NBER WORKING PAPER SERIES

ACCURACY, COMPLEXITY, AND THE INCOME TAX

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Working Paper No. 4631

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
January 1994

I am grateful for comments from Steven Shavell. This paper is part of NBER's research program in Public Economics. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

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ABSTRACT

The complexity of the income tax is an unending source of complaint. Compliance costs have received increasing attention and are estimated to be large. Yet most recognize that some degree of complexity is necessary if ability to pay is to be measured accurately. This article presents a framework for analyzing the value of greater accuracy in income taxation. Formulations for both distributive and incentive benefits of accuracy are offered. The question whether taxpayers have excessive or inadequate incentives to acquire information about taxable income and to challenge tax assessments is also examined.

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1. Introduction

Developed countries use income taxes rather than uniform head taxes to collect much of their revenue.[1] A very high price is paid for this choice: an income tax distorts economic activity, and administrative and compliance costs are incurred. The magnitude of each element is estimated to be on the order of tens of billions of dollars in the United States.[2] This price is thought to be justified by the more desirable distribution of after-tax income than would result with a head tax. Questions of accuracy and complexity of the income tax involve, to a significant extent,[3] choosing where the tax system should be along the continuum that ranges from no attempt to measure ability to pay (a head tax or a purely random levy) to a perfect measure of income (as is assumed in conventional analysis of optimal income taxation).[4] Thus, the problem encompasses major design issues, such as the choice between linear and nonlinear income taxation, and countless particulars, such as depreciation rules, itemized deductions, and regulations governing the time at which income and expenses are accrued.

This article addresses two topics that have received relatively little attention in the literature. In section 2, a framework is developed for analyzing how accurate an income tax should be.[5] Using simple models and a

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[1] Variants of sales taxes and wealth taxes are analogous to an income tax for present purposes. Some property and excise taxes are like user fees to a substantial extent, thereby raising different issues with regard to accuracy.

[2] See, e.g., Browning (1987) and Slemrod and Sorum (1984). As Yitzhaki (1979) has noted, a head tax would involve administrative costs in determining whether an individual could pay it, but such costs would be far less than those involved in determining the income level of all individuals.

[3] Other aspects of complexity, such as its effect on tax avoidance activity, are not examined here. Also, it is not necessarily the case that a more complex set of rules will lead to greater compliance costs, as it is possible that more complex rules will deter more expensive forms of transactions that would arise if rules were simpler.

[4] See, e.g., Mirrlees (1971). Of course, a primary justification for taxing income is that it is the best available proxy for ability, which is even more difficult to measure. See Stern (1982).

[5] Prior discussions of complexity and the income tax include Bradford (1986) and Slemrod (1984). Such work does not offer formulations for the benefits of a more accurate income tax. Stern (1982) examines the value of accuracy in administering lump-sum taxes that vary with ability in a model in which income taxation is implicitly assumed to involve no mismeasurement.

utilitarian social welfare function, two benefits of accuracy are examined. First, a more accurate income tax indeed improves the resulting distribution of income. (Thus, greater accuracy means that it is more likely that high-income individuals pay high taxes and low-income individuals pay low taxes.) It is demonstrated that this benefit can be measured by a risk premium: if individuals with a given actual income might be taxed too much or too little, the distributive benefit is measured by the amount such individuals would be willing to pay for insurance to avoid being exposed to the risk of paying the wrong amount of tax. This measure is appropriate even when the actual situation does not involve risk per se -- that is, when individuals know ex ante whether they will be winners or losers on account of inaccuracy.

Second, a more accurate income tax tends to reduce the distortion of economic activity. This result holds when individuals, at the time they choose their level of effort, are aware of how their income will be mismeasured. When net income is overstated (at the margin), individuals work less; when it is understated, they work more. Both changes in behavior would be inefficient were it not for the preexisting labor-leisure distortion that results from the existence of an income tax relative to a totally inaccurate system that makes no attempt to measure ability to pay.[6] Nonetheless, inaccuracy adds to the familiar labor-leisure distortion: when deadweight loss rises disproportionately with the effective tax rate, errors that result in a higher effective tax rate cause more distortion than is avoided by errors that result in a lower effective tax rate.

The subject of section 3 is whether taxpayers' incentives to acquire information about their taxable income and dispute government assessments are excessive or inadequate.[7] This problem is important because enacting a more

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[6] Yitzhaki (1979) examines a different respect in which a more accurate (comprehensive) tax system can reduce economic distortion: including a wider range of economic activity in the tax base reduces distortion between taxed and untaxed activity.

[7] This subject has received little attention in the tax context, despite the existence of work on taxpayer uncertainty and tax advice. Scotchmer (1989) offers the conjecture that the private and social interest coincide except in the litigation context, where whatever problem that may exist is the same as in other legal settings.

precise (and often more complicated) tax system does not automatically result in the intended distribution of tax burdens, because individuals may not know all relevant details of the tax law and will not always be induced to learn them; nor will the government always correctly assess tax liability. Moreover, the compliance costs of various tax rules depend on the extent of taxpayer efforts that are induced. Such efforts may not be optimal, which affects the desirability of tax rules and suggests that corrective action designed to alter individuals' incentives to undertake compliance efforts be considered.

Three settings are considered in examining the appropriateness of individuals' incentives to acquire information about their taxable income. First, individuals may acquire information about the taxable income arising from different activity choices before they decide upon labor effort. What they learn will affect their effort and thus the taxes they pay. Because individuals care only about after-tax income and not government revenue, their private benefit from information may diverge from its social value. When individuals learn more about their true income (and thereby their taxable income), such a divergence may exist but there is no a priori reason to believe it is in a particular direction. But when information concerns not their true income but idiosyncrasies in the tax system's measurement thereof, there is a tendency for private incentives to be excessive.[8]

Second, information may be acquired after choices affecting true income have been made -- that is, solely to aid in preparing a tax return. Most obviously, such information will reduce the enforcement risk that taxpayers bear. Because risk is a social cost, the private and social values of information will tend to be equal on this account. But in many plausible instances, informed taxpayers will pay less tax on average than if uninformed (for example, informed taxpayers would never mistakenly overstate their

[8] These results are similar to those concerning legal advice about harm-causing activities. See Kaplow and Shavell (1992). The reasoning, however, differs in important respects. Notably, when sanctions are perfect, individuals' behavior tends to be efficient when they are informed, whereas taxes distort behavior relative to what it would be were individuals unaware of the law.

income). In such cases, the private benefit from becoming informed will exceed the social benefit, leading to excessive expenditures on such information.[9]

Third, taxpayers may expend resources to demonstrate to the tax authority that they have been overassessed. Their incentives to expend resources in this context are excessive when the effect is solely distributive. But the prospect of overassessment may be anticipated, in which case ex post expenditures to nullify erroneous assessments may affect ex ante behavior. In particular, work effort may increase which in turn increases tax revenue, a benefit taxpayers do not take into account. Thus, it is possible for taxpayers' incentives to be inadequate, although it tax rates have been set optimally incentives tend to be excessive when errors are small.

Section 4 discusses how the present analysis is relevant to tax policy, how it relates to the primary sources of inaccuracy in income taxation, and how employing welfare criteria more egalitarian than utilitarianism would affect the results.

2. The Value of Accuracy

It is useful to begin with separate analyses of distributive and incentive effects of inaccuracy. A brief discussion of the interaction of the two effects concludes the section.

2.1. Distribution

Assume that individuals' have identical concave utility functions U of differing (exogenously determined) incomes y. Income is subject to a proportional tax at rate t.

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[9] Prior literature has emphasized how uncertainty increases expected revenue and that it might increase welfare, rather than the possible divergence between the private and social value of information to resolve the uncertainty, which is the focus here. See, e.g., Alm (1988), Beck and Jung (1989), Scotchmer (1989), Scotchmer and Slemrod (1989). (Also, these models have penalties for underreporting and no rewards for overreporting -- which produces many of the results -- while cases both with and without rewards are considered here.)

In the case of inaccuracy, the government observes y + e, where e has distribution f(·) with a mean of zero. An individual with income y has expected utility of

$$(1) \quad EU(y) = \int U[(1-t)y - te)]f(e)de.$$

If the government makes the expenditure necessary to achieve accuracy,[10] expected utility is

$$(2) \quad EU(y) = U[(1-t)y].$$

Comparing (1) and (2), it is apparent that the monetary equivalent of the amount by which expected utility with accuracy exceeds that without accuracy is simply the risk premium associated with an individual of income y being exposed to the lottery -te (a lottery with a mean of zero).

Remarks: (a) It is not surprising that the social cost of inaccuracy corresponds to a risk premium. Viewed ex ante, inaccuracy exposes taxpayers to the risk that they will pay the wrong amount of tax. Expenditures on accuracy can be seen as providing insurance, which would be desirable as long as the administrative cost does not exceed the risk premium.[11] Note, however, that this need not be insurance in the conventional sense, for the argument holds even if taxpayers know from the beginning their true level of income and the error that will be made in measuring it.[12] In that case, expression (1) would give the average utility of all taxpayers with actual income of y under an inaccurate system. The per capita benefit of accuracy, measured in dollars, would still equal the risk premium.

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[10] For simplicity, costs are assumed to be borne by the government. If borne by individuals, one could adjust the tax function accordingly to achieve the same result. Also, accuracy is taken to be all-or nothing, rather than a matter of degree. The qualitative results are unaffected; the benefit of accuracy, described below, would simply be the reduction in the risk premium rather than its elimination.

[11] Private insurance would be superior if insurance companies could observe true income more cheaply than the government, which seems implausible in this context.

[12] The formal equivalence to insurance is restored if one imagines taxpayers behind a veil of ignorance, unaware of the particular error that will be made in measuring their income. See Harsanyi (1953).

An ex post perspective might emphasize that equals are treated unequally when income is measured inaccurately, a problem usually characterized as horizontal inequity. In this example, horizontal inequity can be understood as way to talk about risk-bearing costs. Equivalently, one could view this dimension of risk as involving a loss of vertical equity.[13] The after-tax income distribution in the inaccurate regime can be derived from that in the accurate regime by adding a random component to each individual's income. Thus, the income distribution in the inaccurate regime involves greater dispersion, less vertical equity. If the social welfare function is utilitarian, the monetary equivalent of the loss in welfare will be measured by individuals' risk premiums, as previously described.[14]

(b) It is not optimal for the government to collect a tax of t(y+e) when it observes y+e, as was assumed in the model. First, given the income level it does observe, the government could make a Bayesian inference concerning the true y, using its knowledge of the underlying distribution of y and e. Second, the optimal tax to impose would not generally equal t times the mean of the estimated y, but rather a somewhat higher or lower figure to account for the fact that the individual's actual income may differ from the mean. To take these considerations into account, one could allow e to be a function of y and interpret e(y) not as representing a raw observation, but rather what results after these complications are taken into account.

(c) The value of accuracy may depend on income. If absolute risk aversion is decreasing, the value of accuracy will be greater for low-income individuals. But if the magnitude of errors rises with income, greater precision would be more valuable for high-income individuals. Moreover, if

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[13] This coincidence of horizontal inequity and concern for risk or vertical equity is discussed in Kaplow (1989).

[14] Because the optimal income tax involves incomplete redistribution, deviations from the tax burdens specified by the optimal tax in principle involve the problem of the second best. Indeed, measurement errors that involve high-income individuals paying more tax or low-income individuals paying less tax improve welfare (abstracting from any incentive effects). The risk premium includes this, and thus completely captures the relevant welfare effects. (As with an actuarially fair gamble, some of the outcomes are good but it is unambiguous that the prospect as a whole is not.)

high-income individuals face higher marginal tax rates, a given error in measurement would have a greater effect on the taxes they pay.

2.2. Incentives

Suppose that an individual who expends labor effort ℓ is able to produce net income of $y(\ell)$, where $y' > 0$, $y'' < 0$. (Net income equals gross earnings minus the costs of producing income; thus, an overestimate of taxable income might arise by underestimating expenses.) To focus on incentives alone, let utility equal $y(\ell)(1-t) - \ell$. Individuals' first-order condition for their choice of ℓ is

(3) $y' = \frac{1}{1-t}$.

The reduction in effort when $t > 0$ is the familiar labor-leisure distortion.

Now assume that the government observes net income with some error e. It is assumed that the distribution of the error is given by $f(e,y)$ -- that is, the extent of error may depend on the actual income one earns.

Case of error that individuals cannot predict. If the government observes net income with some error and individuals cannot predict the error but know only its distribution, all that matters is how the expected value of the error depends on income. (This is because the stipulated utility function entails risk neutrality.) Thus, if the error is unbiased or biased but independent of income, error will have no effect on incentives.

If the error is systematic and increasing with income,[15] there will be further distortion in work effort. If it is decreasing, the labor-leisure distortion will tend to be offset. In either case, however, it may be possible to adjust the tax rules to account for systematic error. (E.g., if high incomes are systematically overestimated, high estimates could be revised downward.)

Case of error that individuals can predict. Now suppose that, at the time individuals choose their level of labor effort, they know exactly what the

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[15] Increasing error does not refer to absolute magnitude; thus, a negative error that becomes smaller in magnitude is a case of increasing error.

government's error will be. (For example, depreciation schedules and other rules concerning deductions, which are inaccurate in particular cases, are known by taxpayers in advance; also, taxpayers may know their ability to hide income.) In particular, suppose that the error is e(y). Individuals' first-order condition becomes

$$(4)\quad y' = \frac{1}{1-t(1+e')}.$$

As before, the magnitude of the error is not important, but rather how it changes with income. If the error is increasing (decreasing) with income, the distortion will be larger (smaller) than otherwise. For example, if depreciation rules allow deductions that are excessive in an amount proportional to the scope of the activity, the error is falling. (It is negative and increasing in magnitude with ℓ.) Such an error would tend to offset the labor-leisure distortion.

Because anticipated error creates a distortion in the presence of an existing distortion, it is useful to inquire whether the interaction of the two is likely to affect directly how one should assess accuracy. A simple example suggests that, as a rough approximation, accuracy can be considered independently. Begin with the familiar rule that distortion (implicitly assuming perfect accuracy) is proportional to t^2.[16] Now, assume that half of taxpayers anticipate an error in assessed tax equal to the fraction e of income and half anticipate an error of -e. In this case, the distortion would be proportional to $.5(t+e)^2 + .5(t-e)^2 = t^2 + e^2$: inaccuracy causes a distortion proportional to the square of the error, independent of the level of the preexisting tax. (If the error were a proportion of the tax, say et, as in the depreciation example, then the distortion due to the error would be e^2t^2, which does depend on the preexisting tax.)

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[16] This rule is a linear approximation for small t, measuring labor at the undistorted level. See Browning (1987). If elasticity were falling quickly as t rises, marginal deadweight loss could fall with the tax rate, as in Stiglitz's (1982) discussion of randomization prior to individuals' labor decisions. With the preferences and technology in this model, marginal deadweight loss indeed rises with the tax rate (and for some technologies -- e.g., $y(\ell) = \ell^\alpha$, $\alpha \in (0,1)$ -- at an increasing rate). For present purposes, the detail is less important than the general phenomenon.

Remark: When assessing distribution, an inaccurate income tax occupied a position between that of a perfect tax and a uniform lump-sum tax (which makes no effort to differentiate tax burdens based on income). Incentive effects are different in two respects. First, the tax system that makes no effort to measure income -- the lump-sum tax -- is best with regard to incentives. Second, intermediate points, as with an inaccurate income tax, can be worse than both extremes. Just as a system in which rates vary over time tends to cause more distortion than one with unchanging rates,[17] so a system in which effective tax rates vary across similarly situated individuals will cause more distortion. Such inefficiency can arise by design -- as when depreciation rules are created to provide more generous treatment for equipment than structures -- or as a result of inaccuracy -- as when rules embody approximations or when assessments of particular cases involve error of a sort that is predictable at the time individuals decide how much income to earn.

2.3. Distribution and Incentive Effects Combined

A complete analysis would involve modifying the standard optimal income tax problem to incorporate inaccuracy, which would be a rather complex undertaking. Nonetheless, it seems that the two features analyzed in this section would arise in a similar manner, the magnitude of effects depending on the marginal tax rate applicable to a given income level.[18] For example, if an individual knows that his income will be overstated by some fraction, his work effort will be distorted more and the tax he pays will overstate his actual income, producing a less desirable distribution of income. The primary complication is that, for the case in which an individual knows there is inaccuracy but cannot predict the particular error that will be made in

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[17] See Barro (1979).

[18] Mirrlees (1971) indicates that the optimal income tax may be approximately linear, consistent with the present model. If marginal rates varied with income, the analysis would be somewhat more complex for errors large enough to have a significant effect on the applicable tax rate. Also, if the degree of inaccuracy were large, the optimal tax schedule might change in ways that would complicate the comparison. Finally, observe that with regard to the measurement of the income of taxable corporations -- which involves significant complexity and compliance costs -- the incentives analysis alone would be most relevant (as owners of corporations would be approximately risk-neutral with regard to tax uncertainty, which is nonsystematic risk).

assessing his own income, the uncertainty will have an effect on labor effort, which may be favorable or unfavorable (as discussed further in subsection 3.1).

Observe that the effect of inaccuracy on incentives may reduce the degree of inequity from what otherwise would result. Thus, if behavior were fixed, an individual's whose income will be overstated will pay more tax than others with similar income, giving rise to inequity. But, when he reduces his work effort, he reduces his observed income, thereby reducing the inequity. Given his actual, new level of income, some inequity will remain.[19]

3. Taxpayers' Incentives to Acquire and Present Information about Taxable Income

Due to the complexity of the income tax and the activity it governs, taxpayers may be uncertain about their taxable income at the time they decide on their actions (e.g., whether to work more) or at the time they must file their tax return. In addition, they may need assistance (e.g., from a lawyer) to convince the tax authority that their taxable income is lower than the amount that has been assessed. Because significant resources are expended on such matters, it is important to determine whether the private value of information or assistance diverges systematically from its social value. One might suspect that private incentives tend to be excessive, since the taxpayer's gain is the treasury's loss. While sometimes this is true, the analysis is more complicated and depends on the context and assumptions about the nature of uncertainty.

3.1. Information about Taxable Income Used to Decide Upon Labor Effort

Individuals are risk-neutral. When individuals are uncertain about the taxable income resulting from their efforts, they will find it advantageous to

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[19] One can construct examples in which inaccuracy would lead only to inefficiency. Bradford (1986) offers the situation in which failure to permit legitimate home office deductions will lead, in equilibrium, to a switch to production by those who would use ordinary offices, equalizing rates of return between the two modes of production. In most instances, however, individuals' costs and productivity of home offices would vary across a continuum. Thus, in the resulting equilibrium, there would be some individuals who continue to work in their homes. Their behavior may be unaffected, while their taxable income would overstate their actual income.

acquire information before they act, so that they can adjust their effort in light of what they learn. Individuals who learn that the marginal after-tax return is higher than their prior estimate will work harder; those who learn that the return is lower will work less. (Such decisions may often be discrete, as in choosing occupations or deciding whether to operate a second business from one's home.) In both instances there is an externality: individuals who work harder (less) pay more (less) taxes, so the private benefit of becoming informed will be less (more) than the social benefit. Two types of uncertainty will be examined.

First, assume that individuals are uncertain about taxable income because they are uncertain about true income.[20] (The model also can be interpreted as applying to the case in which individuals are uncertain about the tax rate.[21]) In particular, if work effort is ℓ, utility is $y(\ell)(1+e)(1-t) - \ell$ with probability .5 and $y(\ell)(1-e)(1-t) - \ell$ with probability .5. Uninformed individuals have expected after-tax income of $y(\ell)(1-t)$, so the first-order condition for ℓ is given by (3), as in the case in which there is no uncertainty. If an individual becomes informed, his first-order condition is

$$(5)\quad y' = \frac{1}{(1-t)(1+e)}$$

if he learns 1+e (i.e., that income will be high), which involves an increase in work effort and thus in tax revenue. The first-order condition is given by the same expression, substituting -e for e, if he learns 1-e, which involves a reduction in work effort and revenue. To allow further interpretation, assume that $y = \ell^{\alpha}$, where $\alpha \in (0,1)$ -- i.e., income generation is subject to diminishing returns or effort has an increasing marginal cost measured in utility (i.e., ℓ is measured in utils rather than, say, hours). Using (5), it can be demonstrated that

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[20] Much tax compliance effort involves recordkeeping and computation that is similar to what one might do simply to keep track of one's activities. If calculations are made in advance -- or used to make decisions in future years -- then efforts to determine true taxable income and to determine true actual income will tend to be one and the same. This overlap has been noted by those attempting to measure tax compliance costs. See Slemrod and Sorum (1984).

[21] In this case, utility would be $y(\ell)(1-t(1-\phi)) - \ell$ or $y(\ell)(1-t(1+\phi)) - \ell$. If one defines $e = \phi t/(1-t)$, the model is identical to that in the text.

(6) $y = [\alpha(1-t)(1+e)]^{\frac{\alpha}{1-\alpha}}$

when the error is e, and similarly for -e. Thus, when $\alpha = \frac{1}{2}$, individuals who learn that the truth is 1+e (i.e., they underestimated income) increase their net income (and thus revenue) by the same amount that individuals who learn that the truth is 1-e reduce their income (and thus revenue). Because the expected effect on revenue is zero, the private value of acquiring such information will just equal its social value. But when $\alpha > \frac{1}{2}$, $d^2y/de^2 > 0$, so the increase in income (and revenue) when individuals learn 1+e exceeds the decrease when they learn 1-e. As a result, the social value of information exceeds the private value. These results reverse when $\alpha < \frac{1}{2}$. There is no guarantee, therefore, that the private and social values of information are equal. In the absence of particular information about how income is affected by effort, there is no a priori basis for expecting any particular divergence.

Second, consider the case in which individuals know true income but are uncertain about taxable income because they are not aware of the particular idiosyncrasies of the tax process. (For example, there may be standard accounting rules or depreciation schedules that are correct on average, but informed taxpayers may learn whether their effective marginal tax rate is above or below the stated rate.) Errors as before involve over- or understating income by a factor of e, each with equal probability. If individuals are risk-neutral, their behavior when uninformed will again be unaffected by the prospect of error (which has a zero expected value), with the first-order condition being given by (3). If they learn about the true error, their first-order condition is

(7) $y' = \frac{1}{1-t-e}$

when they learn that their effective tax rate is t+e and similarly for t-e. Then, the distortion will tend to be proportional to $t^2 + e^2$ rather than t^2. Thus, the social value of information is negative. The private value, in contrast, is positive, so the incentive to learn of the tax system's idiosyncrasies ex ante is unambiguously excessive.

Individuals are risk-averse. Begin with the second case, in which individuals know their true income but are uncertain about taxable income. The effect of acquiring information can be decomposed (hypothetically) into three steps: (1) uninformed individuals buy actuarially fair insurance against their uncertain tax liability and do not change behavior; (2) such individuals adjust their work effort to reflect the fact that they no longer face uncertainty; (3) individuals are told of the error applicable to them, and make a further adjustment in work effort. The third element is precisely that just analyzed when individuals were assumed to be risk-neutral; it involves an excessive private incentive to acquire information. The first element involves solely the elimination of risk; the private and social values of this are equal, so no divergence arises on this account. The second element is ambiguous. When the risk individuals' bear changes, their work effort may rise or fall.[22] As in previous cases, changing work effort involves an externality since individuals ignore government revenue. Unless eliminating uncertainty, viewed in isolation, would raise work effort substantially, the net effect is that the private incentive to acquire information would be excessive in this case.

For the first case above, in which individuals' uncertainty concerned true income, the result was ambiguous when individuals were assumed to be risk-neutral. The decomposition into the three elements would be the same as for the second case. The difference in result is that, because the expected behavioral effect from the third element is ambiguous, the overall affect is ambiguous even when the second element concerning the effect of risk is insignificant.

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[22] In this model, one can let an individual's total utility be given by $U(y(\ell)(1-t\pm e)) - \ell$. Comparing the first-order condition to that when there is no error (no uncertainty) reveals two effects. First, the average marginal utility of income is higher in the uncertainty case, assuming that $u''' > 0$, as seems most plausible. Second, when $e > 0$, the tax system redistributes income between the two states; more marginal income is earned in the high- than the low-income state, and marginal utility is less in the high-income state. Compare Stiglitz (1982). Note that most prior work on randomization has focused on whether randomization is desirable -- that is, whether there is an incentive benefit that exceeds the risk-bearing cost. The question here is whether there is an incentive benefit at all (any risk-bearing effect involves no private/social divergence), and if not, whether the incentive cost of uncertainty is greater than the incentive cost associated with individuals acting upon the tax system's idiosyncrasies.

3.2. Information about Taxable Income Used to Determine How Much Income to Report

This subsection will consider the case in which individuals' decisions about labor effort are in the past, and the only question is whether they should expend resources to report their income more accurately.[23] (The ex ante analysis of the preceding subsection would be relevant to the extent that individuals acquiring information to file tax returns will be able to use that information to guide future behavior.[24])

Symmetric rewards and penalties. While income tax systems often employ asymmetric sanctions, under which individuals who underreport are penalized but individuals who overreport are not rewarded, it is useful to begin with the analytically simpler case in which rewards and penalties are symmetric.[25] Individuals report taxable income r to maximize expected utility

$$(8)\quad EU(r) = \int [(1-p)U(y - tr) + pU(y - ti - st(i - r))]g(i)di,$$

where i is taxable income with distribution g(i), p is the probability of audit, and s is the sanction rate. Begin with the case in which $s = (1-p)/p$, which implies that individuals' expected payments are unaffected by their report. (For example, if the probability of audit is .1, individuals who underreport by 1 and are audited pay, in addition to the amount t by which their payment fell short of their obligation, a penalty of 9t; in total, on underreported income they pay 10t when audited and 0 when not audited, for an

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[23] There are ex ante effects even in this case: as will be discussed, if individuals will acquire information, the uncertainty of tax liability is reduced; this may affect work incentives and, as discussed previously, there can be a divergence between the private and social costs or benefits of such an effect. This complication will be ignored here.

[24] Thus, the pure case of filing advice would arise for items that would not recur, or when the information is reflected on the tax return but is never understood by the individual (as might happen when a taxpayer delivers a box of receipts to a tax preparer and signs the final return without having each item explained).

[25] This case is also of interest because using rewards in addition to penalties has virtues. As will be seen, compliance may be better for a given penalty and audit rate and individuals' reports may be such that they bear less risk. The benefits of rewards in audit schemes (in a context in which individuals have no uncertainty about the law) are discussed in Mookherjee and Png (1989).

expected payment of t.) Individuals who are uncertain about their true taxable income will pay some amount in the range of possibilities. The optimal report will equate the expected marginal utility of income conditional upon audit with the marginal utility when there is no audit. For the case of a symmetric distribution and making the reasonable assumption that $u''' > 0$, the optimal report will be above the mean, but obviously below the upper bound of possible i.

Individuals who are risk-averse would report their true taxable income if they knew what it was. (This is the only report that entails no risk, and expected payments are the same for any report.) Expected utility if information is to be acquired is

$$(9) \quad EU = \int U(y - ti)g(i)di.$$

Given the stated penalty scheme, expected tax payments are the same whether or not individuals are informed. Thus, the private value of information, the value of (9) minus that of (8) evaluated at the optimal r, consists entirely of eliminating risk. This private benefit is also a social benefit, so one may conclude, roughly,[26] that there is no tendency for the private and social value of information to diverge in this case.

As noted, this result depends on the assumption that individuals' expected tax payments are the same when uninformed and informed, so there is no anticipated rise or fall in revenue when individuals acquire information.

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[26] The conclusion is not precisely true, because the measures of risk are not quite the same. Assuming that taxable income corresponds to a true measure of income, the actual results when individuals are uninformed and if they become informed are somewhat better than they anticipate. (For example, individuals with truly low income, and thus a high marginal utility of income, will be those who receive rewards when uninformed and those who, upon learning true income, would pay less tax. But, by assumption, uninformed individuals with high marginal utilities of income are not aware that their taxable income will be at the low end of possibilities.) Expected social welfare is thus higher than individuals estimate both when they do not acquire information and when they do. This in itself does not imply any private/social divergence in the value of information. There would be a divergence to the extent that these differences between social welfare and private estimates of expected utility change when individuals become informed, as they no doubt will. My best conjecture is that the difference is more likely to be greater when individuals are uninformed (because the risk involved is greater, as rewards and penalties are being imposed), suggesting that the private benefit of information may exceed its social value on this account.

When $s < (1-p)/p$, informed individuals would underreport income to some extent, but reports of uninformed individuals would be lower as well. Most plausibly, expected underreporting would be greater by the informed.[27] Then there would be a revenue loss that individuals do not take into account, so the private benefit of information would exceed its social benefit. (This result would reversed for the case in which $s > (1-p)/p$, one that is perverse in the sense that taxpayers who know their true income would intentionally overstate it to some extent, thereby incurring risk, since there is an expected positive reward from doing so.[28])

Penalties only. Suppose now that there are penalties for underpayment but no rewards when overpayments are discovered. The uninformed choose r to maximize

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[27] The first-order condition for uninformed individuals' choice of r is

$$\int U'(t - ti - st(i - r))g(i)di = \frac{1-p}{ps}U'(y - tr).$$

The left side is the average marginal utility of income when audited and the right side is the marginal utility of income when not audited weighted by an enforcement factor. For informed individuals, the first-order condition for r(i) -- r depends on i since i is learned before making a report -- is

$$U'(t - ti - st(i - r(i))) = \frac{1-p}{ps}U'(y - tr(i)), \text{ for all } i.$$

When $s < (1-p)/p$, the factor on the right side of both first-order conditions exceeds one, indicating that individuals would report less. Begin by assuming that informed individuals contemplate making the report r* that is optimal for the uninformed. Obviously, they wish to raise this report when they learn that i is high and reduce it when they learn that i is low. If one makes the plausible assumption that $u''' > 0$, it follows that, in making adjustments in r to produce the optimal r(i), income in states involving audits must fall by more for the low marginal utility (high income and thus low taxable income) states than it rises for high marginal utility states. Since income in the audit states is linear in reports, reported income similarly must fall more in low marginal utility states than it rises in high marginal utility states. Moreover, the same assumption implies that a given adjustment in reported income will cause less of a change in the marginal utility of income in the no-audit state when reported income is reduced than when reported income is increased, which reinforces the initial effect.

[28] Also, one might expect $s < (1-p)/p$ to be optimal: with respect to the informed, if s is higher, it will be possible to lower p -- thereby saving audit resources -- without resulting in compliance costs. (If $s = (1-p)/p$, a slight reduction in p slightly reduces compliance, but this would not have a first-order social cost; if $s > (1-p)/p$, a slight reduction in p improves compliance by reducing overreporting.)

$$(10)\quad EU(r) = \int_0^r [(1-p)U(y - tr) + pU(y - ti)]g(i)di$$

$$+ \int_r^\infty [(1-p)U(y - tr) + pU(y - ti - st(i - r))]g(i)di.$$

For a given penalty level, taxpayers will make lower income reports than when there also were rewards: if taxable income will turn out to be high, a higher report reduces one's expected penalty, as before, but if taxable income will be low, a higher report provides only a refund but no reward, so that expected payments to the treasury for such outcomes are lower the lower is one's report.[29]

As before, begin with the case in which $s = (1-p)/p$. Reports of the uninformed will be above the bottom of the range of possible taxable incomes. (For $s = (1-p)/p$, the lowest report in the range minimizes expected payments, but the derivative of expected payments with respect to the report is zero; thus, there is no first-order income loss from a slight increase in the report but a positive benefit from reducing risk.) Informed taxpayers will report $r(i) = i$. Information benefits the taxpayer in two ways: they no longer bear risk, and when taxable income is lower than their report when uninformed they pay less in the state in which they are not audited. The former benefit is a social benefit while the latter involves a transfer, so private incentives are excessive.

When $s > (1-p)/p$, reports of the uninformed, and thus revenue, are higher.[30] The informed pay the same expected revenue as when $s = (1-p)/p$, as in both cases the informed report $r(i) = i$. Thus, there are larger transfers

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[29] This can be seen from the first-order condition

$$\int_r^\infty U'(t - ti - st(i - r))g(i)di = \frac{1-p}{ps}U'(y - tr),$$

which differs from that in the case of symmetric rewards and penalties, see note 27, only by the fact that the lower limit of integration is r rather than the lower end of the income range. The r that was optimal in the symmetric scheme was necessarily above the bottom of the range, so the left side of this first-order condition is less than that in the symmetric case when evaluated at that r. To restore equality, the report must be reduced.

in more states, which increases the extent to which private incentives are excessive.

Finally, if $s < (1-p)/p$, the most plausible result is that, as in the case with symmetric rewards and penalties, private incentives will be excessive. Indeed, there is more of a tendency for private and social incentives to diverge in the present case. Uninformed individuals will report less when there are no rewards and informed individuals will make the same reports (because they always underreport, the absence of rewards does not affect their reports). Thus, obtaining information with penalties only involves a greater expected transfer from the treasury to the taxpayer.

3.3. Assistance in Demonstrating that an Assessment Is Erroneous

Suppose that taxpayers know their true net income, but that the government makes assessment errors. Consider the possibility that taxpayers are able to demonstrate errors, which involves the cost of effort or legal services. Taxpayers have an incentive to make such a demonstration only when errors are unfavorable to them. (The errors can be thought of as those that remain after the government has made its optimal expenditure in an audit to determine true income.[31] Since the taxpayer is assumed to know the truth and has better access to relevant information, it would often be possible for taxpayers to correct remaining errors at far less cost than the government could detect them.[32])

Distribution. It is useful first to isolate the distributional effect by considering the case in which correction does not affect work effort. A

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[30] That revenue must be greater can be seen in two steps. First, keeping $s = (1-p)/p$ and raising r increases revenue for states in which taxable income is low. Second, given the higher r, raising s increases revenue for states in which taxable income is high and there is an audit.

[31] The optimal government expenditure in making its initial determination, as well as the level of taxable income it should deem to exist when it remains uncertain, depends on how the process of taxpayer appeals functions.

[32] One might also be interested in the government's incentive to expend resources contesting tax assessments. If one assumes that the enforcer maximizes revenue, its incentive is clearly excessive. Even if the overall enforcement budget were limited centrally [see Sanchez and Sobel (1993)], it would not be efficient if enforcers allocated their efforts so as to maximize revenue.

taxpayer's benefit of correcting an adverse error, ey, when the marginal tax rate is t is eyt; taxpayers would be willing to spend up to this amount to correct the error. While the average effect of correcting errors would tend to be positive if the tax rate has been chosen optimally, it remains true that the fall in revenue is a social cost that taxpayers ignore. Thus, private incentives clearly are excessive. When the error is small, the social benefit of correcting the error will be small relative to the amount of the error, so the problem of excessive incentives will be relatively the greatest. An appeals process could address such a divergence by disallowing appeals except when errors were shown to be large.[33]

Incentives. Individuals' work incentives depend not on the stated tax rate but rather on what they ultimately expect to pay, which will take into account any errors that they expect the tax collector to make. Begin with the case in which the tax collector makes errors that cannot be anticipated. As discussed previously, such errors do not tend to affect behavior (abstracting from systematic error, which might be corrected directly, and the possible effects of randomization on incentives when individuals are risk-averse). Thus, individuals' efforts ex post to correct such errors will not be socially valuable.[34] Correction will, however, be privately valuable.

Now consider the case in which individuals can anticipate that an adverse error of e will be made in their case. (Perhaps some legitimate business expenses that superficially may appear to be personal consumption have a probability of being denied.) Such a prospect may induce individuals to work less.[35] The correction of an error adverse to the taxpayer thus has two

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[33] This purely distributive case is analogous to the problem of an insured individual making expenditures to demonstrate to the insurer that his losses are greater than an initial appraisal indicates. Again, there is a distributive benefit of making insurance payments more accurately reflect losses, but the insured individual ignores ex post the cost of higher payments, which is reflected in premiums ex ante. This analogous case is examined in Kaplow (1993).

[34] Indeed, if the error is unbiased, the prospect of correction by taxpayers will result in an expected tax rate that is lower than the stated tax rate, which would be undesirable if the stated tax rate were set optimally. Of course, stated tax rates might be adjusted to correct for this.

[35] Since the argument to follow depends on the effect on revenue, it is the uncompensated labor supply response that is relevant, which is why the

external effects: given the level of actual income, the treasury loses; but the prospect that the error will be corrected may increase work effort, which benefits the treasury (at the rate t). To illustrate, consider the risk-neutral case in which utility is given by $y(\ell)(1-t(1+e)) - \ell$ and the technology is ℓ^{α}, with $\alpha \in (0, 1)$. It can be demonstrated that a marginal reduction in the error will reduce (increase) revenue if α is less (greater) than $1-t(1+e)$, in which case the private incentive is excessive (inadequate). More concretely, a taxpayer's decision to begin moonlighting may be unaffected by the prospect of an overassessment that will not be corrected or he may be deterred entirely.

As a final note, observe that, as when only distribution was considered, taxpayers' incentives to correct small errors will systematically be excessive. The reason is that, if the tax rate has been optimally set, the effect on welfare (taking into account work incentive and distributive concerns) of applying a slightly higher or lower rate will be negligible relative to the magnitude of the error. The private benefit, however, is always proportional to the amount of the error. On the other hand, if errors are sufficiently large and anticipated by taxpayers, taxpayer incentives for correction will be inadequate. (When errors are large enough and adverse to taxpayers, the effective tax rate will be so high that reducing it would increase revenue.)

4. Discussion

Relevance for tax policy. While substantial efforts have been devoted to analyzing the compliance costs and distorting effects of income taxes and other tax systems, little attention has been given to assessing whether better measurement of ability to pay is worth the cost. An exception is Stern (1982), who compares a nonlinear income tax to a linear income tax (which may be combined with uniform lump-sum grants or taxes) that is far less costly to

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prospect of losing some deductions and thus facing a higher effective tax rate need not result in lower work effort. Note also that any labor supply effect will be limited to the extent of expenditures to correct errors. Thus, if an additional unit of labor will increase tax at the rate $t(1+e)$ if the error is uncorrected, with correction the effective rate will be $t(1+k(e))$, where $k(e)$ is the cost of correcting the error. This cost will be positive, although less than the error; otherwise, it would not be incurred.

administer because taxes may be collected at the source and problems of income attribution among individuals and entities are avoided.[36] In comparing such tax systems, it is relevant that most jurisdictions apply some form of sales taxation -- similar to a linear income tax -- so a substantial portion of the total costs of a separate income tax system are avoidable. One suspects that, in addition to being less costly with regard to compliance, such simpler schemes would involve greater accuracy in measuring income (as there is economy of scale in learning rules and developing computational capacity). If so, the theoretical advantage of a nonlinear income tax may be reduced substantially when one takes into account its greater inaccuracy and higher cost.[37] Moreover, to the extent recent income tax reforms have resulted in a more nearly linear income tax, it is less likely that using a separate system of income taxation would be justified by the redistributive benefits it uniquely can provide.

The costs and benefits of accuracy are also relevant when considering myriad tax rules that refine the definition of income. It is often apparent that a more complex rule is more precise, but there is rarely any attempt to identify, much less quantify, the benefit of such precision, making it virtually impossible to assess the rule in light of greater compliance and administrative costs. The present study seeks to improve the prospects for policy analysis by offering a method for evaluating the potential benefits of greater accuracy.

This investigation also examines the extent to which taxpayers will choose to become informed about their taxable income and the efforts they will undertake to contest government assessments. Examining these aspects of tax compliance serve as a reminder that more accurate tax provisions, which taxpayers find more complex, will not automatically have their desired

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[36] But there would be little resulting simplification for the self-employed, where income tax compliance costs are the greatest. See Slemrod and Sorum (1984).

[37] As first suggested by Mirrlees (1971), it may be that the optimal nonlinear income tax is approximately linear in any event. Stern (1982) finds a nonlinear tax to be significantly advantageous, but in a model with only two ability levels rather than a continuum.

consequences (as taxpayers may not take them into account) and will involve additional costs when they do. Moreover, there is no guarantee that taxpayers will make socially optimal decisions in acquiring information and contesting assessments. In many instances, it appears that incentives are excessive, so compliance and administrative costs will be too large. As a result, more complicated provisions may be less desirable than otherwise, and it may be appropriate to consider policies designed to reduce taxpayers' incentives to acquire tax advice.[38]

Sources of inaccuracy in income taxation. Much discussion of complexity and inaccuracy in the income tax has focused on the difficulty of itemizing deductions. Yet a much larger share of the compliance costs of filing returns (of which recordkeeping is the largest component) and presumably many costs in planning one's affairs involve determining the revenues and costs of income-producing activity. (Indeed, self-employed individuals have much higher compliance costs, and the cost of determining net gains and losses from investment activity is another substantial component of the total burden. Also, much complexity concerns the time at which income or deductions accrue, an issue that usually relates to income-producing activity.)[39] For this reason, the present investigation has focused on determinations involving net income.

Tax evasion is another major source of inaccuracy, responsible for causing many individuals' assessed tax to differ substantially from the tax due on their true income. While tax evasion was not considered directly here, much of the analysis is applicable to it. Specifically, areas of successful tax evasion can be viewed as cases in which taxpayers know in advance that a favorable error will be made. If the nominal tax rate must be increased,

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[38] For example, tax advice is a deductible expense in the U.S. income tax system; this tax benefit could be eliminated. (Changes in the 1986 tax reform effectively make this deduction available to fewer taxpayers.)

[39] See Arthur D. Little (1988), Slemrod and Sorum (1984). In the Arthur D. Little study, it was found that two-third's of total compliance time was incurred by businesses. For partnerships and S-corporations, the issues would be analogous to those arising for sole proprietors (ordinary self-employed individuals). For taxable corporations, such costs determine corporate income and corporate tax, which is an important component of the system for taxing investment returns.

others pay more tax than otherwise, which they know in advance. This sort of inaccuracy was shown to have adverse distributional and incentive effects. Thus, when considering the benefits of enhanced tax enforcement, the benefits of enhanced compliance can be much greater than indicated by confining attention to revenue alone (the benefit of which, in terms of social welfare, must account for the fact that greater revenue involves a transfer).[40]

In addition, the income tax often is inaccurate by design, as when tax expenditures are used to encourage various activities. In such cases, what have here been characterized as adverse incentive effects may be viewed as desirable results, although it remains true that there will be distributive costs. (The problem is not the conventional argument that tax expenditures favor the rich because exclusions and deductions are worth more to those facing higher marginal rates, for their marginal rates can be adjusted to take this into account. Rather, individuals with different opportunities to engage in favored activities will have tax burdens that less accurately reflect their true income.)

Different welfare criteria. The analysis relied on the utilitarian welfare criterion that is typically used in examining costs from distorting incentives. When evaluating distributive effects, more egalitarian norms are often considered. In the present context, a welfare function that showed a stronger preference for equality would indicate that accuracy was more valuable. In the extreme case of maximin and errors that result in overassessments on the poor, it would in principle be appropriate to expend massive resources to eliminate error.[41] Similarly, greater preferences for equality in outcomes would imply that individuals should devote more resources to resolving uncertainty than they would choose (even when there are no external benefits). An ex ante perspective, however, would use individuals'

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[40] The distinction between maximizing revenue and welfare is noted in the literature on complexity and uncertainty cited in note 9 and emphasized in other work.

[41] Compare Stern's (1982) analysis, in which even modest errors in assessing lump-sum taxes would render them undesirable (compared to a nonlinear income tax) if such errors involved overassessment of the poor and the welfare function were sufficiently egalitarian.

own risk premiums to determine the effect of uncertainty on their welfare, in which case the previous analysis would be unaffected by the degree of preference for equality.

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