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# Is Self-Employment Income More Responsive to Income Tax Rate?*

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*The paper analyzes the administrative Schedule C self-employment taxable income data and estimates compensated and uncompensated elasticity of self-employment taxable income of the United States. The paper finds that compensated elasticity of self-employment taxable income ranges from 0.928 to 1.598, suggesting that the calculated average deadweight loss of income tax per $1,000 self-employment income ranges from $9 to $15, and from 7% to 12% of self-employment income tax revenue. The uncompensated elasticity of self-employment taxable income ranges from 0.953 to 2.810. This responsiveness of self-employment income and average deadweight loss reflect short-term responses of static taxable income rather than long-term responses. However, the empirical analysis in this paper suggests that the self-employment taxable income is more responsive to the changes in tax rates than the taxable income of wage workers.*

JEL Classification: H24
Keywords: Self-employment Taxable Income, Elasticity of Taxable Income, Tax Avoidance, Deadweight Loss

## I. Introduction

Progressive income tax schedule may induce tax avoidance motives which enlarge efficiency cost of taxation and could in turn reduce tax revenue. The self-employed are more likely to have tax avoidance incentives than wage workers since the self-employed have more channels of tax avoidance. While wage workers avoid labor income tax through changing forms of compensation and patterns of consumption, the self-employed can use various deductions for business costs and business loss offsets, etc. The self-employed are more keen to the changes in tax

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structure and are more likely to shift incomes through various deductions. Self-employment taxable income, hence, may be responsive to the changes in marginal tax rates, considering other behavioral distortions, such as income shifting. The behavioral responses of the self-employed with respect to income tax and the size of such responses have been of interest, considering that workers remain longer in the labor force by making transition from wage jobs to the self-employed and the efficiency costs associated with such behavioral responses may be larger.

Following Lindsey (1987) and Feldstein (1995a, 1995b), it is widely recognized that distortions arising from the labor income tax are not confined to labor supply responses measured by hours of work. Feldstein (1999) suggested that the elasticity of taxable income embody fuller behavioral responses to the changes in marginal income tax rates than the traditional compensated labor supply elasticity. For the self-employed, the conventional labor supply model gives a poor explanation of tax distortions, more so than for wage workers. The labor supply decisions of the self-employed are more complicated, involving the decision-making on the entry into self-employment, considerations of business environment, and costs of business, etc. The efficiency cost of taxation for the self-employed, then, may be much more misleading when measured only by hours of work. Of empirical researches on the elasticity of taxable income, only a few researches examined the elasticity of self-employment taxable income.[1] Blow and Preston (2002) and Sillamaa and Veall (2001) analyzed the elasticity of self-employment income with U.K and Canadian survey data. However, not much literature examined the self-employment taxable income and the behavioral responses of individual taxpayers.

This paper examines the elasticity of self-employment taxable income to tax rates more closely, using the administrative Schedule C self-employment income from W-2 Self-Employment Income Records from 1980 to 1991 to better identify the responsiveness of self-employment income. During this period, the U.S. income tax system offered conspicuous variations in income tax rates, tax brackets and capital gains taxes with six major tax reforms such as the Economic Recovery Tax Act (ETRA) and the Tax Reform Act (TRA). Fifteen income tax brackets were also reduced into three income brackets during this period, and the tax rates on the highest income brackets reduced from 70% to 50%, from 50% to 28% and then increased back to 31%. These substantial variations in tax rates in the 1980s have attracted numerous studies on tax burdens and changes in economic behavior in response to changes in the tax system. Still, not much attention has been given to the role of self-employment with regards to such behavior.

This paper finds such responsiveness of self-employment income to the changes

[1] One of the reasons why only a few literatures take look at the self-employment taxable income might be data availability. Information on self-employment income data is usually less available than labor income. This study uses the Schedule C self-employment income records for sole proprietors.

in marginal tax rates. The compensated elasticity of self-employment income with respect to the net-of-tax rates range from 0.928 to 1.280, which is substantially larger than that of wage income. The calculated average deadweight loss of income tax is from 7% to 10% of self-employment income tax revenue collected. Overall, the findings of this paper suggest that the changes in marginal tax rates cause other behavioral responses than changes in labor supply.

The paper is organized as follows. Section 2 examines the conceptual framework and reviews the previous literature. Section 3 describes data and variables used. Section 4 the econometric specification and section 5 discusses the estimation results. Section 6 concludes.

## II. Conceptual Framework and Previous Literature

Labor supply model in Feldstein (1995) shows that taxes affect labor supply decision, consumption, and taxable income. With consumption ($C$), leisure ($L$), forms of compensation excluded from labor income ($E$), deductions ($D$), the static labor supply model with taxes is;

$$\begin{aligned} &Max\ U(C,L) \\ &s.t.\ C=(1-t)[w(1-L)-E-D] \end{aligned} \tag{1}$$

The right-hand side of the budget constraint shows after-tax income, $(1-t)TI$, where $TI$ represent taxable income. Increases in net-of-tax rates induce a substitution effect and income effect on taxable income. The substitution effect reduces the price of consumption and increases the relative price of leisure, leading an individual to consume less leisure and work more. The substitution effect of an increase in net-of-tax rates raises taxable income. The income effect is more complicated and depends on other behavioral responses than hours of labor and the consumption of leisure. Gruber and Saez (2000) mentioned,

> "..it is theoretically unclear what sign to expect for the income effect estimates for constructs such as broad or taxable income. For the labor component of total income, we might expect relatively small negative estimates, following on the findings of the labor supply literature (e.g., Pencavel (1986) and more recently Blundell and Macurdy (1999)). But it is feasible that capital income reacts positively to a positive income shock if savings (and thus future capital income) increase. And it is even more difficult to conceive of how activities such as tax evasion or shifts in the form of compensation react to income increases."

In the case that the budget constraint consists of two goods, leisure ($L$) and consumption ($C$) and taxable income is labor income, an increase in net-of-tax rate increases disposable income leading to more leisure and less work. To be more specific, when there are no behavioral responses, the budget constraint (1) can be written as $TI = w(1-L)$. Changes in net-of-tax rates affect disposable income ($y$) and $dTI/dy = -wdL/dy < 0$, since increases in disposable income induce more consumption of leisure.

However, when an increase in disposable income induces other behavioral responses, the income effect on taxable income may be uncertain. From the budget constraint that includes deductions ($D$) and the changes in the forms of compensation ($E$), it can be written as:

$$dTI/dy = (-wdL - dE - dD)/dy$$

The income effect depends on how forms of compensation and amounts of deduction are changed as disposable income changes. An increase in disposable income leads to more leisure consumption and $-wdL/dy < 0$. However, it is uncertain if an increase in disposable income raises excludable income and any kinds of deductions. In studying the self-employment income that may reflect more behavioral responses than wages and salaries, the income effect may be more complicated to predict. It can be inferred that when income definition is closer to pure labor income, a negative income effect on taxable income is more plausible.

A series of empirical papers have studied the price elasticity of taxable income with respect to the net-of-tax rate (Auten and Caroll, 1999; Gruber and Saez, 2000; Sillamaa and Veall, 2001; Blow and Preston, 2002). The magnitudes of the elasticities of taxable income of previous studies have differed greatly, depending on different demographic groups, definitions of taxable income, consideration of mean reversion and income distribution, and various controls and sets of instrumental variables.[2] For example, the size of the elasticity differs by the definitions of income, such as gross income (Auten et al., 1997), adjusted gross income (Feldstein, 1995; Saez, 1999) and taxable income (Auten et al., 1997; Feldstein, 1995; Saez, 1999; Lindsey, 1987; Goolsbee, 2000). Overall, the literature has shown that gross income is less responsive to the net-of-tax rates than taxable income. Previous literature shows that the elasticity of taxable income is from 0.4 to 3.05 and the elasticity of gross income is from 0.96 to 1.10.

For income groups, the elasticity of upper income groups is found to be larger than that of lower income groups. Gruber and Saez (2000) show that the elasticity of the highest income groups is 0.57, while the elasticity of all income groups is 0.40. The estimates of Gruber and Saez (2000) are lower than those of other studies,

[2] Choi (2009) surveyed various estimates of the elasticity of taxable income in the previous literature.

partly because they use longer time period of 1979 to 1990, reflecting longer run responses of tax payers. Goolsbee (2000) also shows that the estimated elasticity of taxable income is 2.218 for the highest income group, and is 1.113 to 1.427 for all income groups.

Studies on self-employment income are much less than literature on overall taxable income. Blow and Preston (2002) analyzed the elasticity of self-employment taxable income in the U.K for the period of 1985 and 1995. They used the Survey of Personal Incomes which is a repeated cross-sectional income tax returns data filed by the Inland Revenue. They found higher elasticity of taxable income for groups of self-employed, ranging from –9.6 to 21.6 depending on various moment conditions they imposed. Sillamaa and Veall (2001) examined Canadian data, showing that the elasticity of self-employment taxable income is much higher than that of overall income. The estimated elasticity is 0.14 for taxable income, 1.33 for self-employment income. They also showed that senior groups were less responsive to the changes of tax rates.

## III. Data and Variable Description

The data used for this analysis are the Wage and Self-Employment Income in Covered and Non-Covered Job (W-2 Self-Employment Income Records) matched with Health and Retirement Survey (HRS) wave 1. Self-employment income in the W-2 Self-Employment Income Records provides official administrative IRS 1040 Schedule C taxable income data for the Health and Retirement Survey (HRS) respondents from 1980 to 1991. Demographic characteristics such as age, sex, education, number of children, race, and marital status are retrieved from HRS wave 1.[3]

Schedule C self-employment income is net profit from business after deducting various business expenses such as advertising, car and truck expenses, commissions and fees, depreciation, rent and lease, office expenses, maintenance, employee benefit programs, wages paid, insurance, taxes and licenses, travel expenses, and other expenses.[4] The dataset also provides information on dual-job self-employed who have wage jobs and self-employment income as well. On average, dual-job self-

[3] The HRS provides rich information on health, job history and the current job, disability, income and wealth, health insurance, and pension plans, as well as demographic background and family structures and transfers. Section A of the HRS wave 1 asks questions on the highest grade of school or year of college completed, race, and marital history. This information is used for the corresponding respondents who have W-2 Self-Employment Income Records.

[4] Under the current U.S. individual income tax system, total income includes wages and salaries, business income from Schedule C, capital gains, dividends, social security benefits, pension benefits, rental real estate, tax refunds, unemployment compensation and any other income.

employed tends to have larger wage income than self-employment income, implying most of the dual-job holders can be considered as wage workers who hold secondary self-employment income.

Table 1 presents the summary statistics. The data contains two self-employment taxable incomes: Column (1) of Table 1 shows summary statistics for the narrowly defined self-employed who have only Schedule C self-employment income, and column (2) presents those for the broadly defined self-employed who have both Schedule C self-employment income and wage income. Average individual self-employment taxable income for the self-employed in the sample is $11,934 in 1984 dollars and average household income is $17,715.[5] When dual job self-employed are included, average self-employment income is $9,565 and average household income is $20,239. Dual-job self-employed appeared to have higher wages and salaries than self-employment income. Inclusion of dual-job self-employed raises the average household income and marginal tax rates on household income, but average self-employment income is reduced than narrow definition of self-employment income. The marginal household income tax rate is 13% for the one-job self-employed and 15% for the self-employed including dual-job self-employment.[6]

**[Table 1]** Summary Statistics

| | (1) Narrow Definition | | (2) Broad Definition | |
|---|---|---|---|---|
| Self-employment taxable income | $11,934 | (11,677) | $9,565 | (11,038) |
| Household income | $17,715 | (18,361) | $20,239 | (19,043) |
| After-tax income (household) | $15,440 | (14,227) | $17,496 | (14,563) |
| Marginal tax rate (household) | 0.13 | (0.130) | 0.15 | (0.129) |
| Net-of-tax rates (household) | 0.87 | (0.130) | 0.85 | (0.129) |
| Tax liability (household) | $2,274 | (4,580) | $2,743 | (4,954) |
| Age | 50 | (6.785) | 50 | (6.766) |
| Married | 0.931 | (0.254) | 0.912 | (0.283) |
| Single | 0.020 | (0.140) | 0.019 | (0.136) |
| Less than high school | 0.242 | (0.428) | 0.224 | (0.417) |
| Bachelor degree | 0.110 | (0.313) | 0.113 | (0.317) |
| Associate degree | 0.039 | (0.194) | 0.042 | (0.201) |
| Masters degree | 0.038 | (0.191) | 0.047 | (0.212) |
| Law, MD | 0.034 | (0.182) | 0.031 | (0.173) |

[5] Monetary units used in analysis are deflated and expressed in real terms.

[6] The TAXSIM calculator of the National Bureau of Economic Research (NBER) is used to calculate marginal tax rates. Household characteristics such as household income, marital status, and children exemptions are the inputs for the program. No itemized deduction is assumed in tax rate calculations. State tax is not considered for tax calculation due to restrictions on data, since W-2 Self-Employment Income Records are restricted to merge with geo-codes, and state of residence information is not available for tax rate calculation.

| | | | | |
|---|---|---|---|---|
| Hispanic | 0.062 | (0.242) | 0.063 | (0.242) |
| Black | 0.054 | (0.226) | 0.057 | (0.232) |
| Other race | 0.029 | (0.169) | 0.021 | (0.144) |
| Female | 0.318 | (0.466) | 0.313 | (0.464) |
| Observations | 2,487 | | 4,018 | |

Notes: Incomes and taxes are 1984 constant dollars.

## IV. Econometric Specification

This study estimates the elasticity of taxable income for the self-employed as follows:

$$\log y_{it} = \alpha_0 + \alpha_1 \log(1-t_{it}) + \alpha_2 \log(y_{it} - T_{it}(y_{it})) + \alpha_3 X_{it} + \mu_i + \nu_{it} \qquad (2)$$

where $y_{it}$ is self-employment income, $(1-t_{it})$ is the net-of-marginal-income-tax rate on household income, $y_{it} - T_{it}(y_{it})$ is after-tax household income, and $X_{it}$ are demographic characteristics such as age, education, gender, race, and marital status.

The econometric specification follows a basic two-goods microeconomic model with consumption and income. With income ($y$), marginal tax rate ($t$), consumption ($c$), virtual income ($Z$), the budget constraint is written as $c = (1-t)y + Z$. Income supply function, $y = y(1-t, Z)$, depends on the net-of-tax rates and virtual income. Changes in tax rates affects income by changing net-of –tax rates and virtual income:

$$\begin{aligned} dy &= -\frac{\partial y}{\partial(1-t)}dt + \frac{\partial y}{\partial z}dz \\ &= -\frac{(1-t)}{y}\frac{\partial y}{\partial(1-t)}\frac{y}{(1-t)}dt + \frac{(1-t)}{(1-t)}\frac{\partial y}{\partial z}dz \\ &= -\varepsilon^u \frac{y}{(1-t)}dt + \lambda \frac{dz}{(1-t)} \qquad (3) \end{aligned}$$

where $\varepsilon^u$ is the uncompensated elasticity of income with respect to net-of-tax rates and $\lambda$ is the income effect parameter. Using the Slutsky equation, $\varepsilon^c = \varepsilon^u - \lambda$, where $\varepsilon^c$ is compensated elasticity of income, the equation (3) becomes as follows:

$$dy / y = -\varepsilon^u \frac{dt}{1-t} + \lambda \frac{dZ}{y(1-t)}$$

$$= -(\varepsilon^c + \lambda)\frac{dt}{1-t} + \lambda\frac{dZ}{y(1-t)}$$
$$= -\varepsilon^c \frac{dt}{1-t} + \lambda\frac{dZ - ydt}{y(1-t)} \tag{4}$$

One of the problems in identification of the above model is that in the data, self-employment taxable income is censored at the taxable maximum. The observed self-employment taxable income, $y_{it}$, is censored at the taxable maximum. Since it is right censored, for $y_{it}$ above the taxable maximum, all information we have is that $y_{it}^* < c$. With right censored data at the taxable maximum, conditional maximum likelihood estimation on panel level, which is random effect tobit model, is used for estimation.[7] Assuming that $\mu_i$ is random effect, for taxable incomes larger than the taxable maximum, the probability that the observations are some constant, $c$, Prob( $\log y_{it} = c$ ) is:

$$\text{Prob}(\nu_{it} \geq -\alpha_0 - \alpha_1 \log(1-t_{it}) - \alpha_2 \log(y_{it} - T_{it}(y_{it})) - \alpha_3 X_{it}). \tag{5}$$

For taxable incomes smaller than the taxable maximum, the censored probability is:

$$\text{Prob}(\log y_{it} = \log y_{it}^*) = \text{Prob}(\log y_{it}^* < c) = f(\log y_{it} \mid \log y_{it}^* < c), \tag{6}$$

where $f(.)$ is the conditional distribution function.

Another problem of the estimation lies in the correlation between changes in the net- of-tax rates and changes in after-tax income with the error term. I use instrumental variables (IV) for those variables and estimate with a two-step conditional maximum likelihood procedure proposed by Smith and Blundell (1986) that is analogous to 2SCML estimator of Rivers-Vong (1988).

The instrumental variables for net-of-tax rates and after-tax household income are constructed using synthetic household income as a tax base to get rid of possible correlation between household income and individual specific characteristics in error term, $\nu_{it}$. The synthetic income is retrieved from regression of individual income on explanatory variables, removing possible individual heterogeneities that are correlated with the error term, $\nu_{it}$. Another problem may arise if $\nu_{it}$ includes individual heterogeneity, $\mu_i$, because $\mu_i$ may be correlated with incomes of any time period $t$. To make the synthetic income at time $t$ uncorrelated with possible

[7] I tried both the pooled tobit using Amemiya Generalized Least Squares (AGLS) estimators for the tobit with endogenous regressors, suggested by Newey (1987). However, a log likelihood-ratio tests comparing the random-effects tobit with the pooled tobit does not accept the variance of individual heterogeneity is zero. I present the estimates with the random effect tobit model.

individual heterogeneity, I pick 1984 as a base year income.[8] The synthetic household income is calculated based on expected value of individual income in 1984, $\hat{y}_i = \hat{\beta} X_i$. Marginal tax rates and tax liabilities are calculated based on the synthetic household income. The instrumental variable for the net-of-tax rates is constructed as $(1-t_t(\hat{y}_i))$ with tax rules at time *t* and synthetic household income. The instrumental variable is not correlated with $v_{it}$ in equation (2) by construction. The instrumental variable for after-tax income is constructed in the same way using synthetic income as the tax base and tax rules at time *t*. The instrumental variable for after-tax income, $(\hat{y}_i - T_t(\hat{y}_i))$, is uncorrelated with error term, $v_{it}$, by construction

The first stage estimations for net-of-tax rates and after-tax income are conducted using random effect estimator. For net-of-tax rate and after-tax income, the first stage estimation consists of two set of estimation as follows:

$$\log(1-t_{it}) = \gamma_0 + \gamma_1 \log(1-t_{it})^{iv} + \gamma_2 \log(y_{it} - T(y_{it}))^{iv} + \gamma_3 X_{it} + u_i + \omega_{it} \tag{7}$$

$$\log(y_{it} - T(y_{it})) = \beta_0 + \beta_1 \log(1-t_{it})^{iv} + \beta_2 \log(y_{it} - T(y_{it}))^{iv} + \beta_3 X_{it} + \phi_i + \psi_{it} \tag{8}$$

where $w_{it}$ and $\psi_{it}$ are correlated with error terms of equation (2), $\upsilon_{it}$. The Breusch and Pagan (1980) lagrange multiplier test for random effects do not accept the null hypothesis of zero variance of $u_i$ and suggests the presence of unobserved effect. The error terms from the first stage are included in the second stage estimations. The second stage estimation for self-employment taxable income is estimated with the first stage error terms as bellows:

$$\begin{aligned}\log y_{it}^* = {} & \alpha_0 + \alpha_1 \log(1-t_{it}) + \alpha_2 \log(y_{it} - T_{it}(y_{it})) \\ & + \alpha_3 X_{it} + \alpha_4 \hat{\omega}_{it} + \alpha_5 \hat{\psi}_{it} + \mu_i + v_{it}\end{aligned} \tag{9}$$

## V. Estimation Results

The estimation of synthetic individual income and the first stage estimations for net-of-tax rates and after-tax income are presented in Table 2 to Table 4.[9] Table 5 presents the estimates of the random effect tobit model with IV. For estimation, two definitions of self-employment income are used. The first definition more narrowly

[8] Alternative IV is tried using 1987 constant income, and the estimates are compared for sensitivity check. The estimates of interest do not differ much both quantitatively and qualitatively.

[9] Since the individual incomes are censored at taxable maximum, I use tobit model to estimate the cross-sectional equation of $\log y_i = \beta X_i + \varepsilon_i$. Expected values of individual income are exponentiated to get constant real income in 1984 dollars.

defines the self-employment income, including only the self-employment income of strictly one-job self-employed (narrow definition). The second definition more broadly defines the self-employment income, including both the one-job self-employed and the dual-job self-employed (broad definition). The first column shows the estimates for the self-employment income of the one-job self-employed. The second column shows the estimates utilizing the broader definition of self-employment income when dual-job self-employment income is also included in the analysis, as well as one-job self-employment.

The estimated compensated elasticity to the net-of-tax rates is 1.280 and 1.080 respectively, and the coefficient on after-tax income is –0.364 and –0.234 respectively. The substitution effect of the net-of-tax rates is positive as theoretical model predicts. The income effect of the net-of-tax rates is also estimated to be negative as traditional labor supply model predicts, implying that behavioral responses such as changes in deductions and forms of compensation do not surpass the negative income effect of traditional labor supply model. The uncompensated elasticities to the net-of-tax rates are 2.209 for narrow definition and 1.662 for broad definition, as the substitution effect and income effect move toward the same direction.

**[Table 2]** Estimation for Synthetic Income

| | | |
|---|---|---|
| Less than high school | -0.410** | (0.046) |
| Bachelors degree | 0.407** | (0.062) |
| Associate degree | 0.070 | (0.094) |
| Masters degree | 0.473** | (0.076) |
| Law-MD | 0.991** | (0.199) |
| Hispanic | -0.326** | (0.073) |
| Black | 0.032 | (0.052) |
| Other race | 0.077 | (0.120) |
| Female | -0.788** | (0.042) |
| Single | 0.050 | (0.107) |
| Married | -0.017 | (0.054) |
| Number of children | -0.113** | (0.020) |
| Age | 0.115** | (0.024) |
| Age2 | -0.001** | (0.000) |
| Constant | 7.266** | (0.568) |
| Observation | 3610 | |
| Log likelihood | -5088 | |

**: significant at 1% level. * : significant at 5% level. +: significant at 9% level.

**[Table 3]** First Stage Estimation: Net-of-Tax Rates

| Dependent Variable: Net-of-tax rate | | |
|---|---|---|
| Synthetic net-of-tax rate | 0.339** | (0.007) |
| Less than high school | -0.006 | (0.004) |
| Bachelors degree | -0.003 | (0.006) |
| Associate degree | -0.001 | (0.009) |
| Masters degree | -0.008 | (0.007) |
| Law-MD | -0.030+ | (0.017) |
| Hispanic | -0.004 | (0.007) |
| Black | 0.018** | (0.005) |
| Other race | 0.009 | (0.010) |
| Female | 0.037** | (0.004) |
| Single | 0.006 | (0.006) |
| Married | 0.039** | (0.002) |
| Number of children | 0.020** | (0.001) |
| Age | -0.012** | (0.001) |
| Age2 | 0.000** | (0.000) |
| Synthetic after-tax income | -0.081** | (0.003) |
| Constant | 0.594** | (0.033) |
| $R^2$ | 0.3107 | |

**: significant at 1% level. * : significant at 5% level. +: significant at 9% level.

**[Table 4]** First Stage Estimation: After-Tax Income

| Dependent variable: After-tax income | | |
|---|---|---|
| Synthetic after-tax income | 1.085** | (0.020) |
| Less than high school | -0.033 | (0.033) |
| Bachelors degree | -0.030 | (0.043) |
| Associate degree | 0.131+ | (0.067) |
| Masters degree | 0.075 | (0.055) |
| Law-MD | 0.044 | (0.133) |
| Hispanic | 0.060 | (0.050) |
| Black | -0.089* | (0.037) |
| Other race | -0.101 | (0.077) |
| Female | 0.034 | (0.027) |
| Single | 0.021 | (0.044) |
| Married | -0.085** | (0.017) |
| Number of children | -0.033** | (0.006) |
| Age | 0.131** | (0.007) |
| Age2 | -0.001** | (0.000) |
| Synthetic net-of-tax rate | 0.272** | (0.049) |
| Constant | -3.672** | (0.227) |
| $R^2$ | 0.3037 | |

**: significant at 1% level. * : significant at 5% level. +: significant at 9% level.

**[Table 5]** Estimation Result

| | (1) Narrow Definition | | (2) Broad Definition | |
|---|---|---|---|---|
| Net-of-tax rate | 1.280** | (0.325) | 1.080* | (0.530) |
| After-tax income | -0.364** | (0.052) | -0.234** | (0.074) |
| Less than high school | -0.644** | (0.029) | -0.001 | (0.076) |
| Bachelors degree | 0.569** | (0.059) | 0.620** | (0.068) |
| Associate degree | 0.008 | (0.051) | 0.309** | (0.074) |
| Masters degree | 0.681** | (0.055) | -0.054 | (0.080) |
| Law-MD | 2.566** | (0.114) | 2.176** | (0.125) |
| Hispanic | -0.449** | (0.036) | -0.490** | (0.088) |
| Black | -0.153** | (0.043) | -0.166* | (0.077) |
| Other race | -0.102** | (0.050) | 0.046 | . |
| Female | -1.268** | (0.034) | -1.072** | (0.059) |
| Single | -0.396** | (0.074) | -0.063 | (0.160) |
| Married | -0.177** | (0.051) | 0.252** | (0.070) |
| Number of children | -0.121** | (0.015) | -0.083** | (0.030) |
| Age | 0.278** | (0.013) | 0.169** | (0.025) |
| Age2 | -0.003** | (0.000) | -0.002** | (0.000) |
| $\hat{u}_1$ | -1.736** | (0.347) | -0.849 | (0.580) |
| $\hat{u}_2$ | 1.347** | (0.054) | 0.959** | (0.079) |
| Constant | 7.882** | (0.413) | 7.734** | (0.622) |
| Observation | 2439 | | 3964 | |
| Log likelihood | -1229.2017 | | -4547.4607 | |

Notes: $\hat{u}_1$ and $\hat{u}_2$ are residuals from the first stage estimations.

**: significant at 1% level. * : significant at 5% level. +: significant at 9% level.

The size of the compensated elasticity of self-employment taxable income is lower than the estimates in previous literature. There exists a possibility that the estimated elasticity may be underestimated, since the Schedule C self-employment income is censored at the FICA taxable maximum. One of the strength of the data is that it is official taxable income records. The estimates can be closer to actual responses of tax payers compared to the estimates using self-reported records in survey data. However, one limitation of the data is that is it top-coded at the taxable maximum subject to FICA tax. Self-employment income in higher income brackets may be severely censored, far less than true income, as the distribution of self-employment income is right-censored. Considering the findings of previous literature that taxable income in higher income brackets responds more to changes in tax rate, this may potentially reduce the size of the elasticity of self-employment taxable income. The sample mean may be far lower than actual mean of the self-employment taxable income. Given the data set, however, the compensated elasticity of self-employment income is much larger than that of wage income, suggesting that the self-employment taxable income is more responsive to the net-of-tax rate than wages and salaries.

**[Table 6]** Compensated and Uncompensated Elasticity of Self-Employment Taxable Income and Wages

| | Self-Employment Income | | | | Wages | |
|---|---|---|---|---|---|---|
| | Narrow Definition | | Broad Definition | | | |
| | (1) | (2) | (1) | (2) | (1) | (2) |
| Net-of-tax rate | 2.209** | 1.280** | 1.662** | 1.080* | 0.450** | 0.598** |
| | (0.446) | (0.325) | (0.545) | (0.530) | (0.118) | (0.072) |
| After-tax income | | -0.364** | | -0.234** | | 0.112** |
| | | (0.052) | | (0.074) | | (0.013) |

**: significant at 1% level. * : significant at 5% level. +: significant at 9% level.

For sensitivity check, additional control variables such as industry dummies and occupation dummies are added to the explanatory variables. Estimates in Table 7 show that the elasticity of self-employment income does not differ much qualitatively and quantitatively with additional controls of industry and occupation. The estimated elasticities with additional occupational variables are similar to those of the baseline, compensated elasticities are 1.263 and 1.15, and uncompensated elasticities are 1.828 and 1.481.

**[Table 7]** Estimation Result: Sensitivity Check with Additional Control Variables

| | Industry Control | | | | Occupation Control | | | |
|---|---|---|---|---|---|---|---|---|
| | Narrow Definition | | Broad Definition | | Narrow Definition | | Broad Definition | |
| | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) |
| Net-of-tax rate | 1.733** | 0.928** | 0.953* | 0.943* | 1.828** | 1.263** | 1.481** | 1.158* |
| | (0.461) | (0.312) | (0.440) | (0.449) | (0.434) | (0.340) | (0.490) | (0.463) |
| After-tax Income | | -0.473** | | -0.187* | | -0.522** | | -0.170* |
| | | (0.055) | | (0.076) | | (0.053) | | (0.077) |

Note: 1. Baseline controls are included.

2. Industry dummies include 'public sector', 'mining and construction', 'transportation', 'sales', financial sector', 'business and repair service', 'entertainment', and 'professional services'.
3. Occupation dummies include 'managerial specialty operation', 'professional specialty operation', 'sales', 'clerical and administrative support', 'health services', 'farming and forestry', 'mechanics', 'construction trade and extractors', 'precision production', 'operators', 'member of armed forces'.

**: significant at 1% level. * : significant at 5% level. +: significant at 9% level.

Table 8 presents the estimates of interest with alternative IV using 1987 as base year. The estimated income elasticities are not much different either, ranging from –0.522 and –0.170. The compensated estimated elasticities to the net-of-tax rates are 1.589 for narrow definition of the self-employed and 0.990 for broad definition of the self-employed. The uncompensated elasticities to the net-of-tax rates are estimated to be 2.810 for narrow definition and 1.857 for broad definition.

**[Table 8]** Estimation Result: Sensitivity Check with Alternative IV

| | Alternative IV | | | |
|---|---|---|---|---|
| | Narrow Definition | | Broad Definition | |
| | (1) | (2) | (1) | (2) |
| Net-of-tax rate | 2.810** | 1.589** | 1.857** | 0.990* |
| | (0.426) | (0.298) | (0.551) | (0.463) |
| After-tax income | | -0.362** | | -0.203** |
| | | (0.045) | | (0.071) |

Note: 1. Baseline controls are included.
2. Alternative IV is constructed using the income of 1987 as a base year income.
**: significant at 1% level. * : significant at 5% level. +: significant at 9% level.

Table 9 presents the calculated deadweight loss with various estimates of compensated and uncompensated elasticities evaluated at the sample mean.[10] It shows that deadweight loss of income tax ranges from 7% to 12% of self-employment income tax revenues, suggesting that for every $1 in self-employment income tax revenue collected, the deadweight loss of income tax is about 7 to 12 cents. Average deadweight loss per $1,000 self-employment taxable income ranges from $9 to $15. When income effect is not compensated, the deadweight loss of income tax ranges from 8% to 21% of self-employment income tax revenue. These estimates of the deadweight loss are not directly comparable to the estimates from literature, since the deadweight loss of income tax is evaluated at different tax base. Feldestein's (1999) deadweight loss of income tax measured by taxable income is as much as 30% of tax revenue collected, while Harberger's 1964 estimates for deadweight loss measured by consumption is about 3% of tax revenue. Although not directly comparable, the average deadweight loss per self-employment income tax revenue is not much substantial compared to other potential government revenue sources such as capital income tax and corporate capital income tax.[11]

[10] Feldstein (1999) showed that the deadweight loss of income tax is equivalent to $0.5t^2(1-t)^{-1}\varepsilon_{TI}TI$, where $\varepsilon_{TI}$ is elasticity of taxable income with respect to net-of-tax rate.

[11] There is possibility that the estimated average deadweight loss per self-employment income tax revenue may be underestimated and not substantially larger. One of the explanation for this may be the censored self-employment income data. The Schedule C self-employment income is censored at the FICA taxable maximum and average deadweight loss evaluated at the average self-employment

Feldstein (1978) estimated the welfare implication of taxing capital incomes and saving, and found that taxing on capital income incurred 3% deadweight loss per national income and 20% per aggregate gross saving in pre-retirement ages. Hausman (1981) estimated the tax-induced distortions on labor supply and found that deadweight loss per tax revenue for workers who earned average hourly wage of $6.18 in 1975 was 22% of revenue collected. Shoven (1976) estimated the distortions caused by corporate taxation and found that average deadweight loss of capital income tax in corporation sector was from 6 % to 15 % of capital income tax revenue.

**[Table 9]** Calculation of Deadweight Loss of Income Tax

| | | | Deadweight Loss | Average Deadweight Loss (per self-employment taxable income ) | Deadweight Loss As a Percentage of Tax Revenue |
|---|---|---|---|---|---|
| Compensated Elasticity | Narrow Definition | (1) | $148 | $0.012 | 10% |
| | | (2) | $108 | $0.009 | 7% |
| | | (3) | $146 | $0.012 | 9% |
| | | (4) | $184 | $0.015 | 12% |
| | Broad Definition | (1) | $137 | $0.014 | 10% |
| | | (2) | $119 | $0.012 | 8% |
| | | (3) | $147 | $0.015 | 10% |
| | | (4) | $125 | $0.013 | 9% |
| Uncompensated Elasticity | Narrow Definition | (1) | $256 | $0.021 | 17% |
| | | (2) | $201 | $0.017 | 13% |
| | | (3) | $212 | $0.018 | 14% |
| | | (4) | $326 | $0.027 | 21% |
| | Broad Definition | (1) | $210 | $0.022 | 15% |
| | | (2) | $121 | $0.013 | 8% |
| | | (3) | $187 | $0.020 | 13% |
| | | (4) | $235 | $0.025 | 16% |

Note: (1) Baseline controls (2) Industry controls (3) Occupation controls (4) Alternative IVs.

# VI. Conclusion

Taxing self-employment income is much harder than wages and salaries, partly because tax avoidance is easier for self-employment income. For this reason, it is often considered that the higher the proportion of the self-employed in a labor force, the larger the size of the shadow economy and the larger the efficiency cost of taxation be. Whether the self-employment income is more responsive to tax rates is

income tax revenue with the far lower sample mean is subject to be underestimated.

one of the empirical questions to explore. The paper analyzes administrative Schedule C self-employment taxable income data and estimates compensated and uncompensated elasticity of self-employment taxable income. It finds that compensated elasticity of self-employment taxable income ranges from 0.928 to 1.280, suggesting that the calculated average deadweight loss of income tax per $1,000 self-employment income ranges from $9 to $15, and 7% to 12% of self-employment income tax revenue. The uncompensated elasticity of self-employment taxable income ranges from 0.953 to 2.20. This responsiveness of self-employment income and average deadweight loss reflect short-term responses of static taxable income rather than long-term responses. However, the empirical analysis in this paper suggests that the self-employment taxable income is more responsive to the changes in tax rates than taxable income of wage workers. The efficiency costs of income tax would be of concern as the proportion of the self-employed in the economy is higher.

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