NBER WORKING PAPER SERIES

IDENTIFICATION IN TAX-PRICE REGRESSION MODELS: THE CASE OF CHARITABLE GIVING

Daniel Feenberg

Working Paper No. 988

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge MA 02138

September 1982

This is a revision of a paper presented at the NBER/SSRC conference "Micro-Data and Public Economics," St. Catherine's College, Oxford. I would like to thank R.W. Blundell, G.A. Hughes, O. Mitchell and S. Yitzhaki for helpful corrections and advice. The research reported here is part of the NBER's research program in Taxation. Any opinions expressed are those of the author and not those of the National Bureau of Economic Research.

NBER Working Paper #988
September 1982

Identification in Tax-Price Regression Models: The Case of Charitable Giving

Abstract

Recent cross-section studies of the demand for charitable giving, owner occupied housing, capital gains realizations, and the supply of labor hours have been careful to use prices net of income tax levies. The use of after-tax prices in a behavioral equation is a direct consequence of utility maximization under a budget constraint and cannot be objected to. Nevertheless, when most or all of the variance in prices comes from differences in marginal tax rates, questions can arise about the identification of structural parameters. The variables which determine marginal tax rates, chiefly income and marital status, are quite plausible determinants of the behavior being modelled, in addition to any indirect effect they might have through the tax price. A non-linear dependence among the explanatory variables of a linear regression is not a source of bias provided the linear specification is known to be correct. Because the function form of a demand equation is not known a priori, this identification through functional form is not persuasive. In this note we propose an instrumental variable estimation designed to exploit any independent variation present, and which allows unbiased estimates of tax-price elasticities under quite general conditions. The estimator is applied to the demand for charitable giving. The tax-price elasticity of the demand for charitable giving is estimated to be -1.23.

Daniel Feenberg
National Bureau of Economic Research
1050 Massachusetts Avenue
Cambridge, MA 02138

(617) 868-3934

Recent cross-section studies of the demand for charitable giving,[1] owner-occupied housing,[2] capital gains realizations,[3] and the supply of labor hours[4] have been careful to use prices net of federal (and sometimes state) income tax levies. The use of after-tax prices and wages in behavioral equations is a direct consequence of utility maximization under a budget constraint and cannot be objected to.[5] Nevertheless, when most or all of the variance in prices across observations comes from differences in marginal tax rates, questions can arise about the identification of structural parameters in the model. It is not the partial equilibrium nature of these regressions -- inevitable after all with cross section data -- but the functional dependence among the explanatory variables which causes the greatest discomfort. The variables which determine marginal tax rates, chiefly income and marital status, are quite plausible determinants of the behavior being modelled, in addition to any indirect effect they might have through the tax-price. A non-linear dependence among the right-hand side variables of a linear regression is not a source of bias provided the linear specification is known to be the correct one. Because the functional form of a demand equation cannot be known _a priori_ this identification through functional form cannot be persuasive.[6]

In particular, there will not usually be any theoretical basis for excluding polymonial and interaction terms in the included variables. As more of the plausible explanatory variables are included, the tax price will approach perfect colinearity with the remaining variables, yet if many are excluded, the possibility that the tax price is merely proxy for an improperly excluded explanatory variable increases.

In this note we propose an instrumental variable estimator designed to exploit sources of independent variation, which allows unbiased estimation of the tax-price elasticity under quite general conditions. The estimator is applied to the demand for charitable giving. A charitable giving equation is an appropriate test for this procedure because it represents the purest case of a tax-price coefficient. That is, taxes are the sole source of variance in the price. The deduction is also a non-trivial policy issue. In 1977 1.4% of gross income was deducted for this reason, about as much as the capital gains deduction.

Since theory is not likely to govern the selection of functional form, the situation is hopeless unless some independent variation among the right hand side variables can be found and exploited.[7] Such variance is normally present in tax-price regressions, and it arises from the complexity of the tax code. Special provisions, including income averaging, the maximum tax on earned income, the minimum tax on preferences, other deductions, disability income exclusions, etc. all contribute to an apparently substantial departure of the tax-price from perfect dependence on the included right hand side variable. Nevertheless, these special provisions all relate to personal characteristics some of which may have a direct effect on the desire or ability to give to charity.

We use the variation in tax law across the states as a source of variance in the tax-price which is independent of personal characteristics, and therefore not subject to the criticism outlined above. The approach is made possible by the recent (1981) release of individual level tax return files with state identifiers for most taxpayers,[8] and by a program created by the National Bureau of Economic Research for calculating state tax liabilities from individual data. We do not merely replace tax prices based upon federal tax rates with a better number based on federal and state rates. The more comprehensive tax rate might still be correlated with variables improperly excluded from the equation.

Therefore, we propose a new approach using instrumental variables. A suitable instrument must be correlated with the tax price but uncorrelated with any personal characteristics of the taxpayers. One possible instrument would be the subsidy rate in the taxpayer's state of residence evaluated at some fixed level of income and deductions. The instrument used in Section V depends upon the full distribution of income in the Tax Model sample.

The correctness of our instrument depends on two assumptions: first, that state tax laws are independent of personal characteristics, and second, that taxpayers react similarly to state and federal taxes. The practicality of such an estimator depends upon the partial correlation between the instrument and the after-tax price. The standard error of the estimated coefficient will increase in proportion to the inverse of the square root of that correlation. While this correlation is bound to be weak -- state income taxes are only 11% of federal income tax revenues in 1978 -- tax-price coefficients are often extremely significant.

Section II of this paper provides a brief summary of previous cross-section estimates of the demand for charitable giving. Section III is a derivation and justification of the new instrumental variables estimator proposed in this paper. Section IV includes a description of the data but is chiefly devoted to the calculation of state income tax rates from federal tax return data. The estimated demand functions, using the traditional and the new specifications are presented in Section V.

II. The Demand for Charitable Giving

In the United States, charitable donations of cash or assets are deductible from gross income on the Federal tax return, at least for those taxpayers with sufficient total deductions to justify itemizing their deductions. (A standard deduction is alloted to each taxpayer without substantiation.) Similar rules obtain under most state income tax laws. Under a progressive income tax this results in a substantial variance across individuals in the after-tax price of a dollar of charitable giving and opens the way for cross-section studies of the demand for charitable giving.

The seminal study in this area is Taussig (1967). Using a stratified random sample of U.S. tax returns, Taussig estimated a log linear equation for charitable giving as a function of disposable income, the marginal tax rate, and several demographic variables.[9] Separate linear regressions were estimated for each of five income classes. Taussig's remains the only published study to find no significant price effect, largely because later investigators have recognized the simultaneity of income and tax rate.[10] Because the charitable giving affects taxable income, and is therefore at least a partial determinant of the tax rate, the observed tax price is endogenous. This problem is first recognized by Feldstein and Taylor (1976) who substituted a so called "first dollar tax rate", i.e. the tax rate that would have been obtained if the taxpayer had no deductions for charitable giving. Disposable income is subject to the same bias, which is corrected in the identical manner.[11]

Contributions of appreciated assets present an additional difficulty. When an asset is sold only a fraction of the appreciation is included in taxable income, but if it is donated to charity the full market value is deductible from taxable income. Suppose m is the tax rate on ordinary income and mc is the effective tax rate on realized capital gains. Then the proceeds from the sale of an asset with current value V and basis B will be V-mc(V-B). The reduction in tax liability if the asset is donated to charity is mV. The difference in the proceeds to the taxpayer of the two dispositions of the asset, divided by the value to the charity of the asset, is the unit price of the gift. That is, $P_{asset} = 1 - mc(1-B/V) - m$. Although gifts of cash and assets are recorded separately on the tax form the ratio of basis to current value is not available.

Feldstein and Taylor (1976) construct an unexpected price for each taxpayer from a weighted average of the cash and asset prices at a constant value of B/V. The weights are given by the shares of cash and asset gifts in the taxpayers income class rather than the taxpayers own decision. If this were not done the tax price would again be endogenous. Most givers of capital assets also give cash, a behavior which is inexplicable under the assumption that the marginal cost of asset donations is less than that of other gifts. Nevertheless, where the data has been available subsequent studies have followed this lead.

The resulting equation, estimated on 1970 tax return data yields:

$$\ln(G+10) = \underset{(.214)}{-1.933} - 1.285\ln(P) + \underset{(.024)}{.702}\ln(Y-T) + \underset{(.038)}{.341}\,MAR + \underset{(.038)}{.419}\,AGE \qquad R^2 = .406, \quad N = 13{,}770$$

where G is the deduction for charitable giving, Y-T is disposable income, P is the marginal tax-price of giving, MAR is a marital status dummy and AGE equals one if at least one of the taxpayers is 65 or older. Standard errors are shown in parentheses. For this equation B/V is assumed to be .5, although other values yield similar results.

The price coefficient of -1.28 implies that each dollar of lost revenue stimulates more than a dollar of charitable giving, i.e. that it is in some sense "efficient" to allow a deduction for giving. The low income coefficient implies that giving is an inferior good.

Because giving is observed only for itemizers, taxpayers who take the standard deduction are typically excluded from the regression. Since charitable giving influences the decision to itemize, this rule induces some sample selection bias. Clotfelter (1980) suggests including only those taxpayers who would itemize for any level of giving. The resulting selection, based as it is solely on independent variables, does not introduce any bias if the model is otherwise correct.

Essentially all subsequent studies have adopted a constant elasticity specification, with only the minimal changes necessary to adapt it to the available data.

Because 95% of (unweighted) returns with itemized deductions show some charitable giving, the potential problems of a limited dependent variable are avoided. Reece (1979) worked with the Consumer Expenditure Survey. The CES includes data on giving for itemizers and non-itemizers alike, and because the CES sample is not dominated by high-income households it includes many non-givers. Reece uses a Tobit estimator appropriate to this situation and generally confirms the earlier results.

Detailed demographic, consumption and wealth data from the 1963 Survey of Consumer Finance were used by Feldstein and Clotfelter (1976) but this did not much affect the estimated price elasticity of giving, which remained at about minus one in essentially all specifications. Clotfelter (1980) has a seven year panel of tax returns. A panel allows the estimation of separate permanent and transitory income elasticities, a fixed effects model, and a partial adjustment model. All of these equations show considerably lower price elasticities (in the range (-.3) - (-.5)) than did the annual models. Nevertheless, the significance of the price coefficient is established in all studies since the first.

III. An IV Estimator

We assume a true model of the form

$$g = [y,p,w] \begin{pmatrix} \alpha \\ \beta \\ \gamma \end{pmatrix} + \mu$$

where g is charitable giving, y is income,[12] p is the tax-price and w is some (possibly random) function of y. The tax-price has a deterministic part non-linearly dependent on y and a random part independent of such personal characteristics. All three variables are measured as deviations from means. A general nonlinear form for the regression would be much more difficult. This specification restricts p to enter linearly without restricting the form in which any other explanatory variable may enter.[13]

In the absence of any knowledge of w, the simplified regression

$$g = [y,p] \begin{pmatrix} \alpha \\ \beta \end{pmatrix} + e$$

has been estimated. Following the standard demonstration of omitted variable bias yields:

$$\begin{pmatrix}\hat{\alpha}\\ \hat{\beta}\end{pmatrix} = ([y,p]'[y,p])^{-1}[y,p]'[y,p,w] \begin{pmatrix}\alpha\\ \beta\\ \gamma\end{pmatrix}$$

$$\operatorname*{plim}_{T \to \infty} \begin{pmatrix}\hat{\alpha}\\ \hat{\beta}\end{pmatrix} = \begin{pmatrix}\alpha\\ \beta\end{pmatrix} + \gamma\,\delta$$

where δ is the vector of coefficients from a regression of w on y and p. That is, $\hat{\beta}$ is biased to the extent that the price of charitable giving is correlated with an important omitted variable. The direction of bias is unknown.

Let $\tilde{p}_i$ be the mean tax price of giving, over a fixed set of taxpayers subject to the laws of the state of residence for taxpayer i. Therefore $\tilde{p}_i$ takes on one of several values depending upon the tax laws at the residence of the taxpayer but independent of his own income. Nevertheless, it is correlated with his own tax-price, and therefore may serve as an instrumental variable.

The standard instrumental variable estimator is:

$$\begin{pmatrix}\hat{\alpha}\\ \hat{\beta}\end{pmatrix} = ([y,\tilde{p}]'[y,p])^{-1}\,[y,\tilde{p}]'g$$

Substituting for g and noting that μ is uncorrelated with the other variables:

$$\operatorname*{plim}_{T \to \infty} \begin{pmatrix}\hat{\alpha}\\ \hat{\beta}\end{pmatrix} = ([y,p]'[y,p])^{-1}[y,p]'[y,p,w] \begin{pmatrix}\alpha\\ \beta\\ \gamma\end{pmatrix}$$

Factor out w to obtain

$$\text{plim} \begin{pmatrix} \hat{\alpha} \\ \hat{\beta} \end{pmatrix} = ([y,\tilde{p}]'[y,p])^{-1}[y,\tilde{p}]'[y,p,] \begin{pmatrix} \alpha \\ \beta \end{pmatrix}$$

$$+ ([y,\tilde{p}]'[y,\tilde{p}])^{-1}[y,\tilde{p}]'w\gamma$$

$$= \begin{pmatrix} \alpha \\ \beta \end{pmatrix} + \frac{\gamma}{\text{Det}(\ )} \begin{pmatrix} p'\tilde{p} & -p'y \\ -y'\tilde{p} & y'y \end{pmatrix} \begin{pmatrix} y'w \\ \tilde{p}'w \end{pmatrix}$$

By hypothesis plim $(y'\tilde{p})$ and plim $(\tilde{p}'w)$ are zero, therefore:

$$\text{plim} \begin{pmatrix} \hat{\alpha} \\ \hat{\beta} \end{pmatrix} = \begin{pmatrix} \alpha \\ \beta \end{pmatrix} + \frac{\gamma}{\text{Det}(\ )} \begin{pmatrix} p'\tilde{p} & -p'y \\ o & y'y \end{pmatrix} \begin{pmatrix} y'w \\ o \end{pmatrix}$$

$$= \begin{pmatrix} \alpha \\ \beta \end{pmatrix} + \frac{\gamma}{\text{Det}(\ )} \begin{pmatrix} y'w\, \tilde{p}'p \\ o \end{pmatrix},$$

and plim $\hat{\beta} = \beta$ itself, while $\hat{\alpha}$ remains biased

It is usual to suppose that specification error of this kind will affect all of the estimated coefficients adversely. That it does not in this case is due to the hypothesized orthogonality of $\tilde{p}$ to y and w.

Notice that the instrument is not the average price of giving in each state. That depends upon the distribution of income in each state as well as the state law. Since states are known to have different levels of income (and therefore quite different average federal tax rates) this would not be independent of the other explanatory variable. Of course, if states vary in income, it is possible that they vary systematically in their residents' taste for charitable giving. Examination of this possibility is beyond the scope of this paper, but it should be noted that this limited independence assumption is also inherent in the traditional OLS tax-price regression.

IV. State Income Taxes

Out of 51 states (including the District of Columbia), a total of 46 levied some form of personal income tax in 1977. Only Nebraska's simple excise tax on federal liabilities was completely dependent upon the federal definitions of income and deductions. The remaining 45 states all exercised at least nominal independence from the federal definition of taxable income, and of course the bracket rates are quite independent of any coordination. A number of long considered changes in the federal law are already in place in some state tax codes, including inflation indexing, optional separate filing for married couples, vanishing exemptions, full taxation (or complete exemption) of realized capital gains, and complete elimination of personal deductions. Although smaller in magnitude than the federal levy marginal tax rates are definitely non-trivial, ranging up to 14% in New York and over 10% in seven other states.

In 33 states charitable giving is deductible from taxable income, providing a direct tax subsidy smaller in magnitude than the federal incentive but identical in form is provided for such gifts. State subsidy rates are shown in Table 1 for several income levels. The taxpayer is assumed to be filing jointly with federal itemized deductions of $3,200 or 24 percent of income (whichever is larger). The entries show the dollar reduction in state tax liability associated with a $100 increase in giving. The indirect effect of the change in

Table 1

Federal and State Marginal Subsidy Rates for Charitable Giving
at Various Income Levels.
1977 Law is Applied, Other Deductions are 24% of Income
(or $3,200, whichever is greater),
Joint Filing is Assumed

Income	10000.00	15000.00	20000.00	30000.00	60000.00
Alabama	2.49	4.00	3.75	3.40	2.50
Alaska	0.00	0.00	0.00	0.00	0.00
Arizona	2.42	3.80	4.56	5.00	3.68
Arkansas	3.50	4.50	6.00	6.00	7.00
California	2.00	4.00	5.00	8.00	11.00
Colorado	2.90	4.50	6.00	5.44	4.00
Connecticut	0.00	0.00	0.00	0.00	0.00
Delaware	7.06	8.50	8.60	9.05	12.80
D.C.	7.00	8.00	9.00	10.00	11.00
Florida	0.00	0.00	0.00	0.00	0.00
Georgia	2.00	5.00	6.00	6.00	6.00
Hawaii	4.75	6.94	7.78	7.69	9.40
Idaho	5.50	7.50	7.50	7.50	7.50
Illinois	0.00	0.00	0.00	0.00	0.00
Indiana	0.00	0.00	0.00	0.00	0.00
Iowa	4.15	5.60	5.25	5.44	5.50
Kansas	3.32	4.00	3.75	4.42	3.75
Kentucky	4.15	4.80	4.50	4.08	3.00
Louisiana	1.75	1.65	1.59	2.32	1.84
Maine	2.00	4.00	6.00	8.00	9.00
Maryland	5.00	5.00	5.00	5.00	5.00
Massachusetts	0.00	0.00	0.00	0.00	0.00
Michigan	0.00	0.00	0.00	0.00	0.00
Minnesota	0.00	12.00	11.25	10.20	7.50
Mississippi	0.00	2.91	2.91	3.84	3.84
Missouri	2.08	3.60	4.50	4.08	3.00
Montana	5.48	7.04	6.60	6.73	5.50
Nebraska	2.72	3.20	4.00	5.12	8.00
Nevada	0.00	0.00	0.00	0.00	0.00
New Hampshire	0.00	0.00	0.00	0.00	0.00
New Jersey	0.00	0.00	0.00	0.00	0.00
New Mexico	1.00	2.20	3.00	4.50	7.00
New York	5.00	8.00	10.00	14.00	14.00
North Carolina	4.00	6.00	7.00	7.00	7.00
North Dakota	2.49	3.20	3.75	3.40	3.75
Ohio	0.00	0.00	0.00	0.00	0.00
Oklahoma	1.63	3.07	4.19	5.57	4.90
Oregon	6.64	8.00	7.50	6.80	10.00
Pennsylvania	0.00	0.00	0.00	0.00	0.00
Rhode Island	3.23	3.80	4.75	6.08	9.50
South Carolina	4.15	7.00	7.00	7.00	7.00
South Dakota	0.00	0.00	0.00	0.00	0.00
Tennessee	0.00	0.00	0.00	0.00	0.00
Texas	0.00	0.00	0.00	0.00	0.00
Utah	5.60	6.20	5.81	5.27	3.88
Vermont	4.25	5.00	6.25	8.00	12.50
Virginia	0.00	0.00	0.00	0.00	0.00
Washington	0.00	0.00	0.00	0.00	0.00
West Virginia	2.30	2.80	3.20	4.00	6.10
Wisconsin	0.00	0.00	9.10	9.50	10.00
Wyoming	0.00	0.00	0.00	0.00	0.00
Federal	17.00	20.00	25.00	32.00	50.00

federal liability on state taxes is included where relevant. In Minnesota, for example, federal taxes are deductible from state taxable income, this results in a surprising decrease in tax rates at higher incomes. Because the IV estimator uses for variance across states rather than across income classes, the variety of subsidy rates is gratifying. Eight states have rates above 10% for at least some taxpayers, while 18 have zero rates for all residents.

With the partial exception of Feldstein and Taylor (1976) previous studies have neglected the role of state taxes in charitable giving. Notice that both the price of giving and disposable income are affected. Feldstein and Taylor considered only the first; furthermore, the calculation of the marginal rate was crude by comparison with the detailed implementation of the federal law. The effect of either omission on the estimated coefficients is ambiguous because the correlation between state and federal tax rates (which would bias the coefficients away from zero) might overwhelm the pure errors-in-variable tendency to depress coefficients.

As part of NBER's general program in state and local taxation we have prepared Fortran programs for calculating state tax liabilities from federal Form 1040 data, as available to us. In spite of the diversity of state laws, the information on the 1040 is sufficient to model the state laws quite closely. While the tax treatment of individual items may vary across states, in most cases the definitions are those of the federal law. Presumably this stems more from a desire to lean on IRS auditing and document matching than on a universal belief in the correctness of those definitions. In any case, most deviations from the federal definitions occur in calculated quantities rather than the basic data. For example, state income taxes are deductible on the federal return but not on most state tax returns. Nevertheless the state income tax deduction is a separate line on the 1040 and this makes possible an accurate calculation of the state itemized deductions. The major exception to this rule is the treatment of interest on government debt. Interest on state and local debt is not taxed by the federal government and is not shown on the 1040. Treasury debt is not taxed by the states, but neither is it broken out on the federal return. Since essentially nothing is known about the distribution of holdings of these debts no attempt was made to adjust for this discrepancy.

Deductions and credits for local property taxes are a feature of many state income tax laws; this presents no problem. Some states extend these provisions to renters, usually by imputing some fraction of rent to property taxes. (The fraction is independent of the local tax rate, however!) Although rent payments could easily be imputed to taxpayers based on their income, this has not yet been implemented.

The state of residence code is taken from the address field of the tax return and is also subject to error. Taxpayers may move, or work in another state (and be subject to that tax law) or might give the address of a bank or attorney in another state.

The accuracy of the federal tax calculation is readily checked by comparison with the tax liability reported by the taxpayer. These match precisely with a few exceptions. The itemized deduction for state income taxes is not a usable check on the state tax liability, because it records cash payments rather than accrued liabilities. That is, it records this years withholding plus net underwithholding for the previous year. Aggregate estimates (by state) of liability from the 1977 calendar year Tax Model data and the TAXSIM program for each state may be compared to reported aggregate revenues for fiscal year 1978 (Tax Foundation, 1979) to get a rough idea of the accuracy of the calculation. In 25 of 44 states the difference between revenues and estimated liability exceeded one standard error of estimate and 12 exceeded two such intervals. The Tax Foundation has been kind enough to supply worksheets showing the calculation of state income taxes in every state for 8 hypothetical individuals. Aside from the problems mentioned above, these figures match those from TAXSIM.

The reciprocal deductibility of state and federal taxes on federal and state tax returns does not create true simultaneity because the federal deduction is based on taxes paid rather than tax liability incurred. Nevertheless it seemed natural to include the effect on future tax liabilities in the current price of giving. In states that allow a deduction for federal taxes there is a series of consequences of each tax on the other continuing until the taxpayer takes the optional standard deduction. The tax-price model adopted here is:

$$P = (1-t_t) = 1-(t_s + t_f - at_s t_f)$$

where t, s, and f subscripts indicate total, state and federal marginal rates and a equals one or two as the state denies or allows a deduction for federal taxes. The state and federal rates are each composed from separate rates for cash and assets according to the procedure in Section II. This cuts off the series after one go-round, ignores the possibility of discounting future tax reductions, and presumes that this year's federal tax rate is a good proxy for next year's rate.[14]

The average tax rates in each state, for a fixed distribution of income and deduction amounts, are calculated from a single random subset of 383 taxpayers from the main Tax Model file. Separate tax rates for gifts of cash and assets are calculated. They enter as instruments separately.

V. Results

Our basic dataset is a one in ten subsample of the 1977 file. The original file is censored to maintain the confidentiality of possibly recognizable returns and excludes taxpayers with adjusted gross income of more than $200,000. The regression sample is further restricted by the exclusion of taxpayers whose non-charitable deductions are less than the standard deduction, and by the elimination of a handful of taxpayers with non-positive disposable income.

An OLS regression on the new dataset using the conventional specification previously dominant in the literature yields the estimated equation:

$$(1)\quad \ln(G+10) = \underset{(.43)}{-2.83} + \underset{(.04)}{.78}\ln(Y-T) - \underset{(.12)}{.79}\ln(P) + \underset{(.06)}{.55}\,MAR + \underset{(.06)}{.47}\,AGE \qquad R^2 = .19,\quad N = 7102$$

Restricting the model to a sample of married couples less than 65 years old yields equation (2):

$$(2)\quad \ln(G+10) = \underset{(.55)}{-2.99} + \underset{(.05)}{.85}\ln(Y-T) - \underset{(.13)}{.56}\ln(P) \qquad R^2 = .17,\quad N = 5866$$

These price elasticities are substantially less than those reported by Feldstein and Taylor or Clotfelter for similar data and an identical specification. If (1) is modified to include only federal taxes, there is a slight change in the coefficients, but this is not the source of the discrepancy. The addition of records from the National Tax Model with adjusted gross income exceeding $200,000 (without state tax rates) has similarly little effect on the point estimates. It does, however, improve the fit and standard errors to figures close to those reported before.

It is not possible to defeat the price effect by the simple addition of interaction terms and squares (of the continuous variables). That exercise yields the equation:

$$
\begin{aligned}
(3)\quad \ln(G+10) = \;& \underset{(1.85)}{15.2} - \underset{(.36)}{2.8}\, n(Y-T) \\
& + \underset{(.13)}{.392} \ln(Y-T)\cdot MAR - \underset{(.15)}{.01} \ln(Y-T)\cdot AGE \\
& + \underset{(.02)}{.175} (\ln(Y-T))^2 + \underset{(.16)}{.338} \ln(Y-T)\ \text{In}(P) \\
& - \underset{(1.43)}{4.26} \ln(P) + \underset{(.33)}{.072} (\ln(P))^2 \\
& + \underset{(.35)}{.52} \ln(P)\cdot MAR - \underset{(.36)}{.589} \ln(P)\cdot AGE \\
& - \underset{(.19)}{.465} MAR\cdot AGE - \underset{(1.2)}{3.0} MAR \\
& + \underset{(1.4)}{.578} AGE
\end{aligned}
$$

which implies a price elasticity of -1.15 (significant at the 5% level). Adding a proxy for wealth (25 times dividend income plus 12 times interest income) to equation (1) does have a dramatic effect, however:

$$
\begin{aligned}
(4)\quad \ln(G+10) = \;& \underset{(.48)}{2.67} + \underset{(.05)}{.727} \ln(Y-T) + \underset{(.005)}{.081} \ln(W) \\
& - \underset{(.12)}{.26} \ln(P) + \underset{(.06)}{.50} MAR + \underset{(.06)}{.24} AGE
\end{aligned}
$$

Although price remains significant the point estimate is now much smaller than any reported since Taussig.

The instrumental variable equivalent to (1) using as instruments the state tax rates shown in Table 2, is given in equation (5).

$$(5)\quad \ln(G+10) = \underset{(1.28)}{-.77} + \underset{(.14)}{.526}\ln(Y-T) - \underset{(.44)}{1.59}\ln(P) + \underset{(.08)}{.65}\,MAR + \underset{(.07)}{.42}\,AGE \qquad R^2 = .19$$

For the married, less than 65 subset the IV estimate is:

$$(6)\quad \ln(G+10) = \underset{(1.28)}{-.494} + \underset{(.14)}{.56}\ln(Y-T) - \underset{(.46)}{1.63}\ln(P) \qquad R^2 = .16$$

The expected loss of efficiency has more than tripled the standard error on the price coefficient, however the resulting point estimate is significantly different from zero and not significantly different from one. The IV estimates therefore provide rough confirmation of the importance of the tax-price in determining charitable giving.

The wealth proxy almost eliminates the price coefficient in the OLS equation, but in the equivalent IV equation:

$$(7)\quad \ln(G+10) = \underset{(1.1)}{-.309} + \underset{(.14)}{.436}\ln(Y-T) + \underset{(.005)}{.0859}\ln(W) - \underset{(.42)}{1.23}\ln(P) + \underset{(.08)}{.614}\,MAR + \underset{(.07)}{.193}\,AGE \qquad R^2 = .21$$

the point estimate is still quite respectable. Here is the equation for the married and less than 65 years old subset:

$$(8)\quad \ln(G+10) = \underset{(1.24)}{.17} + \underset{(.14)}{.45}\ln(Y-T) + \underset{(.006)}{.08}\ln W - \underset{(.46)}{1.24}\ln(P) \qquad R^2 = .19$$

Life-cycle considerations suggest that the wealth proxy cannot be arbitrarily excluded so equation (4) casts some doubt on the importance of income tax deductability on charitable giving. The IV estimate shows that this impotence is an artifact of the correlation between the wealth proxy and the tax-price.

VI. Conclusion

Our estimate of 1.23 (for equation (7)) as the price elasticity of charitable giving is not significantly different from earlier estimates based on tax return data. Because the IV estimator is robust to many specification errors, including the incorrect choice of functional form or the exclusion of variables affecting tax liability, this result strengthens the belief that taxes are an important determinant of charitable giving in the United States.

This is an expensive procedure, both in time and in statistical efficiency, and in the absence of any evidence for bias in the traditional specification the argument for the general adoption of this technique is weakened. Nor does the result imply anything for tax-price models of labor supply, capital gains realizations, or housing tenure choice. Nevertheless, it represents useful confirmation of a technique -- the tax-price regression -- which has proven extremely valuable in a broad range of public finance issues.

Footnotes

1. Clotfelter (1980), Clotfelter and Steuerle (1981), Feldstein (1976), Feldstein and Taylor (1976), Reece (1979).

2. Rosen (1979), King (1980).

3. Feldstein and Yitzhaki (1978), Feldstein, Slemrod and Yitzhaki (1980).

4. Nakamura (1981), Rosen (1976)

5. Rosen (1976) tests and strongly rejects the use of pre-tax wage rates in a labor supply equation when post-tax wage rates are known.

6. A similar issue affects the interpretation of regressions corrected for sample selection bias through the inclusion of a predicted hazard rate among the independent variables (Hechman 1980). The predicted hazard rate is a function of the remaining independent variables, and its effectiveness as a correction for sample selection bias is based on the a priori assumption that nonlinear terms in the independent variable could safely have been excluded from the uncensored model.

7. The remedy is not simply to adopt a more general functional form. The tax price coefficient may be robbed of its significance if a sufficiently general functional form is chosen including all relevant variables, but such an exercise does not begin to answer the question of which variables belong in the equation and which are merely colinear with them.

8. These files are prepared annually by the Internal Revenue Service (1977) for static simulations of the revenue effects of changes in the tax law. The stratification overrepresents small states and large incomes to achieve this end economically. Essentially everything on the Form 1040 (the basic tax form) is included, together with a few items from each of several supporting schedules. Sample size has ranged from 140,000 to 160,000 returns. These files are available to anyone for a nominal fee from the National Archives.

9. Tax return data are as poor in demographic information as they are rich in income information. The number of dependent children, marital status, and the number of taxpayers (one or two) who are 65 years of age or older are the only items available. Age, race and sex are available in a special 1972 match with Social Security records. This file does not include families with income over $100,000 and it has not, to my knowledge been used in any charity study.

10. Taussig worked with an incomplete version of Tax Model, and this may have played a secondary role in the negative finding.

11. To be strictly correct these first dollar rates should have been used as instruments for the endogenous rates rather than as substitutes. If, as might be expected, the first dollar rates have less variance than the actual rate, then the tax price coefficient is biased up.

12. The generalization to multiple personal characteristics is straightforward.

13. White (1982) discusses the possibility of approximating an unknown nonlinear regression function by a linear regression on a Taylor expansion, but he is not encouraging.

14. It might be a very bad proxy if the taxpayer failed to itemize the following year.

References

Clotfelter, Charles T. "Tax Incentives And Charitable Giving: Evidence From A Panel Of Taxpayers" Journal of Public Economics 13 (1980), pp. 319-340.

_________________ and C.E. Steuerle "The Effect Of The Income Tax On Charitable Giving" Office of Tax Analysis, Mimeo. approx. 1981.

Feldstein, Martin S. and C. Clotfelter "Tax Incentives And Charitable Contributions In The United States" Journal of Public Economics 5 (1976), pp. 1-26.

_________________ and Amy Taylor "The Income Tax And Charitable Contributions" Econometrica 44 (Nov. 1976), pp. 1201-1223.

_________________ and Shlomo Yitzhaki "The Effect Of The Capital Gains Tax On The Selling And Switching Of Common Stock" Journal of Public Economics 9 (1978), pp. 17-36.

_________________, Joel Slemrod and Shlomo Yitzhaki "The Effects of Taxation on the Selling of Corporate Stock" Quarterly Journal of Economics XCIV (June 1980), pp. 777-91

Hausman, J.A. "Specification Tests in Econometrics" Econometrica, Vol. 46, No. 6, (November 1978), p. 1251

International Revenue Service. 1977 Individual or State Tax Model File. Department of the Treasury, Washington D.C. 1970.

King, Mervyn "An Econometric Model Of Tenure Choice And The Demand For Housing" Journal of Public Economics 14 (1980), pp. 137-159.

Nakamura, Alice and M. Nakamura "A Comparison Of The Labor Force Behavior Of Married Women In The United States and Canada..." Econometrica Vol. 49 No. 2, p. 451 (March 1981).

Reece, William S. "Charitable Contributions: New Evidence On Household Behavior" American Economic Review, Vol. 69, No. 1, (March, 1979), p. 142.

_________________ "Tax Illusion And The Labor Supply Of Married Women" Review of Economic Statistics, Vol. 58, No. 2, (May 1976), pp. 167-72.

Rosen, Harvey S. "Housing Decisions And The U.S. Income Tax" Journal of Public Economics, Vol. 11, (1979) pp. 1-23.

Tax Foundation Facts and Figures on Government Finance, Tax Foundation, Washington D.C. 1979.

White, Halbert "Using Least Squares To Approximate Unknown Regression Functions" International Economic Review, Vol. 21, No. 1, February, 1980.