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Tax Compliance

JAMES ANDREONI
BRIAN ERARD
and
JONATHAN FEINSTEIN[1]

1. *Introduction*

The problem of tax compliance is as old as taxes themselves. Characterizing and explaining the observed patterns of tax noncompliance, and ultimately finding ways to reduce it, are of obvious importance to nations around the world. The economics of tax compliance can be approached from many perspectives: it can be viewed as a problem of public finance, law enforcement, organizational design, labor supply, or ethics, or a combination of all of these.

As a public finance topic, tax compliance spans the notions of equity, efficiency and incidence. If, for instance, the wealthy can systematically evade a larger share of their taxes than can the poor, then the effective tax system will be less equitable than the legislated one. Also, any effort at tax evasion is on its face deadweight loss, as are costs of compliance. Furthermore, tax evasion clearly complicates measures of the distortionary effect of taxation—given a fixed revenue requirement, evasion means that higher and more distortionary taxes on reported income may be needed, while unreported income largely escapes taxation and its distortionary effects. Cheating also affects incidence, since those whose tax burdens are easier to evade, such as self-employed individuals, pay a smaller share of taxes.

Tax enforcement is also, of course, a problem of law enforcement. Questions about the deterrent effects associated with penalties and the probability of detection are central to both the tax compliance and law enforcement literatures. Unlike other law enforcers, however, tax agents do not start from a crime and work backward to suspects, but scan tax records looking for evidence of evasion. This leads to some important differences for both theoretical and empirical research.

Tax enforcement also raises challenging issues of organization. Designing an institution to enforce tax laws has much

[1] Andreoni: University of Wisconsin, Madison; Erard: Carleton University, Ottawa; Feinstein: Yale School of Management. Acknowledgments: Jim Alm, Ed Feige, Steve Klepper, Jennifer Reinganum, and Suzanne Scotchmer for help and encouragement, and to four anonymous referees and John Pencavel for many valuable comments. We also thank the Internal Revenue Service (particularly Dennis Cox and Chih-Chin Ho) for providing us with tabulations of audit results. Andreoni received financial support from the Alfred P. Sloan Foundation and the National Science Foundation. Erard received financial assistance from the Social Sciences and Humanities Research Council of Canada.

in common with the classic principal-agent problem. How can an authority—with imperfect ability to monitor—design a taxation, audit, and punishment scheme to meet its revenue objectives? This question can be asked in a variety of ways with an assortment of assumptions about information, commitment, and objectives of the tax authority. The questions are complex, but important for both theory and policy.

Tax compliance can also be linked to labor market behavior. The fact that occupations may vary in the degree of evasion possible, or that evasion is related to wages or tax brackets, may affect occupational choice, human capital investment, and labor supply. Finally, studying tax compliance has raised some confounding behavioral issues.

Economists have traditionally modeled tax cheating as if it were adding one more risky asset to a household's portfolio. However, many households comply more fully than is predicted by this approach. Economists are just beginning to grapple with the findings from other social sciences that could explain the observed compliance levels, such as a household's sense of moral or social obligation to pay its taxes.

During the past 15 years there has been a tide of research on tax compliance. Innovative models of tax reporting and enforcement decisions have been used to investigate a variety of policy-related issues, including the impact of enforcement rules on compliance, the shadow value of enforcement expenditures, and the effects of evasion on labor supply and capital investment. There have also been many empirical studies of narrower subtopics, such as the role of paid preparers in reporting decisions, the effects of past audits on evasion, detection of noncompliance, and tax amnesties. In addition, controlled laboratory experiments have delved into other subtleties of the compliance decision.

In this review, we describe the major theoretical and empirical findings in the recent tax compliance literature, focusing solely on personal income tax compliance. Unfortunately, there are many important issues that we do not have room to discuss, most notably the vast literature on the underground economy which exists in part as a means of evading taxes.[2] Nor do we have the space to discuss corporate or business tax evasion, or the relative advantages of sales versus income taxes.

2. *Some Basic Facts on Tax Compliance*

A popular indicator of the magnitude of evasion is the tax gap—the difference between the federal income taxes households actually owe, and what they report and pay voluntarily on a timely basis. For tax years 1973 through 1992, the nominal tax gap sustained nearly a fivefold increase, from $22.7 billion to $95.3 billion.[3] However, this surge in noncompliance coincides with a substantial increase in tax liabilities over this period. The tax gap in 1992 represents about the same proportion of taxes owed, 17.3 percent, as in 1973.

How can we measure tax evasion, which by its nature is concealed? As discussed in Section 5, researchers have creatively employed a number of alternative data sources. It is widely believed that the most reliable information comes from the Taxpayer Compliance Measurement Program (TCMP) of the Internal Revenue Service (IRS).

[2] Edgar L. Feige (1989) provides an excellent window into this research. See also Frank A. Cowell (1990).

[3] See the U.S. Internal Revenue Service (1990, 1996a). These estimates are based on the examiners' recommendations for adjustments. Somewhat smaller figures are obtained if actual assessments following appeals and litigation are employed.

The TCMP for individual income tax returns is a program of intensive audits conducted on a stratified random sample of returns.[4] The most recent TCMP audits were in 1982, 1985, and 1988. While it is well known that the TCMP fails to detect potentially significant amounts of underreported taxes, particularly on those income items not subject to information reporting, it is nonetheless widely regarded as the best source of data on tax noncompliance.

The 1988 TCMP reveals that about 40 percent of U.S. households underpaid their taxes for that year, 53 percent paid correctly, and 7 percent overpaid. Among those who overpaid, most did so only by a relatively small amount. The median tax overpayment for such individuals was $158. If we assume that overpayments are due to error, and that a comparable portion of underpayments also is due to error, this would imply that about two-thirds of all taxpayers intended to pay their taxes correctly.[5] Still, a sizable minority underpaid their taxes by significant amounts. For example, over one-fourth of all taxpayers were found to have underpaid their taxes by $1,500 or more.[6]

How does the IRS enforce compliance? The results of the TCMP audits are used by the IRS to formulate a strictly guarded "discriminant function," which it uses to assign each return a score—called the DIF score—for the likelihood that it contains some irregularities or evasion. Slightly over one-half of all audit selections are based at least partly on the DIF score. The remaining audits are chosen on the basis of special examination initiatives (e.g., the investigation of abusive tax shelters) or alternative selection methods (e.g., "artificial intelligence" models). While the TCMP audits are designed to be random, subsequent audits clearly are not. An average non-TCMP audit by the IRS yields over $5,500 in additional assessments, compared to only $289 for a random TCMP audit.[7]

Over time, the proportion of all individual returns that are audited has fallen substantially. In 1965 this figure stood at 4.75 percent, but by 1990 it had fallen to 0.8 percent. Although the audit rate has begun to climb again in recent years, reaching 1.7 percent in 1995, it is still well below its level in the 1960s.[8]

U.S. taxpayers who understate their tax liabilities may be subjected to civil or criminal penalties. Typically, civil penalties are applied at a rate of 20 percent of the portion of the underpayment of tax resulting from a specified misconduct (negligence, substantial understatement, substantial valuation misstatement, etc.). However, in cases of fraud, which involve clear and convincing evidence that the taxpayer engaged in intentional wrongdoing, a civil penalty may be applied at a rate of 75 percent. In very serious fraud cases, criminal penalties may be applied. A willful attempt to evade or defeat the income tax is a felony and is punishable by a fine of not more than $100,000, imprisonment for not more than five years, or

[4] Stratification is based on the level and primary source (business, farm, or nonbusiness nonfarm) of income.

[5] Some portion of overpayments is likely to be the result of deliberate noncompliance involving improper transfers of income and deductions between tax years in an attempt to reduce total tax payments over a period of several years. However, much overreporting is presumably the result of error.

[6] All of the above figures are based on tabulations provided by the IRS.

[7] The figure for non-TCMP audits was computed from Internal Revenue Service (1991), and the figure for TCMP audits is based on a weighted tabulation provided by the IRS.

[8] These figures are based on Internal Revenue Service (1966, 1996b).

both.[9] A criminal penalty is also in place for the failure to file a return. Unlike fraud, this form of misconduct is considered a misdemeanor and is punishable by a fine of not more than $25,000, imprisonment for not more than one year, or both.

Although the statutory penalties for tax evasion can in some cases be quite severe, penalties are in fact quite infrequently imposed. During the 1995 fiscal year, for example, only 4.1 percent of all U.S. taxpayers whose federal returns were reassessed following an audit received any penalty for fraud, negligence, false withholding, failure to report tips, or other miscellaneous infractions.[10]

The fact that most taxpayers face a low probability of detection and small expected penalty puts the earlier statistics on noncompliance in a different light. For small amounts of evasion, such as slightly overstating charitable deductions or failing to report minor amounts of income, the expected cost of detection would appear to be extremely low for most taxpayers. So, we may ask, why are so many households honest, and why don't cheaters cheat by more?

Part of the explanation lies in the dramatic increase in information reporting in the U.S. since the 1960s. Whereas only about 340 million information documents were received by the IRS during the 1965 fiscal year, over a billion such documents were received in 1990.[11] Moreover, the vast majority of all information documents now received are on magnetic media, which greatly simplifies the matching of such documents to income tax returns. Information reporting severely limits the scope for tax evasion on many significant income and deduction items, such as wages and salaries, interest, pensions, and mortgage interest payments. Information reporting also reduces the potential for unintentional reporting errors by clarifying for the taxpayer the amount that legally should be reported. Based on IRS estimates for tax year 1992, approximately three-fourths of all income that should be reported on tax returns is subject to information reporting.[12]

Although information reporting is extensive in the U.S., certain income sources continue to be exempt from reporting requirements, for example income derived from farms or sole proprietorships. Taxpayers with income from these sources tend to understate their taxes by substantially more than other taxpayers. Compared to an average of $289 for the entire population, the 1988 TCMP statistics indicate that the average tax understatements for taxpayers with farm and sole-proprietor income are $1,058 and $827, respectively.[13] In addition, certain deductions remain exempt from reporting requirements, and TCMP statistics indicate that itemizers engage in significantly more evasion than nonitemizers.

Taking information reporting into account, taxpayers still appear to be more honest than might be expected:

[9] Tax preparers are also subject to penalties for misconduct. For the more serious types of infractions (willful or reckless conduct, promoting abusive tax shelters, or aiding and abetting understatements of tax), a civil penalty of $1,000 per return applies.

[10] This figure was computed based on the examiner assessments from Internal Revenue Service (1996b). In a number of cases the penalties were eventually abated.

[11] These statistics are reported in Internal Revenue Service (1966, 1991).

[12] This statistic was computed from the information presented in Table A-54 of Internal Revenue Service (1988b).

[13] These figures are based on tabulations provided by the IRS. The figures are likely to understate the true degree of noncompliance for taxpayers with these income sources, due to imperfect audit detection.

although three-fourths of income is subject to information reporting, the IRS estimates that for tax year 1992, 91.7 percent of all income that should have been reported was in fact reported.[14] What could explain the extent of honesty? One possibility is that people may tend to overestimate both the probability and magnitude of penalties, or may fear social stigma or damage to their reputation if they are exposed as cheaters. We discuss these possibilities in Section 8. Finally, there may be other reasons for taxpayer honesty that haven't yet been discovered. For example, TCMP statistics indicate that married filers and taxpayers under 65 years of age have significantly higher average levels of noncompliance than their counterparts, which does not appear to be explainable by variations in information reporting requirements.[15]

In addition to investigating average compliance rates, researchers have also explored the relationship between compliance behavior and measures of enforcement, such as audit rates and penalties. Results from these studies, as shown below, suggest that changes in enforcement variables do deter evasion, although the magnitude of the effect is uncertain.

So far we have only discussed evidence from the U.S. Is experience of other countries comparable? Unfortunately, this question is difficult to answer. Compliance and enforcement data, when they exist, are difficult to obtain and few countries outside the U.S. have been studied. Those that have been studied, such as the Netherlands, Spain, Switzerland, and Jamaica, indicate that the effects of income, tax rates and enforcement variables on compliance are similar to those in the U.S.[16] It is important to note, however, that evasion varies widely across nations, reaching extremely high levels in some developing countries.[17]

Clearly, tax noncompliance in the U.S. significantly reduces government revenues. Nonetheless, a relatively small amount of enforcement has gone a fairly long way. With only about 1 percent of returns being audited, and relatively low and infrequently applied penalties, only about 17 percent of taxes go uncollected. Can compliance be improved even more, and would expanding the IRS be efficient? The size and the role of the IRS has been the subject of open political debate in recent years. The IRS budget has been reduced, and plans for a tax year 1994 TCMP audit were canceled. As we discuss below, researchers estimate that an extra dollar of enforcement in some audit classes would raise six or more dollars in direct audit revenue, as well as additional revenue generated through an increase in deterrence. In Section 7.1 we discuss this issue further and consider whether a higher level of enforcement activity would in fact be socially desirable.

[14] Internal Revenue Service (1988a).

[15] The 1988 TCMP results reveal an average tax understatement of $302 on returns not claiming an age exemption, compared to $196 for returns where an exemption is claimed. The results also indicate that married (joint) filers understated taxes by an average of $428, compared to $179 for taxpayers within the other filing categories (primarily single taxpayers).

[16] See Dick J. Hessing et al. (1992) on the Netherlands; Ana de Juan, Miguel A. Lasheras, and Rafaela Mayo (1994) on Spain; Werner W. Pommerehne and Bruno S. Frey (1992) on Switzerland; and James Alm, Roy Bahl, and Matthew N. Murray (1990) on Jamaica. Swiss evasion is estimated to be about 17.5 percent of income, while in Jamaica the estimated level is 3 percent. Nonetheless, in Jamaica 66 percent of taxpayers were found to have underpaid their taxes.

[17] For example, Paul R. Krugman et al. (1992) cite a study for the Philippines which suggests that as little as 50 percent of income taxes in 1985 were actually reported and that only 27 percent of those with taxable incomes filed.

3. *A Simple Model of the Compliance Decision*

Next we consider theoretical models of compliance and enforcement. In this section we review the standard expected utility model of the income-reporting decision, and in the next section we discuss models in which enforcement rules are determined jointly with reporting decisions. We then evaluate the models both in terms of their predictive power and their potential usefulness for policy makers.

One of the earliest and best-known models of tax compliance is that of Michael G. Allingham and Agnar Sandmo (1972).[18] These authors were primarily interested in whether higher tax rates generate more or less compliance. Their answer, while intuitive, illustrates the difficulties and subtleties of studying tax compliance.

Consider a taxpayer with exogenous income y who faces a tax rate t. He is asked to report a number x to the government and pay taxes tx. If the taxpayer is honest he will report $x = y$, but he may cheat by reporting an income $x < y$. Let $z = y - x$ represent the amount by which income is understated. The tax authority does not know the true income y and must enforce compliance through a system of audits and penalties. Assume that the enforcement policy, known to the taxpayer, is to audit reports with a probability p, $0 < p < 1$. For now, assume p is independent of x. In the event of an audit, we assume the tax authority always learns the true income y. If the taxpayer is caught cheating he must pay a penalty θ on each dollar of income evaded, θz, in addition to the evaded tax. For simplicity, assume there are no additional costs of an audit for the taxpayer.

[18] See also T.N. Srinivasan (1973) for an early model of compliance.

We can see that if a tax cheater avoids an audit he will have consumption of $y - tx = y(1-t) + tz$, which is tz more than if the taxpayer is fully compliant. On the other hand, if the cheater is audited, his consumption will be $y - tx - (\theta + t)z = y(1-t) - \theta z$, which is θz less than if the taxpayer is fully compliant. Assuming that individuals are risk averse, the expected utility of a taxpayer is

$$EU = (1-p)u[y(1-t) + tz] + pu[y(1-t) - \theta z] \qquad (1)$$

How does cheating z change with the tax rate t? Examining (1) we see that the effect is ambiguous. Raising t has two effects. First, it lowers the after-tax income from full compliance, $y(1-t)$. If absolute risk aversion is decreasing, then this change should make people more risk averse regarding any z and consequently less likely to accept more cheating. However, as t rises the return to cheating goes up, while the penalty to getting caught stays unchanged. This asymmetry should encourage cheating. Which effect dominates depends on how fast absolute risk aversion declines, that is, on the third derivative of the utility function. However, Shlomo Yitzhaki (1974) has observed that if the penalty is proportional to the amount of *tax* evaded, θtz, then the model predicts that cheating will be reduced when the tax rate increases. The reason is that for any given z, as t rises the expected value of consumption falls and the variance increases, hence cheating declines.

It is well known that a risk-averse person will always be deterred from accepting a gamble if its expected value is less than zero. It is easy to see that the government could readily assure that this condition is met by setting the penalty rate θ sufficiently

high.[19] In fact, governments typically don't set penalties this high. This problem is often dealt with by assuming that, for a variety of reasons such as bankruptcy constraints or equity considerations, penalties this high are not possible.[20]

An obvious generalization of the simple Allingham–Sandmo model makes income endogenous by adding labor supply. This extension has been explored by John H. Pencavel (1979), Cowell (1981), Sandmo (1981), and others. With labor supply in the model, the effects of the enforcement variables all become ambiguous. An increase in enforcement may reduce the effective wage rate, which may decrease total labor supply. However, if the labor supply curve is backward bending, additional enforcement may actually increase labor supply, and may increase the amount of income unreported. Risk aversion also may interact with labor supply in surprising ways. Cheating incentives can encourage individuals to work more in order to self-insure against the losses due to audits (Laurence Weiss 1976), which in turn can lead to increased cheating. Furthermore, since cheating opportunities can differ across occupations, evasion may influence occupational choice (Pierre Pestieau and Uri M. Possen 1991).[21] Overall, adding labor supply substantially complicates the analysis.

Another generalization of the simple model is to account for the repeated nature of the reporting decision. In most countries, filing an income tax return is an annual event, and taxpayers may condition their reports on past reports and audit experiences, as well as future expectations. In one of the only studies that considers the dynamics of tax compliance, Eduardo Engel and James R. Hines, Jr. (1994) find that the cumulative compliance incentives are complex and that, in general, simulations are required to make predictions.

Such complex and confounding effects are not limited to complicated models—even within the simple approach presented above we cannot predict the effects of all policy parameters. Moreover, when such predictions can be obtained, they often depend on the thin reed of the third derivative of utility functions and on inelastic labor supply. The more general approach of the next section will address some of these limitations.

Beyond labor supply and reporting dynamics, the basic Allingham–Sandmo framework has been extended in a number of other directions over the past 25 years. For example, researchers have explored the implications of introducing a richer tax and penalty structure, allowing for imperfect information over such policy parameters as the audit rate and true tax liability, extending the number of items on which the taxpayer must report, and accounting for the roles of morals, social dynamics, and tax practitioners. These and other extensions are taken up in later sections of this article.

4. *Interaction between Taxpayers and the Tax Authority*

A weakness of the Allingham–Sandmo model is that it assumes that

[19] Note that if the expected value of cheating is positive, then regardless of risk aversion, there always will exist some z (however small) that a taxpayer is willing to accept. That is, everyone cheats in this model, if only just a little.

[20] See Gary S. Becker (1968) on optimal models of crime and punishment. More recent contributions by Andreoni (1991b), Steven Shavell (1987) and Dilip Mookherjee and Ivan P. L. P'ng (1989, 1992) discuss other constraints that may limit penalties at the optimum.

[21] It is interesting to note that some of these incentive effects of cheating may be Pareto improving, as pointed out by Joseph E. Stiglitz (1982) and by Weiss (1976), and hence may justify certain cheating incentives as part of an optimal tax system.

the probability of audit is constant. As we discussed in Section 2, audits are not purely random. In the U.S. for instance, the probability of audit is likely to depend on the amount of income reported. Recently, researchers have developed a more general theoretical framework in which the probability of audit is a function of reported income and is determined jointly with cheating as part of an equilibrium. This framework has been used not only to generate predictions about compliance, but also about a tax agency's optimal audit strategy.

The models in this literature generally fall into two groups. The first assumes that the tax agency can announce and commit to its audit rule before taxpayers file returns. These models have much in common with a standard principal-agent problem. In contrast, models in the second group assume that the tax agency cannot commit to its audit rule but instead decides which taxpayers to audit after all returns have been filed. The models in this second group make use of standard game-theoretic concepts of equilibrium, especially sequential equilibrium.

Next we describe simple versions of these models. We also look at two natural extensions, one that assumes some individuals are inherently honest, and another that explores how the government might contract with an independent agency, like the IRS, to collect taxes.

4.1 *A Framework for Equilibrium Analysis*

Consider the following extension of the model presented in Section 3. Assume that there is a large population of filers and that a filer possessing true income y owes $t(y)$ in taxes. True income is distributed along a continuum between $\underline{y}$ and $\bar{y}$ (which may be $+\infty$), according to the density function $f(y)$; we define $F(\cdot)$ to be the distribution function associated with $f(\cdot)$. As before, the tax authority can learn a household's true income y only by performing a costly audit.

The tax collection system consists of two stages. In the first stage, each taxpayer is asked to report his taxable income to the authority and to pay the taxes he claims to owe. Again, let x denote a taxpayer's report, where generally $x \leq y$. In the second stage, the authority audits a subset of cases. Assume that each audit costs c and that the authority has a budget B available for audits, allocated to the authority by the central government before the tax collection process begins. In addition, assume that when the authority audits a taxpayer it learns his true income y; collects the additional tax $t(y) - t(x)$, which may be zero; and assesses additional penalties and interest charges in the amount $\theta[t(y) - t(x)]$, where $\theta[0] = 0$ and $\theta'[q] > 0$ for all q.[22] For a taxpayer with true income y the expected utility from a report x is given by

$$EU(x) = (1 - p(x))U(y - t(x)) + p(x)U(y - t(y) - \theta[t(y) - t(x)]), \qquad (2)$$

where $p(x)$ is the probability of audit associated with report x. For simplicity, we assume that an audit imposes no costs on a taxpayer beyond those related to the underreporting of income.[23]

[22] If the tax authority divides filers into audit classes on the basis of either their exogenous characteristics, such as source of income, or their approximate taxable incomes, the authority may follow a different audit rule in each class.

[23] This framework is reasonably general, but it differs from some of the models that have been developed during the past decade. In this regard, three of our assumptions deserve special notice. First, we assume that income is distributed along a continuum, whereas a number of studies have assumed that income takes on a finite, discrete number of values. Second, we suppose that the tax authority has been allocated a fixed audit budget

Much of our discussion focuses on a restricted version of the model described above, in which both the tax rate and the penalty function are assumed to be linear and taxpayers are assumed to be risk neutral. In general, for either class of models, the qualitative solution of the more general case of nonlinear taxes and risk aversion is similar to the solution assuming linearity and risk neutrality, because the form of the solution is determined primarily by the strategic interaction between the tax authority and taxpayers, not by the shape of the tax schedule or taxpayer utility function.

Finally, what do we assume about the objective of the tax authority? Here we follow the majority of the literature and assume that its objective is to maximize expected net revenue (tax and penalty revenue, less audit costs).[24] As a positive description of how many tax agencies behave in practice, this appears to be a reasonable approximation. For example, as discussed in Section 2, the IRS develops its infamous DIF score for the explicit purpose of identifying those returns within a given audit class with the highest potential audit yield.[25]

The obvious alternative to such a policy would be to allocate audit resources in order to maximize social welfare. The use of this normative criterion would be consistent with the more general literature on optimal taxation and would appear to be particularly natural in the context of the class of models where the tax authority can commit to its policy before taxpayers file their reports. Notice, however, that our specification does not rule out the possibility that the government as a whole is attempting to maximize social welfare. In particular, the model presented below for the tax authority may be viewed as subproblem

that it spends completely on audits, whereas some studies have assumed that the authority conducts as many audits as it desires. Although these two assumptions add some complexity to the analysis, they make the framework more realistic and have a qualitatively important impact on the results. In this regard we note that, as discussed by Michael J. Graetz, Jennifer F. Reinganum, and Louis L. Wilde (1986), taxpayer reporting behavior can be extremely sensitive to the probability of audit when income is restricted to a small number of values, and the introduction of a binding budget constraint for the tax authority in such a case typically will make the decision to cheat extremely insensitive to the values of tax and enforcement parameters. In certain cases, such as when a taxpayer is deciding whether to take a specific deduction, the restriction of reports to a small number of possible values would appear to be reasonable. In addition to the analysis by Graetz, Reinganum, and Wilde, we refer the interested reader to Reinganum and Wilde (1985); Mookherjee and P'ng (1989); Paul J. Beck, Jon S. Davis, and Woon-Oh Jung (1991); Richard C. Sansing (1993); and Mark B. Cronshaw and Alm (1995) for interactive models of tax compliance with discrete income levels and unlimited audit budgets. Third, in order to focus attention on the tax agency's audit decisions, we assume that the tax and penalty schedules are exogenously determined. We discuss results for the case in which the tax schedule is chosen together with the audit function in Section 4.5.

[24] Explicitly, the government maximizes expected revenue, defined as

$$\int_{\underline{x}}^{\overline{y}} [p(x)\{E\{(t(y) + \theta[t(y) - t(x)]) \mid x\} + (1 - p(x))t(x)]dF_X(x),$$

where $E\{z \mid x\}$ represents the conditional expectation of z given the report x, $\underline{x}$ is the lowest report made by any taxpayer, and $F_{-X}(x)$ is the induced distribution function over x. The range of x may be represented by continuous intervals and/or discrete values, depending on whether masses of taxpayers with different true incomes choose to file the same income report. Therefore, the integral sign should be interpreted as generalized notation, representing either the integration or summation over the various regions of the distribution as appropriate. The tax authority must also meet the budget constraint $c\int_{\underline{x}}^{\overline{y}} p(x)dF_X(x) \leq B/N$, where N is the total number of taxpayers. With a binding budget constraint on audit resources, the objective is equivalent to maximizing gross revenue.

[25] It is not obvious, however, that IRS audit resources are optimally allocated across audit classes to maximize revenue in any given year. It appears that a modest amount of resources is allocated to relatively low-yielding classes, presumably to maintain a relatively high level of compliance in these classes in future years.

within a more general framework in which a social planner first chooses all relevant policy parameters, including the audit budget, and then delegates the auditing responsibility to a revenue-maximizing tax authority. This issue is taken up further in Section 4.5. If one is to employ a welfare-maximizing approach to the problem, an unresolved question is whether cheaters should be given the same weight in the social criterion function as honest taxpayers. In particular, how much value should the social planner place on the utility evaders receive from their ill-gotten gains? We do not attempt to resolve this issue here, but rather note that it is an important consideration for a welfare-oriented analysis of tax compliance.

4.2 *When the Tax Authority Can Commit to an Audit Rule*

When the tax authority can announce and commit to its audit strategy before taxpayers make their reports, the strategy that maximizes audit revenue (for a fixed audit budget) typically involves a "cut-off" rule. The simplest cut-off rule consists of a threshold value w and a policy to audit any report below the threshold with some probability p, but to leave all reports above the threshold unaudited. The probability p is chosen to be just large enough that all taxpayers with true income below w report honestly; in particular, when the tax and penalty schedules are linear and taxpayers are risk neutral, the optimal value of p is $1/(1+\theta)$. When p takes this value, taxpayers with true incomes above w choose to report exactly w, paying tw in taxes and bearing no risk of an audit. The threshold w is chosen so that the audit budget is just exhausted in equilibrium.[26]

The simple cut-off rule has been shown to be the optimal audit strategy only under rather restrictive assumptions, including the assumption that taxpayers are risk neutral.[27] The optimal audit strategy has not been determined for the general case in which taxpayers are risk averse.[28]

Why does the cut-off rule maximize net revenue? We can uncover some intuition for this result by exploring several qualitative features of the model in greater detail. One interesting characteristic of the cut-off rule is that it is a nonincreasing function of reported income. The fact that the optimal audit rule possesses this property, at least over the range of incomes actually reported by taxpayers, follows directly from the observation that when the tax authority commits to auditing a positive fraction of all reports at some particular income level, for example level v, its purpose is to deter individuals with true incomes above v from reporting v. In

[26] The cut-off rule was first introduced into the tax compliance literature by Reinganum and Wilde (1985). Isabel Sánchez and Joel Sobel(1993) provide an excellent discussion of this type of model.

[27] Sánchez and Sobel show that the simple cut-off rule maximizes expected net revenue collections when three conditions are met: (i) taxpayers are risk neutral; (ii) the penalty schedule is linear; and (iii) the expression $t'(y)\,\gamma(y)$ is decreasing in y, where $t'(y)$ is the derivative of the tax schedule at income level y and $\gamma(y)$ is the hazard function, $\frac{1-F(y)}{f(y)}$. Note that when the tax schedule is linear, the condition that $t'(y)\,\gamma(y)$ is decreasing in y reduces to the condition that the hazard function $\gamma(y)$ is decreasing in y.

[28] Mookherjee and P'ng (1989) present an analysis of the case in which taxpayers are risk averse; they assume a discrete number of possible true incomes, and determine a number of qualitative properties of the optimal audit strategy. Kim Border and Sobel (1987) present a thorough analysis of the case in which taxpayers are risk neutral and there are a discrete number of possible true incomes. Many of the characteristics of optimal audit strategies identified by Mookherjee and P'ng and Border and Sobel are qualitatively similar to those discussed above for the cut-off rule, so we do not discuss them in detail, but instead refer the interested reader to these papers for additional details.

particular, since audits are costly, the authority will commit to such a policy only when there is at least one income level y above v such that individuals possessing true income y are contemplating reporting v. To discourage such individuals from making this report, the tax authority will set the probability of audit $p(v)$ just high enough that these individuals will be indifferent to reporting v or their next best alternative income (which may be y or some third income level).

To see why this observation implies that the optimal audit rule is a nonincreasing function of income, consider another possible report u, where $u > v$, and assume that taxpayers are risk neutral and that the tax and penalty schedules are linear. The only taxpayers who would consider reporting u are those with true incomes at least as large as u. If $p(u)$ were strictly greater than $p(v)$, so that the audit function were increasing in reported income, no taxpayer with true income y greater than u would ever choose to report u. If $p(v)$ were greater than $1/(1+\theta)$, such a taxpayer would strictly prefer to report his true income y rather than u, and otherwise he would strictly prefer to report v rather than u. In fact, the only taxpayers who might choose to report u in the case of an increasing audit function would be those taxpayers whose true income was precisely u, and the tax authority would obtain no revenue from performing a costly audit of such taxpayers. Thus, if the report u were a part of the equilibrium taxpayer reporting region, the optimal value of $p(u)$ would be no greater than $p(v)$, implying that the equilibrium audit schedule is nonincreasing over the range of reported income values. It is important to note that this argument depends critically on the assumptions that taxpayers are risk neutral and that the penalty function is linear. When these assumptions fail to hold, the optimal audit probability may be increasing in reported income for some income values.[29]

One can imagine several possible modifications of the cut-off rule, but in most cases these modifications lower net revenue. For example, consider reducing the probability of audit below $1/(1+\theta)$ for reports beneath the threshold value w. With this modification all taxpayers with true incomes below w would strictly prefer to report $\underline{y}$ as would those taxpayers with true incomes between w and some value q above w.[30] This first modification to the simple cut-off rule generally lowers total net revenue, precisely because so many taxpayers now report $\underline{y}$. Alternatively, consider maintaining $p = 1/(1+\theta)$ between $\underline{y}$ and some report z, $z < w$, but establishing a lower audit probability between z and w (adjusting w as necessary to keep the total number of audits constant), essentially replacing the simple cut-off rule with a "two-step" rule. Since $p(z)$ is below $1/(1+\theta)$ under this modification, all taxpayers with true incomes between z and w will now report z rather than their true incomes, and all taxpayers with true incomes between w and some higher value r now will report z rather than w. In most cases the two-step rule again results in lower total net revenue, because it sharply reduces vol-

[29] Mookherjee and P'ng provide an example in which taxpayers are risk averse, taxpayers' incomes have three possible values, and the optimal audit rule is non-monotonic in reported income.

[30] The precise value of q depends on the probability of audit for reports below w, rising as this probability falls. The threshold value w may need to be reset so that the total number of audits performed remains at its original level. It can be shown that when income is drawn from a uniform distribution, the number of audits performed remains constant as the audit probability is reduced; hence, in this case the threshold w is completely determined by the audit budget.

[31] Sánchez and Sobel show that, when condition (iii) listed in footnote 27 fails to hold, so that

untary tax payments.[31]

When tax is proportional to income and a cut-off rule is used, taxes become more regressive. Notice, however, that this "regressive bias" is limited to a given audit class. Suzanne Scotchmer (1987) has shown that when a separate cut-off rule is applied to each of many audit classes over which incomes vary, the effective overall tax schedule can be progressive.[32]

4.3 *When the Tax Authority Cannot Commit to an Audit Rule*

When the tax authority cannot commit to its audit strategy, the interaction between taxpayers and the tax authority takes the form of a sequential move game.[33] In solving this game we assume that taxpayers correctly forecast the probability of audit associated with each income value. For ease of exposition, we shall continue to assume that the tax and penalty functions are linear.

Consider first a model in which all taxpayers are willing to cheat "if the price is right," just as in the commitment model of the last section. This model has many possible equilibria, but we focus initially on one, the fully separating equilibrium, in which each observed report x is associated with a single true income level $y(x)$. In this equilibrium each taxpayer underreports by the same amount, $\frac{\lambda c}{(1+\theta)t}$, where c is the audit cost and λ is the shadow value associated with the audit budget constraint. Thus, whereas true income is distributed between $\underline{y}$ and $\bar{y}$, reported income lies between $\underline{x}$ and $\bar{x}$, where $\underline{x} = \underline{y} - \frac{\lambda c}{(1+\theta)t}$ and $\bar{x} = \bar{y} - \frac{\lambda c}{(1+\theta)t}$. Furthermore, the audit function $p(x)$ takes the value zero over the half-strip $[\bar{x},\bar{y}]$, is nonincreasing in x, and is strictly between zero and one over the range $[\underline{x},\bar{x}]$. To see why this solution is an equilibrium of the game, note that if taxpayers report as specified, then when the tax authority observes a report x, it knows that the report corresponds to true income $x + \frac{\lambda c}{(1+\theta)t}$. Hence, the tax authority is just indifferent between auditing and not auditing the return, since the cost of the audit λc is exactly equal to the revenue that can be earned by performing it, $(y-x)(1+\theta)t$. As a result, the authority is willing to follow a mixed strategy and audit with some probability between zero and one. The function $p(x)$ is chosen so that taxpayers find it in their interest to follow the reporting strategy described above. In particular, $p(\cdot)$ is chosen so that the first-order condition associated with the maximization of expected utility is equal to zero when $x = y - \frac{\lambda c}{(1+\theta)t}$. The value of λ is chosen so that the budget constraint is satisfied, normally as an equality. When taxpayers are risk neutral, $p(x)$ is given by the solution to a simple linear first-order differential equation. When taxpayers are risk averse, $p(x)$ is determined as the solution to a somewhat more complex

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$t'(y)\gamma(y)$ is not decreasing around the proposed threshold w, then one form of the optimal audit strategy (it is not necessarily the unique optimal strategy) is a two-step cut-off rule.

[32] Helmuth Cremer, Maurice Marchand, and Pestieau (1990) also present an analysis in which there are several audit classes, focusing on the trade-off between deterrence and equity in the choice of an optimal audit strategy.

[33] Reinganum and Wilde (1986a) present one of the earliest game-theoretic models of tax compliance and enforcement. Josef Greenberg (1984) also presents an early model. However, Greenberg focuses on an equilibrium in which the tax authority deters cheating by threatening to audit certain taxpayers even when they report honestly. This threat is not credible, and hence the equilibrium that Greenberg proposes is not subgame perfect.

differential equation, but taxpayers continue to evade by the same amount.[34] Finally, to sustain the equilibrium, $p(x)$ is assumed to equal one for all reports below $\underline{x}$.

In addition to the fully separating equilibrium, there are many alternative pooling and partially pooling equilibria in this model. In these alternative equilibria, many taxpayers make the same income report, and there are large "empty" regions in which no taxpayers report; neither feature seems consistent with empirical evidence about reporting behavior. Unfortunately, there is no universally accepted criterion for determining whether the fully separating equilibrium or one of the pooling equilibria will be played.[35]

Now consider a second model, which extends the first to a setting in which at each income level y a fraction Q of taxpayers always reports truthfully, while the remaining fraction 1-Q of taxpayers is willing to cheat and reports the value x that maximizes expected utility, just as in the first model.[36] As we discussed in Section 2, many taxpayers do in fact pay their full tax liability despite the financial incentives to cheat. Thus, the introduction of honest taxpayers appears consistent with empirical observation. Somewhat surprisingly, the introduction of honest taxpayers resolves several troubling features of the first model, leading to a more satisfactory—albeit more complex—analysis.

One striking difference between the first and second models is that in the second model, because there are some honest taxpayers reporting at every income level between $\underline{y}$ and $\bar{y}$, nearly all of the pooling and partially pooling equilibria that exist in the first model are eliminated.[37] A second difference between the two models is that in the second model there are two kinds of taxpayers reporting at each x throughout most of the reporting range: honest taxpayers, who possess true income x; and dishonest taxpayers who possess some true income $y(x)$ greater than x, where $y(x)$ is increasing in x. This second difference is critical, and is the main reason that the analysis and solution of the second model is quite different from the first model. In the fully separating equilibrium of the first model, the tax authority gains full knowledge of a taxpayer's true income directly from the taxpayer's report, before performing an audit; this characteristic of the solution contradicts one of the stylized facts about real-world tax auditing, which is that a taxpayer's true income is normally not known prior

[34] Brian Erard and Jonathan S. Feinstein (1994a) erroneously suggest that the level of evasion may vary with true income when taxpayers are risk averse. In fact, if the equilibrium is to be fully separating, the same level of evasion by all taxpayers is required to keep the tax authority indifferent about playing its mixed audit strategy.

[35] Reinganum and Wilde (1986b) have shown that the divinity refinement of sequential equilibrium rules out all of these pooling and partially pooling equilibria. Presumably, they also could be ruled out by other well-known refinements, such as D1 (see In-Koo Cho and David M. Kreps 1987). However, such refinements remain somewhat controversial. Erard and Feinstein have shown that the fully separating equilibrium does not maximize net tax revenue, inclusive of penalties—an equilibrium that typically generates greater revenue follows the fully separating equilibrium from $\bar{x}$ down to some value $x^* > \underline{y}$, but then has all remaining taxpayers report in a pool at $\underline{y}$.

[36] Honest taxpayers were first incorporated into a game-theoretic framework by Graetz, Reinganum, and Wilde (1986). However, these authors considered a model with only two income states, in which including honest taxpayers does not significantly alter the qualitative features of the solution. Including honest taxpayers has a far greater effect in the model we consider here, in which income is distributed along a continuum. Erard and Feinstein (1994a) were the first to demonstrate the important role of honest taxpayers in this model.

[37] Erard and Feinstein prove this result by showing that $p(\cdot)$ and its derivative $p'(\cdot)$ must be continuous throughout the interior of the range $[\underline{y},\bar{x}]$. Thus, pooling is possible only at the very bottom of the reporting region.

to an audit. In the second model, since there are both honest and dishonest taxpayers reporting at each x, the tax authority does not know a taxpayer's true income prior to conducting an audit. As a result, the authority's calculation of the expected revenue to be earned from performing an audit is considerably more complex than in the first model. Expected revenue now depends on two factors: the magnitude by which dishonest taxpayers reporting at x cheat, $y(x) - x$, and the fraction of taxpayers reporting at x who are dishonest, which depends on the ratio of $f(y(x))\left|\frac{dy(x)}{dx}\right|$ to $f(x)dx$, where $\left|\frac{dy(x)}{dx}\right|$ is a Jacobian of transformation that measures the rate at which the true income of dishonest taxpayers $y(x)$ rises as x rises. The increased complexity in the formula for expected revenue significantly complicates the solution of the model, transforming the simple linear first-order differential equation that characterizes the solution to the first model into a complex nonlinear second-order differential equation. Methods for solving this equation are discussed by Erard and Feinstein (1994a). We discuss several other differences between the two models in the next subsection.

4.4 *Critical Discussion of the Models; Future Directions*

The development of the principal-agent and game-theoretic models of tax compliance is an important theoretical advance. Nonetheless, these models are rather poor descriptions of real-world tax systems. In this section we provide a critical analysis of the underlying assumptions and empirical implications of these models. We also suggest some ways in which more realistic models might be developed in future work.

First consider the empirical implications of models related to taxpayer reporting behavior. A fundamental weakness of the principal-agent models is their implication that all audited taxpayers will be found to have reported honestly, at least if a cut-off rule is adopted. The facts contradict this implication: About 40 percent of all taxpayers are found to understate their tax liability, in some cases by a significant amount.

Principal-agent models also generally predict that, within an audit class, high-income taxpayers will all report at or near the threshold value that defines the audit cut-off point. The empirical validity of this implication is difficult to judge, primarily because it is difficult to know how best to define an audit class. If, for instance, one defines audit classes narrowly, so there are many such classes, then the implication is difficult to confirm or refute.

With regard to reporting behavior, the game-theoretic models generate considerably more realistic predictions than the principal-agent models. In the sequential equilibrium of the game-theoretic model, many audited taxpayers are found to have reported dishonestly. Indeed, in the second game-theoretic model presented, some audited taxpayers are found to have reported dishonestly, while others are found to have reported honestly, a reporting pattern that matches empirical observation. The second model is also at least partially consistent with the (somewhat mixed) empirical evidence that the level of underreporting increases with true income. In the second model, evasion generally varies with true income; the level of underreporting typically increases with true income within some,

[38] The reason is that expected audit revenue depends upon the ratio of income densities evaluated at different points along the income distri-

but not all, income intervals.[38] Finally, in the second model the extent of evasion depends upon the shape of the income distribution; while we are not aware of any direct evidence on this important point, it seems intuitively plausible.

Next, consider implications related to audit strategy. Here the principal-agent models seem to generate superior predictions. The cut-off rule associated with the principal-agent solution implies that reports of low income within an audit class will be audited with a probability that is large, but typically (although not always) below one, while reports of high income will not be audited. Many tax agencies apparently do establish cut-off points and focus their audit resources on returns falling below the cut-offs.[39] In addition, the typical agency normally selects only a subset of the total number of returns below its cut-off point for audit. However, it is not clear whether the typical agency randomly selects returns for audit within this group, as the theory implies, or instead relies on additional criteria to select returns.

A critical aspect of the game-theoretic models that seems unrealistic is the implication that in equilibrium the tax authority is just indifferent between auditing and not auditing taxpayers over much of the reporting range.[40] The game-theoretic models, on the other hand, do not imply a sharp cut-off rule. Rather, they predict that high income reports will not be audited and that, beginning somewhere in the middle of the reporting range, the probability of audit will increase smoothly as reported income falls. The indifference of the tax authority over auditing in game-theoretic models may be eliminated under a more general specification of the audit technology.[41]

Finally, consider what the tax agency is predicted to know about taxpayer income in equilibrium. As mentioned above, in the principal-agent models the tax agency can deduce the true income of every taxpayer whose true income lies below the threshold value, since these individuals report truthfully, but not of those whose income lies above the threshold. This implies that the agency knows the true incomes of all individuals who will be subjected to audit prior to conducting any audits. In the second game-theoretic model presented, the tax authority does not know the true income of any taxpayer prior to audit, a situation which is surely typical of real-world tax systems. Although in this model there are only two possible true income levels associated with each income report throughout most of the reporting range, one can readily imagine generalizing the model.

The principal-agent and game-theoretic models may be evaluated not just in terms of their empirical implications, but also in terms of the reason-

bution, and so varies from point to point. The shape of the income distribution does not directly affect reporting behavior in the first game-theoretic model; indeed, in the fully separating equilibrium of that model, all taxpayers evade by the same amount. In that model the income distribution affects the equilibrium only indirectly through the budget constraint—if the income distribution becomes skewed toward lower incomes, more audits must be performed, λ rises, and the entire audit function shifts downward.

[39] This statement is based primarily on our own experience working with federal and several state tax authorities.

[40] Beck and Jung (1989) and Cronshaw and Alm (1995) have shown that the game-theoretic model can be recast as a game of private information in which the tax agency follows a pure strategy in equilibrium. However, their models assume that taxpayer income is either "high" or "low," and it is not clear whether the models can be readily generalized to the case of a continuum of income types.

[41] For example, it disappears when the audit cost is made to depend on the probability of audit, as shown in Reinganum and Wilde (1986a).

ableness of their assumptions. A critical assumption maintained in both models is that taxpayers can correctly deduce the audit rule. Indeed, the value of committing to a specific audit rule would be entirely lost under the principal-agent approach if the taxpayer were to remain ignorant of this rule. Within the context of the principal-agent model, therefore, it would be natural for the tax authority to announce its audit rule prior to the start of the filing season. In practice, however, we are not aware of any tax agencies that follow such a policy. On the contrary, most agencies undertake substantial precautions to maintain the secrecy of their audit selection procedures. Although the tax authority makes no such audit commitment within the game-theoretic framework, the taxpayer is nonetheless assumed to know the rules of the game, and therefore should be able to deduce the equilibrium audit strategy. However, in the real world, taxpayers seem to possess quite poor knowledge of the audit function.[42] (See Section 6.5 for further discussion of this issue.) Tax practitioners may have better knowledge of the factors that trigger an audit, but we suspect that there is substantial heterogeneity of beliefs even among this group. The innovation of allowing for honest taxpayers within the game-theoretic approach partially addresses the inconsistency between model and reality. In particular, inherently honest taxpayers would have no need to know the audit rule facing them, because it would be irrelevant to their reporting decision. However, we doubt that in practice it is only the honest taxpayers who are unaware of the risk of audit. Rather, we believe that there exists an important asymmetry of information over audit policy observed in real-world tax systems that the existing models fail to capture. The issue of audit policy misperceptions is taken up further in Section 6.5.

A standard assumption among both principal-agent and game-theoretic models is that taxpayers only experience a cost from being audited if they are found to have underreported their income. In practice, audits can result in considerable costs even for honest taxpayers, including the time burden of documenting one's claims and meeting with tax authorities, as well as the financial cost of hiring professional assistance. In addition, many taxpayers experience considerable anxiety from being audited. Accounting for such costs might lead to equilibria rather different from those observed in existing models. For example, some taxpayers may actually be willing to overreport their tax liability if doing so would result in a significant reduction in the chance of being audited.

Existing game-theoretic and principal-agent models of tax compliance all assume that the taxpayer reports only a single piece of information, taxable income, to the tax agency. In practice, however, taxpayers make rather detailed reports about their sources of income and deductions, providing the tax agency with multiple signals of their true tax liability. Recently, Jorgé Martinez-Vazquez and Mark Rider (1995) and Shelly C. Rhoades (1996) analyzed how multiple line-item reporting influences equilibrium reporting and auditing strategies, but this remains

[42] A considerable body of survey evidence (e.g., Louis Harris and Associates, Inc. 1988) indicates that many taxpayers have only a rough idea of the average probability of audit in their class, and most have little idea as to how this probability changes with the level of income reported.

[43] Steven Klepper and Daniel Nagin (1989) also discuss how taxpayer reporting behavior is influenced by the presence of multiple line items; however, they do not specify an equilibrium model. See Section 6.3.

an important area for future research.[43]

Another standard assumption of principal-agent and game-theoretic models is that taxpayers are certain of their true tax liability. In practice, many taxpayers make reporting errors precisely because they are uncertain as to their actual tax obligations. The importance of this observation is explored later in Section 9.

If a tax authority could choose whether to commit to its audit policy, would it do so? The theoretical models we have reviewed, which are clearly rather imperfect guides to policy, indicate that the authority would prefer to commit, as audit revenues are higher in this case. For example, suppose that incomes are uniformly distributed between 20 and 40 thousand dollars within a class, the proportional tax rate is equal to 0.3, the penalty for detected noncompliance is double the unpaid tax, the cost of an audit is equal to 0.5, and the audit budget is sufficient to allow 20 percent of all returns to be audited. In this case a revenue-maximizing tax authority would want to commit to audit all reports under 36 with a probability of one-third, and to accept the remaining reports without audit. It is straightforward to compute that this policy would yield an average revenue (net of audit costs) of 8.42 per return. If the authority were unable to commit to this policy, a simulation reveals that the authority would only expect net revenue of 7.52 per return—over 10 percent less than the average revenue from the commitment policy.[44]

[44] This simulation is based on the revenue-preferred equilibrium to the tax compliance game, which involves pooling of some reports at the lower tail of the income distribution. The revenue discrepancy between the cases with and without commitment would be even greater if the fully revealing equilibrium for the latter case were instead employed.

4.5 *Designing Incentives for a Tax Administration*

The models discussed above make no distinction between the tax authority and the remainder of the government. In fact, the distinction raises some important issues. First, if a sovereign government seeks to maximize a broad social welfare function, should its tax authority also seek to maximize the social welfare function, or should it instead seek to maximize net revenue collections? Second, if the objective of a tax authority is different from the objective of its sovereign government, through what means—budgetary, administrative, or political—can the government seek to control the behavior of the authority?

Nahum D. Melumad and Mookherjee (1989) consider a version of the second question, analyzing a government that would like to commit to its audit policy, in order to maximize total tax collection, but cannot. They suggest that the government may be able to replicate the commitment outcome by delegating responsibility for audits to an agent—the tax authority. In particular, they argue that the government can induce the authority to follow the commitment audit rule, even though the authority cannot itself commit to this rule before taxpayers make their reports, by offering the authority an incentive contract of the following kind. If the authority's audits generate no fines, the agent is simply rewarded for meeting its audit budget target; if the audits do generate fines, the authority is rewarded proportionately to the value of the fines. Recognizing that, due to the second feature, the authority has incentive to audit any taxpayers who deviate from the commitment equilibrium and report dishonestly, taxpayers are induced to play the commitment equilibrium. Note

that the government is able to commit to the terms of the agency contract, but these involve only aggregate variables such as total audit expenditures and total fines, and not detailed instructions about audit selection decisions. A possible difficulty with this "tax agency as bounty hunter" framework is that it ignores the potential for corruption that the above reward system induces. Charles Adams (1993) provides a number of historical examples of how similar reward structures have resulted in corrupt tax collection and enforcement systems.

Sánchez and Sobel (1993) also study the delegation of tax collection responsibility to an agent, but focus on the differing objectives of a government and its tax authority.[45] They assume that the tax authority seeks to maximize total tax collection, but that the sovereign government seeks to maximize a more general social welfare function, both providing a public good and redistributing income. Sçnchez and Sobel show that the government generally will provide a smaller budget for the tax authority than the authority itself considers optimal, so that in equilibrium the shadow value of providing an additional dollar of audit resources to the tax authority is larger than one.[46] To gain an intuitive understanding of this result, consider the case in which the shadow value does equal one. In that case the last dollar of audit resources raises exactly one dollar of revenue, and therefore does not increase net revenue at all, while consuming one dollar of real resources. It is easy to see that in this situation the last dollar spent on auditing actually lowers social welfare, so that the audit budget should be reduced, raising the shadow value.[47]

Many questions about the relation between government and tax authorities remain, and are promising areas for future research. These include questions about how different political systems affect the interaction between legislative and executive branches of government and tax agencies, how best to deter tax corruption, and how to integrate tax enforcement across different levels of government.

5. *Data Sources and Methodologies*

Prior to 1980 the empirical academic literature on tax compliance consisted of only a few studies, based either on surveys of taxpayer attitudes or on small, idiosyncratic datasets. Over the past decade, empirical research on tax compliance has blossomed, beginning with the work of Charles T. Clotfelter (1983). Many of the recent studies focus on compliance with the U.S. federal individual income tax. However, there have also been studies of income tax compliance at the state level in the U.S., and at the federal and subnational levels in other countries, including Jamaica, the Netherlands, Spain, and Switzerland.

Although many empirical studies of noncompliance have been conducted

[45] Cremer, Marchand, and Pestieau (1990) also present a model in which a sovereign government maximizes a social welfare function while the government's tax authority maximizes net revenue collections. However, in their model the tax authority is not budget constrained. The authors include several audit classes in their model, and their analysis focuses both on the government's choice of tax rates across classes and on equity issues and welfare comparisons across classes.

[46] This conclusion also is drawn by Dan Usher (1986) and by Joel Slemrod and Yitzhaki (1987), in quite a different context.

[47] Sánchez and Sobel also show that an increase in the cost of an audit does not always lead to a reduction in the amount of the public good that is provided. The intuition for this second result is that the increased audit cost leads to more cheating, which disproportionately benefits higher income individuals, so that the government may increase spending on the public good as a way of indirectly redistributing income.

during the past decade, we believe that the empirical literature is still in its youth, with many of the most important behavioral hypotheses and policy questions yet to be adequately investigated. The most serious drawback of the recent empirical work is that it is only loosely connected with theory. In fact, almost none of the recent empirical findings can be interpreted as tests of existing theories, and, partly as a result, few of the recent empirical findings have led to productive new theorizing.

Tax evasion is difficult to measure, primarily because individuals often undertake substantial efforts to conceal their evasion. We will focus on four alternative sources of information used by researchers to measure and study evasion: audit data, in some cases linked to census information; survey data; tax amnesty data; and data generated through laboratory experiments.[48]

The most reliable information about noncompliance is based on actual tax return information that has been thoroughly examined by auditors. As discussed in Section 3, such data are collected in the U.S. through the TCMP. In the household TCMP, a stratified random sample of federal individual income tax returns is subjected to thorough examination by experienced IRS tax examiners. The TCMP data record the taxpayer's report and the examiner's correction for most line-items on the return, providing extremely detailed information about noncompliance. The IRS conducted the first TCMP survey for the 1963 tax year, and has subsequently conducted household TCMP surveys about every three years, until 1988.[49] For most of these years, the surveys included between 45,000 and 55,000 households.

In some cases the IRS has allowed researchers access to individual TCMP records. In other cases the IRS has aggregated the TCMP data, for example by zip code, before releasing it to outside researchers. Although we believe TCMP data to be among the best available for studying tax noncompliance, the data do suffer from some drawbacks. Because TCMP data are derived entirely from tax returns and tax examinations, they contain little information about socioeconomic and demographic characteristics. In addition, measures of noncompliance based on the examiner's correction of the taxpayer's report are subject to error, mainly because IRS examiners are generally unable to detect all evasion, especially evasion in the form of income understatements.[50]

We are not aware of any other country for which a random sample of audited tax returns of comparable quality to the TCMP is regularly collected. However, some researchers have obtained tax return and tax audit data for other countries, including the Netherlands and Jamaica.[51]

Data aggregates based on individual tax return and audit records also provide valuable information about noncompliance, especially when linked to

[48] A fifth source, which we do not discuss, comes from measurements of discrepancies in economic statistics, such as monetary aggregates. See Feige (1989) for a discussion of measurement techniques and Steven E. Crane and Farrokh Nourzad (1986) for an empirical application.

[49] Surveys exist for tax years 1965, 1969, 1971, 1973, 1976, 1979, 1982, 1985, and 1988.

[50] We discuss studies of the examiner detection process in Section 7.2. Other problems with the TCMP are that it only covers resident filers; cases involving reclassification of reported information are generally not identified.

[51] Henk Elffers, Russell H. Weigel, and Hessing (1987) obtained information from the Dutch Ministry of Finance for approximately 700 taxpayers whose returns were audited in two consecutive years, which they linked together with survey responses from each of the audited taxpayers. Alm, Bahl, and Murray (1990, 1993) collected data containing both tax return information and field audit results for Jamaican taxpayers.

census data. For example, several researchers have linked information from the IRS *Annual Report of the Commissioner* with data from the Bureau of the Census, creating a state-level panel database.[52] Datasets based on aggregate information also have been constructed for other countries.[53]

Surveys provide an alternative source of information about noncompliance. The main advantage of survey data is that they often include many socioeconomic, demographic, and attitudinal variables that are not available with tax return and audit data, allowing researchers to investigate a rich set of hypotheses about the factors associated with noncompliance. The major disadvantage of survey data is that they are based on self-reports, which often provide very inaccurate information. Research by Elffers, Weigel, and Hessing (1987) demonstrates how unreliable survey data can be. These researchers linked tax audit results with survey responses for several hundred Dutch taxpayers. They report that the correlation between assessed evasion and evasion reported on the survey is essentially zero. In general, survey results substantially overstate the degree of compliance.[54]

Surveys on tax compliance have been undertaken in a number of countries, including the U.S., Australia, Canada, Spain, and Sweden.[55] Overall, survey data appears to be most useful in two situations: when matched with tax return and audit data, supplying a rich array of additional social and attitudinal variables; and when incorporated into structural econometric models, to test alternative theories of taxpayer motivation and behavior.[56]

An alternative source of information on tax noncompliance is state tax amnesty data. Self-reported evasion by amnesty participants provides a direct measure of noncompliance, which in principle can be related to taxpayer and tax return characteristics. An obvious difficulty with such data is the sample selection problem: Only a subset of all evaders is likely to participate in a tax amnesty, and this subset may not be representative of the overall population.[57]

Given the difficulties in obtaining reliable third-party information about tax compliance behavior, many researchers have resorted to generating their own data through laboratory experiments.[58]

[52] See Jeffrey A. Dubin, Graetz, and Wilde (1987, 1990) and Kurt Beron, Helen V. Tauchen, and Anne Dryden Witte (1992).

[53] For example, Pommerehne and Frey (1992) present data on political, economic, and tax compliance characteristics of 26 Swiss cantons.

[54] For example, a recent IRS-commissioned national survey on tax compliance (Harris and Associates, Inc. 1988) reports that nearly 80 percent of respondents claimed not to have engaged in any overstatement of deductions or understatement of income during the previous five years. This figure sharply contrasts with TCMP statistics, which indicate that in any given year about 40 percent of all households understate their tax obligations. Of course, some of the difference between these two numbers is probably due to the fact that taxpayers and examiners disagree about what constitutes noncompliance.

[55] In the U.S. the IRS has commissioned a number of large-scale national surveys; Harris and Associates, Inc. (1988) and Schulman, Ronca, and Bucuvalas (1990) are two recent examples. Examples of surveys in other countries are Ian Wallschutzky (1985) for Australia; Neil Brooks and Anthony N. Doob (1990) and KPMG Centre for Government Foundation (1994) for Canada; de Juan, Lasheras, and Mayo (1994) for Spain; and Joachim Vogel (1974) for Sweden.

[56] See Elffers, Weigel, and Hessing (1987) and John T. Scholz and Neil Pinney (1993) on the first, and Steven M. Sheffrin and Robert K. Triest (1992) for an example of the second.

[57] As illustrated in Crane and Nourzad (1992), truncated regression procedures may be employed in an attempt to account for the selection problem.

[58] See, for example, Nehemiah Friedland, Shlomo Maital, and Aryen Rutenberg (1978); Michael W. Spicer and Lee A. Becker (1980); Winfried Becker, Heinz J. Buchner, and Simon Sleeking (1987); Henry S. J. Robben et al. (1990); Paul Webley et al. (1991); Beck, Davis, and Jung (1991); and Alm, Gary H. McClelland, and William D. Schulze (1992).

Such experiments generally consist of a multiperiod reporting game involving participants (frequently students) who make declarations, pay taxes, experience audits, pay penalties for detected noncompliance, and, in some cases, receive rewards for compliant behavior—all within a controlled environment. One does, of course, need to be cautious when interpreting the results of such experiments. The setting by its nature is unrealistic, and there may be aspects of the compliance decision that cannot be replicated in a lab, for example, moral, emotional, and social influences. However, experiments can teach us about basic motivations of individuals in risky situations.

Researchers have generally relied on standard econometric models to study noncompliance, although specialized models have been developed in some cases to deal with unusual issues that arise in the analysis of compliance data.[59] In the case of studies based on individual level audit records, researchers generally employ some form of tobit analysis, using a measure of unreported income or unreported taxes as the dependent variable. In the case of aggregate level data, researchers generally employ linear regression analysis. Frequently, the degree of compliance (or noncompliance) in aggregate data studies is measured as a rate, such as the ratio of reported to true tax liability or the ratio of total tax adjustments to total tax collections.[60]

[59] One such issue is that audits are not always successful in uncovering tax evasion. See Section 7.2 for a discussion of ways to account for imperfect detection. A second issue is that a nontrivial percentage of taxpayers actually overstate their tax liabilities, often unintentionally. See Craig Alexander and Feinstein (1987) and Erard (1997) for econometric models that account for both overstatement and understatement of taxes.

[60] Measures of reported income (e.g., reported adjusted gross income) and reported tax liability have also been used as dependent variables in aggregate data analyses of noncompliance, primarily as an attempt to get around the difficulties associated with directly measuring noncompliance. Studies using one of these dependent variables typically include as independent variables some measure of true income, such as census income, and a variety of measures of income sources. Unfortunately, such a specification makes it difficult to interpret the finding that a particular variable has a negative relationship with reported adjusted gross income (AGI). Such a finding might be an indication that the variable is associated with noncompliance; however, it might just as well be a sign that the variable is a proxy for certain legitimate income allowances (such as an age exemption) or deductions (such as the home mortgage deduction) that reduce legal tax liability.

6. *Explaining Household Noncompliance*

In this section we examine the determinants of noncompliance, particularly the roles of opportunity to evade, marginal tax rate, income, and demographic and social factors in the evasion decision.

6.1 *Income and Tax Rates*

The theoretical models all indicate that, as income rises, tax evasion should increase over most ranges. Although there are special cases in which cheating declines with income, the regressive bias of tax evasion is the general prediction. By contrast, theoretical models generate no clear predictions on the effects of tax rates on compliance. The presence of both income and substitution effects complicates the analysis, and special assumptions about the form of penalties, distribution of income, and shape of preferences are often required to identify any comparative statics.

Clotfelter's (1983) analysis is an important early study of the empirical relationships among income, the marginal tax rate, and evasion. He estimates a standard tobit model of evasion using data from the 1969 TCMP, including as independent variables after-tax income, the combined state and federal marginal tax rate, and a variety of other so-

cioeconomic and demographic characteristics.[61] Clotfelter reports elasticities for the after-tax income, and marginal tax rate variables for each of ten separate audit classes. Coefficients on both the after-tax income and marginal tax rate variables are positive and significant. In addition, the elasticity of underreporting with respect to the marginal tax rate is positive for every audit class, with the magnitude of the elasticity varying from 0.5 to more than 3.0; the elasticity of underreporting with respect to after-tax income is positive for all but one class, ranging from about 0.3 to above 3.0. A number of other studies have investigated the effects of income and marginal tax rates on evasion. Some of these corroborate the finding of Clotfelter, while others contradict it.[62]

As is often the case when both tax rates and income are dependent variables, the strong positive relationship between them makes identifying their independent effects problematic. To circumvent this problem, Feinstein (1991) estimates a model that uses pooled data from both the 1982 and 1985 TCMPs. Since marginal tax rates changed over this period for a given level of income, the separate effects of the two variables are more easily identified. The results from the pooled data indicate that no significant relationship exists between income and evasion, and a significant *negative* relationship exists between the marginal tax rate and evasion. Interestingly, this result is consistent with Yitzhaki's insight discussed in Section 3. However, it conflicts with Clotfelter's finding.[63]

Studies using laboratory experiments typically find that high tax rates are associated with greater evasion. (See, for example, Friedland, Maital, and Rutenberg 1978; James Alm, Betty R. Jackson, and Michael McKee 1992b; and Jonathan C. Baldry 1987). In general, therefore, the effect of tax rates on evasion remains unclear. Given the importance of this topic, it surely deserves further investigation.

Slemrod (1985) examines one piece of the puzzle on tax rates and evasion. He observes that, owing to the wide use of tax tables, tax liability is actually a step function of taxable income for most U.S. households. Under natural assumptions, tax evaders have an incentive to report at the top of a tax bracket rather than within its interior, while honest reporters have no incentive to

[61] In Clotfelter's analysis, after-tax income is defined to be the household's "true" AGI as determined by the examiner minus the household's corrected tax payments; the self-employment tax is included in the computation of the marginal tax rate, and the rate is computed using the household's "true" after-tax income.

[62] In their analysis of noncompliance based on Swiss canton data, Pommerehne and Frey (1992) include both a measure of the canton tax rate and the median income as independent variables. Their results indicate a positive, significant relationship between each of these variables and noncompliance, similar to Clotfelter's result. David Joulfaian and Rider (1996) examine the impact of tax rates (inclusive of Social Security taxes and accounting for the Earned Income Tax Credit) for a random sample of low-income households from the 1988 TCMP. They find that both the probability and the level of noncompliance among low-income proprietors is positively and significantly associated with the marginal tax rate, consistent with Clotfelter. Alm, Bahl, and Murray (1993) report results for Jamaica from the estimation of three-equation models in which the dependent variables are evasion, reported income, and "allowance" income. They include the marginal tax rate as an independent variable in their equations, but do not include any measure of income. Their results indicate that an increase in the marginal tax rate actually lowers evasion.

[63] Although Clotfelter only considered one year of data, his analysis also allowed for some independent variation between income and the marginal tax rate by accounting for state variations in tax rates in his construction of the latter variable. Assuming that taxpayers make consistent reports on their state and federal returns, the combined state and federal marginal tax rate is in fact more appropriate as an explanatory variable than the federal rate alone.

alter their reports. Examining 1977 tax return data, Slemrod finds that a disproportionate share of all reports fall within the top quantile of a reporting bracket, consistent with his bunching hypothesis. Charles W. Christian and Sanjay Gupta (1993) extend Slemrod's analysis and find a significant positive association between the marginal tax rate and bunching.

6.2 *Demographic and Social Factors*

A number of demographic and social characteristics are also related to patterns of noncompliance. As discussed in Section 2, TCMP data indicate that noncompliance is significantly less common and of lower magnitude among households in which either the head or the head's spouse is over age 65, while noncompliance is more common and of greater magnitude among households in which the head is married. These findings continue to hold in econometric studies (Clotfelter 1983; Feinstein 1991) that control for such factors as the level of income and the marginal tax rate.

Compliance rates also appear to differ across occupations. For example, the 1985 household TCMP data indicate that among all sole proprietors those who engaged in sales from fixed locations (car dealerships, stores, restaurants, etc.) understated taxes by the greatest percentage (39 percent), followed by those involved in transportation, communication, and utilities (36 percent) and those in retail sales (31 percent). Business filers in finance, real estate, and insurance; agriculture, forestry, and fishing; and wholesale trade industries understated taxes by the lowest percentages (16, 18, and 19 percent, respectively).[64]

[64] These figures are reported in United States General Accounting Office (1990).

Unfortunately, TCMP data, and tax return data in general, contain information about only a handful of demographic and social factors. Hence, to study the role of variables such as education and race, researchers have linked tax data with other sources of information. The most common approach links aggregate tax data with census data. For example, Witte and Diane F. Woodbury (1985), Beron, Tauchen, and Witte (1992), and Dubin and Wilde (1988) analyzed a dataset provided by the IRS that links 1969 TCMP data, aggregated to the three-digit zip code level, with census and IRS enforcement data. Although an audit-based measure of noncompliance unfortunately is not available with this data, a predicted measure of noncompliance, based on the IRS DIF score, is available and was used in two of the above studies, by Witte and Woodbury, and by Dubin and Wilde.[65]

These studies indicate that, in most audit classes, an area's voluntary compliance rate is greater when the nonwhite proportion of the population is lower, the proportion over age 65 is greater, and the proportion of the adult population employed in manufacturing is higher. However, there are conflicting results on the effects of the unemployment rate and the percent of the adult population with a high school degree.

Experimental studies have also exam-

[65] As another example, Dubin, Graetz, and Wilde (1987, 1990) link information from the IRS *Annual Report of the Commissioner* with census data to create a pooled cross-section time series for the states over the period 1978–85. Alan H. Plumley (1996) also has created a very detailed pooled cross-section time series database for the states, relying on numerous IRS and Census data sources. A micro-level alternative to generating a data base is to link individual tax records with survey information. Both Scholz and Pinney (1993) and Hessing et al. (1992) take this approach. Unfortunately, neither group of researchers has used its data to study the relationship between evasion and either demographic or social characteristics.

ined the role of two demographic factors in compliance: age and sex. Like the audit-based studies, the experimental studies generally find that age is positively associated with compliance (Baldry 1987; Friedland, Maital, and Rutenberg 1978). In the case of the latter variable, Baldry (1987) finds that males tend to evade by more than females do.

6.3 *Penalties and Audit Probabilities*

In the simple theoretical model of Allingham and Sandmo, the effects of penalties and audit probabilities are clear; higher penalties and audit probabilities discourage cheating. However, the more complex game-theoretic and principal-agent models suggest a difficulty with studying the effects of these factors, which is that the probability of an audit (and penalties in some models) is determined endogenously along with cheating.

As discussed in Section 5, one way to deal with the endogeneity of audit risk is to control the enforcement environment artificially by using a laboratory experiment. Experimental studies consistently show that both the penalty rate and the probability of audit have a positive influence on compliance, in accordance with theory.[66] However, Alm, Jackson, and McKee (1992a) find that when these variables are set at levels consistent with those observed in practice their deterrent effect is quite small.

At the level of individual household records, the probability of audit is endogenous, because it depends on characteristics of the taxpayer's report (e.g., the level of income reported) which, according to theory, themselves depend on the probability of audit. Researchers using micro-data have generally relied on proxies for evasion opportunity, such as the presence of business or farm income, to control for audit risk, instead of relying on standard instrumental variable techniques, because no direct measure of the audit probability is readily available.[67] Such studies find that noncompliance is positively associated with these opportunity measures.

In aggregate data studies, the district or state level audit rate is likely to be endogenous, because the extent of auditing in an area is likely to depend on the level of noncompliance, which itself may be sensitive to the level of enforcement. To control for potential endogeneity at the aggregate level, researchers have generally relied on instrumental variables estimation. Although the best choice of instruments is an unsettled issue, the empirical evidence suggests that controlling for endogeneity is important.

For example, Witte and Woodbury (1985) and Dubin and Wilde (1988) estimate similar models of noncompliance using aggregate TCMP data for tax year 1969.[68] A key difference in estimation approaches is that the audit rate for a given zip code area is treated as an exogenous variable in the earlier study, whereas it is treated as a potentially endogenous variable in the later study via instrumental variables procedures. Witte and Woodbury find a significant positive relationship between the risk of audit and their measure of the rate of voluntary compliance in each of the three representative audit classes for which results are presented.[69] In con-

[66] See, for example, Friedland, Maital, and Rutenberg (1978); Becker, Buchner, and Sleeking (1987); and Beck, Davis, and Jung (1991).

[67] See, for example, Clotfelter (1983) and Alexander and Feinstein (1987).

[68] See the description of this data above in Section 6.2. Dubin and Wilde employ a more parsimonious specification than Witte and Woodbury in an effort to avoid multicolinearity problems.

[69] The number of IRS notices sent out as part of data processing efforts is also found to have a positive impact on compliance. Surprisingly, however,

trast, Dubin and Wilde, in their reanalysis of the data employed by Witte and Woodbury, find that the audit rate has a significant deterrent effect on noncompliance in only one of the seven total audit classes when the state-level IRS operating budget per return is employed as an instrument for the audit rate. Further, a specification test indicates that the audit rate is endogenous in five of the seven classes.

Beron, Tauchen, and Witte (1992) also reanalyze the same 1969 data, but employ as an instrument the total number of returns filed in a district divided by the number of full-time equivalent IRS district employees. They find that the audit variable is endogenous, but their results suggest that audits exert only a modest positive effect on compliance.

Dubin, Graetz, and Wilde (1990) analyze a pooled cross-section time-series state dataset. They employ the instrument used by Dubin and Wilde, as well as a second instrument, the number of information returns (other than W-2 forms) per tax return filed. They also conclude that the audit variable is endogenous but, in contrast to other studies, find that an increase in the audit rate exerts a large positive effect on compliance.

Pommerehne and Frey (1992), in their study of Swiss cantons, follow a different strategy. They use lagged values of audit and penalty variables as instruments for the contemporaneous values of these variables. Their results indicate that the probability of audit has a positive, marginally significant association with compliance, while the penalty rate has a positive but insignificant association.

the results show no indication of a deterrent effect for either the probability or magnitude of various penalties.

While each of these instruments seems plausible, none is ideal. Dubin and Wilde argue that the budget allocated to a state is not correlated with the level of noncompliance in the state, so that the standard assumptions for the instrumental variables procedure to yield consistent estimates are satisfied. However, taxpayers' reporting decisions may be affected by their perceptions of the extent of IRS enforcement resources in their state; if that is the case, the budget variable belongs in the reporting equation and cannot be used as an instrument. Further, the allocation of the IRS budget may in fact depend on compliance patterns across states, in which case the budget variable is likely to be correlated with the error term in the reporting equation, rendering it invalid as an instrument.[70] The instrument used by Beron, Tauchen, and Witte suffers from similar concerns. Also, the number of information returns per tax return arguably belongs in the reporting equation as an explanatory variable, because the expansion of the information returns program over time is likely to have had an impact on reporting behavior.[71] Finally, if taxpayers' compliance decisions depend upon past enforcement actions, these lagged values should be included as regressors. Hence, all of these studies come with caveats. Nonetheless, they present a fairly consistent picture in which both penalties and audit probabilities have some deterrent effect, although the magnitude of these effects is still unclear.

Klepper and Nagin (1989) take a

[70] Anticipating the latter criticism, Dubin and Wilde argue that the IRS district budget allocation process is relatively unresponsive to variations in compliance rates across districts.

[71] Moreover, taxpayers have some control over the extent of information reporting through their choices of how to earn and invest their income.

more disaggregated look at the role of penalties and audit probabilities. They note that cheating on some line items may be more likely to be discovered. They posit a model in which the perceived likelihood p_i that line item i of a taxpayer's return will be investigated during an audit is positively related to the degree of noncompliance on the item and negatively related to the cost to the tax authority of establishing noncompliance. The probability that an audit will actually take place is taken to be an increasing function of the line-item probabilities, Σp_i. Klepper and Nagin, using tabulations from the 1982 TCMP, find that the variation in noncompliance across line-items is large and follows a pattern consistent with their theory.

One of the ways the tax authority can reduce its cost of establishing noncompliance is to require information reports from third parties. Susan B. Long and Judyth A. Swingden (1990) explore the impact of information reporting on compliance using data from the 1982 and 1985 TCMPs, which span a period over which new third-party information reporting requirements were instituted. Their comparison of noncompliance levels on the affected line items before and after the new reporting rules came into effect shows that the extent of both underreporting and overreporting on the affected line items dropped significantly with the introduction of these new requirements.

Robben et al. (1990) performed a series of experiments involving a rather sophisticated small business simulation using participants from Belgium, Spain, Sweden, and the United States. They found that participants who had greater perceived opportunities for noncompliance (by having more itemized deductions and more income as cash rather than as checks) tended to be significantly less compliant. Taken as a group, the studies by Klepper and Nagin, Long and Swingden, and Robben et al. provide further evidence that noncompliance is discouraged by a high risk of detection.

6.4 *Prior Audits*

To the extent that being audited in one year raises one's perception of the chances of being audited in the future, one would expect that an audit in one year may influence one's subsequent tax compliance behavior. Such an effect has been observed in experimental studies on tax compliance.[72] However, studies based on actual audit data conflict with the experimental findings. Long and Richard D. Schwartz (1987) examine IRS data involving a group of taxpayers who were first subjected to a TCMP audit of their 1969 tax returns and then later, without prior warning, to a TCMP audit of their 1971 returns. The authors found that the earlier audit was marginally effective in reducing the frequency of subsequent noncompliance, but was not effective in reducing the average magnitude of noncompliance among those who continued to cheat. However, the initial TCMP audit in this study is likely to have been quite different from an ordinary audit experience. For instance, taxpayers know that selection for TCMP audits is random, whereas selection for other audits is not. Hence, TCMP audits may have little effect on behavior.

The deterrent effect of an ordinary audit experience was studied by Erard (1992). Using the 1982 TCMP, which contains details relating to a taxpayer's ordinary prior audit experiences, he

[72] Spicer and Rodney E. Hero (1984), Benjamini and Maital (1985), and Webley (1987) all report that compliance improved significantly in the later rounds of their experiments among those participants who had been audited in earlier rounds.

specifies a two-equation model. The first equation is a tobit specification of noncompliance on the taxpayer's 1982 tax return, which includes a dummy explanatory variable for whether the taxpayer's 1980 tax return was audited. The second equation is a probit specification of whether the taxpayer's 1980 return was audited as a function of information reported on the 1980 return. The two equations are estimated jointly to account for the possibility of sample selection in the 1980 audit selection process.[73] The estimated coefficient for the prior audit dummy is small and statistically insignificant, suggesting that the experience of an audit has little effect on future reporting behavior. Simulation results, however, show that the results are fairly sensitive to the structure of the correction employed for sample selection.

If audits do in fact have very little specific deterrent value, it is important to consider why. One possible explanation is that audits may not turn out as badly as taxpayers initially fear. For example, if an audit fails to uncover noncompliance that is present or if a substantial penalty is not applied to discovered noncompliance, a taxpayer may conclude that it pays to cheat. Alternatively, perhaps taxpayers do find audits to be a negative experience, but the impact of this experience is to make them want to evade by more in the future in an attempt to "get back" at the tax agency. Clearly, more research is needed both to confirm whether there is any specific deterrent effect of an audit and to uncover the reasons for the presence or absence of such an effect. This is an important area, because the econometric results to date suggest that the use of the "stick" to enforce compliance with tax laws may not have any long-run impact.

6.5 *Objective Versus Subjective Enforcement Measures*

The studies discussed above that include a measure of audit risk have generally relied on the actual audit rate. However, taxpayers may not have objective knowledge of the risk of an audit, and their subjective views of the probability may be more important for understanding their compliance behavior. Indeed, survey results suggest that people greatly overestimate the probability of an IRS audit. Scholz and Pinney (1993), for example, compare an objective measure of audit probability with respondents' subjective assessments.[74] They find that for the vast majority of taxpayers there is no significant correlation between the predicted audit probability and the taxpayer's subjective assessment of this probability.[75] In most cases, however, the taxpayer's subjective assessment is

[73] In particular, since the selection process is meant to identify evaders, it may choose taxpayers who would normally be prone to noncompliance in future years (assuming that there is some persistence in noncompliance behavior from one year to the next). To test for an audit effect, then, one would need to account for the possibility that taxpayers selected for an audit in one year would have a different expected level of subsequent noncompliance (in the absence of the audit) than those not selected.

[74] Scholz and Pinney employ a unique data set that links survey responses with tax return and audit information for several hundred U.S. households residing on Long Island. To estimate the actual probability of audit, they rely on a large supplemental data set containing information about IRS audits of Long Island households conducted over the period 1984–86. They estimate probit models of the IRS' audit decision in which the explanatory variables include household characteristics and an approximate value for the DIF score associated with the household's return. They use coefficient estimates from the probit model to predict the probability of audit faced by each household in their main sample.

[75] For a 20–percent subsample of taxpayers considered to be better informed (e.g., self-employed) and to have greater opportunity to cheat, they find a significant positive correlation between subjective and objective measures.

found to substantially exceed the objective measure.

There are several interesting determinants of these misperceptions. Greater knowledge of the tax laws reduces the perceived audit probability, but a greater extent of past contact with the IRS actually increases the subjective probability of an audit. Scholz and Pinney also construct a "duty index" based on respondents' views of their moral responsibility to pay their taxes. They find that, while it is not clear which way the causality—if there is any—goes between these variables, a greater degree of this moral compunction was related to a significantly higher subjective assessment of the probability of audit.

Hessing et al. (1992) also explore factors related to the perceived probability of audit. They combine survey responses and tax enforcement records for a sample of taxpayers in the Netherlands and examine the relationship between the taxpayers' tax enforcement experiences over the 1983–86 tax years and their subsequent perceptions and reporting behavior. Their results indicate that, compared with taxpayers who experienced no corrections to their returns over this period, taxpayers who received one or more corrections for errors tended to perceive a higher level of certainty that evasion in large amounts (F 5000), but not in smaller amounts (F 500), would be detected. Interestingly, however, taxpayers who received one or more corrections for suspected evasion held beliefs about the likelihood of detection similar to those of taxpayers who had experienced no corrections of any kind. In contrast to the findings of Scholz and Pinney, the results of this study therefore provide much weaker support for the notion that a prior audit experience increases the subjective probability of a future audit.

Given that perceptions of audit probabilities are likely to be mistaken, we can ask how these subjective probabilities affect compliance. Sheffrin and Triest (1992) present a structural econometric analysis of the influence of attitudes and beliefs on the perceived probability of detection and evasion behavior. Since their analysis is based entirely on survey data, they have no objective measures of compliance or enforcement and must rely on self-reports. Their model includes two equations, one to explain evasion behavior and a second to explain the perceived probability of detection. They also include, as independent variables, measures of attitude towards government, perceived honesty of other taxpayers, past contact with the IRS, and an indicator for whether the respondent reports knowing anyone who has had "difficulties" with the IRS.[76]

The results indicate that knowing someone who has experienced difficulties with the IRS significantly lowers the perceived probability of detection, while reporting that one has had past contact with the IRS has a small but insignificant positive effect on the perceived probability. The most important finding of Sheffrin and Triest is that individuals who perceive a higher probability of detection report significantly less evasion. Not surprisingly, individuals possessing more negative attitudes toward government and those evincing less faith in the honesty of others engage in more evasion. These results are consistent with the view that individuals seek to present a rational, coherent image in surveys: those who report engag-

[76] Sheffrin and Triest specify a sophisticated latent variable model that accounts for the possibility that reports concerning evasion behavior, the perceived probability of detection, attitudes toward government, and the perceived honesty of others are all measured with error.

ing in evasion provide beliefs to justify their evasion, while those who report that they are honest provide beliefs to justify their honesty.

Elffers, Weigel, and Hessing (1987) present a series of studies in the Netherlands exploring the relationship among taxpayer perceptions of penalties, audit probabilities, self-reports of evasion behavior, and the level of assessed evasion. The survey responses reveal essentially no correlation between the perceived likelihood of apprehension and the perceived severity of penalty. Further, the perceived severity of penalty is associated with neither the level of self-reported evasion nor the level of assessed evasion. The perceived likelihood of apprehension is negatively associated with self-reported evasion, as expected, but has no significant association with assessed evasion. As above, these authors argue that this last result exemplifies the human need for consistent self-presentation, noting that those individuals who reported that they engaged in evasion may have attempted to rationalize their report by claiming a low probability of apprehension.

The studies discussed here indicate that individuals generally make poor predictions of the probability of audit and magnitude of fines from tax evasion. Moreover, there is consistency between their sense of a moral obligation to be honest and the tendency to overestimate the chance of being caught. Perhaps as a consequence, a high subjective probability of detection is associated with significantly more compliant behavior.

6.6 *The Influence of Tax Practitioners*

In the standard model of tax compliance, the taxpayer is fully informed of all relevant aspects of the reporting decision. In practice, however, many taxpayers are bewildered by the complexity of tax laws and the uncertainty of enforcement. To cope with this, taxpayers frequently rely upon the guidance of tax experts. In the U.S., for example, nearly half of all taxpayers employ tax practitioners to prepare their returns.

Recent theoretical research has begun to explore the various roles played by tax practitioners. Scotchmer (1989a) and Beck, Davis, and Jung (1989) consider their role in reducing taxpayer uncertainty about their legal tax obligations. In contrast, Reinganum and Wilde (1991) explore their value in reducing the time and anxiety costs associated with tax return preparation and tax audits. Slemrod (1989) examines the usefulness of tax practitioners in uncovering legal ways to reduce tax liabilities, while Klepper, Mazur, and Nagin (1991) investigate their ability to exploit ambiguous features of tax laws to reduce taxpayer penalties in the event that noncompliance is detected.

Through each of the above roles, tax practitioners may exert an influence on the compliance process. As providers of accurate information, they may reduce the incidence of error and thereby improve compliance. On the other hand, by reducing the perceived chances of audit and penalty, lowering the psychic and monetary costs associated with audits, and/or delivering aggressive tax advice, practitioners may actually promote greater noncompliance. In an analysis of IRS tabulations of line-item tax noncompliance, Klepper, Mazur, and Nagin (1991) find support for both possibilities. Their results suggest that tax practitioners tend to promote compliance on unambiguously defined line items such as wages and salaries but to promote noncompliance on more ambiguously defined items such as employee business expenses. Intuitively, it is the latter sort of item that is most

open to "creative" accounting and aggressive reporting.

A factor not accounted for in the study by Klepper et al. is that taxpayers freely choose whether to hire tax assistance. In principle, their finding could be a consequence of the way taxpayers sort themselves between the self-preparation and paid preparation modes, rather than any actual influence of tax practitioners. Numerous empirical studies suggest that taxpayers who seek the help of tax professionals do in fact differ markedly from those who prepare their own returns.[77]

To account for the role of self-selection in compliance outcomes, Erard (1993) estimates an endogenous switching model that jointly accounts for the choice of tax preparation mode and the level of noncompliance. The model distinguishes lawyers and certified public accountants (CPAs) from other providers of tax assistance (e.g., H & R Block), because the former are widely thought to be more aggressive advocates for their clients than are the latter. Erard estimates a two-part model using a random subsample of about 14,000 observations from the 1979 TCMP. The first part is a trinary probit specification for tax preparation mode, where individuals choose to hire a specialist preparer (lawyer or CPA), to hire a nonspecialist preparer, or to prepare their returns themselves. This specification is embedded in the second part of the model, which is an endogenous switching specification for the compliance decision. Within this specification, a correlation is allowed between the preparation mode and compliance choices.

In contrast to earlier studies, Erard finds that the level of income does not influence the choice of a preparer; rather it is the source of income, such as business, farm, rental, or royalty income, that encourages the use of a preparer. Regarding the determinants of noncompliance, the results suggest that, in general, the same income sources associated with the use of a tax practitioner (business, farm, rental, or royalty) tend to be associated with higher levels of noncompliance, as is having a prior audit experience. The most important finding, however, is that the use of an attorney or CPA specialist to prepare returns is significantly associated with increased noncompliance, even after controlling for self-selection. Overall, this effect contributes to the regressive bias of tax evasion.

7. *The Analysis of Audit Programs*

Although most empirical studies have focused on compliance, there is a growing literature on tax audit selection decisions and assessments. Improved understanding of the audit process is likely to provide guidance in a number of policy areas, including the comparison and evaluation of alternative tax administration systems and the development of better audit selection methods. In this section we first discuss studies of audit selection, including evidence concerning the shadow value of audit resources, then we review models of the detection process and estimates of the tax gap.

7.1 *Audit Selection*

While a number of empirical studies have included audit rates in their analy-

[77] Slemrod and Nikki Sorum (1984); James E. Long and Steven B. Caudill (1987); Collins, Milliron, and Toy (1988); Slemrod (1989); Marsha Blumenthal and Slemrod (1992); Dubin et al. (1992); and Christian, Gupta, and Lin (1993). These studies suggest that married, elderly, self-employed, and upper-income taxpayers are relatively more likely to seek paid assistance as are those faced with complex returns or high tax rates. In contrast, taxpayers with high levels of general education or specialized tax knowledge tend to prepare their own returns.

ses, few have focused on the audit selection process.[78] Recently, two research teams conducted studies of tax audit programs, obtaining individual tax and audit records, and estimating structural econometric models of the audit selection process. Alm, Roy Bahl, and Matthew N. Murray (1993) obtained information about tax returns and audits of self-employed Jamaican taxpayers.[79] Erard and Feinstein (1996) obtained information about federal and Oregon state tax returns and audits for several different audit classes for tax year 1987.[80] Each team has reported results from the estimation of an econometric system that jointly models the tax agency's audit selection decisions and households' reporting decisions.[81]

Although these two studies use data from different countries and estimate very different models, they reach some similar conclusions. Both groups find that the values of certain tax return line items are correlated with the likelihood of an audit. Alm, Bahl and Murray find that reports of capital income or a large tax liability are associated with a greater chance of audit in Jamaica. Erard and Feinstein report that several line items are important in explaining audit selection in the nonbusiness class that they analyze, but that few line items are important in the business and farm classes they analyze. Both studies also conclude that the tax agencies they study possess private information not recorded in the available tax return data, which plays an important role in audit selection. Further, the results of both studies show that this information is highly correlated with actual noncompliance detected during audits.[82]

An important policy variable in the analysis of tax audit programs is the shadow value associated with providing a tax agency with additional audit resources.[83] At first glance it appears that as long as an agency's shadow value is above one, it is socially desirable to provide the agency with additional audit resources. As discussed in Section 4.5, however, the socially optimal shadow

[78] One exception is O. Homer Erekson and Dennis H. Sullivan (1988). Their main finding is that the audit selection rules followed by the IRS in the low-income nonbusiness classes appear to be quite different from the rules followed in the other classes.

[79] Their data contain tax return information for a random sample of 932 taxpayers for tax year 1980, none of whom was subjected to audit for that year, and both tax return information and audit results for an additional 148 taxpayers, each of whom was subjected to audit for one of the tax years 1980, 1981, or 1982.

[80] Their data contain tax return information for a stratified random sample of more than 43,000 households, including information from Form 1040 and most supplemental schedules; approximately 6,500 of these households were placed in a business audit class, while 2,000 were placed in a farm audit class. The data include audit results for the approximately 4,500 households in the sample subjected to a federal audit and the approximately 3,000 households subjected to a state audit.

[81] Alm, Bahl and Murray specify an econometric model consisting of three equations. The first equation concerns audit selection; in this equation the dependent variable is one if the taxpayer is selected for audit and zero otherwise. The remaining two equations relate to noncompliance detected during an audit. In the second equation the dependent variable is one if an audit reveals that the taxpayer has underreported income and zero otherwise. Erard and Feinstein also specify a model consisting of three equations. In their framework the first equation refers to the distribution of true taxable income and the second equation refers to household reporting behavior. The third equation refers to the tax agency's audit selection decision and is derived from the game-theoretic model presented in Erard and Feinstein (1994a) and discussed above in Section 4.3.

[82] Alm, Erard, and Feinstein (1996) find—using the same U.S. data—that the IRS and the Oregon Department of Revenue possess related, but not identical, information about likely noncompliance, and that each agency possesses information that is relevant for the other agency's revenue assessment. These results lead the authors to suggest that information sharing between agencies might improve audit selection.

[83] In the second game-theoretic model considered in Section 4.3, this shadow value is denoted λ.

value is likely to exceed one due to the deadweight loss associated with tax collection and enforcement. Dubin, Graetz, and Wilde (1990) attempt to measure the shadow value for the IRS, using the results of their instrumental variables analysis of aggregate data described earlier in Section 6.3. Their results suggest a very large shadow value of about 25. Dubin, Graetz, and Wilde claim that their estimate takes into account both the direct revenue effect of additional audits and the indirect effect from increased voluntary compliance; they attribute approximately 85 percent of the shadow value to the indirect effect. Erard and Feinstein estimate the portion of the shadow value associated with direct audit revenue, estimating a value of roughly six in the nonbusiness class that they analyze, and between one and two in the nonfarm business class.[84] Whether shadow values of these magnitudes are sufficiently high to justify additional audit resources is an open question. We believe more research is needed on this important topic.

7.2 *Detection and the Tax Gap*

One of the most important issues that must be addressed in the analysis of tax audit data is the problem of nondetection, which arises because not all tax evasion is detected by tax examiners and recorded in audit data. The problem of nondetection causes some tax evaders to appear to be honest and other evaders to appear to have cheated by less than the actual amount. In turn, these misclassifications, unless accounted for in the analysis, can bias estimates of the factors associated with noncompliance.

Feinstein (1990, 1991) has developed an econometric method that accounts for the problem of nondetection, called detection controlled estimation. The detection controlled model consists of two equations. The first equation refers to compliance behavior. In the simplest form of the model, the dependent variable for this equation is one if the taxpayer is not compliant, and zero otherwise; the explanatory variables include social, demographic, and economic factors associated with noncompliance. The second equation models the detection process and is relevant only if noncompliance is present. In that case, in the simplest form of the model the dependent variable in the second equation is one if the noncompliance is detected and zero otherwise. The explanatory variables in the second equation include aspects of the detection process likely to affect the chances of detection, such as the time or location of the audit.[85]

Craig Alexander and Feinstein (1987), Feinstein (1991), and Erard (1997) all present results from estimating detection controlled models using TCMP data. Their empirical findings indicate that controlling for nondetection significantly alters estimates of the factors associated with noncompliance. For example, Alexander and Feinstein report that the coefficients associated with several demographic and income-source variables, such as marital status and occupation, are significantly larger when estimated as part of a detection controlled model than when estimated as part of a conventional probit model. Intuitively, the larger estimated coefficients are the result of examiners hav-

[84] Alm, Erard, and Feinstein estimate shadow values for both the IRS and Oregon; their estimates range from two-and-one-half to eight for the IRS, and from one to two for Oregon.

[85] Feinstein (1991) presents an extension of the basic model in which the first equation can take the tobit form, wherein evasion is either zero or some positive amount, and the second equation can be extended to allow for fractional detection, wherein the examiner can detect all, none, or some fraction of the evasion on a return.

ing more difficulty uncovering noncompliance on joint returns and on returns filed by taxpayers in certain occupations than on other types of returns. The detection controlled procedure effectively imputes additional noncompliance to these returns, thereby raising the magnitude of the estimated coefficients.

The detection controlled models not only provide improved estimates of the factors associated with noncompliance, but also provide information about the detection process. Results reported by the above authors suggest three conclusions about the IRS detection process during TCMP audits. First, it appears that IRS examiners detect approximately one out of every two dollars of evasion during these audits. Second, there is substantial variation in detection rates across IRS examiners. Third, detection tends to be lower when a return has been prepared by a tax practitioner.

Nondetection greatly complicates estimation of the tax gap. Since much evasion goes undetected during TCMP exams, TCMP measures of noncompliance systematically underestimate the size of the gap. To address this problem, the IRS conducts supplemental studies of certain critical line items, such as tip income, to gauge what proportion of evasion on that line item goes undetected and to construct corresponding multipliers that are applied to the TCMP estimates. In aggregate, these multipliers roughly double the estimate of reporting noncompliance based on the raw TCMP statistics. The detection controlled methodology also can be used to estimate the tax gap. Detection controlled models estimate a detection rate for each examiner in the sample, and these rates can be used to construct multipliers that are again applied to TCMP estimates. Feinstein (1991) provides details of this approach and presents estimates for the U.S. for tax years 1982 and 1987. He estimates an individual income tax gap of $73 billion in 1987, which is remarkably similar to the most recent estimate by the IRS for that year: $71.4 billion.

8. *Incorporating Morals and Social Dynamics*

One of the puzzles raised in Section 2 was that individuals are far more compliant than our theory might predict. It has been suggested that factors such as a moral obligation to be truthful, or the social consequences of being a known cheater, may add further enforcement incentives that are not accounted for in our models. In this section we discuss three factors that seem especially important. First we consider moral rules and sentiments that directly guide individual reporting decisions. Second we examine how the issue of fairness, of either the tax code or its enforcement, may affect an individual's willingness to pay his obligation. Third, we discuss how taxpayer evaluations of government expenditures and government corruption might influence compliance.

Two psychological theories that have been broadly discussed in the context of tax compliance are guilt and shame. After reviewing several well-known psychological theories, Erard and Feinstein (1994b) adapt guilt and shame to the context of tax compliance. (See also Harold G. Grasmick and Robert J. Bursick, Jr. 1990.) They argue that a taxpayer who is filling out his return is likely to anticipate guilt when contemplating underreporting and escaping detection, but is likely to anticipate shame when contemplating underreporting and subsequently being caught. The authors find that allowing for such sen-

timents substantially improves the model's fit. However, there are several drawbacks to their approach. First, just how guilt and shame enter the utility function is arbitrary and cannot be derived from economic or psychological theory. Second, since guilt and shame are not directly observable, identification is based totally on functional form assumptions. Hence, while moral sentiments clearly play some role in tax compliance decisions, it is as yet unclear how best to incorporate such sentiments into formal analysis.[86]

The second social factor is the taxpayer's perception of the fairness of his tax burden. The taxpayer may believe that the nominal tax system treats him unfairly relative to others or, alternatively, that the statutory tax rules are being violated to a large extent by tax evasion, creating an unjust disparity in the payments by honest and dishonest taxpayers. In psychological terms, an unfair tax system could lead people to "rationalize" cheating. Spicer and Becker (1980) find in an experimental situation that individuals who were told their taxes were higher than others evaded by relatively high amounts, while those who were told their taxes were lower than others evaded by relatively small amounts, consistent with this hypothesis. However, a similar experiment described in Webley et al. (1991) found that perceived relative tax burden had no effect on reporting behavior.

A number of theoretical analyses have explored the effect of fairness and social comparisons on compliance. James P. F. Gordon (1989) assumes that individuals experience a psychic cost of evasion. In his most interesting model, the psychic cost has a dynamic component, varying inversely with the number of individuals evading in the previous period.[87] Gordon shows that there exist stable interior equilibria in which evaders and honest filers coexist. For any such equilibrium, the proportion of evaders rises with an increase in the marginal tax rate; however, the aggregate level of evasion may either rise or fall in response.

The third kind of moral and social influence is the degree of satisfaction taxpayers have with government. Spicer and S. B. Lundstedt (1976) and Kent W. Smith (1992) hypothesize that a taxpayer will feel "cheated" if he believes that his tax dollars are not well spent, and may reciprocate by refusing to pay his full tax liability.[88] Alm, Jackson, and McKee (1992b) perform experiments to test this idea. They find a greater willingness to comply when participants perceive that they will receive benefits from a public good funded by the taxes collected. Webley et al. (1991) also examine the role of taxpayer satisfaction with government in compliance, using experimental methods. They find that those participants whose responses to a survey taken several months after the experiment indicated an alienation from government or a negative attitude toward laws were significantly more likely to have engaged in evasion during the experiments.

How can we deal with this in a theoretical model of tax compliance? One way is suggested by Pommerehne,

[86] Frey (1992) claims that psychological theories of intrinsic versus extrinsic motivation are also relevant for explaining compliance behavior. When monitoring and penalties for noncompliance are increased, individuals perceive that extrinsic motivation has increased, which in turn may "crowd out" intrinsic motivation to comply with taxes.

[87] See Cowell 1990, Chapter 6 for a related model.

[88] A classic example of this is Henry David Thoreau's refusal to pay his taxes in protest of the federal government's unwillingness to abolish slavery. Thoreau spent one night in jail.

Albert Hart, and Frey (1994).[89] They present a dynamic, recursive analysis of the relationship between government public good provision, government waste, fairness considerations, and taxpayer compliance. In addition, the political regime is governed by majority rule. At the center of the model is the taxpayer's decision about tax compliance. Each period, the individual reflects on the experience of the previous period in deciding how much tax to pay. The greater the deviation between the individual's optimal choice of public good provision and the actual level, the more others have underpaid their taxes; the higher the level of government waste in the previous period, the less the individual is willing to contribute.

As this discussion shows, adding moral and social dynamics to models of tax compliance is as yet a largely undeveloped area of research. There seems to be little dispute about whether these factors are important in individual compliance decisions, but little is known or agreed upon about how best to include these effects in a theoretical or empirical analysis of tax compliance.

9. *Complexity and Amnesty*

Concerns with compliance have surfaced in two widely discussed policy issues: tax simplification and tax amnesty. Next we discuss findings on these two issues.

9.1 *Tax Complexity*

In a 1987 survey (reported in Harris and Associates, Inc. 1988) over half of taxpayers reported getting tax advice, mostly because they felt taxes were "too complicated." About one-fourth of taxpayers said that they did not take a credit or deduction to which they felt entitled. In a 1984 survey (reported in Yankelovich, Skelly, and White, Inc. 1984), about half of all taxpayers felt that IRS enforcement was inconsistent across audits. Hence, taxpayers clearly see the tax code as complex and enforcement as somewhat random.

In contrast to this, our treatment of compliance thus far has assumed that all risk is at the discretion of the taxpayer, and that risk can be eliminated by an honest report of income. However, if tax laws are vague and ambiguous, it may be difficult to fully comply with the law, even if that is the intention. At the other extreme, the laws may be detailed and precise to the point of being unwieldy and difficult to learn. Both of these problems have been studied under the name of tax complexity. The important aspect of the problem is that knowing the true application of the law may be costly and difficult, and may even be impossible to resolve prior to an audit.[90]

An additional problem is that tax laws may be difficult for the auditors and courts to adjudicate. Tax auditors may not always have sufficient tax knowledge, and the discretion of auditors and judges may make the application of the law imprecise. Hence, some noncompliance may go undetected or unpunished; some reports thought to be compliant may be disallowed and penalized; and some fearful taxpayers may forgo deductions they are rightfully entitled to take. This problem of random enforcement again means that a taxpayer can never be free from risk.

[89] For a related model, see also Cowell 1990, Chapter 6. A simpler approach is suggested by Massimo Bordignon (1993). He assumes people face moral constraints; the more the government's tax level and public goods provision differ from an individual's moral ideal, the weaker is an individual's moral obligation to be honest.

[90] The IRS will give a binding interpretation of a law prior to filing a return, but the process of doing so is quite costly for most ordinary taxpayers. See Scotchmer and Slemrod (1989).

In dealing with the theory of complex and random taxes, Scotchmer (1989b) and Scotchmer and Slemrod (1989) assume that a tax agency audit will reveal taxable income to be one of two values, high or low, but taxpayers are free to report any income within or outside of this range. The IRS could always eliminate randomness by setting the high and low incomes at the same value, presumably by clarifying tax laws or perfecting the training of auditors. The authors show that if eliminating randomness is costly, the IRS will not do so. If the IRS increases the difference between the high and low incomes, keeping the mean the same, the taxpayer may get a tax rebate in the event that the low income is revealed but will get a tax bill plus a penalty if the high income is revealed. Hence, randomness edges people toward compliance while saving enforcement costs for the government.[91]

Kate Krause (1996) considers complexity, randomness, and costly tax information in the same model. Building on Louis Kaplow and Shavell (1994), Krause assumes that people have identical priors on whether they deserve a particular tax credit, and differ only in their cost of gaining more information, perhaps because they differ in skills or in time available to study the tax law. She also assumes that complexity and randomness are linked—the IRS cannot make taxes more complex without also making enforcement more random. All taxpayers, however, have the option of purchasing tax advice at a cost, which lowers but does not eliminate the randomness. She shows that some taxpayers will be "chilled" and will neither seek tax advice nor take the credit. At the other extreme, some will be "gamblers" and take the credit without consultation, while those in between will purchase more information. Like the others, Krause finds that complexity and randomness are optimal, from a revenue point of view, because chilled taxpayers pay more taxes, and also allow audit expenses to be redirected toward the gamblers.[92]

In sum, complexity and randomness are real concerns of taxpayers. Theoretical studies indicate that perhaps some uncertainty is there by design because that makes it easier for the IRS to reach its revenue goals.

9.2 *Tax Amnesty*

During the 1980s, tax amnesties were a popular tool for state governments in America to boost revenues. In all, 33 of the 50 states enacted some sort of tax amnesty in which noncompliant taxpayers could voluntarily pay their back taxes, usually with interest, avoiding criminal prosecution and most or all of the penalties. These programs, which typically only lasted several months, were often credited with large revenues.[93]

[91] Scotchmer's simple model assumes a revenue maximizing tax authority. Scotchmer and Slemrod are more general. However, they find that this result holds regardless of whether policy is set to maximize tax collection or social welfare, but that the optimal amount of randomness will generally be lower when maximizing welfare. Using a model that allows for both tax evasion and legal tax avoidance, Alm and McCallin (1990) also find that uncertainty about the tax laws will tend to generate higher tax revenue.

[92] Alm, Jackson, and McKee (1992c) give experimental support to the hypothesis that randomness increases compliance, as long as taxpayers see no connection between their own evasion and the level of government services. However, if their own cheating affects their own consumption of public goods, then randomness has the opposite effect. In related work, Slemrod (1989) shows that there are modest, but not large, welfare gains from simplifying the tax code.

[93] New York raised $401 million, and California, Illinois, Michigan, and New Jersey raised over $100 million each. Others reportedly were less successful, such as Texas, which collected less than one-half million dollars. Numerous other countries also implemented some form of tax amnesty

The models discussed above, perhaps surprisingly, would predict the opposite—amnesty should have no effect. The reason is that amnesty allows a tax evader to become compliant, and since compliance was always a possibility for tax evaders, evasion has been revealed as preferred. Hence, amnesty will be ignored. For amnesty to matter, it must change the opportunities available to tax cheaters, such as unexpectedly increasing fines for past evasion.[94]

John L. Mikesell (1986) takes a broad look at the amnesty experience across states, and finds that it is dubious whether these amnesties actually did produce as much new revenue as might appear. The state amnesties yielding the highest reported revenues included "accounts receivable"—delinquent payments that had already been identified by the states. Amnesties that did not include accounts receivable generated far less revenue. Mikesell concludes that including accounts receivable may get the tax revenue sooner and at a lower cost to the government, but much of it is revenue that the government eventually would have gotten otherwise.[95]

A question remains about the long-run effects of amnesty. Amnesty may hurt long-run compliance if it is viewed as inequitable or if it is interpreted as a softening of enforcement. For example, Arindam Das-Gupta and Mookherjee (1995) find that India's repeated use of tax amnesties may have weakened tax compliance in that country.[96] On the other hand, amnesty may bring into the tax system more people who were previously operating in the informal sector. Unfortunately, Fisher, Goddeeris, and Young (1989) find that amnesty did little to bring in evaders from the informal sector, while Alm and William Beck (1993) find that the long-run effects of the Colorado amnesty were negligible. Hence, while the behavior of people who choose amnesty is not well understood, there does appear to be some agreement that the real effects of amnesties frequently are small and short-lived.[97]

10. *Conclusion*

The economic literature on tax compliance has grown enormously during the past two decades. Important advances have been made in the theoretical modeling of the compliance decision and, more recently, the interaction be-

during the 1980s, including Argentina, Australia, Belgium, Columbia, Ecuador, France, Honduras, India, Ireland, Italy, Panama, the Philippines, and Switzerland. Others, including Canada, Denmark, Mexico, the Netherlands, Norway, Peru, Sweden, and West Germany, have—or have had in the recent past—standing tax amnesty programs for individuals who voluntarily disclose past reporting violations. See Herman B. Leonard and Richard Zeckhauser (1987) for a discussion of the U.S. experience and Elliot Uchitelle (1989) for a discussion of some experiences of other countries.

[94] Other suggestions are that cheating may create unexpected regret (Arun Malik and Robert M. Schwab 1991), and that amnesty may partially complete markets for insurance (Andreoni, 1991a) or may help overcome borrowing constraints (Andreoni, 1992). Alm, McKee, and William Beck (1990) show with an experiment that amnesty claims do rise substantially with increased enforcement. Interestingly, however, amnesty alone is also found to be effective, in contrast to the theoretical prediction.

[95] This was confirmed by Ronald C. Fisher, John H. Goddeeris, and James C. Young (1989) who looked at individual-level data on participants in the Michigan tax amnesty in 1986.

[96] They examine six tax amnesties in India since 1965 and show that, while effective at first, the last four of these amnesties have actually had negative, though insignificant, effects on tax revenues.

[97] Nonetheless, an amnesty may be a useful way of setting the stage for a major shift to a tougher enforcement regime. Most states granting amnesties in the U.S., as well as some federal jurisdictions outside of the U.S. (e.g., Ireland), significantly increased enforcement following their amnesties.

tween taxpayers and tax authorities. Empirical studies have also flourished, especially in the United States. Together, the theoretical and empirical advances over the past 25 years reassure us that tax compliance and enforcement systems are amenable to systematic research and, for the most part, can be described using the standard tools of economics and allied social sciences. Despite the many advances, however, much work remains to be done if we are to develop a fully satisfactory understanding of this intrinsically complex subject.

In considering what has been done, and what topics might be fruitfully explored in the coming years, we have four observations. First, as the organization of our review suggests, a greater synthesis of theory with empirical research might generate important insights. In general, the theoretical models have only served as rough guides for empirical research; few structural econometric models have been estimated, particularly as compared with other applied fields of microeconomics, such as industrial organization and consumer choice. In the past, theoretical models such as the Allingham–Sandmo model and its many refinements have mainly served to generate sensible stylized predictions about tax evasion, and to help guide empirical researchers in their choices of independent variables to explain the compliance decision. More recently, the game-theoretic models have been influential in encouraging empirical researchers to estimate simultaneous equation systems of compliance and enforcement, and to consider the problem of endogeneity in audit activities. But in neither case have the theoretical models' more precise structure and predictions been subjected to rigorous empirical testing. While we believe such tests would most likely reject the theoretical specifications, they would be helpful in indicating the extent and specific ways in which the theoretical models are incorrect.

Second, more work needs to be done exploring the diverse psychological, moral, and social influences on compliance behavior, and integrating these factors into economic models of compliance. The most significant discrepancy that has been documented between the standard economic model of compliance and real-world compliance behavior is that the theoretical model greatly overpredicts noncompliance. We have alluded to this discrepancy at various points in our review. We have also described a number of attempts that have been made to incorporate various noneconomic factors into the standard model, especially in Section 8. In general, incorporating noneconomic motivations, such as a moral preference for honest reporting, does reduce predicted noncompliance. At the present time, however, there are a myriad of such factors that might be incorporated into the basic model; for example, there are many possible psychological factors that may shape compliance behavior, including guilt, shame, regret, envy, anger, and sense of duty. In addition, especially with respect to moral and social influences, there are a variety of ways to formalize these concepts; for example, morality may be modeled as a preference for honesty, as a Kantian rule or constraint, or as utilitarian welfare. More work needs to be done sorting through these various factors in order to determine which are most important and how they might best be incorporated within the standard modeling framework.

Third, greater attention should be paid to the dynamic and complex institutional framework of tax compliance. An example is the reporting of multiple

line items, a topic of obvious empirical relevance which has been ignored until very recently. A second example is the administrative relationship between a tax authority and its sovereign government. Although there have been a few papers addressing this topic, many issues have not been investigated, including the relationship of a tax authority to the legislative and judicial branches of government; how the bureaucratic structure of a tax authority affects its functioning; and the significance of various forms of interaction between the tax authority and taxpayers, such as notices of delinquent payments, information reporting, and withholding. All of these issues are of considerable significance for the functioning of actual tax enforcement systems. Finally, the dynamic, repetitive nature of the interaction between a taxpayer and his tax authority is important, and can be studied within the framework of repeated games.

Fourth, there is a need for more empirical and institutional research within jurisdictions outside the U.S. Available evidence suggests that noncompliance is particularly acute in many developing countries, making them especially fertile areas for future research efforts. In addition, a broadening of the empirical database will improve the power of statistical tests of theoretical models, and spur comparative analysis across countries, perhaps helping to identify important cultural influences on compliance behavior and modes of enforcement.

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