A Further Inquiry into Determinants of Aggregate Income Tax Evasion

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19 June 2001

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ABSTRACT

This study empirically investigates the impact of a variety of factors on income tax evasion in the United States over the period 1973 to 1997. The aggregate estimates indicate that federal income tax evasion may be an increasing function of the federal personal income tax rate and the public's dissatisfaction with government. In addition, income tax evasion may be a decreasing function both of penalties imposed by the IRS on unpaid taxes and IRS audit rates. Moreover, a trend variable that may to some extent reflect the impact of improved IRS income-detection technologies over time exhibits a negative and significant coefficient, implying that such technologies may diminish tax evasion.

I. INTRODUCTION

Numerous studies have investigated income tax evasion behavior. In addition to a variety of principally theoretical models of income tax evasion behavior [Falkinger (1988); Klepper, Nagin, and Spurr (1991); Das-Gupta (1994); Pestieau, Possen, and Slutsky (1994)], there a number of studies of such behavior using (a) questionnaires or experiments [Spicer and Lundstet (1976); Friedland (1982); Spicer and Thomas (1982); Benjamini and Maital (1985); Alm, Jackson, and McGee (!992); Baldry (1987); De Juan (1989); Thurman, (1991)], or, in some cases, (b) what De Juan, Lasheras, and Mayo (1994) refer to as "official data" [Clotfelter (1983); Slemrod (1985); Pommerehne and Weck-Hannemann (1989); Erard and Feinstein (1994); Feige (1994); McLeod (1997).[2] In effect, income tax evasion consists of income that is not reported or that is underreported to the IRS.

It is widely believed that the "degree of income tax evasion in the economy as a whole" (hereafter, "DTE") is affected by income tax rates [Clotfelter (1983); Slemrod (1985); Pommerehne and Weck-Hannemann (1989); Feige (1994))], although there are exceptions to this view [see especially the seminal paper by Allingham and Sandmo (1972)]. Allegedly, the higher the pertinent income tax rate, the greater the benefit (in terms of a reduced tax liability) from not reporting taxable income. Thus, each time a new federal income statute is implemented, to the extent that effective federal income tax rates are altered, so too is the inventive to not report or to underreport income. It is also widely accepted that the greater the risk associated with underreporting or not reporting income, the less the degree to which economic agents will choose either to not report or to underreport their taxable income [Friedland (1982); Spicer and Thomas (1985); De Juan (1989); Alm, Jackson, and McKee (1992); Erard and Feinstein (1994)].

With this backdrop and based on revised, updated estimated for the years 1973 on the relative DTE, this empirical study seeks to provide updated and (hopefully) improved insights into determinants of the relative DTE in the U.S. This empirical study seeks to determine the potential impact on the relative DTE of the following: the federal personal income tax rate, the public's dissatisfaction with government, IRS audit rates, and IRS penalty assessments (including interest) on detected unreported income.

Sections II of this study provides the basic model and identifies formally the key variable in the system. The subsequent section describes the data used to test the model and is followed by the empirical findings section. A summary and overview are found in the concluding section.

II. Basic Model

The economy consists of agents who generate economic value that is reflected in the form of income. These economic agents choose whether or not to report none, some, or all of their income to the tax-collecting authority (IRS). To the extent that said income is reported to the IRS, a tax liability may be incurred.

In this study, the relative probability that the representative economic agent will *not* report taxable income to the IRS is treated as an increasing function of the expected gross benefits to the agent of not reporting income, eb, and a decreasing function of the expected gross costs to the agent of not reporting income, ec. Thus the ratio of the probability of not reporting income to the IRS, pnr, to the probability of reporting income to the IRS, (1-pnr), is described for representative economic agent by

$$pnr/(1-pnr) = f(eb,ec),\ f_{eb}>0,\ f_{ec}<0 \qquad (1)$$

Since the values for pnr will vary across different sectors of the economy, pnr may be viewed as a weighted average of these various probabilities. Expressing probabilities in relative terms such as shown in equation (1) reflects the form of the data, i.e., data where DTE in the economy as a whole is expressed in relative terms.

The expected gross benefits from not reporting income to the IRS are hypothesized to be an increasing function of the income tax rate [Cagan (1958); Bawley (1982); Tanzi (1982, 1983); Clotfelter (1983); Slemrod (1985); Pyle (1989); Feige (1994)]. This study focuses on the federal personal income tax rate (PT), such that

$$eb = g(PT),\ g_{pt}>0 \qquad (2)$$

In addition, following a suggestion introduced by Feige (1994), it is hypothesized that a growing or high level of public dissatisfaction with the performance of government and/or a growing or high level of public distrust and resentment of government may contribute to the DTE in the economy. It might, for example, be argued that the more the public resents how government officials conduct themselves, fail to fulfill obligations to the public, and spend tax dollars, the more benefit (utility) people derive from avoiding taxes through the underreporting of income to the IRS, i.e., the greater will be the subjective benefits of tax avoidance. Hence, as suggested in Feige (1994), the greater the public's dissatisfaction with government (DIS), the larger may be the DTE. Thus, equation (2) can be expanded to

$$eb = h(PT, DIS),\ h_{pt}>0,\ hDIS>0 \qquad (2')$$

The expected gross costs of not reporting income to the IRS are anticipated to be an increasing function of the risks thereof, which can include penalties [Pestieau, Possen, and Slutsky (1994)] such as fines, interest on unpaid past tax liabilities, an increased likelihood of IRS audits in the future [Alm, Jackson, and McKee (1992); Pestieau, Possen, and Slutsky (1994); Erard and Feinstein (1994)], and/or imprisonment, as well as potential fees resulting from legal or other representation. In this study, to the representative economic agent in the society, the expected penalty from not reporting taxable income to the IRS, if said activity is detected by the IRS, is *proximately* measured by the total pecuniary penalty (including both penalties and interest) previously assessed by the IRS (aside from added tax liabilities per se) per audited tax return (PEN). Furthermore, these risks (potential costs) are presumably enhanced by an increase in AUDIT, the percentage of filed federal income tax returns that is audited by the IRS. Indeed, the experience of an IRS tax audit would imply non-pecuniary ("psychic") costs as well as pecuniary costs (such as outlays for legal or other representation, along with the value of one's own time) above and beyond any potential added taxes and penalties (including interest) per se. Thus, we have

$$ec = j(AUDIT,PEN),\ j_{audit}>0,\ j_{pen}>0 \qquad (3)$$

The risk factors identified in equations (3) are essentially based on the theoretical model in Pestieau, Possen, and Slutsky (1994), and to some degree on Alm, Jackson, and McKee (1992) and Erard and Feinstein (1994).

Substituting from (2') and (3) into (1) yields"

$$pnr/(1\text{-}pnr) = b(PT, DIS, AUDIT, PEN) \text{ where } b_{pt}>0,\ b_{DIS}>0,\ b_{AUDIT}<0,\ b_{PEN}<0 \qquad (4)$$

Let AGI represent the actual total value of the adjusted gross income in the economy, i.e., AGI = UAGI+RAGI, where UAGI is the dollar size of the *unreported* AGI in the economy, and RAGI is the dollar size of the reported AGI in the economy. It reasonably follows that

$$UAGI = (pnr)*AGI \qquad (5)$$

and

$$RAGI = (1\text{-}pnr)*AGI$$

since (pnr)*AGI + (1-pnr)*AGI = UAGI + RAGI = AGI. It then follows that (6)

$$UAGI/RAGI = (pnr)*AGI/(1\text{-}pnr)*AGI = (pnr)/(1\text{-}pnr) \qquad (7)$$

from (4) and (7), we obtain, by substitution for pnr/(1-pnr)

$$UAGI/RAGI = b(PT, DIS, AUDIT, PEN),$$

where $b_{pt}>0$, $b_{DIS}>$), $b_{AUDIT}<0$, $b_{PEN}<0$. (8)

III. EMPIRICAL FRAMEWORK

This investigation provides two empirical estimates based on the model represented in (8) above. We initially treat (i.e., in the first estimate) the average effective federal personal income tax rate (AEPIT) as the income tax rate measure. In the second estimate, in lieu of AEPIT, the maximum marginal federal personal income tax rate (MAXPIT) is treated as the income tax rate measure. In addition to AEPIT (or MAXPIT), the variable AUDIT, which is the percentage of filed federal personal income tax returns that has actually been previously subjected to an IRS audit in each year, is included as a measure of the expected likelihood of being subjected to an IRS audit. The variable PEN, which is the total pecuniary penalty

(inclusive of both penalties per se plus interest) previously assessed by the IRS per audited personal tax return in each year, is included to reflect the penalty (above and beyond unpaid tax liabilities per se) from not reporting income if said activity is detected. As observed above, the variables AUDIT and PEN are adopted in this study as identifiable and quantifiable measures of risks associated with underreporting income. Finally, the variable DIS is represented by the answers to the University of Michigan's Institute for Social Research (ISR) surveys concerning whether government officials can be trusted (to honor obligations to the public), whether they are dishonest, and whether government wastes tax dollars. Values for this index of dissatisfaction lie within a range of (-1.5), which corresponds to least dissatisfied, to (+1.5), which corresponds to most dissatisfied: the algebraic value of this index is higher as the public becomes more dissatisfied with government.

In this study, two alternative measures of the federal personal income tax rate are considered: AEPIT (the average effective federal personal income tax rate) and MAXPIT (the maximum marginal federal personal income tax rate). Initially, paralleling Feige (1994, p. 135), we focus on the variable AEPIT. In so doing, we adopt a view that, given the complexity of the Internal Revenue Code and the variety of marginal tax brackets in the Internal Revenue Code, a variable such as AEPIT may be a reasonably useful (albeit only proximal) measure of for tax filers *generally* of tax benefits from underreporting income. Essentially paralleling Feige (1994), we define the variable AEPIT as the ratio of total federal personal income tax collections to aggregate reported AGI, expressed as a percentage.[3] Of course, since AEPIT is an average, it arguable approximates only the average person's incentive for tax evasion. However, since standard economic theory would predict that those facing the highest marginal tax rates would be the most likely to attempt to evade income taxes, using AEPIT as the income tax rate proxy potentially may distort the true incentive for tax evasion. For example, in the United States, the recent trend in federal tax policy has been to focus on lowering the statutory income tax rate in the lower tax brackets. Such policies would tend to0 result in a lowering of the AEPIT while leaving those individuals most likely to endeavor to evade income taxes unaffected. Consequently, this study provides two estimates: one adopting AEPIT as the income tax rate proxy and the other adopting MAXPIT as the income tax rate proxy. The data for AEPIT and MAXPIT were obtained from the IRS (1971-1997).

To measure AUDIT and PEN, respectively, data indicating the percentage of filed federal income tax returns in any given year that were actually audited by the IRS and the total penalty (including interest) assessed by the IRS per audited tax return were obtained from the IRS (1971-1997).

Finally, the data for measuring the relative DTE need to be addressed. A number of studies have estimated the magnitude of the DTE for the U.S. Among the major contributions in this endeavor are those by Tanzi (1982; 1983), Feige (1989; 1994), Bawley (1982), Carson (1984), Pozo (1996), and Pyle (1989). Based on such studies, there appear to be three primary approaches to estimating the size of the DTE (or of the underground economy):

(1) The AGI gap approach;
(2) The Taxpayer Compliance Measurement Program (TCMP); and
(3) Currency Ratio Models, including the General Currency Ratio (GCR) model.

The AGI gap approach is compiled by the B.E.A. (Bureau of Economic Analysis). The B.E.A. computes the discrepancy between the aggregate AGI reported to the IRS and an

independent estimate of the aggregate AGI derived from the N.I.P.A. (National Income and Product Accounts) estimate of aggregate personal income. This approach is argued by certain researchers such as Carson (1984) and Feige (1989) to be a reasonable indicator of the lower bound of the DTE.

A second approach to the size of the DTE is that prepared by the IRS based on their TCMP. In each year when the TCMP is prepared, a sample of roughly 55,000 taxpayers is subjected to a detailed examination by IRS auditors, who endeavor to determine the amounts of income that should have been reported as compared with the amounts that actually were reported. This discrepancy indicates the extent of income underreporting that is judged to occur.

A common approach to estimating the size of the DTE relies on some variant of the general currency ratio (GCR) model, which is perhaps most clearly described in Feige (1989). This model can take a number of different forms. In presumably its simplest and most restrictive form, the currency ratio (CR) model assumes that currency is the exclusive medium of exchange for unreported domestic transactions; that the income velocities of reported and unreported transactions are equal to one another; and that, in some base year, unreported income was zero so that the observed currency/checkable-deposit ratio (as a percentage) in that base year serves as a surrogate for the desired currency ratio in the official economy. As the observed currency/checkable-deposit ratio rises and falls over time, so does the estimated ratio of unreported income to reported income.

For the purposes of this study, in order to measure the DTE in the economy as a whole, the series generated by Edgar Feige is adopted. Feige has generated revised and updated estimates of aggregate unreported income (UAGI) as a percent of reported aggregate adjusted gross income (RAGI) based on the GCR model, employing an IRS estimate of unreported income for 1973 as the base year. Since revised and updated data are available for the years 1973-1997 and since these appear to be the most up-to-date such data set presently available, they are used as the dependent variable (UAGI/RAGI) in the analysis for the study period.

IV. EMPIRICAL ESTIMATES

Based on the model in equation (8) and the data described in Section III, as well as the reasoning above, we initially investigate the following reduced-form equation:

$$(UAGI/RAGI)_t = a_0 + a_1\, AEPIT_{t-2} + a_2\, AUDIT_{t-1} + a_3\, PEN_{t-1} + a_4\, DIS_{t-1} + a_5\, TREND + \mu \qquad (9)$$

where:

a_0 = constant term;

$(UAGI/RAGI)_t$ = aggregate unreported adjusted gross income as a percentage of aggregate reported gross income in year t, t = 1973,……,1997;

$AEPIT_{t-2}$ = the average effective federal personal income tax rate in year t-2, i.e., total federal personal income tax collections t-2 divided by the total reported AGI in year t-2, as a percent;

$AUDIT_{t-1}$ = the percentage in year t-1 of filed federal personal income tax returns that was subjected to an IRS audit;

PEN_{t-1} = the average penalty from underreporting income to the IRS in year t-1, computed as the total pecuniary penalty, including interest charges, on detected unreported taxable income, as assessed by the IRS per audited personal income tax return in year t-1;

DIS_{t-1} = the dissatisfaction index for year t-1 derived by the University of Michigan's Institute for Social Research (ISR); DIS values lie within a range of (-1.5) up to (+1.5);
μ = stochastic term.
The AEPIT variable is lagged for two periods merely to address multicollinearity problems.

The time series examined in this study are annual and cover the 1973-1997period. Both the Augmented-Dickey Fuller (ADF) and Phillips-Perron (P-P) test statistics indicated that two of the variables in equation (9) are stationary only in first differences: PEN and AUDIT. The remaining explanatory variables are stationary in levels, with (UAGI/RAGI) stationary in levels with a trend. Consequently, in the estimation provided in equation (10), variables PEN and AUDIT are expressed in first differences, and the estimate includes a linear trend variable, TREND.

It should be noted that the variable TREND may well be serving at least two functions in the model: (1) addressing the fact that the dependent variable is stationary in levels only with a trend; a (2) reflecting the fact that, over time, technology has increasingly improved the ability of the IRS to detect earned income and has, as a result, increasingly restricted the ability of individuals to choose to engage in income tax evasion. Ideally, the technology in question would be represented by a more precise variable than simply TREND; unfortunately, there appears to be no clear way to quantify this technology. Nevertheless, given that the usage of this technology has been increasing over time; the TREND variable might be a potentially useful (albeit crude) way to help account for the effects thereof on the DTE.

Estimating equation (9) by OLS yields:[4] (10)

$$(UAGI/RAGI)_t = 8.49 + 1.139AEPIT_{t-2} - 7.55\delta AUDIT_{t-1}^{**} - 0.001\delta\, PEN_{t-1}^{**} + 3.06DIS_{t-1} - 0.24\, TREND^{**}$$

(+2.78) (-3.99) (-3.02) (+2.80) (-4.75)

$R^2 = 0.80$, $adjR^2 = 0.75$, DW = 1.64, Rho = 0.13, F = 14.07**

where terms in parentheses are t-values and "δ" is the first-difference operator. In equation (10), * indicates statistically significant at the five percent level and ** indicates statistically significant at the one percent level or beyond. The DW and the Rho statistics reveal the absence of any serious serial correlation problems, whereas, the F-statistic is significant at the one percent level. Finally, the coefficient of determination indicates that the model explains roughly three fourths of the variation in the dependent variable.

As shown in equation (10), the estimated coefficient on the AEPIT variable is positive, as expected, and significant at nearly the one percent level. Thus, it appears that the higher the average effective federal personal income tax rate, the larger the relative DTE. This finding is consistent with the study of data from audits of individual tax returns by Clotfelter (1983), who finds underreporting of income to be an increasing function of marginal tax rates. The results in the present study are also consistent with the findings based on "official data" in Slemrod (1985) and Pommerehne and Weck-Hannemann (1989), as well as the findings based upon experimentation in Baldry (1987), Alm, Jackson and McKee (1992). Benjamini and Maital (1985). Finally, these results are also consistent with the regression estimate in Feige (1994. P. 135, n. 19), where the relative DTE is regressed in levels against a lagged tax variable (and a lagged second variable, D, which corresponds to the variable DIS in the present study).[5]

Next, the estimated coefficient on the AUSIT variable is negative (as hypothesized) and statistically significant at the one percent level, a result that is in sharp contrast to the findings in studies of alternative data sets for earlier periods [McLeod (1997), Cebula and Saltz (2000)].

In addition, the estimated coefficient on the PEN variable is negative (also as hypothesized) and significant at the one percent level. Thus, as tax evasion theory predicts, the greater the risk and penalty from underreporting income, as measured in this study by variables AUSIT and PEN, the smaller the DTE.

The estimated coefficient on the DIS variable is positive, as expected, and significant at the two percent level. Thus, there is evidence that dissatisfaction with government impacts positively on the relative DTE. Apparently, the more dissatisfied the public is with government, the greater the extent to t which the public chooses to underreport income.

Finally, the coefficient on the variable TREND is negative and statistically significant at the one percent level. As suggested above, the is negative coefficient might, at least in part, be reflecting the impact on the DT of technology that results in increasing the efficiency of the IRS's detection of earned income. In other words, as the IRS becomes increasingly aware of sources and amounts of earned income because of technology changes over time, the public's ability to underreport income declines, and the relative size of the underground economy diminishes, *ceteris paribus*.

For the purpose of illustrating the economic significance of these coefficients, a one percent increase in average tax rates is estimated to cause a 1.1 percent increase in relative tax evasion. An increase in audit rates of 0.1 percent is likely to cause a 0.7 percent decrease in relative evasion. A $100 increase in the average tax penalty would be expected to decrease relative evasion by 0.1 percent, and an increase in the dissatisfaction index of 0.1 would increase relative evasion by 0.3 percent.

Not surprisingly, the use of MAXPIT rather than AEPIT for the federal personal income tax rate proxy does not materially alter the above conclusions. This is illustrated in the following estimation, where $MAXPIT_{t-2}$ is the maximum federal personal income tax rate in year t-2 [IRS (1971-1997)]: (11)

$$(UAGI/RAGI)_t = 25.4 + 0.08\ MAXPIT_{t-2}^{*} - 6.22\delta\ AUDIT_{t-1}^{*} - 0.001\delta\ PEN_{t-1}^{**} + 3.3\ DIS_{t-1}^{**} - 0.34\ TREND^{**}$$

(+2.25) (-2.72) (-3.61) (+3.04) (-5.48)

$R^2 = 0.82$, $adjR^2 = 0.77$, DW = 1.74, Rho = 0.05, $F = 14.84^{**}$

In this estimation, the estimated coefficient on the MAXPIT variable is positive and significant at the one percent level, whereas the other findings are effectively consistent with those in equation (10).

V. CONCLUSION

Based on the empirical findings in this study for the period 1973 to 1997, it appears that the relative DTE is an increasing function of the federal personal income tax rate (as measured by either AEPIT or MAXPIT) and the public's level of dissatisfaction with government. It also appears that the relative DTE is a decreasing function of IRS penalty assessments (penalties plus interest) on detected unpaid taxes (i.e., on detected unreported taxable income) and IRS audit rates. In addition, the consistently significant and negative coefficient on the variable TREND might to some degree be indicative of a negative impact on the DTE as a result of technology that over time, has increasingly provided the IRS with better and better information on sources and amounts of earned income.[6]

Among other things, it appears that growth in the relative DTE might, at least in theory, be diminished by increased IRS penalties on detected unreported income as well as by increased IRS audit rates. Of course, it remains to be seen whether such actions are viable (politically feasible). Moreover, such policy actions must also be carefully evaluated in a general equilibrium cost-benefit framework. However, it also appears that restraint from further increases in federal personal income tax rates might help to at least limit the relative DTE. Indeed, it may well be that reductions in such rates could lead to increased tax revenues for the IRS (a Laffer curve type phenomenon).

ENDNOTES

1. The authors would like to thank John Kallianiotis, conference participants at the 2002 B&ESI Conference, and an anonymous referee for their helpful comments. Al remaining errors are the responsibility of the authors.
2. For example, based on a sample of 716 tax filers in Oregon and audit and income tax data for these same taxpayers obtained from the IRS for 1987, Erard and Feinstein (1994) assess the role of expected tax audits as well as guilt and shame in determining the underreporting of income. Other studies, including Clotfelter (1983), using actual individual tax return information, find that higher tax brackets are associated with higher levels of income underreporting.
3. Feige (1994, p. 135) states that "The average tax rate is simply the sum of total government tax receipts divided by AGI [aggregate]." In the present investigation, variable AEPIT is total federal government income tax receipts from individuals divided by the aggregate reported AGI level.
4. To. Correct for heteroskedasticity, the White (1980) correction is adopted in both of the estimates.
5. The Feige (1994) estimate includes two explanatory variables, an average effective income tax rate and a "dissatisfaction index," D, regarding government. This same index is used in the present study to measure variable DIS.
6. A dummy variable to account for inflation indexing, which was introduced into the Internal Revenue Code under provisions of the Tax Reform Act of 1986, was included in the model but was found to exercise no statistically significant impact on tax evasion.

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