The Economic Journal, **117** (*March*), 327–352. Published by Blackwell Publishing, 9600 Garsington Road, Oxford OX4 2DQ, UK and 350 Main Street, Malden, MA 02148, USA.

ESTIMATING TAX NONCOMPLIANCE WITH EVIDENCE FROM UNAUDITED TAX RETURNS

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This article estimates the degree of tax noncompliance using evidence from unaudited tax returns. Measurements of noncompliance are derived from the relationship between reported charitable contributions and reported income from wages and salary as compared to alternative reported income sources such as self-employment, farm and other small business income. Assuming that the source of one's income is unrelated to one's charitable inclinations and that the ratio of true income to taxable income does not vary by income source, any difference in the relationship between charitable contributions and the source of income can be attributed to (relative) underreporting by the individual. We find that the implied amount of noncompliance is significant and that it varies by source of income, as well as between positive and negative values of each type of income.

Tax evasion creates horizontal inequity and, if opportunities for evasion are correlated with income, complicates the attempt to achieve vertical equity. Evasion also imposes economic costs because taxpayers expend resources to facilitate evasion and the tax agency expends resources to contain it. The equity and efficiency implications of tax evasion, and optimal policy to address it, depend on its magnitude and nature which, for obvious reasons, is difficult to ascertain. This article contributes to that effort by developing a new method for estimating the extent and nature of tax noncompliance based on evidence from unaudited tax returns. This evidence is derived from the relationship between reported charitable contributions and reported taxable income from various sources such as wages and salaries, self-employment, nonfarm small-business and farm income, and is based on the assumptions that the source of one's income is unrelated to one's charitable inclinations and that the ratio of true income to taxable income does not vary by income source. We find that the implied amount of noncompliance on non-wage-and-salary income is substantial and that it varies among these sources of income as well as between positive and negative values of each type of income. On average, reported positive self-employment, nonfarm small-business and farm income must be multiplied by a factor of 1.54, 4.54 and 3.87, respectively, in order to obtain true income. Even those individuals who report zero income for a specific income source, but file the schedule for that source, are estimated to have true positive income. Finally, those households that report negative schedule income may actually have greater true income than those households that report positive income.

1. Previous Literature

Accurate measurements of tax noncompliance are difficult to come by because, not surprisingly, tax noncompliance is an act that is meant to be concealed. Past studies on noncompliance can be divided into two groups, those that estimate noncompliance directly based on audits of tax returns and those that estimate noncompliance indirectly from household survey data. The review of past literature that follows will serve as

background for our own study, the first that is based on an examination of unaudited tax returns.

1.1. *TCMP-based Estimates*

The most comprehensive direct measurement of income tax noncompliance in the US, or in any country, comes from the Tax Compliance Measurement Program (TCMP) of the IRS. Under this programme, the IRS conducted a programme of intensive audits on a large stratified random sample of tax returns approximately every three years from 1963 until 1988.[1] The principal operational purpose of the TCMP was to aid in the construction of formulas known as 'discriminant functions' (DIF) that were used to ascertain the likelihood that a tax return understated taxable income and to help determine which returns will be subject to audit. The TCMP data was also the basis of a series of 'tax gap' studies that attempted to estimate the magnitude and nature of tax noncompliance.

The TCMP-based tax-gap studies paint a stark contrast between high tax compliance rates associated with wage and salary income and much lower compliance rates associated with other sources of income such as from self-employment and other small businesses, including farms. The main difference between wages and salaries and the sources of income that show significant noncompliance is that the former is subject to information reporting and withholding, while the others generally are not. Noncompliance is facilitated when income is self-reported and can more easily be concealed as compared to the case when there is a second party involved (e.g., the employer) other than the taxpayer.

As shown in the first column of Table 1, the IRS (1988*a,b*) estimated that in 1987 the percentage of wages and salaries that was voluntarily reported – the 'voluntary reporting percentage', or VRP – was 99.5% for income from wages and salaries. In contrast, this ratio was just 42.1% for partnership and S corporation income,[2] only 13.1% for informal suppliers, and 50.9% for other (i.e., not informal) nonfarm proprietor income. The most recent IRS study (IRS, 1996) was based on the 1985 and 1988 TCMP and a 1988 TCMP survey of nonfilers. The results are summarised in the second column of Table 1. In 1988, the estimated VRP for wages and salaries was 99.1%, for interest income it was 97.7% and for dividends it was 92.2%. In contrast, the VRP for informal supplier income was 18.6%, for nonfarm proprietor income was 67.7% and for partnership and small business corporation income it was 92.5%.[3]

Christian (1994) estimates the rate of compliance in 1982, 1985, and 1988, not by source of income but by categories of taxpayers based on IRS examination classes. Classification of returns for audit examination purposes is based on the largest source of income on the return and certain other characteristics. He finds that in 1988, the voluntary compliance level (VCL, similar to the VRP concept discussed previously) for business returns was 79.9%, compared to 94.5% for nonbusiness returns. Among business

[1] A data gathering effort, known as the National Research Program, collected similar data for the 2001 tax year.

[2] S corporations are businesses that are organised as corporations but are not subject to the corporation tax and instead taxed as pass-through entities similar to partnerships. They are mostly small businesses because of the restriction that an S corporation have no more than 75 shareholders (35 before 1996).

[3] The VRP of 18.6% for informal supplier income is consistent with the earlier VRP estimate of 13.1%. But the later estimates for nonfarm sole proprietor income and partnership and small business income suggest much lower noncompliance rates than the 1988 report does.

Table 1

Voluntary Reporting Percentage (VRP) and Gross Tax Gap Estimates by Underreporting Gap Component for Tax Years 1987 and 1988

	TY 1987		TY 1988	
	VRP (%)	Gap ($billions)	VRP* (%)	Gap ($billions)
Nonbusiness Income		15.7		15.7
Wages and Salaries	99.5	1.4	99.1	2.7
Interest Income	94.6	3.2	97.7	1.1
Dividends	†	†	92.2	1.3
State Income Tax Refunds	95.2	0.1	99.2	<0.05
Alimony Income	71.0	0.2	86.7	0.1
Pensions and Annuities	98.4	0.1	96.0	1.4
Unemployment Compensation	89.1	0.3	93.1	0.1
Social Security Benefits	96.7	†	95.8	0.1
Capital Gains	88.3	6.7	92.8	3.2
Income from Sales of Bus. Property	§	§	72.0	0.6
Other Income	§	3.6	75.3	5.1
Business Income		32.6		31.3
Nonfarm Proprietor Income	50.9‡	16.6	67.7	14.4
Informal Supplier Income	13.1‡	7.7	18.6	10.8
Farm Income	§	1.9	67.8	1.7
Rents and Royalties	§	3.1	82.8	2.0
Partnership and S Corp. Income	42.1‡	3.2	92.5	2.4
Offsets to Income		6.1		7.2
Adjustments	106.3	0.5	102.0	0.2
Deductions	104.4	3.5	104.4	4.3
Exemptions	104.2	2.0	104.5	2.7
Tax Credits	§	0.9	140.2	4.1

Notes. The VRP is the ratio of the total amount of income or other related items that are voluntarily reported to the corresponding correct amount, expressed in percentage terms.

*The IRS reported this information as Net Misreporting Percentage (NMP). The NMP for a given tax return line item is defined as the ratio of the net misreported amount in the taxpayer's favour to the sum of the absolute values of what should have been reported, expressed in percentage terms. For income items the VRP value corresponds approximately to 100 minus the NRP. For offsets, the VRP corresponds approximately to the NMP plus 100. The denominators of the two methods are defined differently. The NMP denominator is the sum of the absolute values of the amounts that should have been reported whereas the VRP denominator is the sum of the algebraic values of the amounts that should have been reported. Thus, the two denominators will be equal only for line items where the amounts that should have been reported are either all positive or all negative.

†Denotes that the item is combined with item above.

§Denotes not reported.

‡Denotes that the figure was not reported in IRS (1988*a*), but was calculated by the authors from other information reported there.

Source: IRS (1988*a*), Tables I-1 and I-2 and IRS (1996), Table 7.

returns, the lowest VCL of 63.9% was for those nonfarm self-employed (Schedule C) filers with total gross receipts less than $25,000. The VCL is generally higher for businesses with higher reported receipts. In addition, business activities traditionally associated with cash income have lower than average VCLs (e.g., transportation and retail trade, with VCLs in 1988 equal to 68.9 and 67.8, respectively), and activities with relatively little cash income (e.g., real estate and wholesale trade, with 1988 VCLs of 84.4 and 82.8, respectively) have higher VCLs. According to Christian (1992), over 30% of the unreported tax detected in the 1988 TCMP examinations of individuals came from sole proprietors, which comprised only 5.5% of the returns filed. Moreover, there was $31.3 billion of underreported business income, compared to $15.7 billion for nonbusiness income.

Klepper and Nagin (1989) used the 1982 TCMP data to compute the compliance rate for all returns for major line items on the income tax return. They find that wages, salaries, tips etc. show nearly perfect compliance (99.9%) while nonfarm self-employment, small business and farm incomes show compliance rates of 67.6%, 25.6% and 51.6%, respectively.

In summary, a consistent finding of studies based on audited income tax returns is the much higher rate of compliance for wages and salaries compared to income sources not subject to information reporting and withholding. There is, though, a basic problem with using audit-based data like the TCMP to estimate noncompliance of non-wage-and-salary income because there are sources of income that even the most intensive audit would have difficulty in detecting, such as cash transactions. There are estimates of this additional, undetected income based on an IRS study of a subsample of the 1976 TCMP survey of individual filers. That study found that, on average, for every dollar of underreported income detected by TCMP examiners without the aid of third-party information documents, another $2.28 went undetected. For this reason, the IRS augments the TCMP with estimates of underreported income by use of a 'multiplier' of 3.28 to expand amounts of unreported income detected in the TCMP without the aid of information documents. The multiplier methodology highlights that the estimated noncompliance rates derived from the TCMP studies are largely based on evidence from supplementary analyses that have nothing to do with the random intensive audits that are the hallmarks of the TCMP and are subject to considerable methodological uncertainty. Both because the TCMP-based analyses are imperfect tools for measuring tax noncompliance and because TCMP-type data are not available in most countries, it is worthwhile developing other methods of measuring noncompliance.

1.2. *The Consumption-based Approach*

Pissarides and Weber (1989) pioneered an intriguing way to estimate taxpayer compliance of the self-employed without relying on special tax audit programmes. Using data from the UK, they estimate food expenditure equations conditional on household characteristics and recorded incomes, differentiating between self-employed and otherwise-employed households. Assuming that self-employed households have the same preferences regarding food as regular employees and that the noncompliance rate among employees is negligible, differences by employment status in the estimated relationship between reported income and food expenditures may be attributed to underreporting of income by the self-employed.

Using the approach outlined above, Pissarides and Weber (PW) estimate that income underreporting of British self-employed in 1982 was approximately 35%. In a follow-up study of the UK, Baker (1993) estimates a range of income underreporting between 17 and 33%. Johansson (2000) applies the PW method to Finland, and concludes that self-employment income in that country is underreported by 25 to 30%. Schuetze (2002) applies the PW method to a pooled data set comprised of six years of Canadian Family Expenditure Surveys and estimates that noncompliance for households with 30% or more of their income from self-employment is approximately 17%. He finds that the degree of noncompliance by the self-employed varies significantly by occupation, age, and the number of household members self-employed. Lyssiotou *et al.* (2004) build

upon the PW methodology and propose a complete demand system approach for the estimation of the size of the black economy from British cross-sectional individual household data. Their methodology avoids the potential bias from confusing preference heterogeneity with underreporting effects in consumer demand that arises because self-employment income may not be spent in the same way as income from other sources. The authors estimate that self-employment-related black economy activities in the UK amounted to 10.6% of GDP in 1993.

The PW study of the self-employed in the UK and subsequent studies using the PW approach conclude that there is significant underreporting by self-employed individuals in many countries. To our knowledge, the PW methodology has yet to be applied to US data.

Although it is the inspiration for the research we discuss below, the PW methodology has certain limitations. Most importantly, it does not allow an examination of noncompliance rates by detailed sources of income that are subject to different enforcement regimes, due mostly to the lack of highly differentiated source-of-income data in household expenditure surveys. In what follows, we adapt the spirit of the PW approach and apply it to a US setting, extending the methodology to data from unaudited income tax returns in order to estimate noncompliance rates for various income sources among US taxpayers.

2. Methodology and Data

Rather than using food expenditures from a household expenditure study, we focus on charitable cash contributions as reported on a sample of actual income tax returns. Controlling for income, relative tax price and other demographic characteristics of taxpayers, we estimate the relationship between charitable contributions and reported income, depending upon the source of income. Assuming that the source of one's income is not correlated with one's charitable inclinations, any difference in the relationship between charitable contributions and income earned from different sources (e.g., wages versus self-employment income) can be attributed to (relative) underreporting by the taxpayers that receive non-wage-and-salary income.[4]

We use tax return data obtained from the Internal Revenue Service 1999 Statistics of Income Public Use Data. The data contain 128,740 records stripped of identifying information and compiled from a stratified sample of the 122.4 million federal income tax returns filed for the tax year 1999. Weights equal to the inverse sampling probabilities are provided. The sample we use contains 76,647 tax returns in which the taxpayer itemised their deductions, rather than taking the standard deduction, from whom we can obtain information on charitable contributions, a deductible activity.[5]

[4] We return later to further examine this central assumption of our approach.

[5] The data contain an additional 3,368 observations for households that are filing for years other than 1999. These observations are dropped. To protect the identity of individuals, the IRS partially disguises data using a method called 'blurring'. In order to blur a specific variable, the IRS sorts the data in descending order by this variable, and then, for every three records, calculates the average of the variable and replaces each of the three records with this average. The IRS performs this blurring procedure on state and local income tax deductions, salaries and wages, real estate tax deductions and net receipts, and other variables. Following Slemrod (1985), we exclude married taxpayers filing separately due to the possibility that their inclusion may bias estimated income and price elasticities.

There are many advantages to using tax return data to study relative tax compliance. First and foremost, tax return data allow us to distinguish between multiple sources of income and to recognise that any given taxpayer may earn, for example, both wage income and self-employment income. Moreover, in addition to self-employment income, tax return data also allow us to investigate noncompliance rates of other sources of income such as capital gain/loss, rental real estate, royalties, partnerships, small-business income, trusts and farm income. Finally, these data allow us to investigate whether the underreporting behaviour of positive and negative reported values of income conveys systematically different information about noncompliance.[6] In addition, our data set enables us to differentiate between those individuals who have zero self-employment income with no opportunity for evasion, and those who report zero self-employment income with opportunity for evasion. We are able to differentiate between two such individuals because a self-employed person must file a Schedule C (for self-employment income) even if income happens to be zero for the tax year. This person almost certainly has different opportunities for evasion than an individual who does not own his or her own business and, for that reason, also has Schedule C income equal to zero. This applies equally to the other separate tax return schedules.[7]

There are also, to be sure, some disadvantages to inferring noncompliance based upon the relationship between reported income and charitable contributions rather than expenditures on food. Information on charitable contributions is only available for those individuals who itemise deductions on their tax return and, because it is deductible, its relative price varies across taxpayers. Thus, we must control for the relative price of charitable giving.

A second problem arises because of the potential interrelationships of tax compliance across income sources. Klepper and Nagin (1989), using data from the 1982 TCMP, conclude that taxpayers appear to allocate their noncompliance across line items to minimise expected penalties. They find that taxpayers avoid extreme noncompliance in one specific category on the tax return and appear to recognise the influence of noncompliance on one line item on the other line items.

The PW methodology relies on the assumption that food expenditure is reported accurately, but this may not be as tenable with regard to charitable contributions reported on tax returns. Slemrod (1989) presents summary statistics from the 1982 TCMP on reported charitable contributions and auditor-adjusted charitable contributions by income class. He shows that the total net downward adjustment in reported charitable contributions over all income classes amounted to 7.2% of reported contributions. Although the average downward adjustment per return increases with income, the relative extent of downward adjustment is, for the most part, sharply decreasing with income. The misreporting of charitable contributions is a problem for

[6] Pissarides and Weber (1989) do not discuss the possibility that reported income is negative but this occurs often for certain income sources.

[7] The estimated equation does not include a dummy variable for having filed a Schedule D. This is because for the other invisible income sources we are able to distinguish between a household that files a schedule and just happens to have zero income for the year, and a household that reports zero and did not file the schedule. We are not able to make this distinction for Schedule D income because there is no obligation to file a Schedule D if no capital gains are received.

our analysis if self-employed individuals, for example, on average, misreport more than others.[8] There is, though, no evidence to support this. Thus, to the extent that taxpayers perceive that a high level of reported charitable contributions (perhaps relative to reported income) increases the chance of an audit, individuals who want to hide noncompliance in another line item may understate charitable contributions, or restrain what would otherwise be more overstatement.

Another problem involves possible self-selection into self-employment by individuals who are inherently dishonest in all aspects of their tax returns, because self-employment presents a greater opportunity to understate income. In this case there would be a negative relationship between reported self-employment income and charitable contributions, the first being understated and the latter being overstated. It is worthwhile to note that given that a 'large' ratio of charitable contributions to reported income may trigger an audit, overstating charitable contributions may not be an optimal strategy, even for the inherently dishonest person.[9]

2.1. *Model*

Consider a one-period model in which charitable contributions, G, are a function of true income, Y, and a vector of other variables, $\mathbf{Z}$, which includes demographic variables and the tax rate-dependent relative price of charity with respect to ordinary consumption, so that

$$G = G(Y, \mathbf{Z}). \tag{1}$$

Now, divide true income into two categories. One category, V, for visible income, is always reported truthfully, perhaps due to the effectiveness of information reports and withholding. The other category, I, for invisible income, is more difficult to monitor and may thereby be underreported. Thus, total true income is given by

$$Y = V + I. \tag{2}$$

The taxpayer must choose how much of his or her invisible income to report to the IRS, which we denote R. In the classic model of optimal tax evasion due to Allingham and Sandmo (1972), this choice will depend on the individual's risk aversion as well as on the tax rate, the probability of detection and the (form and magnitude of the) penalty for detected evasion. With weak assumptions, one can show that reported income increases as invisible income increases, so that

$$R = R(I), \quad 1 > \frac{\partial R}{\partial I} > 0. \tag{3}$$

[8] If charitable contributions are systematically overstated, this will affect the interpretation of, *inter alia*, the α_1 coefficient estimate: it will measure the income elasticity of *reported* charitable contributions rather than the income elasticity of *actual* giving. However, the overreporting will affect our key points only if the misreporting is systematically related to the source of income. Unfortunately, the TCMP data that are publicly available (broad aggregates and tabulated results of some published analyses – the micro data are not publicly available) are not sufficient to evaluate this possibility.

[9] The director of personal financial services with PricewaterhouseCoopers puts this at approximately 9%. Reported in CBS Market Watch: '15 Ways to Trigger IRS Attention', January 30, 2003, http://netscape5.marketwatch.com/

In our model, we focus on the inverse function of (3) so that

$$I = I(R), \quad \frac{\partial I}{\partial R} > 1, \tag{4}$$

describes the relationship between reported invisible income and 'true' invisible income.

Substituting from (2) and (4) into (1), we have

$$G = G[V + I(R), \mathbf{Z}]. \tag{5}$$

We can further simplify the relationship between true invisible and reported income by assuming that true invisible income is a multiple $k(k > 1)$ of reported invisible income, so that

$$G = G(V + kR, \mathbf{Z}). \tag{6}$$

This formulation can be generalised to accommodate many kinds of invisible income, with potentially different relationships between actual and reported income. Given our assumption that the relationship between reported and true income for each type i of invisible income is linear, we can then postulate a vector of k_i values in the relationship

$$G = G(V + \Sigma_i k_i R_i, \mathbf{Z}), \tag{7}$$

where R_i refers to the i^{th} source of income.

As mentioned above, it is possible for certain income sources to be negative. In this case, it is clear that the simple linear function $I = kR$ will not apply meaningfully to both positive and negative values of R. A value of k in excess of one would imply that an individual understates his or her true negative income. For this reason, we allow for a separate value of k_i for negative values of reported income. We expect that k is less than one when the true invisible income of type i is negative. We denote these coefficients as k_{iP} and k_{iN}, for positive and negative values of income source i, respectively.

Finally, we can separate those individuals who have $R_i = 0$ into two categories, those with and those without an opportunity for misreporting. For the reasons mentioned above, we expect that, on average, true income is not the same for these two categories of individuals. Thus, we construct a variable $S_j = 1$ if an individual files the relevant form, indicating that there is an opportunity to have invisible income and $S_j = 0$ otherwise.

In summary, we estimate k_{ih} and b_j in the following model and interpret the coefficients as measures of noncompliance:

$$\begin{aligned} G &= G(V + \Sigma_{ih} k_{ih} R_{ih} + \Sigma_j b_j S_j, \mathbf{Z}), \\ \text{where } i &= \textit{Schedule } C, D, E \textit{ and } F \\ j &= \textit{Schedule } C, E \textit{ and } F \\ h &= P, N. \end{aligned} \tag{8}$$

Schedule C income includes gains and losses from nonfarm self-employment income, Schedule D income includes capital gains and losses. Schedule E income includes income or loss from rental real estate, royalties, partnerships, S corporations, estates and trusts. Schedule F income includes the profit and loss from farming.

We close this Section by noting an important assumption of the model outlined here, which is that the components of income differ *only* in what fraction of true income is reported to the tax authorities. Two other potential differences deserve special mention. First, the tax code, intentionally or unintentionally, may not correctly measure true real income. For example, if the depreciation rules for rental real estate property are more generous than economic depreciation, what is reported as rental income will be less than true income, even in the absence of any noncompliance. If the ratio of real income to taxable income is a fixed fraction j, then $I = jkR$ and not kR as the model assumes. Thus, the parameters k_i we estimate below are in fact estimates of $j_i k_i$. They reflect how much reported taxable income underestimates true income, to be sure, but some of that understatement reflects noncompliance and some of it reflects perfectly legal understatement. Second, if the true flow of some source of annual income is an indicator of permanent income (or whatever label one puts on the measure of well-being that affects charitable giving), holding the other reported components of income constant, the estimated parameter will reflect this, in addition to the noncompliance-related parameter, k.

2.2. *Data Issues*

Contributions are composed of two types of giving: cash and noncash gifts. Due to the differential tax treatment within the category of noncash contributions, it is impossible to measure the correct tax price of the donation accurately, and for this reason we examine only cash contributions.[10] Total contributions cannot exceed 50% of adjusted gross income (AGI) in a given year, and if they do, the taxpayer can carry forward the excess to subsequent years. We do not restrict charitable contributions to less than the 50% of AGI cap because this provides a more accurate measurement of the actual donations in a given year.[11]

Self-employment and farm income differ from wages and salary in their treatment of Social Security and Medicare taxes (12.4% and 2.9%, respectively). For wage and salary income, employers and employees remit equal amounts of tax. In contrast, individuals with self-employment and farm income are required to remit all of the tax. The amount of earnings reported is thus measured after the employer contribution for employees, but not for self-employed individuals or those that report farm income. We adjust for this differential treatment in taxation by subtracting one-half of the Social Security and Medicare taxes from Schedule C (self-employment) and Schedule F (farm) income.[12]

[10] Noncash contributions are subject to different restrictions based upon the status of the asset as ordinary income property (short-term assets) or capital gain property (long-term assets). Gifts of capital gain property are subject to a cap of either 20% or 30% of adjusted gross income (AGI), depending upon the recipient organisation.

[11] This means that an individual whose contributions reach the cap faces a relative tax price different from an individual whose contributions do not reach the cap, *ceteris paribus*. The price for someone who hits the cap is roughly a weighted average of the price he or she faces this year and discounted future tax prices until the deduction is depleted. The data indicate that less than 1% of itemisers actually reach the limit for total contributions.

[12] For households with both self-employment and farm incomes (1,340 observations), we attribute all of the tax to the larger of the two incomes.

Capital losses in AGI are also subject to a cap of $3,000 ($1,500 if married and filing separately) in a given tax year. The remainder of a loss greater than $3,000 can be carried forward to subsequent years (each year subject to the $3,000 limit) until the loss is exhausted. Because of this restriction, the capital loss included in AGI may not represent actual losses in a given year. In order to obtain a more precise measurement of reported gains and losses, short-term gains and unrestricted losses are added to long-term gains and unrestricted losses. This then becomes our measurement of capital gains (Schedule D) income.[13]

The price variable, *PRICE*, is defined as the after-tax cost to the donor of contributing one dollar to charity. For itemisers, this is equal to $1 - \tau$ where τ is the effective federal marginal tax rate applicable on the first dollar of donations. Because the dataset omits state identifiers for those observations with adjusted gross income (AGI) greater than $200,000, we do not make use of the state marginal tax rate in calculating the relative price of charity. For those subject to the Alternative Minimum Tax (AMT), the price of a dollar of charity is equal to one minus the effective AMT marginal tax rate.

We adopt the standard log-log formulation that allows us to calculate (assumed constant) income and price elasticities directly. As is standard in the literature, the dependent variable is $\ln(G + 100)$, where G is the amount of cash contributions, in order to be able to include in the analysis those individuals who itemise deductions but do not report any charitable contributions.[14] Because we want to estimate each k_{ih} and b_j, the estimation of our model necessarily involves the use of a nonlinear procedure. We estimate (8) for charitable contributions with unweighted nonlinear least squares regressions of the following form:

$$\ln(G + 100) = a_0 + a_1 \ln(V + \Sigma_{ih} k_{ih} R_{ih} + \Sigma_j b_j S_j) + c_1 \ln(PRICE) + c_2 NPEX + c_3 MAR + \varepsilon \tag{9}$$

where *NPEX* is the number of nonpersonal exemptions and *MAR* is a dummy variable for marital status, both of which are standard demographic controls in the literature explaining charitable behaviour.

3. Results

3.1. *Descriptive Statistics*

Table 2 contains weighted sample means and standard errors, where the weights represent the number of taxpayers in the full population that the sampled observations in our data represent. Recall that we look exclusively at taxpayers who would still itemise their deductions even without any charitable contributions. These individuals comprise 29% of income tax returns. Thus, all the statistics refer only to this group of taxpayers. Capital gains income, reported on Schedule D, is the most

[13] This does not include the carryover of previous years' losses.

[14] The key empirical results we report later are not dependent on this procedure, and are qualitatively similar if the dependent variable is $ln(G + 20)$ or $ln(G + 50)$, or even if the dependent variable is $ln(G)$ and the observations for those taxpayers for whom $G = 0$ are dropped from the analysis.

Table 2

Descriptive Statistics

Variable	Unweighted fraction non-zero	Mean	Std. Dev.
V	0.943	79,281.74	259,926.20
I_{CP}	0.233	26,336.89	88,950.76
I_{CN}	0.077	−5,888.08	41,868.05
I_{DP}	0.658	45,635.46	823,148.70
I_{DN}	0.102	−9,914.40	135,131.30
I_{EP}	0.447	56,145.28	367,984.80
I_{EN}	0.180	−13,216.20	183,243.90
I_{FP}	0.014	14,678.56	42,393.45
I_{FN}	0.031	−12,986.13	42,258.06
S_C	0.316	0.216	0.411
S_E	0.680	0.248	0.432
S_F	0.047	0.018	0.134
PRICE	*na*	0.784	0.099
NPEX	*na*	0.893	1.164
MAR	*na*	0.739	0.439

Notes. Probability weighted sample means.
Sample includes only those households who filed for the 1999 tax year and would itemise deductions even in the absence of any charitable contributions. Married households filing separately are dropped.
V: Visible income is equal to the sum of all income other than Schedules C, D, E, and F income.
For $i = C, D, E, F$ and $j = C, E, F$:
I_{iP}: Positive Schedule i as reported to the IRS, zero otherwise.
I_{iN}: Negative Schedule i as reported to the IRS, zero otherwise.
S_j: Dummy variable that equals one if the household filed a Schedule j, zero otherwise.
PRICE: Tax price of charitable donations, equal to one minus the first-dollar marginal tax rate.
NPEX: Number of nonpersonal exemptions granted for dependent children and parents, individuals over 65 and blind individuals.
MAR: Dummy variable equal to one if the observation represents a married household, zero otherwise.

common type of non-wage-and-salary income, reported by 76.0% (32.6% weighted) of itemising households.[15]

Schedules E and C income are reported by 62.8% (24.8% weighted) and 31.6% (21.6% weighted) of itemising households, respectively. Only 4.6% (1.8% weighted) of itemising households report Schedule F income. Approximately 46.2% weighted of income tax returns do not have any income from Schedules C, D, E, or F, while the remaining income tax returns have gains or losses from at least one of these sources.

Table 3 provides striking suggestive evidence in support of the hypothesis that non-wage-and-salary income is understated on tax returns. It reports on the ratio of charitable contributions to AGI by decile of the percentage of AGI that is derived from wages and salaries. Low deciles contain those taxpayers who receive little of their income in the form of wages and salaries and high deciles contain those individuals who have the majority of their income source from wages and salaries. Table 3 reveals that, as the ratio of wages and salary to total income increases, the average ratio of charitable contributions to AGI falls. Indeed, the ratio is generally at least twice as high for the top

[15] The percentage of itemisers who claim capital gains (or losses) is much higher than the general population, where approximately 19% of households claim capital gains (or losses).

two deciles as it is for the bottom two deciles. This pattern holds for both total and cash-only contributions and is consistent with our story that for those individuals with income other than wages and salary, reported income understates true income, resulting in what appears to be higher charitable inclinations. In what follows, we test this hypothesis in a more systematic way.

3.2. *Regression Results*

Columns 1–5 of Table 4 report the results of estimating the model described in Section 2.1. Recall that the null hypothesis for each I_{ih} variable is that the estimated coefficient equals one. An estimated coefficient not significantly different from one implies that we cannot reject that reported income equals true income, that is, there is full compliance.

3.2.1. *Positive income*

Consider first the estimated coefficients on the positive components of income. We can reject the null hypothesis at a 5% level of significance for each of the estimated coefficients on the I_{ih} variables. Using the results from columns 2–4 of Table 4, we can calculate the corresponding compliance percentages by inverting the k_{iP} coefficients. In column 2 of Table 4, we exclude observations with any negative source of invisible

Table 3

Cash and Total Charitable Contributions as a Percentage of Income by Decile of the Ratio of Wages and Salaries to Adjusted Gross Income (AGI) and Alternate AGI

Decile	Cash/AGI	Total/AGI	Cash/Alt. AGI	Total/Alt. AGI
1	3.8	5.8	3.7	5.7
2	3.9	6.0	3.6	5.6
3	2.4	5.0	2.2	4.7
4	2.5	4.1	2.2	3.8
5	2.5	3.6	2.4	3.4
6	2.3	3.2	2.2	3.1
7	2.2	2.9	2.2	2.8
8	2.0	2.7	2.0	2.6
9	1.9	2.3	1.9	2.4
10	2.0	2.4	1.8	2.2

Notes. The deciles were created by first calculating the ratio of wages and salaries to AGI or alternate AGI for each observation and then sorting the ratio in an ascending order. The data were then divided into deciles based on a running sum of the probability weights. The ratios of charitable contributions to AGI and alternate AGI were computed by first calculating the weighted sum of each variable and then taking the ratio of those totals. The lowest deciles contain those taxpayers who have little of their income from wages and salaries, whereas the higher deciles contain those individuals who have the majority of their income source from wages and salaries.

It is possible for the ratio of wages and salaries to AGI to be greater than one if one or more components that make up AGI are negative. Moreover, because of possible offsetting positive and negative income sources, a ratio equal to one appears to represent only wage income, while, in reality, there can be multiple invisible income sources for the observation.

Alternate AGI is calculated by subtracting Schedules C, D, E and F income from AGI and then adding back in the absolute values of these numbers. In the case where Schedules C, D, E and F incomes are all positive, then alternate AGI equals AGI.

Table 4

Estimated Regression Coefficients

	(1)	(2)	(3)	(4)	(5)	(6)
ln *(true income)*	0.504	0.571	0.595	0.606	0.595	0.504
	(0.036)*	(0.005)*	(0.004)*	(0.004)*	(0.005)*	—
I_{CP}		1.718	1.597	1.539	1.285	1.407
		(0.089)**	(0.070)**	(0.074)**	(0.089)**	(0.078)**
I_{DP}		0.903	0.901	0.895	0.901	0.935
		(0.014)**	(0.010)**	(0.010)**	(0.011)**	(0.042)**
I_{EP}		5.808	4.672	4.544	4.091	7.402
		(0.239)**	(0.155)**	(0.154)**	(0.164)**	(0.255)**
I_{FP}		6.316	4.674	3.868	4.32	4.673
		(1.081)**	(0.702)**	(0.691)**	(0.829)**	(0.885)**
I_{CN}			−0.569	−0.279	0.291	−0.108
			(0.391)	(0.381)	(0.412)	(0.401)
I_{DN}			−4.022	−4.058	−3.937	−4.33
			(0.710)**	(0.714)**	(0.770)**	(0.906)**
I_{EN}			−3.556	−3.354	−3.569	−5.888
			(0.311)**	(0.310)**	(0.327)**	(0.487)**
I_{FN}			−3.842	−3.036	−1.808	−4.33
			(0.894)**	(0.918)**	(1.177)	(1.222)**
S_C				5,776.8	6,684.6	−881.4
				(2,255.5)*	(2,316.2)*	(1,089.1)
S_E				13,563.5	12,340.3	−3,596.4
				(3,410.8)*	(3,342.2)*	(2,196.0)
S_F				34,860.8	35,527.9	568.1
				(14,699.0)*	(15,188.0)*	(8,725.0)
I^2_{CP}					0.657	
					(0.180)*	
I^2_{CN}					2.250	
					(1.290)	
I^2_{DP}					−0.002	
					(0.000)*	
I^2_{DN}					0.494	
					(1.130)	
I^2_{EP}					0.406	
					(0.079)*	
I^2_{EN}					−0.071	
					(0.038)*	
I^2_{FP}					−0.180	
					(0.103)	
I^2_{FN}					0.566	
					(0.384)	
log*(PRICE)*	0.360	−0.148	−0.178	−0.205	−0.224	−0.289
	(0.231)	(0.039)*	(0.031)*	(0.032)*	(0.032)*	(0.032)*
NPEX	0.004	−0.018	−0.014	−0.013	−0.013	−0.012
	(0.017)	(0.007)*	(0.005)*	(0.005)*	(0.005)*	(0.005)*
MAR	0.386	0.504	0.506	0.505	0.514	0.570
	(0.047)*	(0.021)*	(0.018)*	(0.018)*	(0.018)*	(0.017)*
constant	0.76	0.136	−0.315	−0.485	−0.346	0.778
	(0.345)*	(0.061)*	(0.049)*	(0.058)*	(0.061)*	(0.020)*
Observations	6,349	43,336	76,647	76,647	76,647	76,647
R-squared	0.14	0.33	0.34	0.34	0.34	0.33

Notes: Unweighted non-linear least squares estimation. Robust standard errors in parentheses.
Dependent variable is log of charitable contributions plus 100.
Column 1 contains those observations with only wages and salaries. Column 2 contains those observations with wages and salaries and positive invisible income. Column 3 includes those observations with wages and salaries, positive and negative values of invisible income. Column 4 is similar to column 3 but includes dummy variables for filing a schedule. Column 5 includes quadratic terms for the invsible income variables. Column 6 restricts the coefficient on *log(income)* to equal 0.504 (from column 1).
V: Visible income is equal to the sum of all income other than Schedules C, D, E, and F income.
For $i = C, D, E, F$ and $j = C, E, F$:
I_{iP}: Positive Schedule i as reported to the IRS, zero otherwise.
I_{iN}: Negative Schedule i as reported to the IRS, zero otherwise.
S_j: Dummy variable that equals one if the household filed a Schedule j, zero otherwise.
PRICE: Tax price of charitable donations, equal to one minus the first-dollar marginal tax rate. *NPEX*: Number of nonpersonal exemptions granted for dependent children and parents, individuals over 65 and blind individuals. *MAR*: Dummy variable equal to one if the observation represents a married household, zero otherwise.
**Significantly different than one at 5%.
*Significantly different than zero at 5%.
All coefficients on the squared terms are multiplied by one million.

income. In column 3, we allow for negative income but exclude the dummy variables for filing a particular schedule. Finally, in column 4, we estimate the full model, including positive and negative income sources and schedule dummies. We interpret the majority of these coefficients as evidence that true income is understated relative to wage and salary income. For positive self-employment, Schedule E and farm income, compliance is estimated to be substantially less than 100% because the estimated value of k_{iP} is statistically greater than one. For example, the coefficient of 1.54 on positive self-employment income in column 4 corresponds to a 64.9% compliance rate. Farm income is estimated to have a compliance rate of 25.9% and Schedule E income has an estimated coefficient of 4.54, which corresponds to the lowest compliance rate in this study – 22.0%.[16]

While we cannot make direct comparisons to the compliance rates calculated from the TCMP studies – because these studies do not differentiate between compliance rates for positive and negative income sources – we do observe that the magnitude and ordering of estimated compliance rates are roughly similar to those reported in the TCMP-based study of Klepper and Nagin (1989) and the 1969 TCMP estimates reported in Clotfelter (1983). As they did, we find that among the invisible income sources, the highest compliance rate is for self-employment (Schedule C) and the lowest is for Schedule E income.

The one exception to the pattern of results pertains to Schedule D income, for which the estimated coefficient on the positive schedule income is less than one. We do not, though, interpret this coefficient as evidence of an overstatement of true capital gains income. Because sales of capital assets with capital gains or losses do not represent an accrual of income in that year, *a priori* we would expect capital gains income to have a relatively small effect on charitable contributions. The estimated coefficient thus reflects two offsetting effects. For positive capital gains income, noncompliance leads to an estimated k_{DP} greater than one, while the fact

[16] Schedule E income can be further disaggregated into four components: rental real estate and royalties, small business income, estate and trust income, and partnership income. In results not reported in Table 4, we expanded specification (4) to disaggregate Schedule E income in this way. The estimated coefficients on positive income were 2.49, 4.23, 11.41 and 6.80, respectively, with all of these coefficients significantly different from one at the 5% level. These estimates correspond to compliance rates of 40.2, 23.8, 8.8 and 14.7%, respectively.

What we call visible income could be further disaggregated as well. When we do so, an apparent anomaly appears – the estimated coefficients on interest and dividend income (combined or separately) are generally about 20, suggesting compliance rates with respect to interest and dividends of about 5%, which is implausibly low based on all previous evidence. We suspect that this result obtains because interest and dividends are indicators of wealth and permanent income, holding other components of reported annual income constant. This is likely to be especially true for affluent, retired people. Our efforts to confirm this suspicion have met with mixed results. Because we have no data on the taxpayers' age, we cannot restrict the sample to the non-aged; restricting the sample to only those taxpayers who report no Social Security income did not substantially change the results. However, the anomalous result does not obtain in the panel results that will be discussed in Section 4. This is consistent with our suspicion that interest and dividends are an indication of permanent income given measures of annual income, but are less of a signal given more permanent measures of other income. It could also suggest that, holding income constant, wealth affects giving, and capital income is highly correlated with the value of the underlying assets. We are reassured that when interest and/or dividends are treated separately from other visible income, the coefficients on non-visible income that are the focus of the article are not materially changed, so our conclusions with respect to these sources of income are robust to this specification change.

that capital gains income does not represent an actual accrual of income leads to an estimated k_{DP} near zero.

3.2.2. *Negative income*

One innovation of this article is to investigate separately the extent to which noncompliance is associated with reported losses – do they represent true negative income? Columns 3 and 4 of Table 4 show that negative amounts of each of the four income sources have negative associated coefficients, implying that negative reported income is an indicator of true *positive* income.[17] For example, the coefficients from column 4 of −0.28 and −3.04 on negative self-employment and farm incomes respectively correspond to positive $28 of true self-employment income and positive $304 of true farm income for every negative $100 reported. Negative Schedule E income shows the least compliance, with a true income of $335 for every negative $100 reported. As discussed earlier, it is not surprising that the results for capital loss income are idiosyncratic. Noncompliance associated with capital losses would produce a k_{DN} between zero and one, as would the realisation effect discussed above. In this case, both effects work in the same direction.

3.2.3. *Schedule dummies*

The positive coefficients on the dummy variables, S_C, S_E and S_F in column 4 indicate that merely filing one of these schedules is associated with having a certain positive amount of true income. The estimate of this effect varies among the different schedules, from Schedule F at $34,860 to Schedule C at $5,777. We conclude that, on average, the true income of someone who files one of these schedules, but reports no net income, is higher than someone who does not file the schedule at all.

3.2.4. *A quadratic specification*

In column 5 of Table 4, we extend the model by allowing for a quadratic relationship between true and reported income for each income source, such that $I_{ih} = k_{ih}R_{ih} + d_{ih}R_{ih}^2$. A positive coefficient on the squared term implies that as reported income increases, the ratio of true to reported income eventually rises. Likewise, a negative coefficient implies that as reported income increases, the ratio of true to reported income eventually decreases.

The quadratic specification makes little difference for most income levels. However, positive self-employment and farm incomes do begin to show a difference for very large reported income amounts. In Figures 1 and 2, we plot predicted true income over a range of reported incomes for each of the two model specifications, respectively. In Figure 1, true income is assumed to be a constant multiple of reported income. Note

[17] The log-log specification does not allow for the term inside the right-hand side log to be nonpositive for any observation. Thus, in order to verify that the negative coefficients are not simply an artifact of the estimation procedure, we also estimated the model using a tobit specification where the income terms enter linearly,

$$C = \max\ (100,\ \alpha_0 + \beta_1 V + \beta_1 \Sigma_{ih} k_{ih} R_{ih} + \Sigma_j \beta_j S_j + \varepsilon) \text{ where } \varepsilon | X \sim N(0, \sigma^2).$$

While quantitatively the estimates of the k_{ih} coefficients differ from the original specification, the coeffcients on the negative income sources are negative in the tobit specification as well.

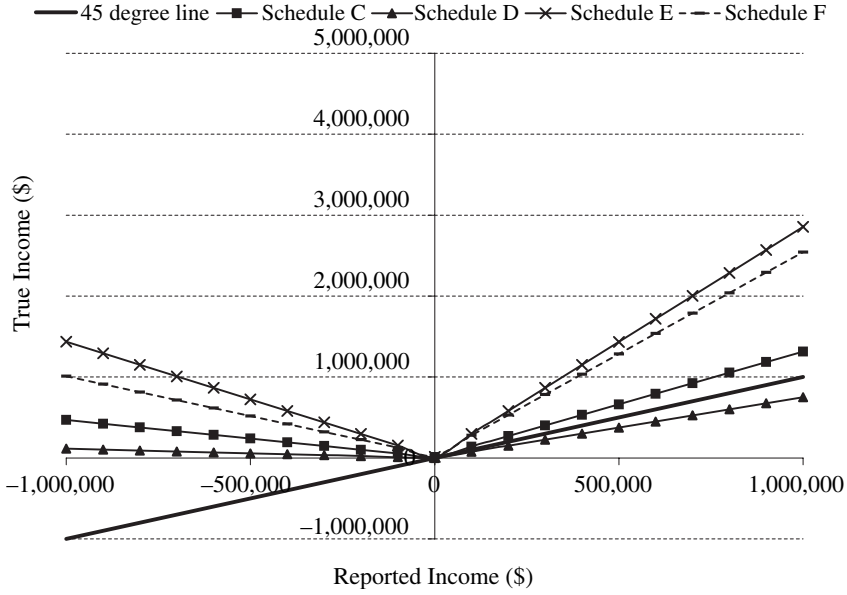

Fig. 1. *Estimated True Income versus Reported Income, Model 1*

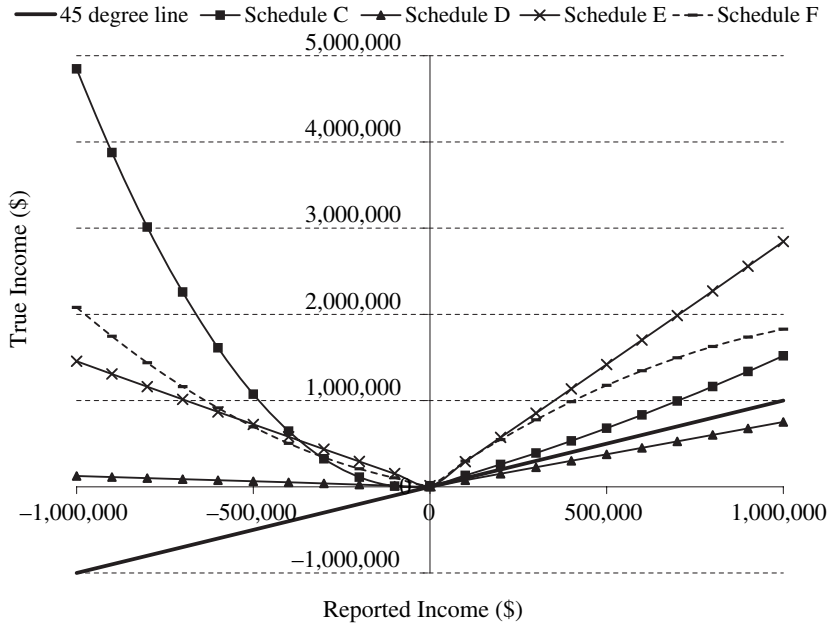

Fig. 2. *Estimated True Income versus Reported Income, Model 2*

that Figure 1 implies that it is possible for two individuals, one with positive and one with negative reported self-employment income, to have the same true income. We can see from the Figures that, other than capital gains income, the predicted true income is

everywhere above the 45-degree line, illustrating that any amount of reported income corresponds to a higher amount of true income. The Figures also show that negative reported income is associated with positive true income. The quadratic specification in Figure 2 shows that for reported self-employment and farm income above $400,000, estimated true income is more than that in the first model. In fact, predicted true self-employment income is over 21% greater in the second model than the first model for a reported income of $1,000,000.

3.2.5. *Other coefficients*

The coefficient on the log of the price of charity, $(1 - \tau)$, implies that holding income constant, a decrease in the marginal tax rate (hence, increasing the price) leads to a decrease in charitable giving. Using the central specification from column 4, we find a price elasticity of -0.21, which is on the low side of other estimates obtained from cross-sectional data. Clotfelter (1985) and Steinberg (1990) summarise a multitude of studies of tax incentives on personal donations. In general, they find that most studies using cross-sectional income tax data estimate a price elasticity of charitable giving of at least one in absolute value, with most estimates ranging from 1.17 to 1.70 in absolute value. Steinberg (1990) reports that price elasticities estimated with aggregate panel or time series data centre on -0.40. Our estimated price elasticity is on the low side of even these studies. This could represent misspecification bias in studies that do not allow for the relationship between charity and income to depend on the source of income.

The coefficient on the log of true income – the estimated true income elasticity – is 0.61 in column 4. This is consistent with the majority of estimates of income elasticity, which are generally less than one in magnitude and range from 0.30 to 0.80, according to Steinberg (1990). The coefficient on the dummy variable for married taxpayers shows that married couples give 66% more charitable contributions than unmarried households holding other variables constant.[18] This is consistent with past literature that has shown that married households tend to give more than other similar households, although are somewhat lower than what we find; see, for example, Feldstein and Taylor (1976), Lankford and Wyckoff (1991) or Duquette (1999). The coefficient on the variable for number of dependent exemptions is equal to -0.01. Slemrod (1989) estimated a dependent children coefficient between 0.12 and 0.18, and Duquette (1999) estimated a coefficient of 0.1 for dependents. The negative sign on this coefficient implies that individuals give less as the number of nonpersonal exemptions grow. While raising children may alert parents to opportunities for charitable giving, the number of dependents may also place a higher financial burden on a household.

4. Permanent Versus Current Income

Pissarides and Weber (1989) differentiate between the mismeasurement of the right-hand side income variables that results from the use of current income rather than

[18] Note that $\log C$ increases by 0.51 for married individuals, which amounts to a 66% increase in charitable contributions.

permanent income and the mismeasurement that results from underreporting by self-employed individuals. They assume that the average effect of aggregate shocks to permanent income is the same for self-employed and otherwise-employed people, and they then proceed to estimate a food expenditure equation including a dummy variable for self-employment. Then, with assumptions on the variances of aggregate economic shocks, the extent of underreporting, and the covariance between the two, they are able to derive an estimate of mean underreporting from the estimated coefficient on this dummy variable. Varying their assumptions allows them to put upper and lower bounds on the degree of underreporting.

Because our estimation strategy differs significantly from that of PW, their correction for the two types of mismeasurement is not directly applicable to our model. However, if charitable contributions are a function of permanent income, our use of current income in the estimation may lead to biased estimated coefficients because current income contains both a temporary and permanent component. The problem is more worrisome if different sources of income have different ratios of temporary versus permanent income. The combination of the nonlinear specification along with the multiple misspecified income variables does not allow us to sign the direction of the bias.

To investigate this issue further, we repeat the analysis using the IRS-University of Michigan panel data set for the years 1979 to 1985 in order to obtain annual averages of the key variables. The data contain 5,687 taxpayers that contain full data over the seven years; of those, 1,688 itemised in every year. We obtain an estimate of reported permanent income by calculating the simple average of each household's income by source (in 1985 dollars). We obtain an estimate of permanent charitable contributions by taking the simple average of cash contributions (in 1985 dollars) over those same years for these itemising households. We replace the schedule dummies (S_C and S_F) from the cross-sectional analysis with variables equal to the number of years a household filed the relevant schedule.[19] The remaining variables *NPEX*, ln (*PRICE*), and *MAR* are obtained by taking the simple average of these variables over the seven years of the data. The estimation procedure is otherwise identical to that described in Section 2.

The summary statistics of the panel data are reported in Table 5 and the panel data results are reported in Table 6. We estimate an income elasticity of 0.94, considerably larger than the 0.61 estimated from the single-year cross section. This difference is consistent with the fact that if charitable contributions are indeed based on permanent income, temporary variation in income that is common to both wages and salaries and invisible income would cause a downward bias of the income elasticity coefficient in the single-year estimation.

The estimated coefficient on positive self-employment income is 1.82, corresponding to a 55% compliance rate for self-employment income. This compliance ratio is slightly smaller than that estimated in the cross-sectional results, suggesting that the use of current income biased the ratio upwards (that is, biased the coefficient downwards). In contrast to the larger estimated coefficient on self-employment income, the estimated coefficients on both positive Schedule E and farm

[19] We are not able to include such a variable for Schedule E income due to data limitations.

Table 5

Descriptive Statistics, SOI Panel, 1979–1985

Variable	Fraction non-zero	Mean	Std. Dev.
V	1.000	47,228.8	35,499.4
I_{CP}	0.203	7,239.9	13,680.7
I_{CN}	0.115	−2,159.9	3,341.7
I_{DP}	0.318	5,124.0	13,669.9
I_{DN}	0.132	−1,118.2	2,683.7
I_{EP}	0.193	7,752.6	24,180.4
I_{EN}	0.209	−4,304.7	10,253.5
I_{FP}	0.005	8,513.8	17,459.8
I_{FN}	0.098	−2,696.1	4,3267.7
S_C	*na*	1.205	2.192
S_F	*na*	0.182	1.026
PRICE	*na*	0.703	0.093
NPEX	*na*	1.471	1.161
MAR	*na*	0.843	0.339

Notes. V: Visible income is equal to the average sum of all income other than Schedules C, D, E, and F income.
For $i = C, D, E, F$ and $j = C, E, F$:
I_{iP}: Estimated permanent positive Schedule i, zero otherwise.
I_{iN}: Estimated permanent negative Schedule i, zero otherwise.
S_j: Variable that equals the number of years that a household filed a Schedule j, zero otherwise.
PRICE: Average tax price of charitable donations.
NPEX: Average number of nonpersonal exemptions granted for dependent children and parents, individuals over 65 and blind individuals.
MAR: The fraction of years between 1979 and 1985 that a household was married.

incomes are smaller than those estimated using the single-year cross section. The coefficient of 1.84 on positive Schedule E income and the coefficient of 2.94 on positive farm income correspond to a 55 and 34% compliance ratio, respectively. Table 7 summarises the estimated compliance percentages estimated in this study, as well as those from selected past studies.

A major difference in the seven-year-average results is the coefficients on the negative income amounts for Schedules C, D, and E. The results of column 1 of Table 6 suggest that an individual who reports negative income for these income sources, in fact has negative income, but not as large a loss as reported. For example, for every negative $100 reported of self-employment income, the household is predicted to have negative $67.20. This stands in contrast to the cross-sectional results that predict that an individual with negative reported income has true positive income. Finally, we estimate that for each year of filing a Schedule C (S_C), a self-employed individual has an additional $659. Contrary to this, the estimated coefficient on S_F, the number of years for which a Schedule F (farm income) is filed, is negative. This implies that the greater the number of years a taxpayer reports any farm income, holding the average level of reported income constant, the lower is true income. We suspect that this is because, unlike for self-employment, once a farmer, always a farmer. Thus, for taxpayers who file a Schedule F in any year, years for which no Schedule F was filed indicate that they are not reporting true farming income. For each year that a Schedule F is filed, we estimate that an individual with farm income has, on average, $2,693 less true income.

Table 6

Estimated Regression Coefficients, 1979–1985 *SOI Panel Data*

	(1)	(2)
log*(true income)*	0.944	0.965
	(0.126)*	(0.128)*
I_{CP}	1.818	2.339
	(0.372)**	(0.570)**
I_{DP}	1.259	1.870
	(0.454)**	(0.603)**
I_{EP}	1.836	1.326
	(0.479)**	(0.607)**
I_{FP}	2.936	6.307
	(2.745)	(9.282)
I_{CN}	0.672	−0.287
	(1.335)	(2.136)
I_{DN}	0.773	−1.276
	(0.545)	(2.065)
I_{EN}	0.545	2.460
	(0.498)	(0.548)**
I_{FN}	−5.148	−5.508
	(2.187)**	(3.201)
S_C	659.1	387.1
	(557.2)	(581.0)
S_F	−2,693.4	−2,807.8
	(1,144.9)*	(1,157.8)*
I^2_{CP}		0.013
		(0.009)
I^2_{CN}		−0.097
		(0.157)
I^2_{DP}		−0.069
		(0.066)
I^2_{DN}		−0.012
		(0.004)*
I^2_{EP}		0.028
		(0.023)
I^2_{EN}		0.400
		(0.110)*
I^2_{FP}		−0.078
		(0.260)
I^2_{FN}		−0.068
		(0.194)
log*(PRICE)*	0.982	1.032
	(0.445)*	(0.447)*
NPEX	0.002	0.002
	(0.020)	(0.020)
MARS	−0.056	−0.065
	(0.079)	(0.080)
constant	−3.074	−3.278
	(1.156)*	(1.178)*
Observations	1,688	1,688
R-squared	0.16	0.17

Notes. Unweighted non-linear least squares estimation. Robust standard errors in parentheses.
Dependent variable is log of average charitable contributions plus 100.
V: Visible income is equal to the average of the sum of all income other than Schedules C, D, E and F income.
For $i = C, D, E, F$ and $j = C, E, F$:
I_{iP}: Average positive Schedule i as reported to the IRS, zero otherwise.
I_{iN}: Average negative Schedule i as reported to the IRS, zero otherwise.
S_C (S_F) ranges from 0–7 depending on the number of years that a Schedule C (Schedule F) was filed. *PRICE* is the average price. *NPEX*: Average number of nonpersonal exemptions granted for dependent children and parents, individuals over 65 and blind individuals. *MAR*: Average number years the observation represents a married household.
**Significantly different than one at 5%.
*Significantly different than zero at 5%.
All coefficients on the squared terms are multiplied by 10,000.

Table 7

Estimated Compliance Percentage by Income Source

	Feldman and Slemrod		Klepper and Nagin	IRS	
				TY 1987	TY 1988
	1999 SOI	SOI Panel	1988 TCMP	1982 TCMP	1988 TCMP
Schedule C	65.0	54.9	67.6	50.9	67.7
Schedule E	22.0	54.5	25.6	–	–
Rents and Royalties	40.2	–	–	–	82.8
Partnership and S Corp. Income	14.7	–	–	42.1	92.5
Schedule F	25.9	34.1	51.6	–	67.8

Notes: Percentage compliance is obtained by inverting the k_{ih} coefficient.

Figures 3 and 4 plot predicted true income over a range of reported incomes using the seven-year-average results. In Figure 3, true income is assumed to be a constant multiple of reported income, whereas in Figure 4 we allow estimated true income to have a quadratic relationship with reported income. We can see from the Figures that for positive reported income, predicted true income is everywhere above the 45-degree line, illustrating that any amount of reported income corresponds to a higher amount of true income. Figure 3 also shows that negative reported income is predicted to be a smaller negative number for all income sources other than farm income.

All in all, the analysis of data averaged over seven years corroborates the finding that reported non-wage income is associated with higher average contributions, suggesting that substantial noncompliance exists. The main weakness of the seven-year-average data is the lack of statistical significance among the estimated coefficients, reflecting the smaller sample size used.[20] Other than for positive self-employment income and negative farm income, we cannot reject the null hypothesis that the remaining coefficients equal one, meaning full compliance. Although the averaging methodology reduces any bias introduced by the varying importance of transitory income across types of income, it does not allow us to make as precise estimates of the magnitude of noncompliance.

We pursue one more strategy for dealing with the possibility that measurement error has biased our key results. As reported in column 1 of Table 4, we estimated the basic model over the sample of tax returns of taxpayers that have only wage and salary income, so that the independent variables included only the logarithm of (wage and salary) income, the logarithm of the tax price, the number of dependents, and a dummy variable for marital status. This procedure yielded an estimated income elasticity of 0.504, slightly lower than the estimated income elasticity of the full model described above, and arguably less susceptible to the measurement error bias that arises

[20] Note that the estimated coefficient on the seven-year-average price is positive, contrary to the single-year cross-section result; we are concerned that averaging the prices (and contributions) ignores the bunching incentives created by year-to-year price changes and sacrifices some of the independent variation of price and income.

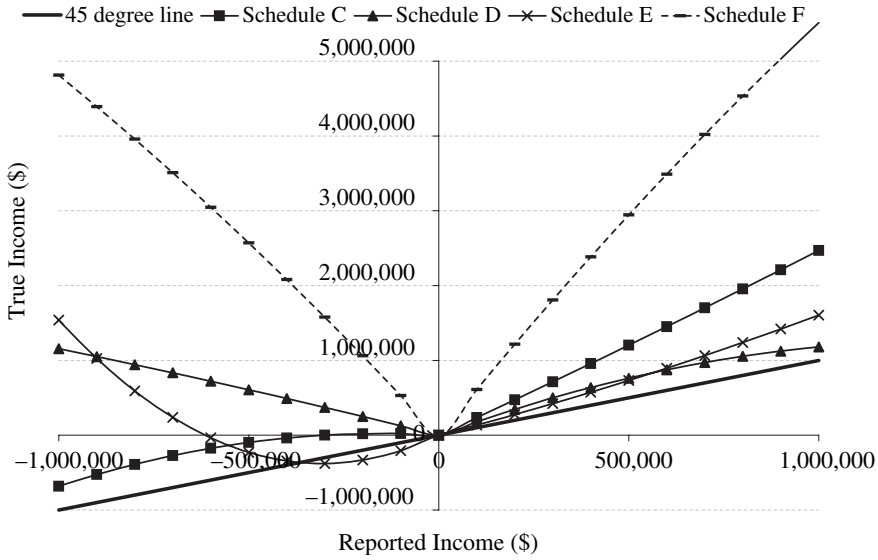

Fig. 3. *Estimated True Income versus Reported Income, Model 4*

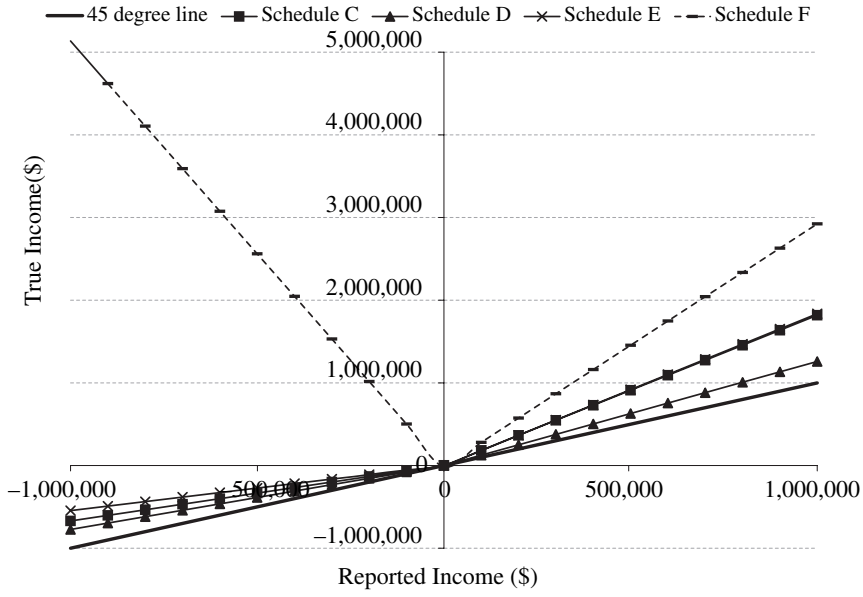

Fig. 4. *Estimated True Income versus Reported Income, Model 3*

from confusing preference heterogeneity for charitable giving with underreporting effects. We then reestimated the full model imposing this elasticity. The results of this estimation are reported in column 6 of Table 4. The estimated parameters of interest

were not substantially changed from what we reported above. This procedure gives us further confidence that our key results are not spurious, but are indicative of differential compliance rates of different sources of income.

5. Discussion and Conclusions

Using evidence from unaudited tax returns, we develop estimates of noncompliance for income sources other than wages and salaries. The estimates rely on three key assumptions: that wage earners truthfully report their income, that the relationship of true income to taxable income does not vary by income source, and that the propensity to make and report charitable contributions at any given level of total true income is not, *ceteris paribus*, associated with the source of income.

We are very comfortable that the first assumption is approximately correct, as it accords with many reputable analyses and the technology available to the IRS of matching individual tax returns to employer-provided wage payment information. The second assumption is difficult to corroborate, although there is certainly no stated intention on the part of legislators to mismeasure, for example, self-employment income – the focus of our study – relative to wage and salary income. We focus on the third assumption below.

If the inclination toward charitable giving is higher among people with non-wage-and-salary income, this would provide an alternative explanation for why charity as a fraction of true income is higher for this group, and some of what we interpret as noncompliance of the self-employed reflects something else. Lyssiotou *et al.* (2004) argue that income from self-employment may not be spent in the same way as income from other sources. They provide the example that households may decide to use their steady wage income on regular non-luxury goods and then use the self-employment income to buy luxuries. Glazer and Konrad (1996) explore the idea that charitable giving is a signal of wealth or income; if this signalling – or the desire to appear more civic-minded – is more important for self-employed people then, controlling for income, we would expect that the individual with a higher fraction of total income from self-employment would have higher charitable inclinations.

We have two responses to this. First of all, while we agree that it is a legitimate concern for household goods, we have no reason to believe that there is heterogeneity in the propensity to contribute to charity based upon the source of income. While all of the non-wage-and-salary income we examine is 'invisible' in that it is much more difficult for the tax authority to detect and monitor, the signalling value of charity certainly differs widely across the different sources of income and the circumstances that apply to the recipients. For example, a salaried person who also moonlights as a housepainter and underreports the latter source of invisible income will not derive any signalling value from charitable contributions, nor would the typical farmer, or a large fraction of the recipients of income from Schedule E, for example. Future research that identifies those situations where charitable giving is dependent upon the source of income or provides a special benefit to the giver would sharpen this analysis but we are doubtful that this phenomenon explains a significant part of our findings.

Second, our argument suggests that a differential propensity to make charitable donations by income source should not appear in data collected in a way where – unlike tax reporting – there is no reward for understating one's income when one can get away with it. To further explore this, we have estimated charity regressions using 1996 data from the Independent Sector's biennial national survey, Giving and Volunteering. The 1996 survey assesses monetary contribution levels from May 1995 to May 1996 for 2,719 households, all of whom were 18 years or older. Respondents were asked a multitude of questions regarding motivations for giving and volunteering, amount of giving, to which organisations they donated time and money, plus a number of demographic questions. The data, and therefore the regression specifications, are not identical to the tax return data. However, using a number of different specifications, we find no evidence that, holding household income constant, the presence of one or both spouses being self-employed is positively associated with charitable giving.[21]

Of course, a differential propensity to consume (food, in their analyses) for employed and self-employed individuals for a given total income as reported in a non-tax-return household survey is exactly the motivating finding of Pissarides and Weber (1989) and the subsequent research in that tradition. The issue rests on the precise circumstances under which someone feels the need to underreport their income. We believe that this incentive clearly exists for reports to the tax authority, and believe it is absent, or at least much less pervasive, with regard to income reported to the Independent Sector, a coalition of nonprofit organisations, foundations, and corporations not connected in any way to the IRS. Thus, the dual finding of an apparent differential propensity to make charitable contributions based on US tax data and the lack of such a finding with US non-tax data is consistent with our interpretation of the results as evidence for noncompliance.

For these reasons, and with the two other unconfirmed assumptions duly noted, we interpret the higher estimated propensity to contribute out of reported non-wage-and-salary income as evidence of underreporting of this type of income. We find that the compliance rate for self-employment income ranges between 55 and 71%, the highest compliance range among the non-wage-and-salary positive income sources. These results obtain for both a single-year cross-section and for seven-year

[21] We regressed total charitable contributions on income, demographics and a dummy variable equal to one if the respondent or his or her spouse was self-employed; zero otherwise. The estimated coefficient on the self-employment dummy was not found to be significant in any of the attempted specifications we examined. Additional details are available from the authors upon request. This type of analysis could be pursued further by analysing other data sets that contain information about household demographics and charitable contributions, such as the Panel Study on Income Dynamics or the Survey of Consumer Finances. We have not pursued this further on the grounds that any analysis of nontax data would be inconclusive because the implications for our study would rest on whether people report their income (and charitable contributions) honestly in nontax data, and whether their response to the survey is in some way affected by how much income they report to the IRS. In our view, it is certainly plausible that someone who is in fact operating a very profitable small business, but has chosen to report little or no taxable income to the IRS, would be reluctant to 'boast' to the surveyor about his or her truly high income. Thus, even if we found the same data patterns as in our tax-return-based study using the nontax survey data (as we do not with the Independent Sector data), it would not be clear what to make of that information. In particular, we do not think it would be compelling enough to 'correct' the tax data gap estimates. A more comprehensive study of tax and nontax data, one that explicitly addresses to what extent the income reports differ between tax reports and surveys for invisible income, would certainly be worth doing, but is beyond the scope of this article.

averages from panel data. We also find, strikingly, that in the single-year cross-section, negative reported income is an indicator of positive true income, although this result does not appear when seven-year average values are analysed, except for farm income, where even persistent losses signal true positive income. In addition, we conclude that merely filing a schedule indicating the presence of some non-wage-and-salary income is associated with having a certain positive amount of true income. These results provide independent evidence that noncompliance is pervasive among income sources that are not subject to information reporting and withholding and show that unaudited tax data can shed light on this phenomenon.

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Submitted: 3 November 2004
Accepted: 7 November 2005

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