AGGREGATE INCOME TAX EVASION: EMPIRICAL RESULTS USING NEW IRS DATA FOR THE U.S.

1. Introduction

Income tax evasion effectively consists of taxable income that is either unreported or underreported to the IRS; it also can consist of spurious or inflated tax deductions. Studies of income tax evasion behavior essentially fall into three categories. First, there are the principally theoretical models of tax evasion behavior, such as Allingham and Sandmo (1972), Falkinger (1988), Klepper *et al*. (1991), Das-Gupta (1994), Pestieau *et al*. (1994), Caballe and Panades (1997), and Gahramanov (2009). Such studies are often elegant mathematically and in many cases identify variables that *theoretically may* affect tax evasion. However, such studies tend to provide limited guidance regarding the expected magnitudes of the effects of variables they model. Second, there are a number of studies that either (a) use questionnaires or (b) undertake experiments, such as Spicer and Lundstedt (1976), Spicer and Thomas (1982), Baldry (1987), Thurman (1991), and Alm *et al*. (1999). These studies are of course empirical in nature, deriving the data largely (if not entirely) from the experiments. Certain of these studies indicate an aversion to the prospect of being audited while others reveal a lack of such risk-averse behavior; still others imply that taxpayers may be averse to tax evasion on moral grounds. Additionally, the incentive to try to evade taxation by underreporting income provided by higher marginal income tax rates is also revealed in various such studies. Third, there are those studies that largely or in some cases exclusively adopt what is referred to as 'official data', data obtained from the IRS (or its counterpart outside of the U.S.) and/or some other 'official', i.e., government source, and/or from a publicly available source. Among, the types of information thusly obtained and analyzed are data on tax evasion, tax rates, and audit rates. Such studies endeavor typically either to estimate the size of the 'underground economy' or the aggregate degree of tax evasion or to identify the determinants of same (Tanzi, 1982, 1983; Clotfelter, 1983; Carson, 1984; Long and Gwartney, 1987; Pyle, 1989; Feinstein,

1991; Erard and Feinstein, 1994; Feige, 1994; Cebula, 2001, 2004, 2008; Ali *et al.,* 2001; Ledbetter, 2004; Connelly, 2004; Christie and Holzner, 2006; Alm and Yunus, 2009; Cebula and Coombs, 2009).

Income tax evasion is of increasing importance in this period of government financial crises and rising government deficits and outstanding debt across many parts of the globe. Income tax evasion estimates are available for a number of nations, although all such estimates are admittedly only crude approximations. That said, according to Christie and Holzner (2006), income tax evasion/tax compliance is not modest; nor is it uniform across nations. As shown in Table 1, the percentage degree of income tax *compliance* among major Western economies ranges from an estimated low of 62.49% for Italy to an estimated high of 84% for the U.S. Of course, the estimated percentage degree of income tax *evasion* therefore ranges widely: 39.51% in Italy to 16% in the U.S. Thus, in this age of financially jeopardized national governments (such as Greece, most obviously, as well as Ireland and Portugal, but even including – at some level – the U.S. and U.K, whose debt credit ratings have been threatened), income tax evasion may have risen as a greater national and international economic problem than it has since the Great Depression. This is all the more the case in view of the fact that so many nations are raising income taxes or planning to do so. In this category is Greece (which has also committed to cracking down on tax evaders) as well as the U.S. and U.K. (also committed to cracking down on tax evaders).

TABLE 1 - *Income Tax Compliance and Evasion Rates*

Nation	Percentage Compliance Rate	Percentage Evasion Rate
United States	84.0	16.0
United Kingdom	77.97	22.03
Switzerland	77.7	22.3
France	75.38	24.62
Austria	74.8	25.2
Netherlands	72.84	27.16
Belgium	70.15	29.85
Portugal	68.09	31.91
Germany	67.72	32.28
Italy	62.49	37.51

Source: Christie and Holzner (2006).

Within this context, the present study seeks to add to the rich literature on income tax evasion by empirically investigating the determinants of aggregate federal personal income tax evasion in the U.S. using the *most current data available* from the Internal Revenue Service (IRS). To date, the empirical literature has effectively failed to investigate determinants of aggregate income tax evasion in the U.S. for recent years; indeed, except for a *single* somewhat narrowly focused study that investigated tax evasion and government-spending-induced budget deficits through the year 2001 (Cebula and Coombs, 2009), the most recent year considered in the tax-evasion-determinants literature is in fact 1997 (Cebula, 2004, 2008; Ali *et al.,* 2001; and Alm and Yunus, 2009). However, the IRS (2010) has very recently released new time-series data on tax evasion running through the year 2005. Using this new data derived by the IRS (2010), the present study seeks to identify the key personal income tax evasion determinants in the U.S. through the year 2005. Aside from the most commonly recognized factors that arguably influence tax evasion, such as a measure of income tax rates and IRS audit rate and penalty levels, factors such as the tax free interest rate yield, the public's job approval rating of the President *per se*, the unemployment rate, the Tax Reform Act of 1986, and the public's dissatisfaction with government (other than the President) are included in the analysis, along with the percentage of filed personal income tax returns that include itemized deductions and the real interest rate yield on Moody's Baa-rated long term corporate bonds. The latter two of these explanatory variables have never been considered before in a time-series analysis. The framework for the empirical analysis is presented in the next section of this study. The formal empirical analysis is provided in the subsequent section of the study. Finally, the closing section provides an overview of the study findings.

2. Framework for the analysis

In this study, the *relative* probability that the *representative* economic agent will *not* report his/her taxable income to the IRS is treated as positively impacted by (an increasing function of) the expected gross benefits to the agent of not reporting income, *eb*, and as negatively impacted by (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 the representative economic agent by:

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

Expressing probabilities in *relative* terms such as shown in equation (1) possesses the virtue that it thereby reflects the form of the available tax evasion data, i.e., data where (as described below in Section 3) the aggregate degree of federal personal income tax evasion is expressed in relative terms (IRS, 2010). This model of tax evasion behavior expands that developed by Cebula and Coombs (2009).

As already observed, the gross expected benefits from *not* reporting income to the IRS are hypothesized to be directly related to the federal personal income tax rate (Cagan, 1958; Bawley, 1982; Tanzi, 1982; Clotfelter, 1983; Pyle, 1989; Feige, 1994). To reflect the federal personal income tax rate, most previous studies using official data for the U.S. have adopted either of two alternative measures: an average effective federal personal income tax rate ($AEPT$) or the maximum marginal federal personal income tax rate ($MAXT$). In this study, the $MAXT$ measure of the income tax rate is adopted because, as argued in Cebula (2004), Connelly (2004), and Gahramanov (2009), this tax rate is likely to be a more representative measure of the overall degree of progressivity of the personal income tax rate schedule than $AEPT$ would be. Accordingly, it is hypothesized, *ceteris paribus*, that:

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

Next, this study endeavors to allow for the potential impact of *legal tax avoidance* on *illegal tax evasion*. To do this, we test the hypothesis by Cebula (2004, p. 419) that

> "… the higher the tax-free interest rate yield on high grade municipal bonds [*TF*] relative to the taxable interest rate yield on… high quality [taxable] bonds or notes such as ten year U.S. Treasury notes [*TEN*], the greater the incentive to engage in legal tax avoidance and the lower the incentive to engage in tax evasion".

Thus, it is expected in the present study that the greater the *TF/TEN* ratio, the lower the aggregate degree of federal personal income tax evasion, *ceteris paribus*. Hence, (2) is now rewritten as:

$$eb = h\ (MAXT,\ TF/TEN),\ h_{MAXT} > 0,\ h_{TF/TEN} < 0 \qquad (3)$$

The Tax Reform Act of 1986 [*TRA*] may have been perceived by at least some portion of the general public as an honest, good faith effort to reform, i.e., to simplify and increase the equity of the Internal Revenue Code. As Musgrave observed (1987, p. 59),

> "The Tax Reform Act of 1986 is the most sweeping reform since the early 1940s …".

Indeed, the *TRA* did introduce a number of reforms, many of which are outlined in broad terms in Ott and Vegari (2003), Barth (1991), and Sanger *et al*. (1990). For example, as observed in Ott and Vegari (2003, p. 279),

> "The Act introduced major cuts in the personal tax rate. When fully effective (by January 1, 1988), only two tax brackets, set at 15 and 28 percent, were to replace the 14 bracket tax schedule with rates in the range of 11 to 50 percent... [while it] broadened the tax base by reducing the itemized deduction".

Musgrave (1987, p. 59) further observes that prior to the *TRA*, a slow erosion of the income tax base had been occurring. Musgrave (1987, p. 57) was particularly dismayed by the widening of tax loopholes and the emergence of high income tax shelters that had

> "… gained momentum in recent years and undermined the public's faith in the income tax".

In this vein, Barth (1991) and Sanger *et al*. (1990) describe how the *TRA* decreased depreciation benefits from financial investments in residential as well as commercial real estate, established limitations on the tax deductibility of losses from 'passive' investments that affected limited partnerships syndications (including those involving real estate ventures), and terminated favorable capital gains treatment of real estate. Musgrave (1987, p. 59) also expressed concern that the

> "… compounding of the investment tax credit and accelerated depreciation diluted and distorted the base of the corporate income tax".

Musgrave (1987, p. 59) asserted that the *TRA*

> "… reversed these trends, a major accomplishment that all reformers will welcome".

Interestingly, Ott and Vegari (2001, p. 279) observe that, among other things, under the *TRA*

> "… the 10 percent investment tax credit for the purchase of equipment was repealed, and the life of the investment was increased for depreciation purposes".

Based on Musgrave's (1987) arguments, then, it is expected in the present study that taxpayers might well have favorably regarded the *TRA* and been less resentful of the Internal Revenue Code than

before, at least initially. Thus, it is hypothesized here that during the time frame when the *TRA* was enacted and became fully effective (1986-1987) and also received the greatest publicity, reduced taxpayer resentment of the federal income tax system/Internal Revenue Code would, at least temporarily, have resulted in a reduced degree of tax evasion, *ceteris paribus*. The reason this reaction to the *TRA* might be only *temporary* is revealed in the words of Slemrod (1992, p. 45), who argues that it would take at least some time for taxpayers

"… to learn about and adjust to the new law [the *TRA*]".

Consequently, it is hypothesized here that, for the period when the *TRA* was first implemented, October, 1986, through the first year when the *TRA* became 'fully effective', 1987, the aggregate degree of federal personal income tax evasion was reduced. Accordingly, (3) above is replaced by (4):

$$eb = j(MAXT,\ TF/TEN,\ TRA),\ j_{MAXT} > 0,\ j_{TF/TEN} < 0,\ j_{TRA} < 0 \quad (4)$$

Next, this study seeks to inquire further into an issue studied by Alm and Yunus (2009), who examined a cross-state panel of *individual* income tax returns for the period 1979-1997. In spirit following Alm and Yunus (2009) but dealing with *aggregate* time-series data rather than individual tax returns, the present study empirically investigates the impact of itemizing deductions on income tax returns on the propensity to engage in income tax evasion. Arguing that the presence of itemized tax deductions would make any individual tax return more complicated for the IRS to investigate or challenge and hence arguing that such itemized deductions created an opportunity for *individuals* to engage in increased tax evasion, Alm and Yunus (2009) found empirical evidence that this factor potentially raised the extent of income tax evasion. This factor has not been considered in the related empirical *time-series* literature. Consequently, in order to help fill this potentially important omission, in the present study, it is also hypothesized that the greater the percentage of personal income tax returns *in the aggregate* that includes itemized tax deductions on U.S. tax Form 1040, Schedule A of [*PCTITEM*], the greater the expected benefits from itemizing deductions and hence the greater the degree of personal income tax evasion, *ceteris paribus*. Based on this expectation, (4) is replaced by (5):

$$eb = j(MAXT,\ TF/TEN,\ TRA,\ PCTITEM),\ j_{MAXT} > 0,\ j_{TF/TEN} < 0,\ j_{TRA} < 0,\ j_{PCTITEM} > 0 \quad (5)$$

Next, based on Alm and Yunus (2009), Gahramanov (2009), and Cebula and Coombs (2009), it is expected that the higher the

unemployment rate [*UN*], the greater the expected benefits of personal income tax evasion, *ceteris paribus*. This is based on the reasoning that the higher the unemployment rate, the greater the extent to which the unemployed work in the 'underground economy' and hence do not report income. Furthermore, this effect may be reinforced to the extent that a higher unemployment creates an incentive even for still-employed people to avoid taxes to the degree that they try to covet extra funds (by under-reporting income) in *anticipation* of a *possible future* lay-off (Alm and Yunus, 2009; Gahramanov, 2009; Cebula and Coombs, 2009). As a result, equation (5) is expanded to equation (6):

$$eb = j(MAXT,\ TF/TEN,\ TRA,\ PCTITEM,\ UN),$$
$$j_{MAXT} > 0,\ j_{TF/TEN} < 0,\ j_{TRA} < 0,\ j_{PCTITEM} > 0,\ j_{UN} > 0 \qquad (6)$$

Finally, there is the issue of the public's job approval rating of the President [*APPROV*]. Following the study of the period *prior to 1998* by Cebula (2008), it is argued here that the higher the public's job approval rating of the President's performance in office, the greater the degree to which there is satisfaction with the President's actions and policies. The latter can be interpreted, at least to some degree, as implying less public resentment towards or greater approval of his various spending and/or tax policies (as well, perhaps, as his other policies). Similarly, the lower the public's job approval rating of the President, the greater the degree to which the public is likely to be dissatisfied with the President's actions and policies. In turn, it can be reasonably argued that the latter can be interpreted, to at least some extent, as implying greater resentment of or less public support of his various spending and/or tax policies (as well, perhaps, as his other policies). Stated somewhat differently, the lower the level of *APPROV*, the greater the *subjective benefits* ('secondary gain') from personal income tax evasion, whereas the higher the level of *APPROV* the lower the *subjective benefits* ('secondary gain') of personal income tax evasion. Based on this symmetrical argument, it is hypothesized that the greater the public's approval rating of the President, the lower the *eb* and hence the lower the aggregate degree of personal income taxation, *ceteris paribus*. Accordingly, equation (6) is transformed into equation (7), as follows:

$$eb = j(MAXT,\ TF/TEN,\ TRA,\ PCTITEM,\ UN,\ APPROV),$$
$$j_{MAXT} > 0,\ j_{TF/TEN} < 0,\ j_{TRA} < 0,\ j_{PCTITEM} > 0,$$
$$j_{UN} > 0,\ j_{APPROV} < 0 \qquad (7)$$

The expected gross costs of not reporting income to the IRS are hypothesized to be an increasing function of the expected risks/costs

thereof (Alm *et al.,* 1992; Pestieau *et al.,* 1994; Erard and Feinstein, 1994; Caballe and Panades, 1997; Cebula and Coombs, 2009). In this study, to the representative economic agent, the expected risks/costs from not reporting or from underreporting taxable income to the IRS are enhanced by an increase in *AUDIT*, the percentage of filed federal personal income tax returns that is formally audited by IRS examiners, *ceteris paribus*. Indeed, the experience of an IRS tax audit could imply non-pecuniary ('psychic') costs as well as pecuniary costs (including outlays for legal or other representation, along with the value of one's own time) above and beyond any potential added taxes, penalties, and interest assessed by the IRS. In addition to *AUDIT*, it is hypothesized that the expected risks/costs of tax evasion also include the magnitude of the IRS imposed penalties [*PENALTY*] should one's tax evasion activities be successfully detected by the IRS. To reflect this penalty, this study adopts the average interest rate charged by the IRS in each year on detected unreported income. Clearly, the greater the value of *PENALTY*, *ceteris paribus*, the greater the *ec* and hence the lower the degree of aggregate personal income taxation that is expected. Thus, we have:

$$ec = j(AUDIT,\ PENALTY),\ j_{AUDIT} > 0,\ j_{PENALTY} > 0 \qquad (8)$$

Substituting from equations (7) and (8) into equation (1) yields:

$$pnr/(1\text{-}pnr) = b(MAXT,\ TF/TEN,\ TRA,\ PCTITEM,\ UN,\ APPROV,\ AUDIT,\ PENALTY),$$
$$b_{MAXT} > 0,\ b_{TFTEN} < 0,\ b_{TRA} < 0,\ b_{PCTITEM} > 0,$$
$$b_{UN} > 0,\ b_{APPROV} < 0,\ b_{AUDIT} < 0,\ b_{PENALTY} < 0 \qquad (9)$$

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

$$UAGI = (pnr)*AGI \qquad (10)$$

and

$$RAGI = (1\text{-}pnr)*AGI \qquad (11)$$

It then follows that:

$$UAGI/RAGI = (pnr)*AGI/(1\text{-}pnr)*AGI = (pnr)/(1\text{-}pnr) \qquad (12)$$

From (9) and (12), substitution for *pnr*/(1-*pnr)* yields the following model of aggregate personal income tax evasion:

$$UAGI/RAGI = b(MAXT,\ TF/TEN,\ TRA,\ PCTITEM,\ UN,\ APPROV,\ AUDIT,\ PENALTY),$$
$$b_{MAXT} > 0,\ b_{TFTEN} < 0,\ b_{TRA} < 0,\ b_{PCTITEM} > 0,\ b_{UN} > 0,\ b_{APPROV} < 0,\ b_{AUDIT} < 0,\ b_{PENALTY} < 0 \quad (13)$$

3. Empirical analysis

Based on the framework provided in (13) above, the following reduced-form equation is to be estimated *initially*:

$$(UAGI/RAGI)_t = a_0 + a_1\ MAXT_{t-1} + a_2\ (TF/TEN)_{t-1} + a_3\ TRA_t + a_4\ PCTITEM_{t-1} + a_5\ UN_{t-1} + a_6\ APPROV_{t-1} + a_7\ AUDIT_{t-1} + a_8\ PENALTY_{t-1} + u \quad (14)$$

where:

$(UAGI/RAGI)_t$ = the ratio of the aggregate *unreported* federal adjusted gross income in year t to the aggregate *reported* federal adjusted gross income in year t, expressed as a percent;

a_0 = constant term;

$MAXT_{t-1}$ = the maximum federal personal income tax rate in year t-1, expressed as a percent;

$(TF/TEN)_{t-1}$ = the ratio for year t-1 of the average annual tax-free interest rate yield on high grade municipal bonds to the average annual taxable interest rate yield on ten-year U.S. Treasury notes, expressed as a percent;

TRA_t = a binary (dummy) variable for the years 1986 through 1987, when the Tax Reform Act of 1986 was initially implemented and became effective: $TRA_t = 1$ for the years 1986 and 1987, and $TRA_t = 0$ otherwise;

$PCTITEM_{t-1}$ = the percentage of filed federal personal income tax returns with itemized deductions listed on Schedule A of Form 1040 in year t-1;

UN_{t-1} = the percentage unemployment rate of the civilian labor force in year t-1;

$APPROV_{t-1}$ = the public's average job approval rating of the President in year t-1: values for $APPROV_{t-1}$ lie between 0 and 100;

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

$PENALTY_{t-1}$ = the average percentage interest rate used by the IRS in year t-1 to assess interest penalties on detected unreported income; and

u = stochastic error term.

The study period runs from 1967 through 2005. The choice of the year 1967 reflects data availability; the choice of the year 2005 reflects the most recent availability of the official *UAGI/RAGI* data. The data are all annual. The *UAGI/RAGI* data were obtained from the IRS (2010, columns 2 and 3). The data for the variable *MAXT* were obtained from the IRS (2009b). The *PCTITEM* data were obtained from the IRS (2009a). The *AUDIT* data were obtained from the Government Accounting Office (1996, Table I.1) and the U.S. Census Bureau (1984, Table 544; 1989, Table 540; 1994, Table 519; 1998, Table 550; 1999, Table 556; 2001, Table 546; 2009, Table 469), and the *PENALTY* data were obtained from the IRS (1967-2009). The *TRA* variable is a dummy variable. The data for the variables *TF/TEN* and *UN* were obtained from the Council of Economic Advisors (2010, Tables B-73, B-35). The data for the variable *APPROV* were obtained from the Gallup Poll (2009).

The (*P-P*) Phillips-Perron and *ADF* (Augmented Dickey-Fuller) unit root tests indicate that the variables *MAXT* and *TF/TEN* are stationary only in first differences, whereas the variables *AUDIT* and *PENALTY* are stationary only in second differences. Furthermore, the variables *PCTITEM* and *APPROV* are stationary in levels, and the variables (*UAGI/RAGI)* and *UN* are stationary in levels with a trend variable. Accordingly, in the estimations, the variables *AUDIT* and *PENALTY* are expressed in second differences, and the variables *MAXT* and *TF/TEN* are expressed in first differences. In addition, a linear trend variable (*TREND*) is included in the analysis.

The OLS (ordinary least squares) estimation of equation (14), adopting the Newey-West heteroskedasticity correction, is given by:

$$\begin{aligned}(UAGI/RAGI)_t = {} & 14.35 + \underset{(+4.87)}{0.107}\ \Delta MAXT_{t-1} \\ & \underset{(-1.71)}{-5.7}\ \Delta(TF/TEN)_{t-1} \underset{(-4.28)}{-1.64}\ TRA_t + \underset{(+2.71)}{0.09}\ PCTITEM_{t-1} \\ & + \underset{(+5.36)}{0.915}\ UN_{t-1} + \underset{(+7.69)}{0.17}\ TREND - \underset{(-7.41)}{0.226}\ APPROV_{t-1} \\ & \underset{(-0.08)}{-0.06}\ \Delta\Delta AUDIT_{t-1} \underset{(-2.41)}{-0.28}\ \Delta\Delta PENALTY_{t-1} \\ R^2 = 0.90,\ adjR^2 = 0.84,\ F = 16.54,\ DW = 1.83,\ Rho = 0.08 \quad & (15)\end{aligned}$$

where terms in parentheses are *t*-values, Δ is the first-differences operator, and $\Delta\Delta$ is the second-differences operator.

In equation (15), the estimated coefficients on all eight of the explanatory variables exhibit the hypothesized signs, with five being

statistically significant at the one percent level, one statistically significant at beyond the five percent level, and one statistically significant at the ten percent level. The coefficient of determination is 0.90, so that the model explains nine-tenths of the variation in the dependent (tax evasion) variable. The F-statistic is significant at the one percent level, attesting to the overall strength of the estimate. Finally, there should be no concern regarding autocorrelation.

The estimated coefficient on the *MAXT* variable is positive and statistically significant at beyond the one percent level. Thus, the higher the maximum marginal federal personal income tax rate, the greater the degree of federal income tax evasion by households, presumably because a higher income tax rate increases the incentive to evade taxes. This finding is consistent in principle with the conventional wisdom and with several previous empirical studies, e.g., Tanzi (1982), Clotfelder (1983), Feige (1994), and Cebula and Coombs (2009). The estimated coefficient on the *TF/TEN* variable is negative and significant at the ten percent level, affirming (albeit weakly) the hypothesis in Cebula (2004) that this form of *legal tax avoidance* acts to reduce the degree of *illegal tax evasion*. The estimated coefficient on the Tax Reform Act of 1986 dummy variable [*TRA*] is negative, as hypothesized (Musgrave, 1987), and statistically significant at the one percent level, providing evidence that taxpayers may have regarded the Tax Reform Act of 1986 as a genuine, honest effort to reform the inequities of and diminish the complexities (compliance costs) of the existing Internal Revenue Code. Alternatively, as implied by Slemrod (1992, p. 45), the observed drop in personal federal income tax evasion for this brief period may simply have reflected the time frame required by taxpayers to learn about and adjust to this allegedly 'sweepingly reformed' (Musgrave, 1987) new version of the Internal Revenue Code. The estimated coefficient on the *PCTITEM* variable is positive and statistically significant at the one percent level, a finding consistent with Alm and Yunus (2009). This result implies that the greater the percentage of filed tax returns that contain itemized deductions on Schedule A of Form 1040, the greater the degree of aggregate federal personal income taxation. As argued in Alm and Yunus (2009), such itemization may provide opportunities for taxpayers to exaggerate their tax deductions and thereby to avoid some degree of income taxation liability. The estimated coefficient on the unemployment rate variable (*UN*) is positive, as hypothesized, and statistically significant at the one percent level. This finding is consistent with the hypothesis that the higher the unemployment rate, the greater

the degree to which households enter the underground economy (Alm and Yunus, 2009; Gahramanov, 2009; and Cebula and Coombs, 2009). The variable *TREND* is positive and statistically significant, as one would expect in view of the results of the *P-P* and *ADF* tests. Next, there is the issue involving the Presidential job approval rating: "Does a lower (higher) job approval rating of the President by the U.S. public act to increase (decrease) the degree of aggregate federal personal income tax evasion?" As shown in equation (15), the estimated coefficient on variable *APPROV* is negative (as hypothesized) and statistically significant at the five percent level. Thus, this finding in equation (15) provides empirical support for this hypothesis (Cebula, 2008).

The estimated coefficients on the variables *AUDIT* and *PENALTY* are both negative (as hypothesized); however, whereas the coefficient on the *PENALTY* variable is statistically significant at the three percent level, that on the *AUDIT* variable fails to be statistically significant at even the ten percent level. The latter result is consistent with other studies for the U.S., including the recent analysis by Cebula and Coombs (2009). In any case, these two findings combined would suggest that although taxpayers are *not discouraged* from tax evasion behavior by increased prospects of detection (as represented by variable *AUDIT*), they *are dissuaded* from engaging in income tax evasion by higher interest rate penalties imposed when such tax evasion behavior is in fact detected (as reflected in the variable *PENALTY*).

In order to test the robustness of this analysis, two extensions of the basic model are estimated. To begin, the first new variable integrated into the system is the real interest rate yield on long term Moody's Baa-rated corporate bonds, *RBaa*, where *RBaa* is the nominal interest rate yield on Moody's long term corporate bonds in a given year *minus* the actual inflation rate during that year (Council of Economic Advisors, 2010, Tables B-73, B-64). This is a variable altogether overlooked in previous related empirical studies. It is argued here that the higher the *RBaa*, the greater the expected benefits (*eb*) from engaging in income tax evasion since the dollars gained from that tax evasion can be invested in higher yielding securities (even after having adjusted for inflation). Alternatively stated, the higher the level of *RBaa*, the greater the *opportunity costs of tax compliance*. Accordingly, it is hypothesized that the higher the *RBaa*, the higher the *eb* associated with income tax evasion and hence the higher the aggregate degree of federal personal income taxation, *ceteris paribus*.

Adding this variable to the empirical model in equation (14) yields the following reduced-form equation:

$$(UAGI/RAGI)_t = a_0 + a_1\, MAXT_{t-1} + a_2\, (TF/TEN)_{t-1} + a_3\, TRA_t + a_4\, PCTITEM_{t-1} + a_5\, UN_{t-1} + a_6\, APPROV_{t-1} + a_7\, AUDIT_{t-1} + a_8\, PENALTY_{t-1} + a_9\, RBaa_{t-1} + u \quad (16)$$

where:

$RBaa_{t-1}$ = the *ex post* real interest rate yield on Moody's long term corporate bonds in year t-1, expressed as a percentage.

Estimating equation (16) by OLS, adopting the Newey-West heteroskedasticity correction, yields the results shown in column (a) of Table 2. In column (a), eight of the nine estimated coefficients on explanatory variables exhibit the expected signs, with six statistically significant at the one percent level, one statistically significant at the five percent level, and one statistically significant at the ten percent level. Once again, the $\Delta\Delta AUDIT$ variable fails to be statistically significant, while the coefficient on the *new* variable *RBaa* exhibits the hypothesized positive sign and is statistically significant at the ten percent level. Overall, except for the result for this new variable, the results in column (a) are consistent with those in estimate (15) above.

Thus, based on the results provided in column (a) of Table 2, it is inferred that, as expected, over the study period running through 2005, aggregate federal personal income tax evasion was positively impacted by $\Delta MAXT$, i.e., that the higher the maximum marginal federal personal income tax rate, the greater was the degree of aggregate federal personal income tax evasion. It also is inferred that, as hypothesized, the degree of aggregate federal personal income tax evasion was positively impacted by *PCTITEM* (the percentage of filed federal personal income tax returns that included itemized deductions) and *UN* (the unemployment rate). Furthermore, as hypothesized, it is inferred that this income tax evasion was negatively impacted by *Δ(TF/TEN)*, the ratio of the tax free interest rate yield to the taxable yield, *TRA*, the Tax Reform Act of 1986, *APPROV*, the Presidential approval rating, and $\Delta\Delta PENALTY$, the IRS interest rate penalty on detected unreported income. Finally, there is modest evidence in this estimate that the *new* variable, *RBaa*, the real interest rate yield on Moody's long term corporate bonds, exercised a positive impact on tax evasion, presumably by providing an incentive in the form of a higher inflation-adjusted interest rate on invested unpaid taxes.

As one final test of the strength of the model in explaining aggregate federal personal income tax evasion for the heretofore unstudied period for the U.S. running through 2005, the variable *DIS* is introduced. The variable *DIS* is the so-called public dissatisfaction with government index (University of Michigan Institute for Social

TABLE 2 - *Alternative Estimates*

Variable\Estimation	(a), OLS Estimation	(b), TSLS Estimation
Constant	13.83	12.8
$\Delta MAXT_{t-1}$	0.108***	0.11***
	(5.77)	(4.87)
$\Delta(TF/TEN)_{t-1}$	6.43**	-6.2***
	(2.24)	(-2.78)
TRA_t	1.66***	-2.07***
	(-4.57)	(-4.62)
$PCTITEM_{t-1}$	0.098***	0.115***
	(2.69)	(3.10)
UN_{t-1}	0.943***	0.94***
	(5.75)	(6.42)
TREND	0.18***	0.18***
	(7.57)	(11.01)
$APPROV_{t-1}$	0.225***	-0.213***
	(-7.07)	(-10.80)
$\Delta\Delta AUDIT_{t-1}$	+0.02	+0.25
	(0.02)	(0.26)
$\Delta\Delta PENALTY_{t-1}$	0.31***	-0.36***
	(-2.85)	(-3.96)
$\Delta\Delta RBaa_{t-1}$	0.098*	0.16**
	(1.71)	(2.45)
ΔDIS_t	-------	1.01**
		(2.21)
R^2	0.90	-------
$AdjR^2$	0.84	-------
F	15.14***	16.56***
DW	1.88	2.18
Rho	0.05	-0.09

*** indicates statistically significant at the 1% level; ** indicates statistically significant at the five percent level; and * indicates statistically significant at the ten percent level.

Research, 2007). This variable measures: (a) the degree to which the public distrusts public officials (other than the President) to fulfill their job obligations; (b) the degree to which the public regards government officials as dishonest; and (c) the degree to which the public believes that government officials waste tax dollars. The value of the index ranges from –1.5 to +1.5, with a higher index value signifying a greater degree of dissatisfaction with government. Interestingly, as observed in Cebula (2008), the variables *DIS* and *APPROV* are almost entirely unrelated statistically; indeed, they have a correlation coefficient of only +0.139. In any event, the impact of this variable on tax evasion has been studied twice before (Feige, 1994; Cebula, 2001). Following Feige (1994) and Cebula (2001), it can be argued that the greater the public's dissatisfaction with government, the greater the *secondary gain* from not reporting or from under-reporting taxable income, *ceteris paribus*. Accordingly, since a higher level of *DIS* implies a higher level of *eb* (through these secondary gains), it is hypothesized that the aggregate degree of federal personal income taxation is positively impacted by *DIS*, *ceteris paribus*.

The equation to be estimated is now given by the following:

$$(UAGI/RAGI)_t = a_0 + a_1\, MAXT_{t-1} + a_2\, (TF/TEN)_{t-1} + a_3\, TRA_t + a_4\, PCTITEM_{t-1} + a_5\, UN_{t-1} + a_6\, APPROV_{t-1} + a_7\, AUDIT_{t-1} + a_8\, PENALTY_{t-1} + a_9\, RBaa_{t-1} + a_{10}\, DIS_t + u \qquad (17)$$

Observe that the variable *DIS* is un-lagged. This reflects the finding in Cebula (2001), albeit for the earlier period 1973-1997, that the decision as to whether or not to evade taxes was contemporaneous with the public's dissatisfaction with government. Furthermore, as in the earlier period studied by Cebula (2001), the *P-P* and *ADF* tests both reveal that the variable *DIS* is stationary only in first differences; therefore, *DIS* must be expressed only in first differences form in any estimation, i.e., as ΔDIS_t.

Given that the variables $(UAGI/RAGI)_t$ and DIS_t are contemporaneous, the possibility of simultaneity bias exists. Accordingly, the model in equation (17) is estimated by TSLS (two-stage least squares), with the instrumental variable being the two-year lag of the average effective federal personal income tax rate, ATR_{t-2}. The choice of this instrument is based on two findings: (1) that variables ATR_{t-2} and ΔDIS_t are highly correlated and (2) that the instrument is not correlated with the error terms in the system.

The TSLS estimate of equation (17) is provided in column (b) of Table 2. In this estimate, nine of the ten coefficients on the explanatory variables exhibit the expected signs (with $\Delta\Delta AUDIT_{t-1}$

being the exception). Of these nine 'correctly signed' estimated coefficients, seven are statistically significant at the one percent level and two are statistically significant at the five percent level. The F-statistic in this TSLS estimate is statistically significant at the one percent level, attesting once again to the overall strength of the model. Overall, these results are compatible with those in equation (15) and in column (a) of Table 2, except that these results: (a) are, in general, more robust, i.e., the estimated coefficients have higher t-values than their counterparts in equation (15) and column (a), especially in the cases of variables $\Delta(TF/TEN)_{t-1}$ and $\Delta\Delta RBaa_{t-1}$; and (b) yield a statistically significant positive coefficient on the additional variable reflecting the public's dissatisfaction with government (ΔDIS_t).

Based on the findings summarized in column (b), it appears that the aggregate degree of federal personal income tax evasion, $(UAGI/RAGI)_t$, is *directly impacted by* the variables $\Delta MAXT$, $PCTITEM$, UN, $\Delta\Delta RBaa$, and ΔDIS, while being negatively impacted by the variables $\Delta(TF/TEN)$, TRA, $APPROV$, and $\Delta\Delta PENALTY$. It also appears that the IRS audit rate of filed income tax returns, unlike the penalty interest rate assessed on detected unreported income, does *not* influence household tax evasion behavior. The variables $PCTITEM$ and $RBaa$ have not previously been investigated in aggregate time-series studies of personal income tax evasion in the U.S., whereas the variable $APPROV$ has been previously studied only once (Cebula, 2008) and the variable ΔDIS has previously been studied only twice (Feige, 1994; Cebula, 2008).

4. Conclusion

This study has used OLS and TSLS estimations to identify key determinants of aggregate federal personal income tax evasion for the period 1967-2005. To date, only one related study has appeared that investigates beyond the year 1997, and that more narrowly focused study (Cebula and Coombs, 2009) runs only through the year 2001 and uses a non-IRS dataset (Ledbetter, 2004).

The empirical estimates provided in the present study indicate that the aggregate degree of federal personal income tax evasion, $(UAGI/RAGI)_t$, is *directly impacted by* the maximum marginal federal personal income tax rate ($\Delta MAXT$), the percentage of filed federal personal income tax returns that includes itemized deductions ($PCTITEM$), the unemployment rate (UN), the real interest rate yield on Moody's Baa-rated long term corporate bonds

($\Delta\Delta RBaa$), and the public's dissatisfaction with government, other than the President, (ΔDIS). Aggregate personal federal income tax evasion also is negatively impacted by the variables $\Delta(TF/TEN)$, the ratio of the tax-free interest rate yield on high grade municipals to the taxable interest rate yield on ten year Treasury notes, *TRA*, the various provisions of the Tax Reform Act of 1986, *APPROV*, the public's job approval rating of the President *per se* (i.e., as opposed to government in general), and $\Delta\Delta PENALTY$, the interest rate penalty imposed by the IRS on detected unreported income. It also appears that the IRS audit rate of filed income tax returns, unlike the penalty assessed on detected unreported income, does *not* influence household tax evasion behavior. The uniqueness of this study derives in part from the adoption of variables *PCTITEM* and *RBaa*, which have not previously been analyzed in aggregate time-series studies of personal income tax evasion, whereas *none* of these factors has been investigated to date for the years 2002-2005, the most recent years for which the IRS has developed its newest estimates of household (personal) income tax evasion.

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ABSTRACT

This study empirically investigates the determinants of aggregate federal personal income tax evasion in the U.S. using the *most current data available* from the IRS. In 2010, the IRS released a new series on personal income tax evasion data running through the year 2005. Using this new data, the present study seeks to identify any new as well as traditional determinants of domestic personal income tax evasion. Aside from investigating the most commonly recognized factors that allegedly influence tax evasion, such as a measure of income tax rates and IRS audit rate and penalty interest rate levels, the tax free interest rate yield, the public's job approval rating of the President, the unemployment rate, the Tax Reform Act of 1986, and the public's dissatisfaction with government *per se* are included in the analysis, along with two variables previously unstudied in a purely time-series context, namely, the percentage of filed tax returns that include itemized deductions and the real interest rate yield on Moody's Baa-rated long term corporate bonds. With the exception of the IRS audit rate, all of these factors are found to significantly influence the aggregate degree of personal income taxation over the 39-year period from 1967 through 2005, the most recent several years of which have not been previously investigated**.**

Keywords: Income Tax Evasion; Real Interest Rate Yield; Benefit-Cost Model

JEL Classification: E26, E62

RIASSUNTO

L'evasione aggregata del reddito: risultati empirici ottenuti utilizzando i nuovi dati IRS per gli USA

Questo studio esamina le determinanti dell'evasione aggregata dell'imposta sui redditi personali negli USA sulla base degli ultimi dati disponibili forniti dall'*Internal Revenue Service* (IRS). Nel 2010 l'IRS ha reso noti nuovi dati su tale evasione relativi all'anno 2005. Tramite l'utilizzo di questi dati questo lavoro cerca di individuare nuovi elementi – in aggiunta a quelli già noti – che portano all'evasione delle tasse personali sul reddito. Oltre a investigare i fattori che notoriamente influenzano l'evasione fiscale (quali la percentuale delle imposte sul reddito, la quota di dichiarazioni controllate formalmente dall'IRS e il valore delle sanzioni inflitte), sono inclusi nell'analisi il rendimento dei tassi di interesse *tax free*, il livello di approvazione dell'operato del Presidente, il tasso di disoccupazione, il *Tax Reform Act* del 1986 e il livello di insoddisfazione nei confronti del Governo, insieme a due variabili mai considerate precedentemente in un contesto puramente *time-series*: la percentuale di dichiarazioni dei redditi che includono deduzioni dettagliate e il tasso di rendimento reale dei corporate bond a lungo termine con rating Moody Baa. Fatta eccezione per il tasso di audit dell'IRS, tutti questi fattori risultano aver influenzato significativamente il grado aggregato di imposta sui redditi personali del trentennio 1976-2005.