The Underground Economy in the U.S.A: Preliminary New Evidence on the Impact of Income Tax Rates (and Other Factors)on Aggregate Tax Evasion, 1975-2008

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THE UNDERGROUND ECONOMY IN THE U.S.: PRELIMINARY NEW EVIDENCE ON THE IMPACT OF INCOME TAX RATES (AND OTHER FACTORS) ON AGGREGATE TAX EVASION, 1975-2008

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Abstract

This empirical study seeks to identify determinants of the underground economy in the U.S. in the form of *aggregate* federal personal income tax evasion over the period 1975-2008, with a specific focus upon the *net* impact of higher federal income tax rates on personal income tax evasion. In this study, we use the most recent data available on aggregate personal income tax evasion, data that are derived from the General Currency Ratio Model and measured in the form of the ratio of unreported AGI to reported AGI. Most other studies of federal income tax evasion for the U.S. do not use data this current. It is found that the impact of increases in the federal income tax rate on aggregate personal income tax evasion may, on balance, be *ambiguous*, possibly suggesting that the income effect is negative and outweighs the positive substitution effect for the representative taxpayer. It is also found that the degree of aggregate federal personal income tax evasion may be an increasing function of the percentage of federal personal income tax returns characterized by itemized deductions and a decreasing function of the Tax Reform Act of 1986 (during the first two years of implementation), the ratio of the tax free interest rate yield on high grade municipals to the interest rate yield on ten year Treasury notes, and higher audit rates of filed federal income tax returns (as a measure of risk from tax evasion) by IRS personnel. Finally, unpopular wars may provide a secondary benefit for and therefore act as an inducement for greater tax evasion.

J.E.L. classifications: G18, G28, H26

Keywords: tax evasion; substitution effect; income effect; incentives; disincentives

I. Introduction

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, Nagin, and Spurr (1991), Das-Gupta (1994), Pestieau, Possen, and Slutsky (1994), and Caballe and Panades (1997). As a rule, most such studies are not empirical in nature, but they potentially can provide insights into new variables that might influence tax evasion behavior in the aggregate. 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), Alm, Jackson, and McGee (1992), Thurman (1991), and Alm, McClelland, and Schulze (1999). These studies are empirical in nature, deriving the data largely (if not entirely) from the experiments, and also potentially can provide insights into new variables that might influence tax evasion behavior in the aggregate. 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. Third, there are those studies that largely or in some cases exclusively adopt what is referred to as "official data," i.e., data obtained from the IRS (or its counterpart outside of the U.S.) and/or some other "official source," i.e., a credible government agency. Among the types of information thusly obtained and analyzed are data on income tax evasion, income tax rates, penalties assessed on detected unpaid income taxes, and audit rates. Such studies endeavor typically either seek to estimate the relative extent of tax evasion or to identify determinants thereof (Tanzi, 1982, 1983; Clotfelter, 1983; Carson, 1984; Crane and Nourzad, 1987; Poterba, 1987; Pyle, 1989; Erard and Feinstein, 1994; Feige, 1994,1996; Joulaian and Rider, 1996; Cebula, 1997, 2001, 2004, 2011, 2013; Ali, Cecil, and Knoblett, 2001; Alm and Yunus, 2009; Cebula, Coombs, and Yang, 2009).

In the empirical literature, it has often been found that the degree of federal personal income tax evasion is positively affected by income tax rates (Tanzi, 1982; Clotfelter, 1983; Crane and Nourzad, 1987; Poterba, 1987; Feige, 1994; Joulaian and Rider, 1996; Cebula, 1997, 2001, 2004, 2011, 2013). Interestingly, Yaniv (1994) characterizes Clotfelter (1983) as "the most relevant study" with respect to the impact of income tax rates on tax evasion, whereas Cox (1984) questions his findings. In any event, in a purely static framework, this perspective *appears* simple and straightforward, namely, the higher the income tax rate, the greater the benefit (in terms of a reduced tax liability) from not reporting taxable income, *ceteris paribus*. However, as observed by a number of scholarly papers, including Crane and Nourzad (1986), Caballe and Panades (2007), Gahramanov (2009), and Freire-Seren and Panades (2013), there is an apparent contradiction between the empirical evidence on the response of taxpayers to increased or decreased income tax rates and the predictions of *theoretical* models of income tax evasion. In other words, on theoretical grounds it can be argued that the effect of, say, an increase in the income tax rate on income tax evasion is *ambiguous*. For example, it follows from Crane and Nourzad (1986) that the net response of tax evasion to a change in the tax rate depends upon the relative strength of the substitution and income effects of a tax rate change.

The purpose of this exploratory study is two-fold. First, it seeks to add to the rich literature on income tax evasion by identifying key determinants of *aggregate* federal personal income tax evasion in the U.S. using data up to and including the year 2008. For the most part, earlier studies of *aggregate* tax evasion in the U.S. do not go beyond the year 1997, althlough the recent study by Cebula (2013) uses official IRS data that estimate the "AGI gap" approach that run through the year 2005. Thus, by investigating tax evasion through 2008, the study period is more current than the nearly all of the existing published literature. Second, it provides a number of empirical estimates of aggregate income tax evasion that adopt two alternative income tax rate measures in the effort to provide information that may be pertinent to the controversy and debate concerning the actual *net* response of aggregate income tax evasion to, say, an increase in the tax rate, depending upon the relative strengths of the substitution and income effects of a tax rate change.

It is noteworthy that focusing on *aggregate* income tax evasion and its determinants permits the analysis of *actual* (official) as opposed to *hypothetical* or *experimental* tax evasion data and also permits the analysis of a variety of actual real-world explanatory variables; furthermore, the aggregate time-series approach adopted in this study permits analysis of aggregate federal personal income tax evasion over time. Finally, the use of aggregate data can provide researchers and policymakers with a convenient tool for estimating the lost tax revenues resulting from tax evasion and potential tax receipts increases that various public policies can potentially generate; indeed, policymakers arguably might well be much more interested in the results from aggregative analysis using official data because such information may be easier to present to elected officials seeking to enact new legislation to limit income tax evasion.

The framework/model is presented in Section II. Section III provides the formal empirical analysis. These estimates first consist of OLS (ordinary least squares) results and, as a test of robustness, subsequently of 2SLS (two stage least squares) results. Section IV provides a summary of the study findings and certain policy observations.

II. A Benefit-Cost Model of Under-Reporting Taxable Income

In this study, the *relative* probability that the *representative* economic agent will under-report his/her taxable income to the IRS (*pur*) is treated as an increasing function of the expected gross benefits to the agent of under-reporting taxable income, *egb*, and as a decreasing function of the expected gross costs to the agent of under-reporting taxable income, *egc*. Thus, the ratio of the probability of under-reporting taxable income to the IRS, *pur*, to the probability of fully reporting taxable income[1] to the IRS, *(1-pur)*, is described for the representative economic agent by:

$$pur/(1-pur) = f(egb, egc), \text{ such that } f_{egb} > 0, f_{egc} < 0 \qquad (1)$$

Expressing the probabilities described in equation (1) in *relative* terms possesses the virtue that it thereby reflects the form of the tax evasion data, i.e., data where (as described in Section III) the aggregate degree of federal personal income tax evasion is expressed in such *relative* terms. Needless to say, these probabilities, *pur* and (*1- pur*), can differ from one taxpayer to another. The aggregative approach adopted here, like that of its predecessors, effectively is a *de facto* average of those probabilities and is not perfect.

Expected Direct Benefits of Under-Reporting Taxable Income

Arguably, on a superficial static level, an example of potential expected benefits from income tax evasion could *simply* be the value of the taxes not paid to the IRS (Internal Revenue Service). To the extent that an individual engages in income tax evasion and underpays income taxes by, say, \$X, those \$X are a direct benefit to the individual, who can (in theory) spend and/or save the \$X. It follows that the higher the marginal federal income tax rate that the individual is subject to, the greater the pecuniary benefit from underreporting his or her income. For instance, if the maximum marginal income tax rate for the taxpayer in question is 10%, tax evasion in the amount of \$5,000 potentially would be expected to yield the tax evader \$500; however, if the taxpayer in question faced an increased/higher percent income tax rate, say 40%, the expected direct benefit of this same degree of tax evasion would appear to be \$2,000. Thus, it might be logical to deduce that, *ceteris paribus*, the higher the maximum marginal income tax rate faced by a taxpayer, the greater the incentive to engage in income tax evasion because the higher that income tax rate, the greater the expected benefits of the tax evasion behavior. Clearly, the probability of underreporting income

[1] Fully reporting all taxable income is complete income tax compliance.

may differ by income level and from one person to another, even with the same income. The way in which the tax evasion data are gathered reflects a *de facto* average response of taxpayers to tax-evasion incentives and influences.

However, from a more rigorous theoretical perspective, it can be hypothesized that the effect of an income tax rate change on income tax evasion is actually *ambiguous* (Crane and Nourzad, 1986; Caballe and Panades, 2007; Gahramanov, 2009; Freire-Seren and Panades, 2013). The sign on the partial derivative of tax evasion with respect to the income tax rate theoretically depends upon the relative strengths of the *substitution effect* associated with the tax rate change on the one hand and the *income effect* associated with the tax rate change on the other hand. Assume an income tax rate increase is implemented. On the one hand, the substitution effect, which is always positive, implies an increased incentive to engage in greater income tax evasion. As Freire-Seren and Panades (2013, p. 810) observe, "This effect generates incentives to substitute tax evasion for honesty." On the other hand, under the assumed income tax rate increase, the income effect could either be positive or negative, depending upon the taxpayer's attitude towards, i.e., tolerance of, risk of detection for tax evasion by the IRS. If the income effect is positive, then the taxpayer will likely engage in increased income tax evasion as a reaction to the tax rate increase. However, if the income effect is negative and if it outweighs/dominates the positive substitution effect, then the partial derivative of tax evasion with respect to the income tax rate is negative. Consequently, the theory implies that, *ceteris paribus*, the net effect of an income tax increase on tax evasion may well be *ambiguous*.

This study seeks provide potential insight into the actual net impact of higher income tax rates on income tax evasion in the economy as a whole. To reflect the federal personal income tax rate, this study adopts two different measures of the federal personal income tax rate: the maximum marginal federal personal income tax rate (*MAXMARGTX*)[2] and the average effective personal income tax rate (*AVETXRATE*). Arguably some very recent related research on aggregate personal income tax evasion has used a maximum marginal tax rate and found it to exercise a positive and statistically significant impact on personal income tax evasion (Alm and Yunus, 2009; Cebula, 2011, 2013); interestingly, unlike the other studies of aggregate income tax evasion, the study by Cebula (2011) provides autoregressive (AR) estimates. In any event, it is observed that these two tax rate measures are considered in *separate* estimates because they are rather highly correlated, i.e., r(*AVETXRATE*, *MAXMARGTX*) = 0.631.

Aside from empirically investigating the substitution effect-income effect controversy at the aggregate level, this exploratory study seeks to provide contemporary insights into other potential income tax evasion determinants. For example, in the U.S., Form A of Schedule 1040 provides a variety of itemized deductions types that enable the taxpayer ultimately to reduce his/her taxable income. These include allowances for medical expenses, state and local government taxes, mortgage interest payments, charitable contributions, and other such outlays. The larger the pecuniary value of these deductions, the lower the taxable income of the taxpayer. Furthermore, given the rather varied, numerous, and sometimes complex forms of these deductions, and given

[2] This particular measure of the income tax rate is adopted because it can be argued that it not only is an actual income tax rate but it also potentially reflects to some degree the extent to which the income tax rate schedule at any point in time is progressive.

the limited ability for the IRS to directly verify many of these itemized deductions, taxpayers filing their tax returns and claiming itemized deductions have an opportunity to derive direct tax benefits by overstating their itemized deductions. Thus, it is hypothesized that the greater the proportion of taxpayers who itemize their tax deductions (*PCTITEM*),[3] the greater the degree to which itemized deductions are exaggerated and hence the greater the direct expected benefits of federal personal income tax evasion. Interestingly, this variable, which reduces taxable income, has been effectively ignored in the official tax evasion literature to date.

Whereas higher income tax rates and the opportunity to claim exaggerated itemized deductions can yield expected *direct* tangible benefits from income tax evasion, there is at least one course of action that can tangibly *reduce* the expected direct benefits of income tax evasion. Moreover, it is a legal course of action, namely, it is *legal tax avoidance*. One avenue through which this course of action is made possible is the existence of the municipal bond market, where qualified bonds issued by cities, counties, and states in the U.S. pay interest that is free from federal income taxation to the owners of record of such bonds.[4] In particular, following Cebula (2004), it can be argued that the greater the ratio of *tax free* interest rate yield on high grade municipals relative to *taxable* interest rate yield such as that on 10-year U.S. Treasury notes, *TFTEN*, the greater the benefits of *tax avoidance*, which is *legal*, and hence the lower the expected direct benefits of *tax evasion*, which of course is illegal.

Thus, the expected gross direct benefits from income tax evasion are expressed as:

$$egb = egb\,(MAXMARGTX \text{ or } AVETXRATE,\ PCTITEM,\ TFTEN) \qquad (2A)$$

B. Expected Secondary Benefits of Under-Reporting Taxable Income

Aside from the issues of tax rates and itemization of deductions, persons who have taxable income may be able in certain cases to derive *secondary* benefits from income tax evasion behavior, i.e., from under-reporting taxable income. For example, if people disapprove of the way in which the federal government is spending their tax dollars, they may be angered or frustrated. To relieve this anger and/or frustration, they may consider income tax evasion as a means of expressing this anger and/or frustration (Feige, 1994).

Consider the case of the U.S. military being engaged in an unpopular war. For example, there is empirical evidence (Feige, 1994; Cebula, 2001) that the unpopularity of the Vietnam War so angered the public that many chose to underreport their income and/or exaggerate their itemized tax deductions. This form of income tax evasion behavior was undertaken because of the disapproval by much of the U.S. public of the U.S. involvement in and expenditures to finance the Vietnam War using their tax dollars. As the Vietnam War raged on, at least some portion of the public received *secondary* benefits/gains from the experience that they were withholding financing of that military action.

Similarly, it is hypothesized in the present study that the U.S. military involvement in Iraq, i.e.,

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3 Instead of claiming the "standard deduction."

4 In states which impose a state income tax, there is an exemption from those state taxes for state residents purchasing qualified tax-exempt bonds issued within that state (the so-called "dual exemption").

the War in Iraq (*IRAQWAR*), that began in 2003 and was still raging on through and beyond the end of the study period for the present paper, quickly became very unpopular with the U.S. populace as a whole. Indeed, Cebula, Cook, and Issa (2007) found strong empirical evidence that, unlike the (brief) war involving not only the U.S. and Iraq but also numerous others nations that took place in 1991 and invoked immense patriotism (and approval) within the U.S., the War in Iraq that began in 2003 very quickly became very unpopular with a large percentage of the U.S. population. Hence, the latter War in Iraq is hypothesized here to have created a circumstance for people to express their dis-satisfaction by engaging in a greater degree of income tax evasion that yielded them a "secondary gain."

Thus, the expected gross direct *and* secondary *benefits* from income tax evasion are expressed as the following:

$$egb = egb\,(MAXMARGTX \text{ or } AVETXRATE, PCTITEM, TFTEN, IRAQWAR) \qquad (2B)$$

C. A Control Variable: The Tax Reform Act of 1986

In 1987, Musgrave observed (1987, p. 59), "The Tax Reform Act of 1986 is the most sweeping reform since the early 1940s…" Indeed, the *TRA* (Tax Reform Act) did introduce a number of reforms, many of which are outlined in broad terms in Barth (1991), Barth and Brumbaugh (1992), Ott and Vegari (2003), and Sanger, Sirmans, and Turnbull (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 (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." Furthermore, as Barth (1991, pp. 45, 124) observes, among other things, that 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.[5] Thus, it is hypothesized here that at the time the *TRA* was being enacted and being fully implemented (1986-1987), there were many complex and new provisions added to the U.S. Internal Revenue Code. Consequently, taxpayers in general, including would–be as well as "repeat" tax evaders, were unfamiliar with all of the sweeping changes in IRS policies. It logically follows that not only honest taxpayers but also those contemplating or planning on income tax evasion required time to climb the "learning curve" associated with the TRA, resulting in at least some *temporary* dimunition of the aggregate degree of federal personal income tax evasion. Indeed, the idea that this reaction to the *TRA* might be only *temporary* was originally revealed in the words of Slemrod (1992, p. 45), who some years ago argued that it would take at least some time for taxpayers "…to learn about and adjust to the new law [the *TRA*]." In any case, it is hypothesized here that, for the period when the *TRA* was initially implemented, 1986, through the year the *TRA* became "*de facto* fully effective," 1987 (Barth, 1991; Barth and Brumbaugh, 1992; Cebula, Coombs, and Yang, 2009), the value of *egb* was reduced. Accordingly, (2B) above is replaced by (3):

[5]The Tax Reform Act of 1986 was actually signed into law by President Reagan in October, 1986.

$$egb = egb\ (MAXMARGTX \text{ or } AVETXRATE, PCTITEM, TFTEN, IRAQWAR, TRA) \quad (3)$$

D. Expected Gross Costs of Under-Reporting Taxable Income

The *expected gross costs* of not reporting or under-reporting taxable income to the IRS and/or of reporting exaggerated itemized deductions to the IRS are hypothesized to be an increasing function of the *expected risks/costs* thereof (Pestieau, Possen and Slutsky, 1994; Erard and Feinstein, 1994; Caballe and Panades, 1997). In this study, to the representative economic agent, the expected risks/costs 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/personnel, *ceteris paribus*. Indeed, the experience of an IRS tax audit could imply non-pecuniary ("psychic") costs (such as psychological stress) as well as direct pecuniary costs (including outlays for attorneys and/or other representation such as accountants or financial advisors, along with the value of one's own time) above and beyond any potential added taxes, penalties, and interest assessed by the IRS. Hence, this study adopts the probability of a formal audit as a measure of risk to the would-be tax evader. In addition, IRS penalty assessments on detected unreported income are also adopted as a measure of the risks/costs associated with tax evasion. In particular, the greater the average penalty assessed by the IRS per audited tax return (*PEN*), the greater the expected costs of tax evasion, *ceteris paribus*.

Hence, the expected gross costs of engaging in income tax evasion at the aggregate level is represented in this study by:

$$egc = egc\ (AUDIT, PEN)) \quad (4)$$

E. The Synthesized Model

To express the full model, simply requires substituting from equations (3) and (4) into equation (1), yielding:

$$pur/(1\text{-}pur) = f(MAXMARGTX \text{ or } AVETXRATE, PCTITEM, TFTEN, IRAQWAR, TRA, AUDIT, PEN) \quad (5)$$

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,[6] and *RAGI* is the dollar size of the *reported aggregate federal adjusted gross income* in the economy. It logically follows that the relative degree of aggregate income tax evasion can be expressed as: (*pur*)/*(1-pur) = UAGI/RAGI*. Thus, it follows that equation (5) can be replaced by equation (6):

$$UAGI/RAGI = f\ (MAXMARGTX \text{ or } AVETXRATE, PCTITEM, TFTEN, IRAQWAR, TRA, AUDIT, PEN) \quad (6)$$

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[6] For an explanation of how *unreported* adjusted gross income is calculated using the General Currency Ratio model, see Feige (2009) and Cebula and Feige (2012).

Equation (6) constitutes the foundation for the empirical model considered in the next Section of this study.[7]

III. Empirical Analysis

a. The Empirical Model

Based on the framework provided in equation (6) above, the following reduced-form equations are to be estimated initially:[8]

$$(UAGI/RAGI)_t = a_0 + a_1\, MAXMARGTX_{t-1} + a_2\, PCTITEM_{t-1} + a_3\, TFTEN_{t-1} + a_4\ TRA_t + a_5\, IRAQWAR_t + a_6\, AUDIT_{t-1} + a_7\, PEN_{t-1} + u' \quad (7)$$

$$(UAGI/RAGI)_t = b_0 + b_1\, AVETXRATE_{t-1} + b_2\, PCTITEM_{t-1} + b_3\, TFTEN_{t-1} + b_4\ TRA_t + b_5\, IRAQWAR_t + b_6\, AUDIT_{t-1} + b_7\, PEN_{t-1} + u'' \quad (8)$$

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 , b_0 = constant terms;

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

$AVETXRATE_{t-1}$ = the average effective marginal federal personal income tax rate in year *t-1*, expressed as a percent;

$PCTITEM_{t-1}$ = the percentage of federal personal income tax returns that included Schedule A, itemizing deductions, in year *t-1*;

$TFTEN_{t-1}$ = the ratio of the average nominal interest rate yield on high grade tax free municipal bonds in year *t-1* to the average nominal interest rate yield on 10-year Treasury notes in year *t-1*, expressed as a percentage;

$IRAQWAR_t$ = a binary (dummy) variable for the years 2003-2008 of the study period during which the U.S. was involved in an unpopular war, i.e., the War in Iraq ("Operation Iraqi Freedom"): $IRAQWAR_t$ = 1 for the years 2003-2008 and $IRAQWAR_t$ = 0 otherwise;

TRA_t = a binary (dummy) variable for the years 1986 and 1987: TRA_t = 1 for the years 1986, 1987 and TRA_t =0 otherwise;

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

PEN_{t-1} = IRS imposed penalties plus interest on detected unreported income in year *t-1*, expressed as a percent of per capita real GDP in year *t-1*; and

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[7] Clearly, *UAGI* = (*pur*)**AGI* and *RAGI = (1-pur)*AGI*. It then follows that: *UAGI/RAGI* = (*pur*)**AGI/(1-pur)*AGI* = (*pur*)/*(1-pur)*. Substitution of *UAGI/RAGI* for *pur/(1-pur)* in (5) yields: *UAGI/RAGI* = *f*(*MAXMARGTX* or *AVETXRATE, PCTITEM, TFTEN, TRA, IRAQWAR, AUDIT, PEN*), which is equation (6).

[8] Cebula (2011) includes variables reflecting public dissatisfaction with government and the opportunity cost of tax compliance but overlooks the variables *PCTITEM* and *AVETXRATE* and measures *PEN* differently from this study, i.e., in terms of the average penalty per audited return.

u', u" = stochastic error terms.

The study period runs from 1975 through 2008, reflecting availability of the data used, in particular, for the variables *PCTITEM* and *PEN*, in the analysis. The data are annual. For the interested reader, descriptive statistics for the study period for each of the variables are found in Table 1 of this study. Note that the number of observations is only 33 due to data limitations; clearly a larger *N* would be preferable, but more recent data on the dependent variable is currently unavailable. A group unit root test (which assumes a common unit root process) reveals that the variables in the model represented in equation (7) are stationary in levels over the study period; similarly, a group unit root test reveals that the variables in the model represented in equation (8) are stationary in levels over the study period as well.[9]

The series adopted to measure income tax evasion, in this case represented by the variable (*UAGI/RAGI*), were obtained from Cebula and Feige (2012).[10] Based on the General Currency Ratio (GCR) model, Cebula and Feige (2012, Table B-2) provide estimates of the ratio of aggregate *unreported* adjusted gross income to aggregate *reported* adjusted gross income. These data are provided in Table 2 of the present study. The data for *MAXMARGTX* and *AVETXRATE* were obtained from the Internal Revenue Service (2010, Table 6). The *AUDIT, PCTITEM,* and *PEN* data were obtained from the Government Accounting Office (1996: Table I.1) and the U.S. Census Bureau (1994, Table 519; 1998, Table 550; 1999, Table 556; 2001, Table 546; 2010, Table 469). The data for the variable *TFTEN* were obtained from the Council of Economic Advisors (2013, Table B-73). The *IRAQWAR* and *TRA* variables are binary (dummy) variables.

b. *The Initial Estimation Results: The Linear Specification*

The OLS estimation of equations (7) and (8) in linear form are provided in columns (a) and (b), respectively, in Table 3; in both cases, the Newey and West (1987) heteroskedatsicity correction was adopted.[11] In column (a), all seven of the estimated coefficients exhibit the expected signs. Four of these estimated coefficients are statistically significant at the 1% level, and two are statistically significant at the 5% level. The coefficient of determination (R^2) is 0.72, so that the model explains approximately seven-tenths of the variation in the independent variable. Based on the *DW* and *Rho* statistics, there is no concern regarding autocorrelation. Finally, the *F*-statistic is statistically significant at the 1% level, attesting to the overall strength of the model.

According to the results provided column (a) of Table 3, the coefficient on the maximum marginal federal personal income tax rate variable (*MAXMARGTX*) is positive and statistically significant at the 1% level. Thus, the higher the maximum marginal federal personal income tax rate, the greater the extent of that income tax evasion. This finding is consistent with several previous empirical studies of income tax evasion (Tanzi, 1982; Clotfelter, 1983; Crane and Nourzad, 1987; Poterba, 1987; Feige, 1994; Joulaian and Rider, 1996; Ali, Cecil, and Knoblett, 2001; Cebula, 1997, 2001, 2004, 2011, 2013). As observed above, the sign on the partial derivative of income tax evasion with respect to (in this case) the maximum marginal federal personal income

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9 These results will be supplied upon e-mail request.

10 See also Feige (2009); the GCR model actually refers to underreported *taxable* income.

11 Testing for heteroskedasticity revealed a need to make such a correction in *all* of the estimations in this study.

tax rate, theoretically depends upon the relative strengths of the *substitution effect* on the one hand and the *income effect* on the other hand associated with the tax rate change. The finding in column (a), of an in itself, would seem to imply that, for the *representative taxpayer*, the substitution effect, which is always positive, outweighs the income effect (be it positive or negative). And as Freire-Seren and Panades (2013, p. 810) observe, "This effect [the substitution effect] generates incentives to substitute tax evasion for honesty." But of course this is but one finding in one estimation.

The estimated coefficient on the *PCTITEM* variable is positive and statistically significant at the 5% level. This finding implies that the greater the percentage of taxpayers that itemizes their personal deductions (on Schedule A of Form 1040), the greater the degree to which taxable income is underreported and hence the greater the degree of aggregate federal personal income tax evasion. This finding has effectively *not* been formally researched in the tax evasion literature to date.

The estimated coefficient on the tax free/taxable interest rate variable, *TFTEN*, is negative, as hypothesized, and statistically significant at the 1% level, providing compelling empirical evidence that the greater the rewards for legal tax avoidance (as measured here), the less the aggregate degree of illegal personal income tax evasion. This finding is consistent with Cebula (2004), who first proposed and tested this hypothesis, albeit with data running only through the year 1997.

Consistent with the arguments in Musgrave (1987) and findings in Cebula, Coombs and Yang (2009) and Cebula (2011), the results for *TRA* variable are compelling. In particular, the estimated coefficient on variable *TRA* is negative and statistically significant at the 1% level. Thus, there is evidence that the Tax Reform Act of 1986 is shown to have reduced federal personal income tax evasion in the U.S., albeit only briefly. Given the specification of *TRA* as applying to the short-term period of just 1986 and 1987, these results would seem to confirm the arguments in Slemrod (1992) and the findings in Cebula, Coombs and Yang (2009), who also argue that it would take at least some time for taxpayers to understand the revisions in the Internal Revenue Code and to adjust to those revisions.

The estimated coefficient on the *IRAQWAR* dummy is positive and statistically significant at the 4% level, which is consistent with the hypothesis proffered above that an unpopular war elicits a reduction in income tax compliance. This behavior arguably reflects a "secondary gain" from income tax evasion.

Next, there is the audit rate (by IRS examiners) variable. As shown in the first column of Table 3, the estimated coefficient on this variable is negative and statistically significant at 1% level. Thus, it appears that the audit rate variable (*AUDIT*), of and in itself, may be viewed as a deterrent to federal personal income taxation. This finding is consistent with previous studies such as Pestieau, Possen and Slutsky (1994), Erard and Feinstein (1994), and Caballe and Panades (1997), who suggest that IRS policies such as a higher audit rate by IRS personnel impose a variety of costs, both pecuniary and psychic, that act to dissuade income tax evasion behavior.

Finally, the estimated coefficient for the IRS penalty variable, *PENt-1*, is negative, as expected; however, it is not statistically significant at even the 10% level. Thus, in this linear estimate, the evidence implies that higher levels of IRS imposed penalties and interest do not materially act to discourage federal personal income tax evasion.

In column (b) of Table 3, the OLS estimate of equation (8) is provided. This estimate differs in construct from that in equation (7) only insofar as it adopts an alternative measure of the aggregate income tax rate structure, namely, $AVETXRATE_{t-1}$. In column (b), all seven of the estimated coefficients exhibit the hypothesized signs, with two statistically significant at the 1% level, one statistically significant at the 5% level, and three statistically significant at the 10% level; hence, these results appear to be somewhat less robust than those in column (a). The coefficient of determination is 0.70, so that the model in equation (7) explains approximately seven-tenths of the variation in the dependent variable. Once again autocorrelation is not a problem. Finally, the F-statistic is statistically significant at the 1% level, as its counterpart in column (a) was.

According to the results in column (b) of Table 3, the coefficient on the average effective federal personal income tax rate variable (*AVETXRATE*) is positive but statistically significant at only the 8% level. Thus, there is evidence, but not terribly compelling evidence, that the higher the average effective federal personal income tax rate, the greater the expected benefits of tax evasion and hence the greater the extent of that income tax evasion. This finding is arguably inconsistent with several previous empirical studies (Tanzi, 1982; Clotfelter, 1983; Crane and Nourzad, 1987; Poterba, 1987; Feige, 1994; Joulaian and Rider, 1996; Ali, Cecil, and Knoblett, 2001; Cebula, 1997, 2001, 2004, 2011, 2013), which found more compelling evidence that higher income tax rates elicit higher income tax evasion. As observed above, in the aggregate, for the *representative taxpayer*, the sign on the partial derivative of income tax evasion with respect to, in this case, the average effective federal personal income tax rate, theoretically depends upon the relative strengths of the *substitution effect* associated with the tax rate change on the one hand and the *income effect* associated with the tax rate change on the other hand. The finding in column (b), of an in itself, does *not convincingly* imply that the substitution effect, which is always positive, outweighs the income effect (be it positive or negative). Indeed, the failure of this estimated coefficient to be statistically significant at the 5% level, *potentially* could be interpreted as implying that the impact of a higher income tax rate (as measured by variable *AVETXRATE*) on income tax evasion is *ambiguous*, depending upon whether statistical significance at the 8% level is considered robust enough to deduce something resembling a clear positive impact of tax rates on tax evasion. Nevertheless, based on this result in Table 3, one must be cautious about accepting or rejecting this inference. Results shown in Table 4 are relevant to this issue.

In column (b), the estimated coefficient on the *PCTITEM* variable is positive and statistically significant at beyond the 10% level. This finding implies, although un-compellingly, that the greater the percentage of taxpayers that itemizes their personal deductions (on Schedule A of Form 1040), the greater the degree to which taxable income is underreported and hence the greater the degree of aggregate federal personal income tax evasion.

The estimated coefficient on the tax free/taxable interest rate variable, *TFTEN*, is negative, as hypothesized, and statistically significant at the 1% level, providing additional empirical evidence (along with the counterpart finding shown in column (a)) that the greater the rewards for legal tax avoidance (as measured here), the less the aggregate degree of illegal personal income tax evasion.

Consistent with the arguments in Musgrave (1987) and findings in Cebula, Coombs and Yang (2009), the results for *TRA* variable are compelling. In particular, in column (b), the estimated coefficient on variable TRA is negative and statistically significant at the 1% level. Thus, there is further evidence that the Tax Reform Act of 1986 reduced federal personal income tax evasion in the U.S., albeit only briefly. As observed above, given the specification of TRA as applying to just

1986 and 1987, these results would seem to confirm the argument in Slemrod (1992) and the later findings by Cebula, Coombs and Yang (2009), who also argued that it would take at least some time for taxpayers to understand the many revisions in the Internal Revenue Code and to adjust to those revisions.

Unlike the finding for this variable in column (a), the estimated coefficient on the *IRAQWAR* dummy is positive and statistically significant at only the 8% level, which is "weakly" consistent with the hypothesis proffered above that an unpopular war elicits a reduction in income tax compliance. This behavior implies, but not strongly, that the unpopularity if the War in Iraq provided a "secondary gain" for taxpayers from income tax evasion.

Next, there is the audit rate (by IRS examiners) variable. As shown in column (b), the estimated coefficient on this variable is negative and statistically significant at 3% level. Thus, it once again appears that the audit rate variable (*AUDIT*) may be viewed as a deterrent to federal personal income taxation. This finding is consistent with the result in column (a) and with previous studies such as Pestieau, Possen and Slutsky (1994), Erard and Feinstein (1994), and Caballe and Panades (1997), who suggests that IRS policies such as a higher audit rate by IRS personnel impose a variety of costs, both pecuniary and psychic, that act to dissuade income tax evasion behavior.

Finally, the estimated coefficient for the IRS penalty variable is negative, as expected; however, as found to be the case in column (a) on Table 3, it is not statistically significant at the 10% level. Thus, in this linear estimate, the evidence implies that higher levels of IRS imposed penalties and interest do not measurably act to discourage federal personal income tax evasion.

c. *Alternative Estimation Results: The Log-log Specification*

In this sub-section of the study, the results of estimating the models in equations (7) and (8) in log-log form are provided in columns (a) and (b) of Table 4. Once again, it is noted that the Newey and West (1987) heteroskedatsicity correction was adopted in both estimates. In column (a) of Table 4, all seven of the estimated elasticity/coefficient values exhibit the expected signs, with three statistically significant at the 1% level and two statistically significant at the 5% level. The *F*-statistic is statistically significant at the 1% level, and the R^2 value is 0.73, so that the model explains in excess of seven-tenths of the variation in the dependent variable.

According to the results provided column (a) of Table 4, the coefficient/elasticity on the maximum marginal federal personal income tax rate variable (*MAXMARGTX*) is positive but it fails to be statistically significant at even the 10% level. This finding is inconsistent with several previous empirical studies of income tax evasion (Tanzi, 1982; Clotfelter, 1983; Crane and Nourzad, 1987; Poterba, 1987; Feige, 1994; Joulaian and Rider, 1996; Ali, Cecil, and Knoblett, 2001; Cebula, 1997, 2001, 2004, 2011, 2013), as well as the results in column (a) of Table 3 (and, arguably column (b) of Table 3) in this study, which found higher tax rates to elicit increased tax evasion. As observed above, for the *representative taxpayer*, the sign on the partial derivative of tax evasion with respect to, in this case, an increase in the maximum marginal federal income tax rate, theoretically depends upon the relative strengths of the *substitution effect* on the one hand and the *income effect* on the other hand associated with the tax rate change. The finding in column (a), of and in itself, would seem to imply that for the *representative taxpayer* the substitution effect, which is always positive, merely offsets a negative income effect, so that in this estimate the impact of the *MAXMARGTX* measure of the income tax rate on tax evasion is on balance *ambiguous*.

Also in column (a) of Table 4, the estimated coefficient/elasticity on the *PCTITEM* variable is positive and statistically significant at the 2.5% level. This finding implies that the greater the percentage of taxpayers itemizing their personal deductions (on Schedule A of Form 1040), the greater the degree to which taxable income is underreported and hence the greater the degree of aggregate federal personal income tax evasion. For example, a 1% increase in the value of *PCTITEM* would lead to a 0.491% *increase* in (*UAGI/RAGI*).

Once again, the estimated coefficient/elasticity on the tax free/taxable interest rate variable, *TFTEN*, is negative, and statistically significant at the 1% level, providing additional compelling empirical evidence that the greater the rewards for legal tax avoidance (as measured), the less the aggregate degree of illegal personal income tax evasion (Cebula, 2004). Indeed, a 1% increase in the value of *TFTEN* would lead to a 0.633% *decrease* in (*UAGI/RAGI*).

Consistent with arguments in Musgrave (1987), Slemrod (1992), and Cebula, Coombs and Yang (2009), the results for *TRA* variable are again robust. In particular, the estimated coefficient on variable *TRA* is again negative and statistically significant at the 1% level. Thus, there is further evidence that the Tax Reform Act of 1986 is shown to have reduced federal personal income tax evasion in the U.S., albeit only briefly.

The estimated coefficient on the *IRAQWAR* dummy is positive and statistically significant at the 3% level, which is consistent with the hypothesis that an unpopular war elicits a reduction in income tax compliance. This behavior arguably implies the presence of secondary gains from income tax evasion.

Next, there is the audit rate (by IRS examiners) variable. As shown in the first column of Table 4, the estimated coefficient/elasticity on this variable is negative and statistically significant at 1% level. Thus, there appears to be further evidence that the audit rate variable (*AUDIT*) may be viewed as a deterrent to federal personal income taxation. For instance, a 1% increase in the value of *AUDIT* would lead to a 0.157% *decrease* in (*UAGI/RAGI*). Finally, the estimated coefficient/elasticity for the IRS penalty variable, *PENt-1*, is once again negative; however, it is not statistically significant at even the 10% level. Thus, in this log-log estimate, the evidence implies that higher levels of IRS imposed penalties and interest do not act to discourage federal personal income tax evasion.

In column (b) of Table 4, all seven of the estimated elasticity/coefficient values exhibit the expected signs, with three statistically significant at the 1% level and two statistically significant at the 10% level. The *F*-statistic is statistically significant at the 1% level, and the R^2 value is 0.74, so that the model explains nearly three-fourths of the variation in the dependent variable.

According to the results provided column (a) of Table 4, the coefficient on the average effective federal personal income tax rate variable (*AVETXRATE*) is positive but it fails to be statistically significant at even the 10% level. This finding also is inconsistent with several previous empirical studies of income tax evasion (Tanzi, 1982; Clotfelter, 1983; Crane and Nourzad, 1987; Poterba, 1987; Feige, 1994; Joulaian and Rider, 1996; Ali, Cecil, and Knoblett, 2001; Cebula, 1997, 2001, 2004, 2011, 2013), as well as the results in column (a) of Table 3 (and, arguably column (b) of Table 3) in this study, which found higher tax rates to elicit increased tax evasion. As observed above, for the *representative taxpayer*, the sign on the partial derivative of tax evasion with respect to, in this case, the average effective federal income tax rate, theoretically depends upon the relative strengths of the *substitution effect* on the one hand and the *income effect* on the other hand associated with the tax rate change. The finding in column (a), of and in itself, would seem to imply that for the *representative taxpayer* the substitution effect, which is always positive, merely offsets a negative income effect, so that the impact of the *AVETXRATE* measure of the income tax rate on tax evasion is, on balance, *ambiguous*.

Also in column (b) of Table 4, the estimated elasticity on the *PCTITEM* variable is positive and statistically significant at the 6% level. Arguably, this finding implies that the greater the percentage of taxpayers that itemizes their personal deductions (on Schedule A of Form 1040), the greater the degree to which taxable income is underreported and hence the greater the degree of aggregate federal personal income tax evasion. This outcome is effectively consistent with our three previous results for this variable. For example, a 1% increase in the value of *PCTITEM* would presumably lead to a 0.48% *increase* in (*UAGI/RAGI*).

Once again, the estimated elasticity on the tax free/taxable interest rate variable, *TFTEN*, is negative, and statistically significant at the 1% level, providing additional compelling empirical evidence that the greater the rewards for legal tax avoidance (as measured), the less the aggregate degree of illegal personal income tax evasion. Indeed, a 1% increase in the value of *TFTEN* would apparently lead to a 0.604% *decrease* in (*UAGI/RAGI*).

The results for *TRA* variable are once again robust. In particular, the estimated coefficient on variable *TRA* is again negative and statistically significant at the 1% level. Thus, there is further evidence that the Tax Reform Act of 1986 is shown to have reduced federal personal income tax evasion in the U.S., albeit only briefly.

The estimated coefficient on the *IRAQWAR* dummy is positive and statistically significant at the 9% level, which is modestly supportive of the hypothesis that an unpopular war elicits a reduction in income tax compliance through a secondary gain from income tax evasion.

Next, there is the audit rate (by IRS examiners) variable. As shown in the first column of Table 3, the estimated coefficient/elasticity on this variable is yet again negative and statistically significant at 1% level. Thus, there appears to be further evidence that the audit rate variable (*AUDIT*) may be viewed as a deterrent to federal personal income taxation. For instance, a 1% increase in the value of *AUDIT* would lead to a 0.134% *decrease* in (*UAGI/RAGI*).

Finally, although the estimated coefficient/elasticity for the IRS penalty variable, *PENt-1*, is negative, it once again is not statistically significant at the 10% level. Thus, in this log-log estimate, the evidence implies that higher levels of IRS imposed penalties and interest do not dissuade federal personal income tax evasion.

d. *2SLS Estimation Results: A Robustness Test*

As a test of the robustness of the results of the basic model, this sub-section of the study provides 2SLS estimates of the following re-specified versions of equations (7) and (8):

$$(UAGI/RAGI)_t = a_0 + a_1\, MAXMARGTX_{t-1} + a_2\, PCTITEM_{t-1} + a_3\, TFTEN_{t-1} + a_4\, TRA_t + a_5\, IRAQWAR_t + a_6\, AUDIT_t + a_7\, PEN_{t-1} + u' \quad (9)$$

$$(UAGI/RAGI)_t = b_0 + b_1\, AVETXRATE_{t-1} + b_2\, PCTITEM_{t-1} + b_3\, TFTEN_{t-1} + b_4\, TRA_t + b_5\, IRAQWAR_t + b_6\, AUDIT_t + b_7\, PEN_{t-1} + u'' \quad (10)$$

These specifications differ from those in equations (7) and (8) insofar as the audit variable is now shown as un-lagged. This specification implies that the greater the current IRS audit rate, which might well be the case if the relevant IRS audit has been publicly announced or otherwise made known to the public during the tax-filing season, the greater the risk of tax evasion and hence the lower the current aggregate degree of tax evasion. As such, the dependent variable, $(UAGI/RAGI)_t$, and the explanatory variable $AUDIT_t$ are contemporaneous. As a result of this circumstance, the possibility of simultaneity bias arises. To address this issue, the model in both equations is estimated by 2SLS. The instrumental variable adopted is the two-year lag of the federal/central government budget deficit expressed as a percent of GDP, $DEFY_{t-2}$. The choice of this instrument is based on the fact that $DEFY_{t-2}$ and $AUDIT_t$ are highly correlated, whereas $DEFY_{t-2}$ is uncorrelated with the error terms in the system.

The 2SLS estimation of equations (9) and (10) are provided in columns (a) and (b) of Table 5. For the most part, the non-tax rate results in this Table parallel those in Table 3, where OLS results for the models were reported. What is most interesting is that in column (a), the estimated coefficient on the tax variable $MAXMARGTX_{t-1}$ is positive and statistically significant at the 1% level, whereas in column (b) the estimated coefficient on the tax variable $AVETXRATE_{t-1}$ is not statistically significant at even the 10% level. Thus, the higher the maximum marginal federal personal income tax rate, the greater the extent of aggregate income tax evasion; however, a higher average income tax rate elicits no statistically significant change in the aggregate degree of tax evasion. These results are consistent with the OLS estimates reported in Table 3 and imply that the impact of higher federal personal income tax rates is "ambiguous, i.e., it can be fairly stated that this *exploratory* study once again, this time using 2SLS, finds evidence most compatible with "*ambiguity*." Indeed, the same conclusion is reached is equations (9) and (10) are estimated by 2SLS in log-log form.

IV. Summary and Closing Observations

This exploratory empirical study of the underground economy in the U.S. examines a new and updated series based on the General Currency Ratio (GCR) Model on aggregate personal income tax evasion for the period 1975 through 2008, with 2008 being the most recent year for which income tax evasion data are available for the U.S. Focusing on *aggregate* income tax evasion and its determinants permits the analysis of *actual* (official) as opposed to *hypothetical* or *experimental* tax evasion figures and also permits the analysis of a variety of actual real-world explanatory variables; furthermore, the aggregate time-series approach adopted in this study allows analysis of tax evasion over time. Finally, the use of aggregate data can provide researchers and policymakers with a convenient tool for estimating the lost tax revenues resulting from tax evasion and potential tax receipts increases that certain public policies may *potentially* generate. In any event, the IRS has data based on the AGI-gap approach; however, the most recent year for its data is 2005 (Internal Revenue Service, 2010, Table 6). Thus, the present study is more "contemporary" than previous studies using "official data."

The purpose of this exploratory study is two-fold. First, adopting a cost-benefit model of income tax evasion decision-making, this study seeks to identify key determinants of *aggregate* federal personal income tax evasion in the U.S. using data up to and including the year 2008. Second, it provides a number of empirical estimates of aggregate income tax evasion that adopt two alternative income tax rate measures in the effort to provide information that may be pertinent to the controversy and debate concerning the actual *net* response of aggregate income tax evasion to, say, an income tax rate increase and the relative strengths of the substitution and income effects of a tax rate change. The estimates initially take the form of OLS estimates; however, as a test of robustness, 2SLS estimates are also provided. Both the OLS and 2SLS estimates yield the same conclusions regarding the impact of income tax rates on income tax evasion: ambiguity.

More specifically, over the study period, the principal conclusions are the following: federal personal income tax evasion is an increasing function of the percentage of filed federal personal income tax returns that itemizes deductions, and U.S. involvement in an unpopular war, in this case, the War in Iraq. The study also finds persistent evidence that; (a) the Tax Reform Act of 1986 acted to (briefly) discourage tax evasion; (b) a higher IRS audit rate by IRS personnel acted to discourage tax evasion; and (c) the greater the benefits of *legal tax avoidance*, as measured by the ratio of the tax free interest rate yield on high grade municipals to the taxable interest rate yield on 10-year Treasury notes, the less the degree of illegal tax evasion. By contrast, the study finds consistent evidence that IRS imposed penalties and interest on detected unreported income to have no discernible impact on aggregate personal income taxation.

Six different estimates addressed the impact of higher income tax rates on aggregate federal income tax evasion. In the linear OLS model estimates, the coefficient on the maximum marginal personal income tax rate was positive and statistically significant at the 1% level, whereas the average effective personal income tax rate while positive was statistically significant at only the 8% level. In the two log-log OLS estimates, both income tax rate measures were found to be statistically insignificant at even the 10% level. Finally, in the 2SLS estimates, the coefficient on the maximum marginal personal income tax rate was positive and statistically significant at the 1% level, whereas the average effective personal income tax rate, while positive, was not statistically significant at even the 10% level. On balance, it is unclear what the *net* impact of a higher income tax rate is.

Given the tax rate measures considered, it would appear that there is a reasonable argument that can be made that the tax-evasion impact of higher income tax rates *may* well be *ambiguous*. However, this is but one study. The decision to engage in tax evasion is complex and difficult to model, especially across an entire economy with so many millions of taxpayers, each with her/his own utility function; indeed, behavioral patterns will also change over time both as a reflection of taxpayer "turnover" and changing cultural, political, and economic conditions, among other things. Moreover, for any given time frame, alternative specifications may yield different results than these, as might studies of longer time periods or studies based on experimentation. Nevertheless, it can be fairly stated that this *exploratory* study finds preliminary evidence most compatible with "*ambiguity*."

The findings imply, among other things, that in the pursuit of greater tax revenues, limiting the ability to itemize personal tax deductions may be a fruitful path to consider; indeed, it was a significant component of the Tax Reform Act of 1986. However, it is a path requiring careful planning so as to avoid political fall-out with the taxpaying public. Obviously, avoidance of what is likely to be an unpopular war would be wise not only on moral, ethical, and political grounds, but also on the practical grounds of avoiding tax revenue losses. Finally, although increasing the IRS examiner audit rate may yield additional tax revenues, political pragmatism would seem to require a circumspect implementation of such a policy change: Draconian IRS empowerment would likely not be well received by the populace...

In closing, it is observed that subsequent related research might seek to identify additional factors potentially influencing income tax evasion in the U.S., including the presence of undocumented immigrants within U.S. borders. In addition, although 2SLS estimates have been provided in this study, future research might undertake a more in-depth investigation of the possibility of simultaneity issues between tax evasion and other variables (Cebula, 2001; Alm and Yunus, 2009). Finally, as more current data become available over time, revisiting the issues at hand may yield greater insights.

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Table 1. Descriptive Statistics

Variable	Mean	Standard Deviation
Period: 1975-2008:		
(*UAGI/RAGI*)	21.013	2.027
MAXMARGTX	48.157	15.73
AVETXRATE	13.99	1.087
TRA	0.0513	0.224
PCTITEM	31.863	3.692
TFTEN	89.9	10.8
AUDIT	1.362	0.4
PEN	2.648	1.832
IRAQWAR	0.181	0.381
N = 33		

Table 2. Data for Dependent Variable*, UAGI/RAGI, by Year, 1960-2008*

Year	**UAGI/RAGI**	**Year**	**UAGI/RAGI**
1960	16.10	1985	21.11
1961	15.47	1986	18.89
1962	15.86	1987	17.42
1963	16.44	1988	18.74
1964	15.88	1989	21.06
1965	14.62	1990	21.06
1966	14.86	1991	21.39
1967	15.36	1992	19.04
1968	15.21	1993	17.70
1969	15.32	1994	17.98
1970	16.30	1995	20.01
1971	16.04	1996	18.64
1972	16.16	1997	18.66
1973	16.27	1998	18.30
1974	17.47	1999	20.55
1975	18.81	2000	22.29
1976	20.17	2001	22.73
1977	20.37	2002	23.94
1978	20.63	2003	23.17
1979	21.14	2004	21.57
1980	22.84	2005	21.98
1981	22.25	2006	23.85
1982	22.93	2007	24.90
1983	21.46	2008	23.94
1984	21.86		

UAGI/RAGI is expressed as a percentage. Source: Cebula and Feige (2012, Table B-2, p.282).

Table 3. Empirical Estimates, 1975-2008, OLS

Dependent Variable: (*UAGI/RAGI*)	(a)	(b)
Specification: Linear		
MAXMARGTX	0.07***	--------
	(3.69)	
AVETXRATE	--------	0.616*
		(1.81)
PCTITEM	0.27**	0.292*
	(2.07)	(1.72)
TFTEN	-12.4***	-11.88***
	(-3.81)	(-4.14)
TRA	-4.313***	-4.292***
	(-4.22)	(-4.62)
AUDIT	-3.223***	-1.872**
	(-4.29)	(-2.37)
PEN	-0.218	-0.302
	(-1.22)	(-1.30)
IRAQWAR	2.328**	3.39*
	(2.27)	(1.85)
Constant	24.81	16.43
R^2	0.72	0.70
AdjR^2	0.64	0.61
F	8.78***	8.02***
DW	1.76	1.72
Rho	0.12	0.14

Terms in parentheses are t-values. ***indicates statistical significance at the 1% level; **indicates statistical significance at the 5% level; *indicates statistical significance at the 10% level.

Table 4. Empirical Estimates, 1975-2008, OLS

Dependent Variable: log (*UAGI/RAGI*) Specification: (Log-Log)	(a)	(b)
logMAXMARGTX	0.059 (1.03)	--------
logAVETXRATE	--------	0.303 (1.07)
logPCTITEM	0.491** (2.40)	0.48* (1.95)
logTFTEN	-0.633*** (-3.65)	-0.604*** (-3.85)
TRA	-0.201*** (-4.52)	-0.204*** (-5.21)
logAUDIT	-0.157*** (-5.59)	-0.1604*** (-3.19)
logPEN	-0.028 (-1.05)	-0.033 (-1.20)
IRAQWAR	0.103** (2.37)	0.145* (1.77)
Constant	1.085	0.539
R^2	0.73	0.74
AdjR^2	0.65	0.66
F	9.16***	9.51***
DW	1.82	1.93
Rho	0.08	0.03

Terms in parentheses are t-values. ***indicates statistical significance at the 1% level; **indicates statistical significance at the 5% level; *indicates statistical significance at the 10% level.

Table 5. Empirical Estimates, 1975-2008, 2SLS

Dependent Variable: (*UAGI/RAGI*)	(a)	(b)
Specification: Linear		
MAXMARGTX	0.156***	--------
	(3.30)	
AVETXRATE	--------	0.448
		(0.63)
PCTITEM	0.005	0.244*
	(0.04)	(1.72)
TFTEN	-19.7***	-27.8***
	(-2.76)	(-3.09)
TRA	-3.69***	-3.37***
	(-3.96)	(-4.01)
AUDIT	-7.67***	-6.14**
	(-2.92)	(-2.57)
PEN	-0.02	-0.47*
	(-0.10)	(-2.00)
IRAQWAR	4.49***	4.50**
	(3.47)	(2.13)
Constant	40.42	39.93
F	5.00***	3.97***
DW	1.74	1.80
Rho	0.13	0.10

Terms in parentheses are t-values. ***indicates statistical significance at the 1% level; **indicates statistical significance at the 5% level; *indicates statistical significance at the 10% level.