for some factors, suggests that the period after 1988 was different from the earlier period in significant ways.²⁸

Focusing on the period after 1988, the reestimated models show some sign changes in the coefficients on socioeconomic factors, including a

shift in the roles played by manufacturing and service industries. Because these effects were previously understood in terms of the possibility for individual noncompliance and opportunities to evade, it is more likely that TRA changes in IRS policy focused on service industry geographies or that a change in the relative economic conditions of these two sectors explains the change in predicted compliance.

Several empirical experiments showed that CI factors have statistical significance when considered as counts. Little significance remains, however, when these counts are expressed as rates. Although a theoretical justification may be made for using rates as estimates of probabilities, and although probabilities are motivated by the theoretical criminology and economics literature, the empirical finding is that CI *rates* reveal low correlation with compliance. The finding that absolute counts matter, however, suggests that general deterrence may result from the overall level of CI activity rather than the rate at which these investigations take place. This interpretation affirms the assurance theory of CI activity.

In table 2, I present the estimated econometric models for reporting and tax return filings. I also include the reduced form equation for the endogenous audit rate (*IAR2*) to demonstrate the significance of the selected instrumental variables. These models replicate the DGW specification but add additional factors for CI enforcement, use new instrumental variables, and update the time period. As the table shows, the IRS budget per return filed is a very significant factor in determining the audit rate. Also, the instrument for exam time devoted to direct examination is significant and positive in the audit reduced form. This finding implies that in districts and time periods with larger resources devoted a priori to examination, the audit rate is relatively greater. This result is clearly logical and was expected.

The updated models show that audit rate effect remains statistically significant under an instrumental variables generalized least squares (IV-GLS) estimation and continues to demonstrate a positive role for the audit rate.²⁹ As the IRS audit rate increases, compliance and reported taxes similarly increase. The effect of audits on filings reveals a new finding, however. DGW had argued that increases in the federal audit rate decrease the benefits and increase the costs of filing a return and underreporting taxes due. DGW expected (and found) that an increase in the audit rate decreased returns filed per capita. My results for the post-1987 period seemingly contradict the findings of DGW pre-1988. Compliance theory predicts, however, that either returns filed would decline or returns filed would increase with greater compliance. My results indicate that the latter situation is now in effect—increases in the audit rate lead to greater levels

Table 2
Econometric Model Summary

Variable	ALR	RTR	RCAP	IAR2
Constant	0.5101 (1.443)	0.5525 (1.567)	0.1712 (4.308)	2.0831 (4.207)
% of families on welfare	0.0021 (0.251)	0.0022 (0.262)	-0.0003 (-0.36)	0.0514 (3.984)
State tax rate	-0.0076 (-1.30)	-0.0076 (-1.30)	-0.0024 (-3.08)	-0.0198 (-2.58)
Personal income per capita	0.3216 (18.33)	0.3209 (18.34)	0.0118 (6.029)	-0.0986 (-4.37)
Family size	-3.2702 (-3.24)	-3.3619 (-3.34)	0.6035 (5.452)	-0.6773 (-0.46)
Farms per household	-0.7826 (-0.43)	-0.6027 (-0.33)	-0.3616 (-1.23)	4.4182 (1.895)
% of adults with high school diploma	-0.5224 (-3.73)	-0.5352 (-3.84)	0.0311 (2.404)	-0.9447 (-3.87)
% of population older than 65	2.8583 (2.884)	2.8748 (2.903)	-0.3649 (-2.68)	-4.6331 (-3.71)
% of employed persons in manufacturing	-0.4492 (-1.46)	-0.4534 (-1.48)	0.1925 (4.982)	-0.9959 (-2.39)
% of employed persons in service	0.3364 (0.839)	0.3733 (0.934)	-0.0092 (-0.21)	1.0260 (1.819)
Unemployment rate	-3.0195 (-5.21)	-3.0728 (-5.33)	-0.2194 (-4.41)	0.4603 (0.440)
Audit rate	0.1980 (4.161)	0.1804 (3.811)	0.0216 (5.029)	—
Direct examination time	—	—	—	1.1848 (6.167)
Budget per return	—	—	—	22.5861 (9.237)
Total sentences (tax and money laundering only)	0.000508 (2.073)	0.000490 (2.006)	-0.000026 (-0.97)	-0.000043 (-0.12)
% of total sent related to tax	0.0450 (1.199)	0.0427 (1.145)	0.0014 (0.449)	-0.1729 (-2.57)
% of total sent related to money laundering	0.0400 (0.915)	0.0367 (0.846)	0.0039 (1.056)	-0.3162 (-4.24)
% of tax sent neither to prison nor on probation	0.0157 (0.167)	0.0027 (0.029)	0.0120 (1.533)	-0.4579 (-2.70)

(Continued)

Table 2
(Continued)

% of money laundering sent neither to prison nor on probation	-0.3808 (-4.66)	-0.3611 (-4.44)	-0.0203 (-2.92)	0.9522 (8.205)
Number of observations				700
Years				1988-2001
Instrumental variables generalized least squares (IV-GLS) estimation				

Source: Author

of compliance and a greater number of honestly prepared returns. Several of the socioeconomic variables were found to lack statistical significance in the 1988-2001 period. These include factors for the percentage of families on welfare (*PWELFAM*), the percentage in service and manufacturing (*PSERV* and *PMAN*), and the percentage of farm households (*FRMFAM*). The explanatory variables for the percentage of the population with at least a high school education (*PERED*), and for per capita income (*PICAP*), state tax rates (*STAXR*), and unemployment (*UI*), are all statistically significant with hypothesized effects. The percentage of the population older than sixty-five (*PER65*) and family size (*FAMSIZ*) are also statistically significant, but with signs that differ from those determined in the 1977-1987 period. These effects are nonetheless consistent with deterrence theory as discussed above.

Finally, I examine the CI enforcement effects. Based on preliminary investigations, I aggregated prison and probation cases, and constructed a factor for the percentage of sentenced cases not receiving prison or probation. I find that the number of CI sentences related to tax or money laundering (*TOTM*) has a statistically significant positive effect on reporting. The mix of such cases (*T_TOT* and *M_TOT*), however, was not found to be statistically significant. In addition, variables that measure the percentage of cases not receiving either probation or prison (*TNEI_T* and *MNEI_M*) show that additional fines for money laundering cases increase noncompliance.³⁰

I conclude from these final specifications that CI activity has a statistically significant effect on tax compliance. Although, however, I have found that sentenced cases that do not receive prison time or probation lead to lower compliance levels, I am not able to find a specific mix of tax and money laundering cases that would raise compliance over existing levels.³¹

6. Simulations

I perform two basic simulations to determine the direct revenue (spillover) effect of audits. Following the methodology established in DGW, I calculate a predicted value for the increase in total assessed liability for a particular year that would result from a doubling of the audit rate. I also calculate the effect of this audit rate change on reported liabilities (excluding additional taxes and penalties resulting from IRS examinations). The difference between the two estimates represents the direct revenue effect of the increase in audit rates. DGW estimated that the spillover effects of audits produce six out of every seven dollars of additional revenue.

In these simulations, a change in the audit rate (and, later, the levels of CI activity) leads to two measurable effects. First, the change in audit rate causes assessed liabilities and reported liabilities to increase. Let $dALR$ denote the change in assessed liability per return for a change in the audit rate of $dIAR$. Similarly, let $dRTR$ denote the change in reported tax liability per return for the same change in the audit rate $dIAR$. DGW called $dALR$ the total revenue effect (because it includes both reported amounts and additional taxes and penalties) and called $dRTR$ the indirect effect. The direct effect of audits is defined as $dALR - dRTR$. Because $ALR - RTR$ is a measure of additional taxes and penalties, $dALR - dRTR$ is simply the change in additional tax and penalties resulting from the audit change. Consequently, it is the direct effect. DGW defined the spillover measure as the ratio $dRTR / dALR$. It measures the percentage of total change that occurs from general deterrence resulting from the change in the audit rate.

I consider several experiments. In some cases, I double individual components such as the audit rate or the number of tax sentences or money laundering sentences. For marginal effects, I increase the enforcement factors by 5 percent. The simulations are shown in table 3. To understand the results, consider the simulation in which audit rates are doubled. The first row of table 3 shows that estimated assessed tax collections would rise to \$963.4 billion from \$941.5 billion in 2001; the \$21.8 billion change is the total revenue effect. These estimates also show that reported tax collections rise by \$20.47 billion; this change is the indirect effect of doubling the audit rate. The difference between these two estimated differences is approximately \$1.356 billion and represents the direct revenue effect. This amount is 93.8 percent of the total revenue effect.

Using the same model, I find that doubling CI activity (tax and money laundering cases) leads to \$15.30 billion in increased reported taxes,

**Table 3
Results from Revenue Simulation**

	Estimated Assessed Tax Collections			Estimated Reported Tax Collections			Actual Reported Collections (G)	% of Estimated Reported Difference and Actual Reported Tax Revenue (F/G) (H)	% of Estimated Reported Difference and Estimated Reported Tax Revenue (F/E) (I)	% Change in Estimated and Assessed Reported Tax Revenue (C-F)/F (J)	Indirect Revenue Effect (L)	Indirect Revenue Effect/ Total Revenue Effect (L/[K + L]) (%) (M)	
	Modified Amount (A)	Original Amount (B)	Difference (A-B) (C)	Modified Amount (D)	Original Amount (E)	Difference (D-E) (F)							
	(A)	(B)	(C)	(D)	(E)	(F)							
IRS1 audits doubled	\$963,310.94	\$941,600.50	\$21,710.44	\$959,942.75	\$939,588.56	\$20,354.19	\$882,128	2.3	2.2	6.7	\$1,356.25	\$20,354.19	93.75
IRS1 audits increase 5%	\$942,679.88	\$941,600.50	\$1,079.38	\$940,600.69	\$939,588.56	\$1,012.13	\$882,128	0.1	0.1	6.6	\$67.25	\$1,012.13	93.77
IRS1 total sentences doubled	\$957,619.19	\$941,600.50	\$16,018.69	\$954,893.94	\$939,588.56	\$15,305.38	\$882,128	1.7	1.6	4.7	\$713.31	\$15,305.38	95.55
IRS1 total sentences increase 5%	\$942,409.69	\$941,600.50	\$809.19	\$940,361.81	\$939,588.56	\$773.25	\$882,128	0.1	0.1	4.6	\$35.94	\$773.25	95.56

	Amount before Change (A)	Amount after Change (B)	Difference (B-A) (C)	Direct Change in Revenue (D)	Indirect Change in Revenue (E)	Total Change in Revenue (D+E) (F)	Direct Revenue Change per Audit or per Sentence (D/C) (G)	Indirect Revenue Change per Audit or per Sentence (E/C) (H)	Total Revenue Change per Audit or per Sentence (F/C) (I)						
										Amount before Change (A)	Amount after Change (B)	Difference (B-A) (C)	Direct Change in Revenue (D)	Indirect Change in Revenue (E)	Total Change in Revenue (D+E) (F)
										(A)	(B)	(C)	(D)	(E)	(F)
IRS1 audits doubled	403,340	201,670	201,670	\$1,356,250,000.00	\$20,354,187,500.00	\$21,710,437,500.00	\$6,725.10	\$100,928.19	\$107,653.28						
IRS1 audits increase 5%	211,753,4844	201,670	10,083,48438	\$67,250,000.00	\$1,012,125,000.00	\$1,079,375,000.00	\$6,669.32	\$100,374.53	\$107,043.85						
IRS1 total sentences doubled	3,464	1,732	1,732	\$713,312,500.00	\$15,305,375,000.00	\$16,018,687,500.00	\$411,843.24	\$8,836,821.59	\$9,248,664.84						
IRS1 total sentences increase 5%	1,818,59985	1,732	86,59985	\$35,937,500.00	\$773,250,000.00	\$809,187,500.00	\$414,983.40	\$8,928,999.30	\$9,343,982.70						

Source: Author

\$16.01 billion in increased assessed tax revenue, and a direct revenue increase of \$0.714 billion. Hence, I measure the spillover effect to be approximately 96 percent. Importantly, doubling CI activity or the IRS audit examination rate leads to similar revenue increases and implies similar levels of increased general deterrence.

The marginal analysis is reported in table 3. For instance, the second row of table 3 (lower section) shows that increasing the audit rate by 5 percent leads to 10,083 additional audits and increases total revenues by \$1.085 billion. The marginal effect is the increase in total revenue of \$1.085 billion divided by 10,083 audits, or roughly \$107,632 per audit in specific and general deterrence. The direct revenue effect is an increase of \$67.25 million, or \$6,669 per audit. The simulation in which the audit rate was doubled (table 3, row 1) leads to an increase of \$21.8 billion of additional total revenue and corresponded to 201,670 additional audits. These numbers average out to be \$6,724 per audit, a figure not dissimilar from that obtained in the marginal simulation with a 5 percent increase. In contrast, doubling CI sentenced cases (table 3, row 3, lower section) leads to 1,732 additional cases and \$16.0 billion in additional revenue. This corresponds to \$9.25 million per additional sentenced case in specific and general deterrence.

There are two important conclusions from this analysis. First, the spillover effect of audits and CI enforcement is quite large and generally estimated to be greater than 95 percent. Second, an increase in IRS examination activity could have important fiscal impacts and make a large contribution toward reducing the tax gap. I find no evidence, however, that correspondence audits have made up for the decline in face-to-face tax audits. This result may be due to the limited time period during which I was able to measure the correspondence audit rate. Based on these results, whether an IRS policy shift in enforcement is warranted depends on the relative costs and benefits of increasing audits and CI enforcement levels. I turn to these issues below.

7. Conclusions

This article has updated and extended the original DGW state-level taxpayer compliance analysis from the period 1977 through 1987 to the period 1988 through 2001 while introducing new measures of CI enforcement activity. First, I find that CI activities have a measurable effect on voluntary compliance. I have found statistically significant results from my measure of CI sentenced cases on general tax deterrence. Second, I

conclude that the mix of sentenced cases (tax and money laundering) is not a significant determinant of tax compliance (perhaps because the mix has been already optimally set). Most importantly, I find that CI activities have a measurable effect on voluntary compliance, especially incarceration and probation (rather than fines). Based on these results, it would seem that an emphasis on prison and probation time should be encouraged.

Indeed, it is not too speculative to suggest that the IRS could double its audit rate without doubling its organizational size. Clearly, the IRS has not shrunk in size in the same proportion that audits have declined. Conversely, doubling CI activities might easily double the economic and physical resources devoted to CI. CI has never sentenced a number of cases represented by the doubling of its current load. According to estimates from Plumley (1996, 41, table 5), the cost for a CI conviction was nearly eighty times more expensive than an audit in 1991. Although these unit costs are unlikely to apply to doubling CI activity, we can get some idea of the dollar magnitude of total costs using Plumley's reported figures.

In 1991, Plumley reported a unit cost of \$1,298 per audit and a unit cost of \$103,064 per CI conviction. These are \$1,597 and \$126,801 in 2001 after adjusting for inflation. In the same year, there were approximately 202,244 individual audits performed and only roughly 2,000 tax and money laundering sentences. Plumley's estimates of unit costs include overhead, support, and follow-on costs.³²

Doubling tax and money laundering sentences would cost \$254 million (at these unit cost estimates), whereas doubling the audit rate would cost \$323 million. Doubling the audit rate is, however, estimated to result in a \$20.47 billion increase in per annum reported collections, whereas doubling tax and money laundering cases was predicted to increase reported tax collection by \$15.30 billion per annum. Hence, an additional dollar allocated to audit would return \$63 in general deterrence,³³ whereas an additional dollar allocated to CI would result in \$60.³⁴ Because this difference is not statistically different from zero, little should be made of the point estimate differences estimated here.

It is unlikely, however, that CI could double its activity level without incurring substantially greater costs than these marginal (per unit) estimates imply. Moreover, the larger the increase in CI activity we simulate through the model, the less reliable the estimates become as we move away from measurable historical experience. Doubling CI activity is very different from doubling the individual audit rate because CI has never operated at twice its current size. Conversely, doubling the individual audit rate is within the IRS's historical experience.

Still, an increase in the IRS budget of \$25 million allocated to CI for additional investigations, prosecutions, and sentencing would not appear to push the envelope of historical experience. Such an amount might be used to increase tax and money laundering cases by roughly 200 per year, and would necessitate roughly 250 additional tax agents. These numbers represent a roughly 10 percent increase in tax and money laundering cases at 2001 levels. More importantly, this increase is within the range of historical CI experience. According to the simulations, general deterrence would rise by nearly \$1.7 billion as a result of the \$25 million allocation to cases processed by CI. With fixed budgets, a cost savings of this magnitude allocated to prosecutions and sentences could achieve the same result if efficiency and productivity gains could be achieved.

Notes

1. The tax gap attributable to individual taxpayers was estimated to be \$70 billion in 1988, the date of the last complete Taxpayer Compliance Measurement Program (TCMP) audit. Recent estimates of the tax gap are based on the audits of 46,000 individual income tax returns from 2001 conducted as part of the National Research Program (NRP). The NRP reported a noncompliance rate of 16.3 percent of true tax liability, 80 percent of which was due to underreported income.

2. The Webster report (*Review of the Internal Revenue Service's Criminal Investigation Division*, April 1999; see Webster 1999) observed that a previous lack of empirical evidence "makes it impossible to prove that the cases CI has investigated previously and is currently investigating either do or do not foster compliance." In this study, I provide the empirical evidence that Judge Webster sought.

3. The similarity to DGW is due to using proxy evasion measures for the economy rather than direct evasion measures. Another similarity is using a time-series data source as opposed to a purely cross-sectional data source, such as the 1969 TCMP. DGW (1990b), however, combined both cross-sectional and time-series information in their empirical analysis.

4. Plumley (1996) modified some of the DGW reporting and compliance equations using income and offsets rather than tax collected, and tax return filings relative to expected filings rather than to population. Plumley introduced refinements to the DGW audit rate measure (based on start rates versus closure rates), and considered new factors for taxpayer burden and CI enforcement activity.

5. Tax-related investigations encompass all Title 26 violations (tax evasion, failure to file, filing of false returns, filing fraudulent returns, or aiding or providing assistance to fraudulent returns) as well as tax violations that fall under Title 18 USC §286, 287, 371 (conspiracy to defraud the government or commit offense or false claims). CI also has jurisdiction over Title 31 cases (currency reporting violations).

6. DGW (1990b) noted that fewer and fewer cases were being referred to CI from audits during the period from 1979 to 1988. The Webster report (Webster 1999) also noticed and discussed this same trend.

7. These requirements stipulate that banks must report certain large currency transactions, disclose foreign bank accounts, and report currency movements across the border. These regulations trigger the reporting of currency transactions involving dollar amounts greater than \$10,000. In addition, the Money Laundering Control Act established criminal offenses for engaging in unlawful monetary transactions. More recently, in 1996, financial institutions were required to report suspicious financial activity that could indicate loan fraud or money laundering.

8. CI summarizes its activities in different ways. First, CI reports its cases by the title and section of law for which there is a violation or an alleged violation. For fiscal year 1999, for example, CI reports cases recommended for prosecution as follows: 1,068 for Title 26 violations, 1,988 for Title 18 violations, and 64 for Title 31 violations. Of these 3,120 cases, CI further classifies 1,959 cases as fraud related and 1,161 cases as narcotics related. Tax cases, in this study, include all primary and secondary recommended violations of tax-related offenses (Title 26, 18-287, 18-286, or 18-371K). Money laundering cases, in this study, include all primary and secondary recommended violations of money laundering-related offenses (Title 18-1956, 18-371T, 18-371M, or 18-1960, or Title 31).

9. My finding that CI enforcement levels are significant determinants of taxpayer compliance reinforces the assurance theory aspects of behavior rather than the deterrence theory. Conversely, the empirical support for significant audit rates found in this study and others suggests that deterrence theory is valid for some types of taxpayer behavior.

10. Limiting the analysis to sentenced cases introduces a potential selection bias, as noted by one of the referees. Alternative specifications using a count of all CI prosecuted cases produced similar results, however. Moreover, the simulations performed below proscribe a larger number of sentenced CI cases, as opposed to a larger number of cases recommended for prosecution to induce greater tax compliance. The former is more difficult to effectuate than the latter, making the policy implications of this research more meaningful.

11. The conclusion that CI enforcement factors are exogenous may be due to poor instruments. Unlike the case of the audit rate, I was not able to find good exogenous proxy instruments for CI enforcement factors. Those that served as reasonable possibilities showed, at best, weak correlations with CI activity. Analysis of CI budgets, for instance, did not reveal close correlation with CI cases prosecuted or the case mix. These deficiencies may affect the specification test results.

12. The estimation method assumes a time-series cross-section structure with endogenous factors. I use an instrumental variables generalized least squares (IV-GLS) estimation method in the reported results.

13. The final models were estimated assuming the Anderson-Hsiao specification using Stata's XTIVREG procedure (Stata 1996-2007).

14. The tax collections and examination variables rely on data reported in the annual report of the commissioner of internal revenue, the *IRS Data Book* (Internal Revenue Service n.d.-a), and the *IRS Statistics of Income Bulletin* (Internal Revenue Service n.d.-b).

15. Statistics on examination coverage variables such as numbers of returns examined, additional taxes and penalties recommended after examination, and costs incurred by the IRS were broken down by district office and service center in the *IRS Data Book* (Internal Revenue Service n.d.-a) and the annual report of the commissioner of internal revenue. In states where there were multiple districts, I performed an aggregation to derive state-level figures for those factors. The IRS Reform Act reorganized the entire district system and required many district offices to be responsible for the tax returns filed by multiple states. As a result, most of the district-level statistics from 1997 to 2001 included services provided to multiple

states. Because only state-level data are used in the analysis, I took the 1996 allocation of examinations, additional taxes, and cost incurred for each state among all states in the newly defined districts and extrapolated the annual figures for 1997-2001 based on 1996 percentages. This step may introduce some unavoidable measurement error. Reorganization of the IRS after 2000 and 2001 and significant changes in IRS accounting undermine a state-level analysis for time periods after 2001.

16. The IRS claims that automated programs such as the CP2000 program and other correspondence audits have partially offset this decline in audit rates. Alternative specifications (available on request) did not show statistical significance of correspondence audits in the reporting or filing equations. This may be due to the shorter time period for which this information was available (post 1993).

17. The TRA was a major shift in United States tax policy. Tax rates were cut, the tax base was broadened, IRA rules were changed, and the tax laws were generally simplified.

18. Given the importance of this factor as an instrument for IRS audit levels, I extended this figure for the 2000 and 2001 period at 1999 levels. There is little consequence from this approximation in which *budget per returns filed* serves as an instrumental variable.

19. DGW (1990b) used a measure of information returns filed as an instrument in some of their models, but this factor was not available at the state level for the time period covered in this study. I also assembled several political factors (Metz 2002) to be used as potential instruments but found that they lacked systematic correlation with the audit rate.

20. As discussed by Plumley (1996), the direct examination measure is a reasonably exogenous measure of audit activity.

21. The media coverage breakdown was available for only a short time span and hence was of limited usefulness in my analysis.

22. It is logical to expect that sentenced cases are most influential in affecting taxpayer compliance because such cases receive the greatest media attention. The empirical results were similar, however, whether sentenced or prosecuted cases were used in the econometric models. Similarly, a factor measuring the percentage of cases recommended for prosecution that were sentenced was not statistically significant in the econometric models. The close correlation between indictment and conviction rates was originally discussed in Dubin, Graetz, and Wilde (1990a).

23. The preponderance of CI cases had either tax or money laundering aspects.

24. As the percentages reveal, CI classifies a small number of cases under its review as neither money laundering nor tax cases. Similarly, there are a few cases identified as money laundering and tax. I have included such cases as both money laundering and tax cases. The amount of double counting is, however, insignificant.

25. Conviction rates have also increased in comparison to the 1978-1988 period. Here, I define the *conviction rate* as the total number of cases that CI sentenced relative to returns examined. The figures demonstrate a rapid increase in conviction rates for the CI division. As noted by DGW, however, the sentences at issue may not be a result of cases selected for tax examination.

26. Deterrence and assurance theories predict that compliance should increase with *TOTM* (greater enforcement), and deterrence theory predicts that compliance will decrease with *TNEL_T* and *MNEL_M* (because fines are less severe than either prison or probation). The effects of *T_TOT* and *M_TOT* are ambiguous. For instance, they may show no effect on compliance if CI has historically set its case mixture in an optimal fashion.

27. In sum, increases in *UI*, *STAXR*, and *PERED* are expected to decrease compliance and reported taxes due; increases in *PICAP* and *PWELFAM* are expected to increase reported taxes due; whereas increases in *PER65* and *FAMSIZ* are expected to have ambiguous effects.

28. It is not possible to use a completely common specification for the two time periods 1977-1987 and 1988-2001, because key CI variables were not available for earlier time periods. Using a common specification but omitting CI factors, I found that the DGW model failed a Chow test for temporal structural stability. This occurrence may be due to the passage of the Tax Reform Act of 1986, as suggested by one of the referees. As discussed below, coefficient sign changes were limited but nonetheless remain consistent with compliance theory.

29. At the margin, the estimated audit rate effects are approximately 10 percent higher in the 1988-2001 period as compared to the 1977-1986 period. This result is expected when there are increasing returns to examination and a general decline in examination rates.

30. The corresponding variable for tax cases (*TNEL_T*) was not statistically significant. This may be due to the emphasis placed by CI on money laundering cases during the 1988-2001 period.

31. Although insignificant, the measured coefficients on these percentages are similar.

32. On further analysis, these estimates would appear somewhat low. The CI budget in 2001 was \$445,043,278. Of this, roughly 30.1 percent is attributable to money laundering cases, yielding an average cost of \$259 million divided by 878 money laundering cases, or \$295,259 per case. Similarly, 58.3 percent of the budget is devoted to tax cases and leads to \$288,362 per case on average (based on 899 tax sentenced cases in 2001). The overall average is \$227,147 per case (\$393.4 million / 1,732 tax or money laundering cases).

33. Plumley's (1996) estimate of the return to audits was similar. He found a marginal indirect revenue-to-cost ratio of 55.

34. The elasticity of audit rates with respect to the IRS budget, as determined in the reduced form audit equation, implies that the incremental cost of an audit may be twice as large as that assumed here. This would significantly lower (by half) my estimate of the dollar return to doubling the audit rate. Nonetheless, with an estimated elasticity greater than one, the IRS is likely operating with increasing returns to scale so that increased budgets can readily expand the rate of individual audits. Similarly, the recent CI incremental cost estimates cited above would reduce (by roughly half) the estimated CI revenue-to-cost ratio.

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