

THE SENSITIVITY OF COMMON HORIZONTAL EQUITY MEASURES TO VARIATIONS IN OMITTED INCOME

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ABSTRACT

This paper examines the sensitivity of horizontal equity measures (coefficient of variation (CV) and coefficient of residual variation (CRV)) to a common assumption in horizontal equity studies – that changes in level of omitted income do not change horizontal equity experienced by taxpayers in similarly situated income groups. It has been assumed in many prior studies that certain income exclusions or deductions allowed from taxable income have no effect on the resulting horizontal equity measurements. This paper examines whether the CV and CRV remain low within each income group when the mortgage interest deduction and the charitable contribution deduction are disallowed. In general, the omission of certain income does create a wider variation of effective tax rates within income groups. The results of this study indicate that future horizontal equity studies should consider that omitted income, either through income exclusions or deductions allowed, may affect horizontal equity measures. In addition, for policy makers, taking steps to decrease the tax gap also increases horizontal equity.

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KEYWORDS: taxation, horizontal equity, coefficient of variation, coefficient of residual variation

INTRODUCTION

Horizontal equity refers to the idea that taxpayers with the same economic income should have the same tax burden (Musgrave 1959). The “tax gap” refers to the differences between what the US government should be collecting from its taxpayers versus actual collections. The tax gap is reportedly over \$300 billion per year (IRS 2005). This gap hurts the economy in two ways. First, to make up for the difference, the tax rates must increase, or debt must increase (along with interest rates). Second, the public perception that, in a self-reporting tax system, that some taxpayers are “getting away with cheating” lessens the ability of the government to collect from everyone. As this paper shows, the “tax gap” also effects horizontal equity – which is another important point of public perception of the tax fairness and hence tax collectability. Prior to this study, tax equity studies often made the assumption that the amount of omitted income has no substantive effect on the outcome of horizontal equity measures calculated. This study examines whether varying levels of income through disallowance of the deductions for home mortgage interest and charitable contribution affects the horizontal equity measures. The purpose of this study is to provide guidance to future tax equity researchers in understanding the capabilities as well as the limitations of currently existing horizontal equity measures. It also points out that decreases in the tax gap will strength horizontal equity. This paper is outlined as follows. Section two describes some of the motivation for the study and provides a literature review. Section three introduces the research design and the hypotheses. Section four presents the results and section five concludes.

LITERATURE REVIEW

The study of equity and tax distribution is one of the broad paradigms which comprise the accounting literature in taxation. Studies in this paradigm compare the relative tax burdens borne by individual

taxpayers or groups of taxpayers. Generally, these studies focus on vertical equity (ability to pay), horizontal equity (similarly situated taxpayers being tax equally), or both.

The optimal level of vertical equity has been a controversial issue over the years. Horizontal equity, however, has been described as the “most universally accepted of all principles of tax policy”, (White and White 1965, 225).

Legislators have used concerns for “improved horizontal equity” or “improved vertical equity” and results of equity studies as a means of gaining approval for tax policy changes. Given the important and influence of equity studies, it is clear that tax equity needs to be measured in an accurate, reliable and consistent manner to ensure that tax policymakers are informed.

The measure of dispersion is considered the measure of horizontal equity. Horizontal studies use archival data, sorting it in groups of “equal economic circumstance,” and then computing the coefficient of variation (CV) or the coefficient of residual variation (CRV) for each income group in what is considered to be the measure of horizontal equity.

In most of the studies common assumptions are made, whether or not explicitly stated, that variations in certain factors have no substantive effect on equity measures calculated in the study. One of these factors is the amount of income omitted in the databases used in the study. Expanded income is assumed to be an appropriate surrogate for economic income. Thus the implicit assumption is made that income not reported, whether omitted intentionally or not, has an immaterial effect on horizontal equity.

For example, White and White (1965) examined horizontal inequity arising from the homeowners’ understatement of income due to the mortgage interest deduction, the property tax deduction and the “imputed net rental return on the homeowner’s equity.” The taxpayers were first divided into four family status groupings, and then thirteen “equal-circumstance” groups. To statistically measure horizontal inequity, the coefficient of variation (the standard deviation divided by the mean) was used to determine “the relative dispersion in tax liability or disposable income among members of equal-circumstance groups” (White and White, 1965, 226). There was no adjustment made for any possibility of omitted income

Studies which also used the coefficient of variation to measure the dispersion within income groups, but made no adjustment for the consideration of omitted income include Brennan (1971), Fields and Fei (1978), Madeo and Madeo (1981), Anderson (1985), Pierce (1989), Ricketts (1990) and Enis and Craig (1990).

This study moves beyond those studies by considering the possibility of omitted income. Such income would include transfer payments from social security, worker’s compensation, excluded capital gains not required to be reported on tax returns as well as reportable income that taxpayers either willfully (i.e., through the “black economy”) or by mistake fail to include in their return.

With regard to legally omitted income, Bakija and Steuerle (1991) estimated that, for 1988, 15/2 percent of personal income was excluded from adjusted gross income according to the following categories: 1) Net nontaxable government transfers – 6.4 percent; 2) Net nontaxable labor-related income – 3.8 percent; 3) Other statutory exclusions – 1.6 percent; and 4) Other net differences (i.e., imputed rent on owner-occupied home, etc.) – 3.4 percent.

After subtracting 1.7 percent for Social Security and Railroad Retirement, -.5 percent for pension and profit sharing, and 1.6 percent for statutory exclusions (which are all available in the IRS Tax File), an

average of 12.4 percent of personal income excluded from 1988 taxable income was not included in the IRS Tax File. For this study, 12.5 percent was the assumed average.

The “black economy” is a term used to describe tax evasion of illegally omitted income. While it is not easy to measure an activity that is by nature covert, estimates between 2 and 10 percent of the GNP in Western industrialized countries have been made (Cowell 1990). Pyle (1989) reported figures as high as 14.2 percent of the GNP for the United States in 1980. Also, the Subcommittee on Oversight of the Committee on Ways and Means (2004) noted that self-employed taxpayers represented the group with the greatest compliance problem, and they reported that taxpayers providing services for a “fee rather than wages, report 97 percent of the income they report on information returns, but only 83 percent of income which is not on information returns... whereas wage earners report 99 percent of their wages on Forms W-2 and subject to withholding.” Furthermore, Graetz and Wilde (1985) reported that 10-15 percent of taxable income in the United States went unreported. For the purpose of this study, it is assumed that the average illegally omitted income is 15 percent.

Based on these estimates of the black economy in conjunction with the estimates of legally omitted income, it is assumed that the IRS Tax File data used in this study includes an average combined omitted income of 27.5 percent, with a range of zero to 55.5 percent.

HYPOTHESES AND RESEARCH DESIGN

This study investigates the validity of the assumption that omitted income has no effect on horizontal equity by examining the effect of two horizontal equity measures, the coefficient of variation (CV), and the coefficient of residual variation (CRV), on changing two tax laws. The first tax law change is the disallowance of the mortgage interest deduction, and the second is the disallowance of the charitable contributions deduction. To test the validity of this omitted income assumption, the following two hypotheses are proposed:

H1: For each horizontal equity measure studied, the percentage of omitted income has no effect on the weighted average percentage change in the horizontal equity measure when the mortgage interest deduction is disallowed.

H2: For each horizontal equity measure studied, the percentage of omitted income has no effect on the weighted average percentage change in the horizontal equity measure when the charitable contributions deduction is disallowed.

The Internal Revenue Service 1989 Tax File (ITF) for individuals was used to examine the sensitivity of the equity measures to variations in the number of income groups. The ITF is a machine-readable data source including a stratified sample of 96,588 individual returns selected from a population of 112.2 million returns. The ITF for 1989 was selected for two reasons: 1) the last year for the ITF in this format was 1992 and 2) the years after 1989 would have seen significant distortion from income and expense shifting due to the Omnibus Budget Reconciliation Act of 1990.

For each return the Internal Revenue Service provides a corresponding weighting factor that indicates how many population returns the single sample represents. Of the 96,588 sample of returns in the ITF, 59,870 Form 1040 returns classified as married filing jointly for the calendar year 1989 were selected for this study. This study only used married filing jointly returns in to make the equal circumstance groups as homogenous as possible.

Before horizontal equity can be measured, taxpayers must be classified into equal circumstance groups according to ability-to-pay. To operationalize ability-to-pay, adjusted expanded income (“AEI”) as used

by Ricketts (1990) and similar to expanded income used in numerous studies (Anderson 1985; Pierce 1989; Enis and Craig 1990; and Grasso and Frischmann 1992), was the income measure incorporated in this study because it is a broader income measure that better approximates income. Therefore, for each sample return, AEI was calculated by adding to the taxpayer’s AGI tax-exempt interest, allowable IRA, Keogh and SEP contribution deductions, allowed passive losses, nontaxable security benefits, nontaxable pensions, and tax preferences items (assumed to be passive activity related) in excess of the absolute value of losses allowed for passive activities. After calculating AEI for each taxpayer, the taxpayers were grouped from the least to the greatest AEI.

To explore whether a variation in the percentage of omitted income has an effect on the percentage change in the coefficient of variation or the coefficient of residual variation, horizontal equity measures were calculated using eleven alternative combinations of omitted income shown in Table 1.

Table 1: Research Design Matrix Used to Create Categories of Income Differences Between Taxpayers

Factor Studied	Mortgage Interest Deduction Disallowed	Charitable Contributions Deduction Disallowed
Percentage of Omitted Income – Mortgage Deduction	I1, I2, I3, I4, I5, I6, I7, I8, I9, I10, I11	none
Percentage of Omitted Income – Charitable Contribution Deduction	none	I1, I2, I3, I4, I5, I6, I7, I8, I9, I10, I11

Ii = Percentage of omitted income simulations. Groupings by income deciles has been the most commonly used number of income groups when grouping equal numbers of taxpayers in each group. Also, it is not known whether omitted income is constant across income groups, higher for the upper income groups, or higher for the lower income groups. Therefore, there are eleven alternative combinations of omitted income which represent each of these possibilities while maintaining the same midpoint percent of omitted income for each alternative simulation.

As discussed previously, the use of adjusted expanded income as the income measure implicitly assumes that omitted income has no material effect on calculated changes in horizontal equity measures. The assumed average omitted income from the ITF was 27.5 percent; however, whether income is constant across income groups, higher for the upper income groups, or higher for the lower income groups is not known. Therefore, this study examined eleven alternative combinations of omitted income which represent each of these possibilities while maintaining a midpoint of 27.5 percent for each scenario. Grouping by income deciles has been the most commonly used number of income groups when grouping equal numbers of taxpayers in each group. This study used eleven groups because it was close to ten, and it allowed 27.5 percent to be the omitted income percentage for the sixth income group with five groups above and below. Table 2 outlines the assumed omitted income percentage for each income group in the eleven alternative simulations.

Table 2: Omitted Income Simulation Alternatives between Equally Situated Income Groups

I	Omitted Income Simulations											
		I1	I2	I3	I4	I5	I6	I7	I8	I9	I10	I11
N	1	0.0	5.5	11.0	16.5	22.0	27.5	33.0	38.5	44.0	49.5	55.0
O	2	5.5	9.9	14.3	18.7	23.1	27.5	31.9	36.3	40.7	45.1	49.5
M	3	11.0	14.3	17.6	20.9	24.2	27.5	30.8	34.1	37.4	40.7	44.0
E	4	16.5	18.7	20.9	23.1	25.3	27.5	29.7	31.9	34.1	36.3	38.5
	5	22.0	23.1	24.2	25.3	26.4	27.5	28.6	29.7	30.8	31.9	33.0
G	6	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5	27.5
R	7	33.0	31.9	30.8	29.7	28.6	27.5	26.4	25.3	24.2	23.1	22.0
O	8	38.5	36.3	34.1	31.9	29.7	27.5	25.3	23.1	20.9	18.7	16.5
U	9	44.0	40.7	37.4	34.1	30.8	27.5	24.2	20.9	17.6	14.3	11.0
P	10	49.5	45.1	40.7	36.3	31.9	27.5	23.1	18.7	14.3	9.9	5.5
	11	55.0	49.5	44.0	38.5	33.0	27.5	22.0	16.5	11.0	5.5	0.0

Note: Cell entries represent the percentage increase in income applied to each taxpayer within that income group. The assumed average omitted income was 27.5 percent. Thus the 27.5 amount was applied consistently to all eleven income groups in simulation 16. The same midpoint percent of 27.5 was applied to income group 6 in all eleven simulations with omitted income percentages increasing in the upper income groups at different rates for alternative simulations 11 – 15, and decreasing at different rates in the lower income groups for alternative simulations 17 - 11.

To test the omitted income assumption, the sample taxpayers' incomes were ordered from the least to the greatest AEI and classified into eleven equal groups of taxpayers. Then each taxpayer's taxable income was increased by the product of the appropriate percentage from the table above multiplied by each taxpayer's AEI. Tax liabilities were recalculated using a 20 percent proportional tax and each taxpayer's effective tax rate was determined for the pre-tax law change scenario. Two of the larger deductions used by married couples who file joint tax returns are the home mortgage interest deduction and the charitable contributions deduction. Each of these deductions was disallowed separately, and the tax liabilities were also recalculated and each taxpayer's effective tax rate determined for each of the post tax-law change scenarios. For each of these deductions and the corresponding simulations, horizontal equity was measured using the CV and the CRV by allowing the deduction (pre-tax law change) and then by disallowing the deduction (post-tax law change).

Coefficient of Variation

In earlier studies the coefficient of variation was calculated by either using taxpayers' actual tax liabilities (White and White 1965; Anderson 1985; and Enis and Craig 1990) or effective tax rates (Pierce 1989; and Ricketts 1990). Pierce and Ricketts both note that by using effective tax rates comparability should be improved by lessening dispersion within a group that results from the range of incomes. The coefficient of variation formula used in this study is as follows (adapted from Ricketts 1990, 41)

If CV_j is the coefficient of variation for group j, SD_j is the standard deviation of the effective tax rate for group j and ETR_j is the mean effective tax rate for group j, then the coefficient of variation can be stated as follows:

$$CV_j = \frac{SD_j}{ETR_j} \times 100$$

Coefficient of Residual Variation

In an attempt to reduce an overstatement of the coefficient of variation due to the progressivity of income within equal circumstance groups, Grasso and Frischmann (1992) proposed a new approach to measuring horizontal equity called the coefficient of residual variation. The first step involves regressing the effective tax rate on AEI for each equal circumstance group. The following regression equation was used to predict the effective tax rate for each tax payer within each equal circumstance group (adapted from Grasso and Frischmann 1992, 128):

IF ETR is the tax liability divided by the AEI, LnAEI is the natural logarithm of the AEI and I is either 1 if AEI is less than zero or zero if the AEI is greater than or equaled to zero, then the CRV for group j is (adapted by Grasso and Frischmann 1992):

$$CRV_j = \frac{\sqrt{\sum_{i=1}^{n_j} (ETR_{ij} - \overbrace{ETR_j}^2) / (n_j - 2)}}{ETR_j} * 100$$

Where:

ETR_{ij} = the effective tax rate (tax liability/AEI) for the ith taxpayer on group j

$$\begin{aligned} \overbrace{ETR_j} &= \text{the predicted effective tax rate for the } i\text{th taxpayer in group } j \\ \overline{ETR_j} &= \text{the mean effective tax rate for group } j \\ n_j &= \text{the number of taxpayer in group } j \end{aligned}$$

Percentage Change in HE

As discussed earlier, the horizontal equity measures were tested for their sensitivity of variations in the percentage of omitted income. Therefore, percentage changes in horizontal equity measures were computed for both tax law change scenarios under each alternative simulation (similar to Anderson 1985; Pierce 1989; and Ricketts 1990). The formula for the percentage change in the coefficient of variation is as follows for the PCHE for income group i:

$$PCHE_i = \frac{HE_{pre} - HE_{post}}{HE_{pre}} \times 100$$

Where:

- PCHE_i = Percentage change in horizontal equity measure for income group i
 - HE_{pre} = Horizontal equity measure for the pre-tax law change simulation
 - HE_{post} = Horizontal equity measure for the post-tax law change simulation
 - i = Percentage change in omitted income
- A positive change indicates improved horizontal equity

Weighted Average Percentage Change in CV

Next, the overall weighted average percentage change in the horizontal equity measures from the pre- to the post-law change for each of the percentage of omitted income group alternative simulations. The equation is as follows:

$$WAHE = \frac{\sum (N_j * PCHE_j)}{\sum N_j}$$

Where:

- WAHE = weighted average percentage change in horizontal equity measures for each alternative simulation
- N_j = Number of taxpayers in income group j
- PCHE = Percentage change in horizontal equity measure for income group j
- j = Number of income groups

Since there were eleven simulations, there were eleven WAHE for each of the two hypothetical tax law changes. To test the hypotheses, WAHE measures were tested for a trend using the Cox and Stuart Trend test (Conover 1971).

RESULTS

Coefficient of Variation and Coefficient of Residual Variation Pre- and Post-Tax Law Change

By comparing the pre-tax law change CV and CRV to the post-tax law change CV and CRV for the individual income AEI groups, it can be observed that in each case the post-tax law change CV and CRV is always less than the pre-tax law change CV and CRV. A decrease in the CV and CRV represents an increase in horizontal equity. This, for all percentage of omitted income alternatives, the disallowance of the mortgage interest deduction and, alternatively, the charitable contributions deduction resulted in an improvement in horizontal equity.

Sensitivity Analysis

To measure the improvement in the horizontal equity, the percentage change in each horizontal equity measure (PCHE) and for each hypothetical law change was calculated. A positive percentage change in the HE indicates an improvement in the horizontal equity while the negative percentage change indicates a decline in horizontal equity. Consistently, the PCHE was positive for all the alternative simulations. Therefore, disallowance of either the mortgage interest deduction or the charitable contributions deduction resulted in improved horizontal equity for all income groups using either the CV or the CRV.

Finally, an overall weighted average of the percentage change in the CV and CRV (WAHE) was calculated for each alternative simulation of the percentage of omitted income.

To apply the trend test, the overall WAHE in the CV for each simulation were grouped in Table 3. In each scenario, for all five pairs the second measurement was higher than the first. The resulting WAHE gradually increased as the higher omitted income percentages gradually switched from the higher AEI groups to the lower AEI groups. Thus, H1 and H2 are rejected as the omitted income percentage apparently does have an effect on the resulting CV.

Table 3: H1 and H2 Cox and Stuart Trend Test – Coefficient of Variation

Omitted Income Paired Simulations	WAHE – Tax Law Change Scenario	
	Mortgage Interest (pre-tax law change, post-tax law change)	Charitable Contributions (pre-tax law change, post-tax law change)
(11, 17)	(8.98 , 9.32) *	(2.34 , 2.45) *
(12, 18)	(9.01 , 9.46) *	(2.35 , 2.49) *
(13, 19)	(9.05 , 9.56) *	(2.35 , 2.52) *
(14, 110)	(9.10 , 9.67) *	(2.37 , 2.53) *
(15, 111)	(9.18 , 9.72) *	(2.40 , 2.52) *
	T = 5	T = 5

Note: This table shows the results of the Cox and Stuart trend test for the coefficient of variation. The middle simulation 16 was deleted, and the first half of the omitted income simulations (11 – 15) was paired with the other half (17-111). Each simulation indicates that the second paired WAHE was higher than the first. The test statistic T (total number of pairs) was used in a two-tailed trend test.

** The acceptance region for the hypotheses H1 and H2 that the percentage of omitted income has no effect on the WAHE for each of the tax law changes was $0 < T < 5$. For both tax law change scenarios, H1 and H2 are rejected because T equals 5. Therefore, there is support that the omitted income percentage does affect the coefficient of variation at the .05 level.*

Table 4 shows the trend test results for the CRV. Table 4 illustrates that the WAHE in the CRV increased for both tax law changes as the omitted income percentage adjustment decreased for the upper income groups and increased for the lower income groups. In both cases, H1 and H2 are rejected. Therefore, there is support that the omitted income percentage does affect the CRV.

As the omitted income percentages for the lower AEI groups increased and the omitted income percentage for the upper AEI groups decreased, the WAHE for the CV and CRV increased. However, while there is a statistically significant trend in the WAHE for the CV and the CRV for both hypothetical tax law changes, one may argue it does not result in a material difference.

Table 4: H1 and H2 Cox and Stuart Trend Test – Coefficient of Residual Variation

Omitted Income Simulations	Paired	WAHE – Tax Law Change Scenario	
		Mortgage Interest (pre-tax law change, post-tax law change)	Charitable Contributions (pre-tax law change, post-tax law change)
(11, 17)		(9.10 , 9.43) *	(2.37 , 2.47) *
(12, 18)		(9.13 , 9.56) *	(2.37 , 2.51) *
(13, 19)		(9.17 , 9.66) *	(2.38 , 2.54) *
(14, 110)		(9.22 , 9.76) *	(2.40 , 2.55) *
(15, 111)		(9.30 , 9.81) *	(2.43 , 2.53) *
		T = 5	T = 5

Note: This table shows the results of the Cox and Stuart trend test for the coefficient of residual variation. The middle simulation 16 was deleted, and the first half of the omitted income simulations (11 – 15) was paired with the other half (17-111). Each simulation indicates that the second paired WAHE was higher than the first. The test statistic T (total number of pairs) was used in a two-tailed trend test. *The acceptance region for the hypotheses H1 and H2 that the percentage of omitted income has no effect on the WAHE for each of the tax law changes was $0 < T < 5$. For both tax law changes H1 and H2 are rejected because T equals 5. Therefore, there is support that the omitted income percentage does affect the coefficient of residual variation at the .05 level.

CONCLUDING COMMENTS

This study examines the changes in horizontal equity (as measured by the coefficient of variation and the coefficient of residual variation) when considered omitted income, as varied between zero and 55 percent, within each “equal economic circumstance groupings.” While the omission of income (or overstatement of deductions) in the US tax system can be considered widespread, most horizontal equity studies assume that omitted income is not important when measuring the variations of tax liabilities within income groups.

Using the Internal Revenue Service Tax File database for roughly 60,000 married filing joint returns we measure the sensitivity of equity indicators, coefficient of variation and coefficient of residual variation, to two hypothetical changes in the tax laws – the disallowance of the mortgage interest deduction and the charitable contribution deduction. We found the disallowance of either deduction increases horizontal equity using the CV and the CRV. The results of this study should prove useful to tax policy analysts, legislators, and the general public. This research predicts that increase compliance with the tax code increases the horizontal equity within income groups, leading to a stronger belief in the overall fairness of the tax system. This study should provide guidance to policy analysts, legislators and other government officials that reliance should be placed on equity measures in equity studies that consider this exception.

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