The Tax Compliance Game

Using game theory to study the interaction between the IRS and the taxpayer, Caltech economists are turning up some surprising results.

IN 1968 Gary S. Becker of the University of Chicago published a seminal paper called "Crime and Punishment: An Economic Approach." In it he put forth the radical notion that criminal behavior is not necessarily aberrant and senseless. Rather, crime can be seen as a rational economic decision made by an individual who weighs the expected gains from criminal activity. the probability of being caught and convicted, and the levels of punishment.

Since then, Becker's method has been applied to many different crimes, including the crime of tax avoidance. But until a group of current and former Caltech researchers started working on the problem, these studies suffered from a serious defect: they failed to properly consider the actions of the Internal Revenue Service (IRS). The early studies assumed that the only economic actor in the system is a taxpayer who is certain about both the probability of being detected and the level of sanctions.

It turns out that the results of such studies are overly determined by things like an individual's attitude to risk, while at the same time they ignore factors that enhance or inhibit the IRS's ability to enforce tax laws. For example. these studies are forced to con-

clude that in a truly efficient tax system, cheats would be tortured and hanged when discovered. Under those circumstances enforcement costs would be low, since few would risk the penalty. While this scheme might well work, in the real world such theoretically desirable sanctions are, of course, inconceivable because of a variety of legal, moral, and political constraints.

A major contribution of the Caltech researchers to the analysis of the tax system is their inclusion of the IRS as an active participant. Using the mathematics of game theory, they model the interaction between the IRS and the taxpayer as a two-player game in which each player tries to maximize his self-interest. The taxpayer in such a game has the option of underreporting his income to lessen his tax liability, but he knows that there's a chance that the IRS will catch him and force him to pay additional taxes and fines. The IRS can audit a tax return to determine a taxpayer's true income, but conducting an audit is costly.

In addition, the Caltech models are more realistic in their inclusion of a variety of real-world constraints. For example, the sum of taxes and fines is prohibited from exceeding a taxpayer's total income.

In their first attempts at modeling tax compliance, Louis Wilde, professor of economics, Jennifer Reinganum, associate professor of economics, and Michael Graetz, a lawyer formerly at Caltech and now at the Yale Law School, used a "principal-agent" framework. In a principal-agent game the two players are not equivalent. The principal — in this case the IRS — moves first, pre-committing to a strategy that it must follow, even if it later turns out not to be in its interest to do so. The taxpayer is the agent in this game and responds to the principal's announced strategy with his own best strategy.

In the principal-agent framework the IRS's strategy takes the form of pre-announced audit policies. For example, the IRS could announce that it will audit all taxpayers who report incomes below a certain cutoff level and no taxpayers who report incomes above that level. Taxpayers with high incomes may underreport a little bit — down to the cutoff level — without fear of discovery. Taxpayers with incomes below the cutoff level must report their true income since they're certain to be audited. In such a scheme, the only people who get audited are those with no

incentive to lie. In one sense, the IRS's audit costs are wasted, since auditing will not generate additional revenue. But the IRS must carry through on its threats in order to maintain the incentives against serious under-reporting by high-income taxpayers. In their first principal-agent study, Reinganum and Wilde determined that cutoff schemes are more efficient (that is, they generate more revenue to the IRS at less cost) than schemes in which the IRS audits a random selection of tax returns.

While Reinganum and Wilde demonstrated the advantages of an audit policy that exploits the information provided to the IRS by taxpayers, they did not characterize the *best* such policy. This was done in a related principal-agent analysis by Kim Border, associate professor of economics, and Joel Sobel, a former visiting associate professor in economics, now back at the University of California, San Diego. Their work led to the conclusion that audit schemes exist that are more efficient than either of the schemes Reinganum and Wilde evaluated. Border and Sobel determined that the most efficient tax system should have the following properties:

● The higher a taxpayer's income, the more he should pay in taxes.

● Within any given class of taxpayers the probability of being audited should decrease with increasing reported income. This would deter high income taxpayers from reporting lower incomes since, if they did so, there would be a greater likelihood of being audited.

● Taxpayers who are found to have lied about their incomes after an audit should be fined, while taxpayers who are found to have told the truth should actually be given a rebate. In this way taxpayers would prefer to tell the truth and would want to be audited.

The somewhat startling idea of giving rebates to truth tellers is at first glance appealing, but Border does not expect rebates ever to become part of tax law. "It's not clear that it would be fair for the government to throw the dice and give certain people rebates for telling the truth, while other people who told the truth without being audited receive no rebates," he says. He also believes it unlikely that American lawmakers could be persuaded to reward people for doing what they ought to be doing as good citizens without reward. And, to create the proper balance of incentives, the theory predicts that only certain income classes should receive rebates for

truth-telling. Which income classes would be eligible for rebates depends crucially on actual distributions of income in the population. Getting such a fine-tuned system through even a willing Congress would be difficult, if not impossible, according to Border.

The purpose of the Border/Sobel study was to analyze the properties of an idealized revenue collection system, in which the IRS can both precommit and choose all the relevant policy variables. For those reasons, many of their assumptions are, in practice, unrealistic. They assume, for example, an IRS that has the freedom to set tax rates, fine schedules, and audit probabilities, when in reality the IRS has control only over the last of these. Congress sets taxes and fines and has other objectives aside from maximizing revenue: stimulating certain industries and promoting certain social goals are two examples. Another, less crucial, unrealistic assumption of the model is that taxpayers receive only one sort of income and that an audit unambiguously reveals the truth. In reality, the tax code treats wages differently from capital gains and dividend income. And the tax code is so filled with gray areas that an unambiguous determination of true income is often impossible. A third assumption is that all taxpayers are "risk-neutral," that is, they have no preference between receiving X dollars right away or taking a gamble that, on average, returns X dollars. Psychological studies have shown, however, that most people are risk-averse — they prefer the certain return to the gamble.

While studies of idealized revenue collection systems are valuable, they are limited in their practical usefulness. Recently, Graetz, Reinganum, and Wilde have developed a model of the tax compliance problem that incorporates additional features of the real world. The most significant difference between this latest approach and the earlier one is that it no longer assumes a principal-agent framework. Instead, it assumes that the IRS must use an audit strategy that maximizes revenue net of audit costs given the tax returns it actually receives, instead of precommitting to a strategy ahead of time. An examination of how the IRS actually conducts audits reveals why this is a reasonable change.

The IRS conducts three sorts of audits. The simplist of these is an automatic comparison of tax returns with third-party reports such as W2 and 1099 forms, which are submitted by employers to the IRS and which detail payments to wage earners and to outside contractors. A computer kicks out any discrepant returns, which are then audited. It is this program that most approaches precommitment on the part of the IRS — everyone knows that if the wage income he claims is lower than that listed on the W2 form, he's certain to be audited. Strategic behavior thus becomes futile.

The second type of audit is part of the

In a recent model of the tax system, Graetz, Reinganum, and Wilde divide taxpayers into two classes: strategic players who are willing to "game the system" and habitual compliers. A taxpayer can have a high income (I_H) or a low income (I_L). A strategic player can choose to lie about his income. The IRS has no reason to audit high-income reports, but does have an incentive to audit a certain percentage of low-income reports.
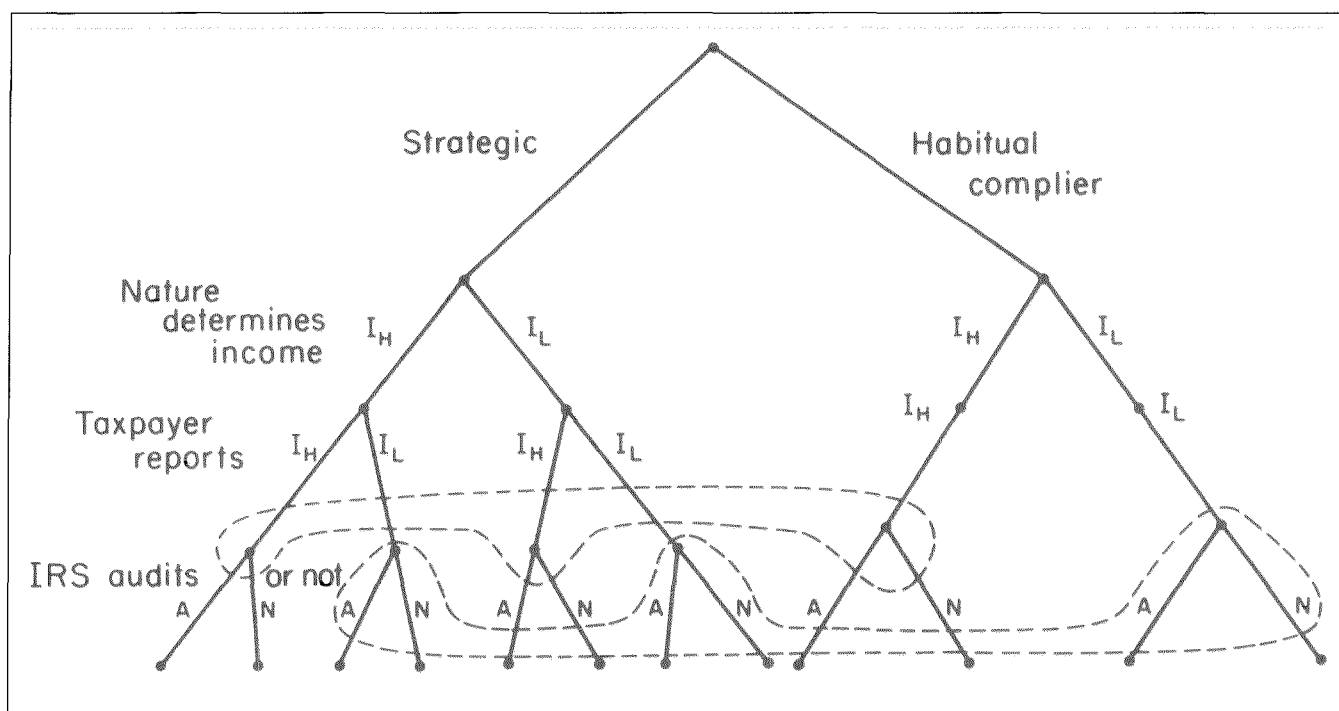

Figure I

Taxpayer Compliance Monitoring Program (TCMP). Explains Wilde, "Every two or three years the IRS conducts a series of 50,000 totally random audits. These are the horror-show audits you hear about. They're the line-by-line audits, the ones you just don't want to have to deal with. For example, if you claim you're married, they want to see the marriage certificate. If you claim dependents, they want to see birth certificates. It's just unbelievable."

The information from TCMP audits is compiled to produce the Discriminant Income Function (DIF), a scoring rule that is later applied to all other tax returns. Tax returns that receive high DIF scores are those that are most likely to be subject to large adjustments after an audit. These returns are then audited, but this third type of audit is far more selective than the TCMP audits — the auditor may just be interested in verifying a single line on the return; he may ask for proof of a claimed capital loss, for example. Since the DIF-based audits are conditioned on information taxpayers supply to the IRS, and since the IRS keeps the DIF formula a closely guarded secret, there is no precommitment, and for that reason Graetz, Reinganum, and Wilde have moved away from the principal-agent framework.

They have also added a number of other features that make their model richer and more realistic. For example, they take into account the fact that most taxpayers are risk-averse. In addition, they include in the model two groups of taxpayers — habitual compliers and strategic players. As their work proceeds, they expect to add several other types of taxpayers as well. These may include people who don't fully "game the system," but who avoid feeling like dupes by lying only as much as they think other people are lying. And future versions of their model may incorporate people who can't report their true income since it is derived from illegal activities.

Another realistic assumption in the new model is that the IRS is only allowed to set audit policy, not tax rates or penalties, which are imposed on the IRS by Congress. But in the initial version of this new model, Graetz, Reinganum, and Wilde assume that taxpayers have only one of two incomes — either high or low. This was done for simplicity of exposition and the authors have included additional income levels in subsequent versions.

In the basic model, a low-income taxpayer

has no motive to lie, but a high-income taxpayer may find it in his interest to claim low income, thereby reducing his tax burden. The IRS, for its part, has no reason to audit a taxpayer who admits high income, but since there's a chance that someone who claims low income may be lying, it is in its interest to audit some proportion of these people. By applying the mathematics of game theory to this setup, the authors are able to determine the best response of each of the players to the other's strategy. This simultaneously determines an equilibrium level of auditing and compliance as a function of a number of underlying parameters. These parameters include the cost of an audit, the probability that a taxpayer has a high income, the percentage of strategic taxpayers, and the level of taxes and fines.

This approach can yield some counterintuitive results. "Suppose that the percentage of people who are willing to act strategically goes up," says Wilde. "On average, one of the low-income reports will be more likely to come from a strategic taxpayer with high income who lied, and less likely to come from someone who actually had low income. So, at the first cut, the IRS ought to want to audit more often. But if it audits more often, then strategic taxpayers are going to want to lie less often. Countervailing forces are present here, and it turns out that in this simple model those forces exactly balance each other out. In this framework, at least, changes in the percentage of strategic taxpayers have no effect on the number of audits the IRS will conduct or the number of people who actually lie."

Another surprising result has to do with the effect of tax rates on compliance. It is widely believed that there is currently a "crisis of compliance" in the American tax system, with more and more people underreporting their income. Although this belief, according to Wilde, is not supported by solid data, many commentators are quick to assign causes to this perceived increase in the compliance gap, and just as quick to offer solutions. The dominant belief is that when marginal tax rates go up, underreporting increases since the gain from underreporting also goes up. If this is true, then a lowering of tax rates should be accompanied by an increase in compliance and an increase in revenue to the IRS. The model says that this received wisdom is exactly wrong.

"An *increase* in the marginal tax rates

"Other folks have to pay taxes, too, Mr. Herndon, so would you please spare us the dramatics!"

should increase compliance," maintains Wilde. "The reason is two-fold. When you increase the marginal tax rate it's true that you increase the gain from underreporting, but you also increase the penalties for being caught, since fines are proportional to the amount of taxes evaded. And on top of that you increase the IRS's incentives to audit." The model predicts that a taxpayer's increased incentive to underreport is more than balanced out by the increased number of audits the IRS would be conducting and the larger fines they would be collecting from the cheaters who were caught.

Some evidence for Wilde's assertion that lower tax rates will actually *increase* cheating comes from the example of the tax on capital gains. Although capital gains are taxed at a much lower rate than normal income, evasion of capital gains taxes is one of the biggest compliance problems the IRS has. "This is not what we would call hard evidence," admits Wilde, "because there are a lot of confounding factors. Capital gains also happens

to be an area where there's a lot of opportunity to evade. But nonetheless it suggests that lower rates alone aren't enough to get us out of the 'crisis of compliance.'"

The model has other implications for tax policy as well. For example, it predicts that the IRS's revenue would increase if there were additional third-party reporting requirements. The IRS's best strategy is not to fine-tune the game, but to eliminate the opportunity of many taxpayers to play it. The research has also yielded some negative conclusions, according to Wilde. "It says that moral suasion — TV ads telling people that they ought to be good citizens, courses in elementary school to teach children that 'the IRS is your friend' — may not be to the point at all. The game is a tough game for the government to play. The enormous resources it would take to give the IRS a really fair advantage are not likely to be forthcoming in an era in which budget cuts are the rule. You've got to change the nature of the game instead of fine-tuning it." □ — *RF*