Is charity a homogeneous good?

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Abstract

In this paper I estimate income and price elasticities of donations to six different charitable causes to test the assumption that charity is a homogeneous good. In the US, charitable donations can be deducted from taxable income. This has long been recognized as producing a price, or tax-price, of giving equal to one minus the marginal tax rate faced by the donor. A substantial portion of the economic literature on giving has focused on estimating price and income elasticities of giving as the received wisdom suggests that a price elasticity greater than unity is indicative of the 'treasury efficiency' of the tax deductibility of charitable contributions, as the loss to tax revenue is less than the increase in giving. However, a major limitation of nearly all the previous attempts to identify such effects has been the implicit assumption that charity is a homogeneous good, meaning giving to one type of charity is a perfect substitute for any other and that the cause-specific responsiveness of giving to changes in price and income is equal across those causes. If this assumption is violated, then estimates may be biased and policies designed to increase charitable contributions may be sub-optimal. Results suggest that the tax-price of giving only affects giving to religious organisations and that the income effect is invariant over charitable causes.

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1 Introduction

People are still going to be able to make charitable contributions. It just means if you give $100 and you're in this tax bracket, at a certain point, instead of being able to write off 36 (percent) or 39 percent, you're writing off 28 percent. Now, if it's really a charitable contribution, I'm assuming that that shouldn't be the determining factor as to whether you're giving that hundred dollars to the homeless shelter down the street.
-President Barack Obama

Economists have long been interested in philanthropic behavior and its underlying determinants, producing an extensive literature looking at the effects of the price, income, donor characteristics, government actions, interdependent preferences and recipient behavior on giving. However, despite decades of research on charitable contributions, many issues remain unresolved.

The economic literature on giving has largely focused on the impact of changes in income and price on the decision of how much to give. The question of to whom or what one gives has largely been ignored As a result, nearly all of the empirical work has been carried out with a rather strong implicit assumption; that charity is a homogeneous good. This assumption requires that, all else being equal, giving to one charitable cause, or type of organization, say the Donkey Sanctuary, be a perfect substitute for giving to any other type, the Catholic Church, say.

While the assumption of homogeneity is not necessarily invalid, it should be immediately apparent that it is questionable and, at the very least, should be verified by identifying cause-specific variation in the determinants of charitable giving. The identified motivations for giving are many and it is difficult to make a case for any one motivation or combination being the sole determinant of giving to all causes under all circumstances.

A frequent pursuit of economists in this field has been the identification of the price elasticity of giving. In the US taxpayers do not pay income tax on any declared charitable contributions. One result of Becker's 1974 Pure Public goods model is that a price elasticity in excess of unity is indicative of the efficiency, or treasury efficiency as it is sometimes called in the literature, of the tax deductibility of giving as the foregone tax revenue is exceeded by the increase in aggregate giving.[1] Thus, the total provision of the public good will increase. This concept of treasury efficiency is meaningful only for contributions to non-religious charities as the US government is restricted from funding religious organizations, though this has been challenged to a degree in recent years.[2] The identification of the price elasticity with real policy implications therefore requires the disaggregation of giving into religious and secular components.

Even conventional single equation models of secular giving will offer an incomplete picture of the decision to give if the implicit homogeneity assumption is invalid as the identification of the determinants of aggregate secular giving may hide different effects on giving to different causes. A 'one-size-fits-all' incentive for giving may be sub-optimal in terms of maximizing charitable giving.

Furthermore, if using an aggregate dependent variable, then parameters estimated using the aggregate donations may be biased. Consider the following simple model of charitable giving. Let d_{ji}

[1] If t is the marginal tax rate, and D is the deducted donation, then tax revenue is decreased by tD. The increase in contributions will then exceed tD if

$$\frac{\partial D}{\partial t} > t\frac{\partial D}{\partial t} + D \tag{1}$$

note that $\frac{\partial D}{\partial t} = -(1-t)$
Rearranging gives

$$\left(\frac{\partial D}{\partial (1-t)}\right)\left(\frac{(1-t)}{D}\right) = \left(\frac{\partial D}{\partial t}\right)\left(\frac{t}{D}\right) < -1 \tag{2}$$

The loss in revenue is therefore exceeded by the increase in contributions if and only if giving is price elastic.This exposition of the issue is outlined in Bradley, Holden, and McClelland (2005)

[2] See: 'Mr. Bush's 'Faith Based' Agenda', New York Times, July 8, 2001; 'Obama Upholds Bush's Faith Policy', Los Angeles Times, February 6, 2009

be household $i's$ donation to cause j, y_{it} be household $i's$ income and p_i be the tax-price of giving, one minus the marginal tax rate, faced by household i. Such that total household giving is given by

$$g_i = c + \beta y_i + \gamma p_i + \varepsilon_i \tag{3}$$

and giving to cause j is given by

$$g_{ji} = c_j + \beta_j y_i + \gamma_j p_i + \varepsilon_{ji} \tag{4}$$

The cause specific parameters β_j and γ_j can be treated as the sum of the constrained parameters in equation and an additional cause-specific element, κ_j, such that $\beta_j = \beta + \kappa_j^{\beta}$ and $\gamma_j = \gamma + \kappa_j^{\gamma}$. Total household giving can be obtained by summing over j. Adding and subtracting g_i and re-arranging yields

$$g_i = c + \beta y_i + \gamma p_i + \varepsilon_i + \left[(\sum \beta_j - \beta) y_i + (\sum \gamma_j - \gamma) p_i + (\sum \varepsilon_{ji} - \varepsilon_i) \right] \tag{5}$$

The final term in equation 5 is an extra error component which will be correlated with the regressors if $\sum \beta_j \neq \beta$, $\sum \gamma_j \neq \gamma$ or $\sum \varepsilon_{jit} \neq \varepsilon_{it}$. Note the conditions will not be satisfied in the constant elasticity (log-log) specification commonly used in the literature if charity is a homogeneous good.

Previous estimates of the determinants of cause-specific giving have not been consistent from one study to the next. The estimation procedures used have not accounted for the high proportion of non-donors, unobserved individual effects (Yen 2002), cross-equation correlation (Bradley, Holden, and McClelland 2005) or all of the above (Feldstein 1975b). In this paper I consider a system of censored demand equations to model household donations to six charitable causes using household survey data from the US. To do so, I employ a correlated random effects system of Tobits which accounts for correlation between the regressors and the unobserved individual effects, the large number of non-donors and the correlation across donations to different charitable causes. Advances are made in the construction of the price variable, a function of the marginal tax rate and so correlated with income. Using data on state income taxes and non-cash donations and the exogenous change in the federal tax schedule enacted in 2001 and 2003, I construct price that is essentially uncorrelated with income allowing for identification of the separate effects.

The paper proceeds as follows. Section 2 reviews the theoretical and empirical literature by which the current paper is motivated and in which it is placed. Section 3 describes the data used in the analysis. The econometric approach is outlined in section 4. Results are presented in section 5 and conclusions drawn in section 6.

2 Literature Review

The theoretical literature on giving has focused primarily on explaining how seemingly selfless behavior can be reconciled with the classical conception of the self-interested economic agent with a well-behaved utility function. The motivations for giving identified by economist can be divided into three principal schools: Pure Public Goods (Becker 1974; Ribar and Wilhelm 1995), Warm Glow (Andreoni 1989, 1990) and Impact (Duncan 2004; Atkinson 2009).[3]

The most evident benefit from making a donation to a charity is the effect of that donation on the activity of the charity. One who likes donkeys will contribute to The Donkey Sanctuary in order to sustain or enhance the service provided to the 2,000 donkeys currently cared for by the organization in the United Kingdom.[4] The increase in that care provided increases the donkeys' welfare which, in turn, increases the welfare of all who care for donkeys, donor or otherwise. The same logic is applicable to donations made to organizations working with people, restoring art, or researching a cure for cancer. Thus the benefit of housing a homeless man or caring for a donkey can be treated as

[3] Behavioral models of pro-social behavior also exist (e.g. Cappellari, Ghinetti, and Turati 2007).

[4] See http://www.thedonkeysanctuary.org.uk for details.

a public good. This Pure Public Goods model, where donors derive utility from the overall provision of the public good, was formalized in Becker (1961) and Becker (1974) and enhanced elsewhere (e.g. Bergstrom, Blume, and Varian 1986)

The second motivation, while recognized as early as Becker (1961), was not formalized until Andreoni's work in the 1980's. The Warm Glow theory of giving has donors deriving a utility from the act of giving itself. Duncan (2004) notes that donors motivated by pure warm glow would be indifferent if their donation got lost in the mail as they derive utility from the size of their sacrifice.

Duncan (2004) introduces the Impact model of giving whereby donors derive utility from the direct impact of their donation on the provision of the public good. This model differs from the Public Goods model in that donors do not consider the government provision of the public good funded by taxes as part of their impact on the provision of the public good. Duncan also introduces a concave production function so that donors are not indifferent to the current provision of the public good.

Duncan's model nests both the Warm Glow and the Pure Public Goods models. I amend his model slightly to allow for a proportional tax and two different public goods in the simple presentation that follows. Let there be a single donor that can give to one of two public goods (charitable causes): Secular (S) and Religious (R). Secular can be provided by donations, d_S, from the philanthropist and by a government which collects a share, t where $0 \leq t \leq 1$, of the the donor's net income, $y - d_j$. Religious can only be provided by donations, d_R. Donations of either type are deductible from the donor's taxable income. Let $Z(h_j)$ be the production function for charitable output where $h_j = (e_j + d_j + G_j)$, e_j is the endowment charitable good j, d_j is the donation made to j, $G_S = t(y - d_S)$ is the government provision of Secular and $G_R = 0$.

The utility function of a warm glow donor is given by $V((1-t)(y-d_j), (1-t)d_j)$ as she derives utility from the size of her sacrifice. The utility function of the public goods donor is given by $V((1-t)(y-d_j), Z(h_j))$, as she derives utility from the overall provision of the public good. An impact donor's utility function is given by $V((1-t)(y-d_j), Z(e_j+d_j+G_j) - Z(e_j+G_j))$ as her utility is derived from the increase in the provision of the public good funded directly by her donation. Assume a quasi-linear utility function such that the impact donor's utility can be written as

$$V = U((1-t)(y-d_j)) + \alpha \sum_{j=S,R} [\alpha_j Z(e_j + d_j + G_j) - \alpha_j Z(e_j + G_j)] \tag{6}$$

where α is what Duncan calls the altruistic parameter, $\alpha_S = 0, 1$ and $\alpha_R = 1 - \alpha_S$ indicates whether the donor cares about Religious or Secular. The warm glow donor's utility function is can be obtained by assuming $Z(h)$ is linear such that $Z(e_j + d_j + G_j - Z(e_j + G_j) = \theta(e_j + d_j + G_j) - \theta(e_j + G_j) = \theta d_j$. Maintaining the simplifying assumption that utility is linear in $Z(h)$ and dropping the last term in equation 6, $\alpha_j Z(e_j + G_j)$, produces the utility function of the pure public goods donor.

It is from the public goods approach that the traditionally specified price of $1-t$, and the importance of the unitary price elasticity, originated. This is the price of a donor's contribution towards the public good in terms of forgone consumption. This is different, however, from the price of increasing the public good in terms of foregone consumption as it ignores the change in the government contribution, G_j, to the public good caused by the decrease in tax revenue when a donation is made. This distinction becomes important when considering cause-specific (Secular or Religious) giving. Taking this additional change into consideration when formulating the price means the price of increasing the provision of Secular and Religious will differ as G_R is fixed at zero. For the public goods donor, the price of giving is given by

$$p_j^{PG} = -\frac{\partial(1-t)(y-d_j)}{\partial(d_j + G_j + e_j)} = -\frac{\partial(1-t)(y-d_j)}{\partial d_j} / \frac{\partial(d_j + G_j + e_j)}{\partial d_j} \tag{7}$$

If the donor gives to Secular then the denominator in equation 7 is

$$\frac{\partial(d_S + G_s + e_S)}{\partial d_S} = 1 - t \tag{8}$$

and the numerator remains the same. Therefore, the price of increasing the provision of Secular faced by a public goods donor is $p_S^{PG} = 1$; a one unit increase in the provision of Secular requires a one unit decrease in non-charitable consumption. For the public goods price of increasing Religious, the denominator in equation 7 is replaced by

$$\frac{\partial(d_R + G_R + e_R)}{\partial d_R} = 1 \tag{9}$$

and the numerator is the again the same (recall $G_R = 0$). Therefore, the price of increasing the provision of Religious faced by a public goods donor is $p_R^{PG} = (1-t)$. Note this is the classically conceived of price of giving. Therefore, the price of increasing Secular is fixed at one, so a change in giving to Secular in response to a change in the marginal tax rate, and thus the price, will be due to the income effect only. The price of increasing Religious is $1-t$. A change in giving to Religious in response to a change in the marginal tax rate will be due to the price effect only. In other words, a change in the marginal tax rate will lead to a shift of the budget constraint for Secular donors and a change in the slope of the budget constraint for Religious donors. Therefore, estimated price elasticities might vary over secular and religious giving.

2.1 Empirical Literature

Despite decades of empirical work on the question of the efficiency of the tax deductibility of donations (e.g Feldstein 1975a; Reece 1979; Reece and Zieschang 1985; Kingma 1989; Randolph 1995; Auten, Sieg, and Clotfelter 2002; Bakija and Heim 2008) no consensus has emerged as results have proven sensitive to estimation method and data. The earliest papers (Taussig 1967; Schwartz 1970) found giving to be price inelastic. Then through the 1970's a number of studies (Dye 1976; Boskin and Feldstein 1977; Abrams and Schitz 1978) found that giving was in fact price elastic. This early consensus was then challenged in Feigenbaum (1980), which used GLS estimation and identified statistically significant inelastic price effects. In the 1980's a great deal of work (Auten and Rudney 1986; Brown 1987; Reece and Zieschang 1985; Glenday, Gupta, and Pawlak 1986; Kingma 1989) was done in this area, yet conclusions as to how responsive donors were to changes in the price varied, at times substantially, from study to study. From the late 1980's researchers began in earnest to use panel data. The ability to account for individual effects has been found to be important in studies of giving as those studies employing panel data tend to find that giving is price inelastic (Broman 1989; Daniel 1989; Randolph 1995; Eaton 2001; Auten, Sieg, and Clotfelter 2002).

The price is not the only variable of interest to economists looking at the determinants of charitable giving. Gender has been shown to be a significant determinant of both to whom to give and how much to give (Andreoni, Brown, and Rischall 2003) as has marital status (O'Neil and Richard 1996). Okten and Osili (2005) find race to be a significant determinant of charitable behavior. Carman (2003) shows that the giving behavior of peers can affect one's decision to give. Age and the level of education are generally found to be significant (Reece and Zieschang 1985; Leslie and Ramey 1988). Differences in the effects of permanent versus transitory income and prices have been identified in Randolph (1995) and Auten, Sieg, and Clotfelter (2002), though results are sensitive to the estimation methods used.

2.1.1 Donations by Cause

Nearly all of the above studies look at the impact of changes in socio-economic factors on total individual or household giving. Far less research has been done on cause specific giving (Feldstein 1975b; Dye 1976; Feldstein and Clotfelter 1976; Reece 1979; McClelland and Kokoski 1994; Yen 2002; Bradley, Holden, and McClelland 2005). Table 1 summarizes the income and price elasticities in several of these papers all of which use data from the US.

Table 1 about here.

Feldstein (1975b), column (1), found that price elasticities vary significantly over the causes under examination: religious, education, hospitals, health and social welfare, and other. Using IRS data from 1962 containing the value of itemized charitable contributions across 17 adjusted gross income cohorts, he found that gifts to education institutions and hospitals are very sensitive to the cost of giving whereas giving to religious causes is found to be much less price sensitive. Feldstein also estimated a price elasticity of aggregate giving very close to negative one and invariant over income cohorts.

Reece (1979), column (2), looked at giving to different causes using a subset of the 1972-1973 Bureau of Labor Statistics Consumer Expenditure Survey (BLS CEX) containing data on eight classifications of contributions, though counted among these was alimony and inter-personal gifts (e.g. birthday gifts). A significant benefit of using survey data is that data on non-donors (non-itemisers) is available; zero values are observed only if the individual failed to make a charitable donation. With US data from tax files, zero donations are observed for those not declaring any donations and those not itemising their taxes, though these people may have made a donation. Age of the household head is found to be positive and significant for all causes, though the identified effect varies by cause, being smallest for religious giving. The results in Reece conflict with those in Feldstein (1975b), as Reece finds religious giving to have the largest price elasticity and education the smallest.

McClelland and Kokoski (1994), column (3), use a panel from the BLS CEX to look at giving to religious and service organizations independently. They find that giving to religious charities is close to unitary elastic and giving to non-religious causes is price elastic. In addition to price and income, the authors include age and education. Results suggest the affect of age is larger for religious giving and that education increases both types of giving similarly.

Bradley, Holden, and McClelland (2005) look at total giving and giving to social welfare organizations. The authors use a two-stage semi-parametric method to estimate price and income elasticities using data from the 1982-1984 waves of the Consumer Expenditure Survey. The authors look at giving to only two defined causes; social welfare groups and total giving, finding that giving to welfare organizations is price elastic and total giving is price inelastic (column(4)).

Only Yen (2002) allows for the joint nature of the donation decisions by estimating the determinants of cause-specific donations using a system of Tobits and data from the 1995 Consumer Expenditure Survey. Yen finds little variation in the estimated income elasticities of giving to three different causes. However, the cross-sectional nature of the data exposes the estimator to potential omitted variable bias as the individual effect is left unaccounted for. Moreover, Yen does not include a price variable in his estimations.

Cause-specific giving has been studied elsewhere (Schiff 1985; Khanna, Posnett, and Sandler 1995; Khanna and Sandler 2000) though these papers use charity-level data and the price variable they include is not directly comparable to that used in the literature reviewed above. Important to note, however, is that each of these papers finds cross-cause variation in the determinants of a charities income.

3 The Data and Descriptive Statistics

3.1 The PSID

There have been to date a number of studies on giving that have used survey data. Most notable of these surveys is the BLS CEX, the biennial survey Giving and Volunteering in the U.S., used in Andreoni, Brown, and Rischall (2003), Clotfelter (1997), and Andreoni, Scholz, and Gale 1996. Other employed surveys have included General Social Survey used by Gruber (2004), a survey of National Public Radio listeners used in Kingma (1989), and a Florida Consumer Attitude Survey used in Brown (1987). Most of the above are, however, one-off surveys except the BLS CE which is annual but is not a true panel. Questions about charitable behavior have recently been added to the Panel Study of Income Dynamics (PSID) survey.

The PSID began as an annual survey of a sample of U.S. individuals and the family units in which they live. The central focus of the data is economic and demographic, with substantial detail on income sources and amounts, employment, household composition, and residential location.

Since 2001, the PSID has included the Center on Philanthropy Panel Study (COPPS) module containing data on giving and volunteering disaggregated by charitable cause. Wilhelm (2006) compares the PSID data to tax return data in the number of missing values and the amounts being reported and finds that the PSID survey data is of 'high quality' comparable to that obtained from documentary analysis of tax returns.

The raw panel used in this paper is constructed from three waves of the PSID (2001, 2003, 2005) containing 7,406, 7,822 and 8,002 households respectively. The low income over-sample is dropped leaving a representative sample of American households. Households with a change in marital status are dropped. Observations with a working Head [5] that give away more than 50 percent of their income were dropped (Feldstein 1975b; Reinstein 2006) as were those with a year-on-year change in total giving in excess of 25% of income. Observations with negative after tax income were dropped. Endogenous itemisers are those households which do not have sufficient non-donation deductions to itemize. Results were found not to be sensitive to the exclusion of these endogenous itemisers and so they are not dropped as has been done in some of the literature (Clotfelter 1980). Of the remaining households, only those present in all three years are maintained. The resulting balanced panel contains 10,899 observations for 3,633 households over three years.

3.2 The price of Giving[6]

In the simplest terms, the price of giving is merely one minus the marginal tax rate for those who itemize and one for everyone else. Such a simple formulation is precisely how some researchers (e.g. Taussig 1967) defined the variable. However, the marginal tax rate is a non-linear function of income and therefore the two will be correlated. A sufficiently high correlation can make identification of the model difficult and efforts have been made over the decades to produce a price variable with sufficient income independent variation.

Feldstein (1975a), and Randolph (1995) account for gifts of appreciated assets. Reinstein (2006) and Auten, Sieg, and Clotfelter (2002) calculate the price first by computing the marginal rate with donations set to zero and then again using a predicted increment of charitable giving set at 1 percent of average income. Other identified sources of income independent variation are the use of state taxes (Abrams and Schitz 1978; McClelland and Kokoski 1994) and the use of pseudo-natural experiment methods to take advantage of exogenous changes to the federal or state income schedule during the period of observation (Randolph 1995, Auten, Sieg, and Clotfelter 2002).

The price variable developed in the current paper builds on these specifications, addressing two sources of endogeneity as discusses in Clotfelter (1980) and producing income independent variation in the price variable.

The first source of endogeneity is in the decision to itemise which can be determined by the level of donations. Itemization status is predicted using each households interest paid on a mortgage, childcare costs, medical costs in excess of 7.5% of taxable income, property taxes and state taxes and charitable giving predicted as 2% of aggregate gross income (the sum of taxable and transfer income of the Head and Wife). If the sum of these components is greater than the relevant (for the year and filer type) standard deduction then the household is denoted as an itemiser. This process slightly

[5] According to the PSID Guidebook, "the Head of the family unit must be at least 16 years old and the person with the most financial responsibility for the family unit. If this person is female and she has a husband in the family unit, then he is designated as Head. If she has a boyfriend with whom she has been living for at least one year, then he is Head. However, if the husband or boyfriend is incapacitated and unable to fulfill the functions of Head, then the family unit will have a female Head." Generally speaking, for married/co-habituating couples the household Head is male unless the alternative is explicitly stated by the interviewee.

[6] Appendix A contains a fuller discussion of the price variable in studies of charitable giving.

under-estimates the number of itemisers in the sample (34.6% predicted versus 38.6% declared). It is assumed that those itemizing federal taxes are also itemizing state taxes.

The second source of endogeneity (price is a function of donations and income) is addressed in line with previous work by using the mean of the marginal rate using a level of predicted giving (1% of income) and the marginal rate calculated without any charitable contributions. The inclusion of state income taxes further provides price variation that is independent of income and donations as the existence and magnitude of state income taxes varies as does the detectability of charitable donations from state taxes. Moreover, the change in American tax law between 2000 and 2004 (significant reduction in the federal marginal rate, adjusted schedule) provides an added source of exogenous variation and establishes a sort of natural experiment element to the analysis.

The changes to tax schedule and brackets provides an exogenous change in price that would otherwise not be available. The contemporaneous change in the tax rates and schedule results in some major swings in price for some households. For example, the marginal tax rate faced by households earning $43,851 in 2000 and $46,700 in 2002 fell by thirteen percentage points over that period.

The issue of how donations are composed (cash, material goods or appreciable assets) is addressed using data on the proportion of non-cash gifts that are in fact appreciated assets and thus subject to a different tax deduction schedule. Ackerman and Auten (2008) shows that the composition of non-cash donations varies as income increases. The wealthy are more likely to make donations of appreciated assets, while the middle and lower classes tend to claim deductions for clothing and household items (which do not have any capital gain tax to be avoided as they have generally depreciated in value). The price variable is calculated using data from Ackerman and Auten (2008) and data from the IRS archives on the percentage of donations likely to be appreciated property (i.e., stock and real estate) across seven broad income bands.

The annual price variable to be used in the current paper is defined as:

$$P = 1 - \delta_D \left[\frac{mtr_F \chi_C + (1-\chi_C) W_C \omega_C + mtr_S \delta_S - mtr_F mtr_S \delta_F - mtr_F mtr_S \delta_S}{1 - mtr_F mtr_S \delta_F} \right] \tag{10}$$

where δ_D is a dummy equal to one if i itemizes, mtr_F is the federal marginal tax rate faced by i, χ_C is the proportion of donations that are cash for i's income cohort, W_C is a weighted mean of the long and short term federal capital gains tax rates in i's income cohort times the proportion of donations that are non-cash, $(1-\chi_C)$, times the proportion of non-cash donations that are appreciated property in i's income cohort, ω_C, mtr_S is the state marginal tax rate, δ_S is a dummy equal to one if donations can be deducted from state returns, and δ_F is a dummy if federal taxes can be deducted from state returns.

Marginal tax rates are obtained using NBER's Taxsim program (Feenberg and Coutts 1993). The price variable used in the analysis is the mean of the first-dollar price and the price generated with a predicted level of giving of 1% of income and δ_D is the predicted rather than actual itemisation status. This construction mitigates the potential endogeneity of the price variable and reduces the correlation between price and income from -0.48 for a price based simply on income tax bands to -0.09 for the price as defined in equation 10.

3.3 The Causes

The COPPS module includes a number of questions about which causes contributions were made to, the amounts contributed and a series of ranges given should the interviewee not recall the exact amount. In 2000, donations were decomposed into five separate causes: religious organizations (Religious), combination funds like the United Way (Combination), groups helping the needy (Needy), health and medical organizations (Health) and educational institutions (Education). In addition to these five causes for which actual amounts are available, binary variables indicating positive donations made to five more causes (Youth, Arts, Community and Neighborhood, Environment, and

International) are available with the total amounts given to these causes summed up in a single continuous variable. The analysis here focuses on the causes available for all three years.

Causes in the COPPS survey are donor defined. As the interest is in impact of socio-economic characteristics on donations to different causes, it is not relevant how the recipient organization defines what it does, nor how the government or researchers define what it does. The definition of interest is that applied by the donor. The cost of using donor defined causes is that an individual may change how she classifies a charity or, if different people from the same household undertook the survey in different years, than the households classification may not be consistent.

Table 2 presents the distributions of the variables used in this study. Panel A presents the regressors and panel B presents the donations by cause.

Table 2 about here.

The unit of analysis is the household and variables are defined at the household level all monetary figures are in 2008 prices, deflated using the Consumer Price Index.[7]

Panel A reports descriptive statistics for the explanatory variables used in this study and panel B reports the participation rates and mean positive donations for each cause. Income is defined as the sum of taxable and transfer income of the Head and Wife, if there is one, net of state and federal income taxes. Annualized wealth is the reported level of household net wealth including home equity multiplied by 2.5%.[8] Age refers to the mean age of the household Head and Wife, if present. Years of education is based on the most educated person of the Head and Wife, if there is one. The percentage of households that are religious refers to those households in which either the Head or Wife, if present, has stated a preferred religion (e.g. Catholic, Muslim). Race is based on the racial composition of the household. An observation is denoted as *White* only if both the Head and Wife, if present, are white and analogously for black households. All other racial compositions are included in a third category. The percentage of households in good health is based on a question in the PSID survey. The 'Good Health' dummy is equal to one if both the Head and Wife, if present, report health that is 'Good', 'Very Good' or 'Excellent' and zero otherwise.

The probability of making a donation of any kind is 71% with a mean positive household donation of \$2,319.66.[9] Both the participation rates and mean donations vary between causes. Half of all households make a donation to a religious charity while only 17.6% give to Education. The participation rates for Health and Other are very similar at about a quarter of the sample, though the mean donation to Other is about 50% higher. The most popular secular cause is Combination, perhaps indicative of the popularity of organisations like The United Way. The decisions to contribute do not, however, appear to be independent of one another as the probability of a household contributing to cause X conditional on contributing to any other cause (not shown) is higher for every cause than the unconditional probability of donating to cause X for all causes. This is consistent with results in Micklewright and Schnepf (2009) and suggests that the interdependence of the cause-specific donation decisions should be accounted for in estimation.

4 Model and Estimation

Let d_{jit} be the donation to cause $j = 1, 2 \ldots, J$ by household $i = 1, 2 \ldots, , N$ at time $t = 1, 2 \ldots, T$. The model I wish to estimate can then be represented as

$$d_{jit} = max\{x_{it}^{'}\beta_j + e_{jit},\ 0\} \tag{11}$$

[7] See: http://www.bls.gov/cpi/

[8] I am grateful to Richard Steinberg for guidance concerning this variable.

[9] The survey question in the COPPS module is whether or not a donation in excess of \$25 was made in the last year.

where β is a $K \times 1$ vector of unknown cause-specific parameters to be estimated, x_{it} is a $K \times 1$ vector of K_V time variant and $K - K_V$ time invariant household specific characteristics in time t including household income and price and for which the first element is 1. The error term, $e_{jit} = \gamma_{jt} c_i + \varepsilon_{jit}$ where c_i is a time invariant individual effect, which may be correlated with the regressors, γ_{jt} is the time and cause varying factor loading, ε_{jit} is a random error term which is assumed to be orthogonal to the regressors and c_i.

My primary interest is in obtaining consistent estimator of β_j though estimates of γ_{jt} are also of interest as time varying factor loads can be useful in applied contexts including testing stationarity assumptions necessary for some other censored panel data estimators (e.g. Honoré 1992). Time varying factor loadings were used in the context of a single equation censored regression model in Honoré (1998).

A consistent estimator of the cause-specific price and income elasticities should appropriately account for two characteristics of the data: censoring and the individual effect, c_i. Efficiency gains are obtained by considering the cross equation correlation of e_{jit}. I consider how these are addressed below.

Censoring Greene (2002) notes that when the dependent variable is censored OLS will be biased towards zero with the severity of bias an increasing function of the censoring rate. For most causes, more than two-thirds of the households do not make a donation. Therefore estimation methods must account for this censoring. Tobit models (Tobin 1958) and variants of the Tobit have been used in single equation studies of household donations using cross-sectional data (Brown 1987; Lankford and Wyckoff 1991; O'Neil and Richard 1996; Andreoni, Brown, and Rischall 2003; Bradley, Holden, and McClelland 2005). Eckel and Grossman (2003) use a random-effects Tobit to estimate price of giving elasticities using data collected from laboratory experiments. The censoring of donation data has also been accounted for using sample selection model (Banks and Tanner 1997), SCLS and CLAD (Wilhelm 2008).

Wilhelm (2008), who also uses PSID data on giving, finds that the Tobit performs well relative to semi-parametric alternatives such as CLAD (Powell 1984). I therefore employ the Tobit framework to account for the high censoring rate.

Unobserved individual effect Often with panel data the individual effect is assumed to be orthogonal to the observed regressors and integrated out of the likelihood function. However, if the orthogonality assumption is violated, then the estimator is inconsistent. Alternatively, in the case of a linear model, the individual effect can be left unspecified, assumed to be time invariant and differenced out of the equation to be estimated or, should T be large relative to N, dummies included for each cross-sectional unit. Leaving the individual effect unspecified in non-linear models, such as the Tobit approach adopted here, requires the strong secondary assumption that the errors are stationary (Honoré 1992). I employ a third more flexible option using a correlated random effects approach which allows for time varying factor loadings by making assumptions about the structural form of the individual effect.

Following Mundlak (1978) I specify the individual effect as a linear projection on the time-means of the regressors such that

$$c_i = \bar{x}_i' \theta + v_i \tag{12}$$

where θ is a $K_V \times 1$ vector of parameters, $\bar{x}_i$ is a $K_V \times 1$ vector of the time means of the time variant regressors and v_i is independent of the regressors and distributed $N(0, \sigma_v^2)$.where v_i is assumed to be orthogonal to the observed characteristics. This approach is adopted in the estimation of a system of uni-variate Tobits in Meyerhoefer, Ranney, and Sahn (2005).

Interdependence A small number of studies have sought to estimate cause-specific income and price elasticities of donations, though none of these have accounted for the potential interdependence of donations to different causes. Brown and Lankford (1992) and Andreoni, Scholz, and Gale (1996) estimate a multi-variate Tobit simultaneous equations models of donations of time and money, though no disaggregation by cause is undertaken. Shaikh and Larson (2003) estimate an Almost Ideal Demand System (AIDS) including donations of time and money, though again, there is no disaggregation by cause.

The use of an AIDS is desirable though not appropriate given the uniformity of the price of giving across causes. As the tax-price of giving does not vary across causes, it is not possible to identify an AIDS model of cause-specific giving.

Robinson (1982) showed that non-linear estimators will be consistent even in the presence on cross-equation correlation but I appeal to the generalized Tobit system estimator, first developed in Amemiya (1974), to gain efficiency.

4.1 A heteroscedastic robust correlated random-effects multi-variate Tobit

Substituting equation 12 into equation 11 gives the reduced form model

$$d_{jit} = max\{x_{it}^{'}\beta_j + \gamma_{jt}\left(\bar{x}_i^{\prime}\theta + v_i\right) + \varepsilon_{jit},\, 0\} \tag{13}$$

This specification nests alternative specifications of the individual effect. Under the assumption that $\theta = 0$, the conventional random effects estimator is obtained. Alternatively, the random effects can be assumed to be time invariant ($\gamma_t = \gamma$). Note that the γ_{jt} are identified up to a scale factor and identification requires the normalization of γ such that $\gamma_{11} = 1$.

The composite error term $u_{jit} = \gamma_{jt} v_i + \varepsilon_{jit}$ is assumed to be orthogonal to the regressors and jointly distributed $N(0, \Delta_t)$ for each t where

$$U_t = \begin{bmatrix} \sigma_{11t} & \sigma_{12t} & \cdots & \sigma_{1Jt} \\ \sigma_{21t} & \sigma_{22t} & \cdots & \sigma_{2Jt} \\ \vdots & \vdots & \ddots & \vdots \\ \sigma_{J1t} & \sigma_{J2t} & \cdots & \sigma_{JJt} \end{bmatrix} \tag{14}$$

Although the covariance matrix of the error term u_{jit} has a particualr structure, I allow for a general covariance structure in the above. Efficiency gains are obtained by allowing for non-zero covariances over j for each t. Heteroscedasticity will result in the Tobit estimator being inconsistent (Hurd 1979). A general approach used to allow for heteroscedasticity, thus yielding a consistent non-linear estimator, is to model it explicitly (Yen and Jensen 1996; Chavas and Kim 2004; Meyerhoefer, Ranney, and Sahn 2005) . I therefore specify σ_{jjt}^2 as a function of a set of regressors which explain the non-constancy of the variance. Formally,

$$\sigma_{jjit}^2(z) = \sigma_{jjt}^2 e^{z_{it}^{'}\zeta_{jt}} \tag{15}$$

where z_{it} is a $G \times 1$ vector of variables on which the variance depends, ζ_{jt} is a $G \times 1$ vector of parameters to be estimated and σ_{jjt}^2 is a common parameter that is estimated as part of the covariance matrix. The covariances are treated as estimated parameters capturing contemporaneous cross-cause effects.

Let ρ be a $\frac{J!}{(J-2)!2!} \times 1$ vector of the correlation coefficients, ρ_{jlt}, between each pair of causes j, l and Π_t be the $F \times 1$, where $F = J(K + K_V + G) + \frac{J!}{(J-2)!2!}$ unrestricted parameter vector at time t such that

$$\Pi_t = \left[\beta_{01t}, \beta_{11t}, \ldots, \beta_{KJt}, \theta_{11t}, \theta_{21t}, \ldots, \theta_{K_V Jt}\, \zeta_{01t}, \zeta_{11t}, \ldots, \zeta_{GJt}, \rho^{'}\right]^{'} \tag{16}$$

with corresponding $F \times F$ covariance matrix V_t.

I obtain Π_t for each t and then stack Π_t over time to obtain the $TF \times 1$ reduced form coefficient vector Π such that

$$\Pi = \begin{bmatrix} \Pi_1 \\ \Pi_2 \\ \vdots \\ \Pi_T \end{bmatrix} \tag{17}$$

The corresponding $TF \times TF$ covariance matrix is given by

$$V = \begin{bmatrix} V_1 & 0 & \cdots & 0 \\ 0 & V_2 & \cdots & 0 \\ \vdots & \vdots & \ddots & \vdots \\ 0 & 0 & 0 & V_T \end{bmatrix} \tag{18}$$

I then use minimum distance methods to obtain the structural parameters of interest.

4.2 Estimation Procedure

Estimation of the above model is a two-step procedure. Equation 17 is consistently estimated for all causes simultaneously via Quasi maximum Likelihood. Step 2 uses minimum distance methods to impose linear restrictions on the reduced form parameters in order to obtain structural parameters.

Minimum Distance Estimation[10] is a two-step procedure which requires the estimation of reduced form parameters in the first stage. In the current case, these reduced form parameters are the parameter estimates obtained via quasi-maximum likelihood estimation of a system of Tobits, outlined below, for each t compiled into Π. In the second stage restrictions necessary for the identification of structural effects, the correlated random effects and the factor loadings are imposed.

The minimum distance estimator is easy to implement empirically and allows for consistent estimation of the structural parameters without transforming the data (e.g. mean differencing) and with minimal structure imposed on c_i, allowing for correlation between the unobservable c_i and the regressors and time varying factor loadings. Furthermore, it provides a formal test of the restrictions required to obtain the structural parameters.

Step 1: Quasi Maximum Likelihood Estimation Systems of censored equations can be parametrically estimated using Simulated Maximum Likelihood (SML) or Quasi Maximum Likelihood (QML) techniques. Simulated Maximum Likelihood techniques are computationally demanding and computer time intensive. Moreover, as noted in Barslund (2007), convergence of the SML estimator can be difficult to achieve. QML estimation provides a viable alternative to the SML estimator.

There is a fairly well developed literature on the QML approaches to estimating systems of Tobits (e.g. Amemiya 1974; Wales and Woodland 1983; Cornick, Cox, and Gould 1994; Yen, Lin, and Smallwood 2003; Meyerhoefer, Ranney, and Sahn 2005; Barslund 2007). QML estimation of the above model can be done in two ways. First, if the cross-equation correlations are not of interest than the system of Tobits can be consistently estimated by simultaneously maximizing the likelihoods from J uni-variate Tobits, the approach used in estimating a demand system with panel data in Meyerhoefer, Ranney, and Sahn (2005). This yields a consistent estimator of β but $\frac{J!}{(J-2)!2!}$ fewer parameters than the SML estimator as the correlation coefficients cannot be estimated directly. However, the correlation coefficients are of interest. Barslund (2007) finds that the performance of the QML estimator is affected by the magnitude of the cross-equation correlations when they exceed about 0.4 on average. The second QML approach, outlined in Yen, Lin, and Smallwood (2003),

[10] See Wooldridge (2002) pp. 442-448 for more details.

involves simultaneously maximising the likelihoods from a series of pairwise bi-variate Tobits. This approach was used to estimate the determinants of giving to three causes in Yen (2002).

This second QML estimator yields as many parameters as the SML estimator, but is computationally less demanding. Barslund (2007) shows in a Monte Carlo simulation that little is gained from using the SML approach when the cross-equation correlations are not too large in absolute terms a result supported by Yen, Lin, and Smallwood (2003). However, Barslund finds that QML estimation of a series of bi-variate Tobits does outperform estimating the same model using a series of uni-variate Tobits as sample size increases.

The QML approach I employ approximates the true likelihood function, that simulated in SML, by linking together a chain of pairwise bi-variate Tobits (i.e. I simultaneously estimate bivariate Tobits for each pair of causes). Formally, the likelihood contribution of i in time t from the joint equations is given by the bi-variate Tobit likelihood function for individual i, pair of causes j, l and time t

$$L_{jlit} = \begin{cases} \Phi_2(q_{jit}, q_{lit}, \rho_{jlt}) \; if \; d_{jit} = 0, d_{lit} = 0 \\ \left[\frac{\phi_2(q_{jit}, q_{lit}, \rho_{jlt})}{\sigma_{jjt}\sigma_{llt}}\right] \; if \; d_{jit} > 0, d_{lit} > 0 \\ \frac{\phi(q_{jit})}{\sigma_{jjt}} \Phi\left(\frac{(q_{jit} - \rho_{jlt} q_{lit})}{(1-\rho_{jlt}^2)^{\frac{1}{2}}}\right) \; if \; d_{jit} = 0, d_{lit} > 0 \\ \frac{\phi(q_{lit})}{\sigma_{llt}} \Phi\left(\frac{(q_{lit} - \rho_{jlt} q_{jit})}{(1-\rho_{jlt}^2)^{\frac{1}{2}}}\right) \; if \; d_{jit} > 0, d_{lit} = 0 \end{cases} \tag{19}$$

where $q_{jit} = {}^{u_{jit}}/\sigma_{jjit}$, ρ_{jlt} is the correlation coefficient between each pair of causes j, l, Φ is the standard normal uni-variate cumulative distribution function, ϕ is the standard normal uni-variate probability density function, Φ_2 is the standard normal bi-variate cumulative distribution function and ϕ_2 is the standard normal bi-variate probability density function. Estimates are obtained by maximizing the quasi log likelihood function

$$lnL_t = \sum_{i=1}^{N} \sum_{j=1}^{J-2} \sum_{l=j+1}^{J-1} L_{jl}^{i} \tag{20}$$

separately for each t.

Step 2: Minimum Distance Estimation Having obtained estimates of Π and V, I use minimum distance methods to impose the restriction that the estimated effects are time invariant (e.g. $\beta_t = \beta$).

Let ψ_t be the $R \times 1$ unrestricted parameter vector where ψ_t is a sub-matrix of Π_t containing only those parameters to be constrained. This, as Chamberlain (1984) notes, is another advantage of the minimum distance approach in that the researcher can restrict a selected subset of parameters, those included in ψ_t, while the others remain unrestricted. Stacking ψ_t over time yields the $TR \times 1$ vector Ψ. Let δ be the $R \times 1$ restricted structural parameter vector of interest. The constraint is $\Psi = h(\delta)$ where $h(.)$ is a function mapping δ into Ψ . In practice the restriction imposed in order to obtain structural parameters is $\psi_t = \psi$, that is that the coefficients of interest are time invariant. The vector δ is set such that the weighted Euclidean distance between $\hat{\Psi}$ and $h(\delta)$ is minimised. Let $\hat{V}_\Psi$ be any consistent estimator of the asymptotic covariance matrix of Ψ, V_Ψ (a $TR \times TR$ matrix with T t-specific $R \times R$ covariances matrices on the diagonals and zeros on the off diagonals), which can be used as the weighting matrix. In the current case, $\hat{V}_\Psi$ is the bootstrapped estimate of V_Ψ using 500 replications.

Formally, the Minimum Distance Estimator of δ is obtained by solving

$$min_\delta \left\{\hat{\Psi} - m(\delta)\right\}' \hat{V}_\Psi^{-1} \left\{\hat{\Psi} - m(\delta)\right\} \quad (21)$$

If the mapping from δ to Ψ is linear, $\Psi = M\delta$, as assumed here, then the solution to equation 21 is

$$\hat{\delta} = \left(M' \hat{V}_\Psi^{-1} M\right)^{-1} M' \hat{V}_\Psi^{-1} \hat{\Psi} \quad (22)$$

where M is $TR \times R$ identity matrix. The covariance matrix used for inference is

$$A\hat{var}(\hat{\delta}) = \left(M' \hat{V}_\Psi^{-1} M\right)^{-1} \quad (23)$$

5 Results

I test for the heteroscedasticity as a function of household characteristics, the nature of the individual effects and the validity of the restrictions imposed in equation 21.

I test for the presence of heteroscedastic errors using a Lagrange Multiplier test (Breusch and Pagan 1980). Errors are homoscedastic if $\zeta_{jt} = 0$. Under the null hypothesis that $\zeta_{jt} = 0$, the test statistic, defined as $0.5(ESS)$ from the regression of e_{jit} on z_{it} (Greene (2002), p. 224), has a limiting χ^2 with G degrees of freedom. I reject the null hypothesis of a constant variance at the 1% level for every cause except Health. Other specifications of the heteroscedasticity (e.g. square of income, age) were also examined but results were not sensitive. I therefore proceed with the more parsimonious approach of specifying the heteroscedasticity as a function of the log of household income.

The restrictions imposed for the identification of the structural parameters ($\beta_t = \beta$) are tested using a simple Wald-type test. Under the null that the restrictions are valid the distance function is distributed as a χ^2 with $TR - R$ degrees of freedom. Formally,

$$\{\hat{\psi} - m(\delta)\}' \hat{V}_\psi^{-1} \{\hat{\psi} - m(\delta)\} \sim \chi^2_{TR-R} \quad (24)$$

provides a Wald test of parameter restriction validity.

I also test the specification of the individual effects as both the assumption that the individual effects are orthogonal to the regressors ($\theta = 0$) and the assumption the the random effects are time invariant ($\gamma_{jt} = \gamma_j$) are nested in the CRE specification. These nested alternatives can be tested for by subtracting the distance function (equation 24) of the alternative restricted model (2) from the distance function of the model under the unrestricted correlated random effects specification (1) such that[11]

$$\{\hat{\psi}_1 - m(\delta_1)\}' \hat{V}_{\psi 1}^{-1} \{\hat{\psi}_1 - m(\delta_1)\} - \{\hat{\psi}_2 - m(\delta_2)\}' \hat{V}_{\psi 2}^{-1} \{\hat{\psi}_2 - m(\delta_2)\} \sim \chi^2_{(df_1 - df_2)} \quad (25)$$

Results for tests of the restrictions imposed in equation 21 and for the nested specifications of the individual effects are reported in table 3.

Table 3 about here.

The first row of table 3 presents the results of the Wald test for the restriction $\beta_t = \beta$, where β contains all the explanatory variables and the null hypothesis is that the restriction is true. The second row presents the results of the test where only the β coefficients on income and price are restricted to be time invariant. The third row presents the results of the test of the restriction $\rho_t = \rho$ applied to the vector of cross-equation correlations. I fail to reject the null of valid restrictions for all three tests at the 10% level.

[11] See Chamberlain (1982) for details.

I also test the assumed correlated random effects specification against the two nested alternatives. The results in the third row of table 3 show that the orthogonality of the individual effects is rejected by the data ($\chi^2_{(84)} = 372.61$) at the 1% level. The time invariance of the random effect is also rejected at the 1% level ($\chi^2_{(6)} = 34.72$).

Results from the system of heteroscedastic robust correlated random effects Tobits are reported in table 4.

Table 4 about here.

The results reported in table cannot be interpreted as elasticities but are consistent with earlier work in terms of the signs on coefficients. Income is generally found to have a positive impact on giving (Feldstein 1975b; Auten, Sieg, and Clotfelter 2002) as are age and education. The point estimates for price are all negative, though only significantly different from zero for Religious. Gender, racial and religious differences also are present and some interesting cause specific heterogeneity emerges. Education, for example, increases giving to each cause, though the effect is more pronounced for giving to education charities. Religious households are, unsurprisingly, more likely to donate to religious charities but are give less to three of the other causes (Education, Needy and Other). Given such differences, the profile of the average donor to each cause will vary. However, as these demographic characteristics are included primarily as controls in this study of income and price effects, I do not pursue their interpretation further here.

The cross equation correlations are presented in table 5. Note each correlation is positive, consistent with findings in Micklewright and Schnepf (2009), and are all significant at the 1% level re-enforcing the importance of accounting for the cross-equation correlations in estimation. Correlations tend to be smallest for Religious, though not always. The mean correlation is 0.24 with a maximum of 0.41, smaller than the correlation coefficients found in Yen (2002), reflecting perhaps the parametrisation of the individual effect here.

Table 5 about here.

Comparing the coefficients in table 5 across causes is not correct as the coefficients do not refer to changes in the level of donations. Valid cross equation comparisons must be done by comparing the price and income elasticities. The key elasticity for policy makers interested in efficiency is the the impact of a change in the price on the unconditional mean donation. Generally, the probability of $d_j > 0$ is given by $\Phi\left(\frac{x'\beta_j+\gamma_j c}{\sigma_j}\right)$ and the mean positive donation to cause j is given by

$$E\left[d_j | d_j > 0\right] = exp\left[x'\beta_j + \gamma_j c + \sigma_j \frac{\phi\left(\frac{x'\beta_j+\gamma_j c}{\sigma_j}\right)}{\Phi\left(\frac{x'\beta_j+\gamma_j c}{\sigma_j}\right)} + 0.5\left(1 - \frac{\phi\left(\frac{x'\beta_j+\gamma_j c}{\sigma_j}\right)}{\Phi\left(\frac{x'\beta_j+\gamma_j c}{\sigma_j}\right)}\right)\sigma_j\right] \tag{26}$$

The unconditional mean can therefore be expressed as

$$E\left[d_j\right] = \Phi\left(\frac{x'_{it}\beta_j + \gamma_{jt} c_i}{\sigma_j}\right) exp\left[x'\beta_j + \gamma_j c + \sigma_j \frac{\phi\left(\frac{x'\beta_j+\gamma_j c}{\sigma_j}\right)}{\Phi\left(\frac{x'\beta_j+\gamma_j c}{\sigma_j}\right)} + 0.5\left(1 - \frac{\phi\left(\frac{x'\beta_j+\gamma_j c}{\sigma_j}\right)}{\Phi\left(\frac{x'\beta_j+\gamma_j c}{\sigma_j}\right)}\right)\sigma_j\right] \tag{27}$$

Income and price elasticities are obtained by partially differentiating equation 27 and these are reported in table 6. Standard errors for the elasticities are obtained using the delta method (See: Wooldridge (2002), p. 44)

Table 6 about here.

The income elasticity of total giving, estimated via a uni-variate correlated random effects Tobit, is 0.22 and is significant at the 1% level. Little cause-specific variation in the estimated income elasticities is apparent with the point estimates all sitting around 0.2. A formal test of the null hypothesis that the income effects are equal across causes is undertaken and *p*-values presented in table 7.

Table 7 about here.

The income elasticities do not significantly differ at the 10% level for any pair of causes. The results suggest that a 10% increase in income will increase donations by about 2% regardless of the cause to which the donation is made, on average and *ceteris paribus*. This type of homogeneity is in contrast to the earlier cause specific studies reported in table 1 (Feldstein 1975b; Reece 1979). The identified homogeneity of the income effect is not dissimilar to the results in Yen (2002) though the estimated elasticities there are much larger perhaps due to the unaccounted for individual effect.

The price elasticity is of total giving -0.86 and is significant at the 1% level. The estimated price elasticity for religious giving is -0.79 and is significant at the 5% level. Results suggest that the tax incentive for charitable giving in the US has no effect on secular giving. Though the signs on the price elasticities for giving to the other causes are all negative, as would be expected, the point estimates are all close to zero, save for Needy. Table 8 presents the *p*-values from tests of cross-equation equivalence of the price elasticities.

Table 8 about here.

The price elasticity of giving to Religious differs from every other cause, except Needy, at the 10% level. Results are consistent with a homogeneous price effect over secular giving.

With respect to the question of treasury efficiency, I can reject the hypothesis that the price elasticities are greater than unity for every secular cause at the 1% level. Though I cannot reject the hypothesis that giving to Religious is price elastic, the concept of treasury efficiency cannot be applied to religious giving for reasons discussed above.

The income and price elasticities obtained here are very similar in size and significance and to results obtained using Honoré's 1992 'fixed effects' Tobit and differ from elasticities obtained from conventional random effects Tobits (see appendix 6) suggesting that allowing for correlation between the individual effects and the observables in studies of charitable giving is important.

Considering the income and price effects together, the evidence here is consistent with giving to secular charities being a homogeneous good. Religious giving, however, appears to differ and therefore future modeling of charitable behavior should consider disaggregating household giving into religious and secular components when possible.

6 Conclusion

There are many reasons to donate and many charitable causes to which one can donate. Given the diversity of motivations and causes, the conventional treatment of charitable giving as a homogeneous good is questionable. In this paper I test the assumption of homogeneity explicitly and check the pattern of estimated price effects against the theoretical predictions of three models of charitable behavior. Using US data from the Panel Study of Income Dynamics I estimate a model of giving to six identified causes: Religious, Education, Health, Combination, Needy and Other.

A consistent estimator of such a model should account for the censoring of donations at zero and unobserved individual effects. To do so I employ a system of heteroscedastic robust correlated random effects Tobits.

Although the mean donation and participation rates vary by charitable cause (see Table 2), results indicate that impact of a change in income is the same for each cause. This differs from the estimated price effect which is statistically significant for only one of the six causes; Religious.

The ineffectiveness of the tax incentive for most of the causes means that the tax deductibility of charitable donations is leading to a fall in the overall provision of public goods as the foregone tax revenue is met with no discernible increase in giving to five of the six identified causes. The only cause for there is evidence that the tax incentive for giving has a measurable effect is Religious which also is the only cause for which the concept of treasury efficiency is meaningless. This result suggests that the the tax deductibility of charitable donations in the US essentially amounts to a constitutionally questionable government subsidy of religious organisations. Given the findings here, recent calls to abolish the incentive may be warranted from an efficiency standpoint. However, it may be the case that motivations for giving vary with size of the donation and therefore the responsiveness to changes in the price would also vary with the size of the gift. Fack and Landais (2010) provide some evidence on this by using quantile regression techniques. They find that while price effects do tend to be small, they increase with the size of the gift.

The price effect might also increase with the level of income as wealthier households are more likely to have tax advisors that might recommend strategic, in terms of tax avoidance, giving. Clotfelter (1997) points out that while 'a few sophisticated taxpayers (and their tax or financial advisers) might be sensitive to variations in tax rates, the average taxpayer is too oblivious or unresponsive to the marginal tax rate for anything like the economic model to be realistic representation of reality.'

There are a number of potential extensions to this work. The above model may still be misspecified as household can contribute time as well as money following on from the work in Duncan (1999). Thus including contributions of time would be a natural extension and a demand system might be estimated à la Shaikh and Larson (2003). A second extension, is the estimation of structural production functions using charity level data in order to obtain cause-specific or even charity-specific prices faced by impact donors (Duncan 2004). Obtaining these would allow for the estimation of cross-price elasticities and would bring together elements of the demand and supply sides in the market for charity.

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Tables

Table 1: Price and income elasticities by cause

	(1)	(2)	(3)	(4)	(5)
	Feldstein (1975b)	Reece (1979)	McClelland & Kokoski (1994)	Bradely et al. (2005)	Yen (2002)
All					
Income	0.82*	0.88*		0.56*	1.16**
Price	-1.24*	-1.19*		-0.78*	
Hospitals					
Income	1.08*				
Price	-2.44*				
Religious					
Income	0.63*	0.4*	1.02*		0.98**
Price	-0.49*	-1.60*	-1.06*		
Education					
Income	1.22*	1.64*			
Price	-2.23*	-0.08			
Welfare					
Income	0.85*	1.67*	0.86*	0.38*	
Price	-1.18*	-0.4	-2.38*	-1.34*	
Estimator	OLS	Tobit	Tobit	Semi-Para	Tobit System

Bootstrapped standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2: Descriptive Statistics

	Mean	SD	Min	Max
Panel A: Regressors				
Household Income ($)	81,635.23	128,913.60	7.29	6,040,767.00
Price (per $)	0.93	0.10	0.51	1.00
Annual Wealth ($)	8,866.10	32,761.90	0.00	1,299,420.00
Age (Years)	46.71	14.80	17.00	98.00
Education (Years)	13.87	2.52	1.00	17.00
White (%)	81.72	38.66	.	.
Black (%)	7.58	26.47	.	.
Other Race (%)	10.70	30.92	.	.
Religious Preference (%)	87.32	33.27	.	.
Has children (%)	43.82	49.62	.	.
Male Head (%)	81.80	38.59	.	.
Married (%)	72.12	44.84	.	.
Good Health (%)	85.25	35.46	.	.
Panel B: Donations (Mean donations are conditional on being positive)				
Donation ($)	2,319.66	4,032.48	5.49	92,815.73
Donation (%)	71.15	45.31		
Religious ($)	2,113.81	3,399.49	1.16	78,554.99
Religious (%)	50.12	50.00		
Education ($)	449.96	1,195.90	1.16	15,106.73
Education (%)	17.56	38.05	.	.
Health ($)	265.36	824.18	1.10	24,170.77
Health (%)	23.81	42.59	.	.
Combination ($)	558.27	1,359.47	1.10	46,920.29
Combination (%)	32.12	46.70	.	.
Needy ($)	527.00	1,095.80	1.10	18,128.07
Needy (%)	31.26	46.36	.	.
Other ($)	405.84	1,214.90	1.16	32,026.27
Other (%)	25.77	43.74	.	.

Table 3: Wald tests of parameter restrictions and individual effects

(1)	(2)	(3)	(4)
Test of:	χ^2	df	P-value
Parameter Restrictions			
$\beta_t = \beta$	198.71	192	0.35
$\beta_{Incomet} = \beta_{Income}, \beta_{Pricet} = \beta_{Price}$	28.32	24	0.25
$\rho_t = \rho$	40.13	30	0.10
Specification of individual effects			
$\theta = 0$	372.61	84	0.00
$\gamma_t = \gamma$	34.72	6	0.00

Table 4: Results from Quasi-Maximum Likelihood estimation of a system of heteroscedasticity robust Tobits

	(1)	(2)	(3)	(4)	(5)	(6)
	Religious	Education	Health	Combo	Needy	Other
Log Income	0.496***	1.304***	0.758***	0.544**	0.723***	0.972***
	(0.179)	(0.333)	(0.244)	(0.225)	(0.236)	(0.246)
Log Price	-1.573**	-0.084	-0.026	-0.205	-1.116	-0.182
	(0.740)	(1.126)	(0.951)	(0.878)	(0.901)	(0.928)
Log Wealth	0.019	0.017	0.050	0.087	0.021	0.173**
	(0.056)	(0.096)	(0.072)	(0.065)	(0.069)	(0.074)
Age	0.329**	0.536**	0.538***	0.221	0.746***	0.484***
	(0.134)	(0.219)	(0.167)	(0.160)	(0.163)	(0.176)
Age2	-0.003**	-0.003	-0.004**	-0.004**	-0.007***	-0.001
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
No HS	-2.064***	-2.526***	-1.975***	-2.314***	-1.916***	-1.595***
	(0.286)	(0.686)	(0.397)	(0.381)	(0.378)	(0.427)
Some Uni	1.293***	1.564***	0.642***	0.886***	1.268***	1.281***
	(0.174)	(0.327)	(0.228)	(0.209)	(0.216)	(0.234)
Degree	1.660***	4.028***	1.322***	1.129***	1.642***	2.549***
	(0.186)	(0.321)	(0.238)	(0.224)	(0.231)	(0.242)
Graduate School	1.373***	5.206***	1.614***	1.367***	2.183***	3.451***
	(0.208)	(0.330)	(0.252)	(0.239)	(0.245)	(0.252)
Other Race	0.378	-2.367***	-2.017***	-1.281***	-1.225***	-1.380***
	(0.256)	(0.465)	(0.369)	(0.330)	(0.320)	(0.348)
Black	1.088***	-0.478	-0.987***	-0.086	-0.532	-1.875***
	(0.270)	(0.516)	(0.382)	(0.336)	(0.352)	(0.409)
Religious Preference	2.940***	-0.872***	-0.290	0.796***	-0.450*	-0.861***
	(0.233)	(0.316)	(0.258)	(0.254)	(0.232)	(0.247)
Children	0.828***	2.177***	-0.276	-0.282	0.239	-0.027
	(0.149)	(0.229)	(0.189)	(0.172)	(0.178)	(0.187)
Male Head	-1.247***	-1.050**	-1.637***	-0.650*	-2.046***	-1.170***
	(0.290)	(0.498)	(0.350)	(0.334)	(0.341)	(0.351)
Married	2.783***	-0.465	0.698**	0.582*	1.326***	0.283
	(0.276)	(0.459)	(0.332)	(0.312)	(0.327)	(0.334)
Good Health	0.251	0.533	-0.002	-0.115	0.337	-0.056
	(0.250)	(0.443)	(0.318)	(0.304)	(0.304)	(0.316)
Constatnt	-19.786***	-47.055***	-27.831***	-34.328***	-27.319***	-31.596***
	(1.213)	(2.420)	(1.824)	(1.663)	(1.683)	(1.765)
Observations	10,899	10,899	10,899	10,899	10,899	10,899
Households	3,633	3,633	3,633	3,633	3,633	3,633

Bootstrapped standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 5: Cross Equation Correlations

	(1) Education	(2) Health	(3) Combination	(4) Needy	(5) Other
Religious	0.164***	0.165***	0.196***	0.138***	0.130***
	(0.017)	(0.015)	(0.014)	(0.014)	(0.015)
Education		0.362***	0.222***	0.306***	0.405***
		(0.019)	(0.018)	(0.018)	(0.019)
Health			0.207***	0.291***	0.360***
			(0.016)	(0.016)	(0.017)
Combination				0.171***	0.206***
				(0.015)	(0.016)
Needy					0.345***
					(0.016)

Bootstrapped standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 6: Price and Income Elasticities, Unconditional Mean

	(1) Religious	(2) Education	(3) Health	(4) Combo	(5) Needy	(6) Other
Income	0.248***	0.229***	0.181***	0.175**	0.226***	0.250***
	(0.090)	(0.058)	(0.058)	(0.072)	(0.074)	(0.063)
Price	-0.788**	-0.014	-0.006	-0.066	-0.349	-0.047
	(0.371)	(0.198)	(0.226)	(0.282)	(0.282)	(0.239)

Bootstrapped standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 7: P-values from tests of the cross equation equality of income elasticity

	(1) Education	(2) Health	(3) Combination	(4) Needy	(5) Other
Religious	0.85	0.50	0.48	0.84	0.99
Education		0.50	0.52	0.97	0.77
Health			0.95	0.59	0.33
Combination				0.59	0.39
Needy					0.78

Table 8: Cross Equation Elasticity Equality: Price

	(1)	(2)	(3)	(4)	(5)
	Education	Health	Combination	Needy	Other
Religious	0.06	0.06	0.09	0.33	0.09
Education		0.97	0.87	0.28	0.90
Health			0.86	0.30	0.89
Combination				0.45	0.96
Needy					0.35

Appendix A

There are two significant sources of endogeneity in such a price variable that warrant further discussion.

The first source of endogeneity comes out of an individual's decisions to itemize. Charitable donations are deductible but only for those who itemize their deductions. The decision to do so is generally based on a comparison of the appropriate standard deduction (based on filing status) and the total amount of itemized deductions. When itemizing, the individual adds up all the allowed for deductions (e.g. medical costs, charitable donations) and subtracts that from their taxable income. If the sum of all itemized deductions is greater than the standard deduction, one would be expected to itemize. In 2004 the standard deduction was $4,850 for individual filers and $9,700 for joint filers (slightly higher for the blind and those aged over 65). However, endogeneity becomes a problem if the itemized deductions exceed the standard deduction (resulting in the tax return being itemized) only with the charitable donations. To address this issue of "endogenous itemisers," economists have at times excluded them from the sample (Auten, Sieg, and Clotfelter 2002) and elsewhere have used a method of predicting itemization status (Reece 1979). In the current paper the price variable is defined using predicted rather than actual itemization status.

Endogenous itemisers, those who would not have itemised were it not for their donations, were identified (4.6% of the sample). Rather than exclude these observations the price was calculated using predicted rather than actual itemisation status. Itemisation status is predicting using each households interest paid on a mortgage, childcare costs, medical costs in excess of 7.5% of taxable income, property taxes and state taxes and charitable giving predicted as 2% of aggregate gross income (the sum of taxable and transfer income of the head and Wife). If the sum of these components is greater than the relevant (for the year and filer type) standard deduction then the household is denoted as an itemise. This process slightly under-estimates the number of itemisers in the sample (34.6% predicted versus 38.6% declared). It is assumed that those itemising federal taxes are also itemizing state taxes.

The second source of endogeneity comes from the fact that, even taking one's itemization status as given, the price variable is still a function of taxable income which its self will be a function of donations made. Reece (1979) argued that this source of endogeneity was over-stated and used the actual marginal rate faced by individuals citing the low correlation between the marginal rate and income. Since the early 1970's however, every attempt to estimate price elasticities of giving has dealt with this source of endogeneity and economists have addressed it in a number of ways. The long time standard practice was to use the marginal rate assigned with no donations made (Feldstein and Taylor 1976 Slemrod 1989). Some economists went further to obtain some variation in the price variable that was independent of variation in income and donations. Feldstein (1975b) and Randolph (1995) use a more complicated formula to account for gifts of appreciated assets. Reinstein (2006) and Auten, Sieg, and Clotfelter (2002) calculate the price first by computing the marginal rate with donations set to zero and then again using a predicted increment of charitable giving set at 1 percent of average income. Other identified sources of income independent variation are the use of state taxes (Abrams and Schitz 1978) and the use of pseudo-natural experiment methods to take advantage of exogenous changes to the federal or state income schedule during the period of observation (Randolph 1995; Auten, Sieg, and Clotfelter 2002).

The price I construct uses data on non-cash donations, variation in state income tax rates and the deductibility of donations from state income tax, marginal tax rates calculated using a level of predicted giving (1% of income) and changes to the federal tax code during the observed period to obtain a price which is uncorrelated with income and exogenous to the size of the donation.

Donations of appreciated assets create additional price variation that is not directly dependent on income. When an asset is given away, its full value can be deducted from the donor's taxable income but there is no realized gain and therefore the donor need not pay capital gains tax on the appreciated value of the asset. The price of the donation then depends not only on the marginal income tax rate but also on the proportion of donations that are appreciated assets, the fraction of the asset's value that is accrued capital gain and the alternative disposition of the asset.

An asset originally bought for $10 is now worth $100 and the marginal capital gains tax rate is 20% and a marginal income tax rate of 40%. Donating the asset will reduce taxable income by $100, reducing tax liability by $40, so after tax income is increased by $40. If the asset is sold and the gain realized then 20 percent on the capital gain of $90, or $18; will be paid and after tax income will increase by $72. Under these conditions, the price of the donated asset in terms of foregone consumption is $72-$40=$32. Defining price in terms of foregone consumption yields a price of 32 cents per dollar of the current value of the donated asset versus a price of 60 cents per dollar of cash donated.

A handful of previous studies have addressed this issue (Feldstein and Taylor 1976; Auten, Sieg, and Clotfelter 2002) where the price is computed as the weighted average of the price of giving cash and the price of giving appreciated property, though most, due to lack of data, avoid it and use only the marginal income tax rate. One limitation of the studies that have sought to account for appreciated assets is that they typically assume that the non-cash donations are all appreciated property. This assumption is tempered in the price variable used here.

The inclusion of state income taxes further provides price variation that is independent of income and donations as the existence and magnitude of state income taxes varies as does the deductibility of charitable donations from state taxes.

Rather than calculate the price using the actual level of donations, I calculate the marginal tax rates for each household at zero donations and at a predicted 1% of household income. I then use the mean of these two in the construction of the price variable.

Lastly, the change in American tax law between 2000 and 2004 (significant reduction in the federal marginal rate, adjusted schedule) provides a source of exogenous variation and establishes a sort of natural experiment element to the analysis.

The changing of the tax schedule and brackets provides an exogenous change in price that would otherwise not be available. The contemporaneous change in the tax rates and schedule results in some major swings in price for some households. For those earning between $43,851 in 2000 and $46,700 in 2002 the marginal rate faced by these households falls thirteen percentage points over that period. An analysis of those households that experienced large, exogenous shifts price might prove interesting.

Appendix B

Honoré (1992) develops a non-parametric estimator for use with truncated and censored panel data with fixed individual effects. This trimmed least absolute deviations (LAD) and trimmed least squares estimators are also known as 'fixed effects Tobits', the parametric counterpart of which is known to be inconsistent (Greene 2002). Honoré (1992) shows that these estimators are consistent and perform well in small samples. Honoré(2008) derives marginal effects from non-parametric censored regressions with fixed effects, showing that they can be obtained in a manner analogous to the derivation of marginal effects from standard parametric Tobits. Table D.1 presents the income and price elasticities for the six identified causes.

Table D.1: Price and Income Elasticities from 'fixed effects Tobits',

	(1)	(2)	(3)	(4)	(5)	(6)	
	Total	Religious	Education	Health	Combination	Needy	Other
Income	0.165***	0.185***	0.108***	0.139***	0.106*	0.174***	0.157***
	(0.062)	(0.062)	(0.034)	(0.043)	(0.063)	(0.055)	(0.046)
Price	-0.755***	-0.656***	0.036	-0.019	-0.055	-0.379*	-0.061
	(0.190)	(0.185)	(0.142)	(0.176)	(0.223)	(0.227)	(0.168)

Bootstrapped standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Results here are very similar to those reported in table 6. Table D.2 presents the income and price elasticities obtained from uni-variate random effects Tobits. These tend to be much larger, in absolute terms, than those obtained via the 'fixed effects' approach or the correlated random effects approach indicating the need to control for correlation between individual effects and observabel characteristics when estimating panel data models os charitable giving.

Table D.2: Price and Income Elasticities from random effects Tobits

	(1)	(2)	(3)	(4)	(5)	(6)	
	Total	Religious	Education	Health	Combination	Needy	Other
Income	0.591***	0.296***	0.287***	0.340***	0.469***	0.427***	0.365***
	(0.045)	(0.047)	(0.031)	(0.033)	(0.043)	(0.042)	(0.035)
Price	-1.619***	-1.072***	-0.213	-0.305*	-0.717***	-0.777***	-0.284*
	(0.211)	(0.205)	(0.139)	(0.160)	(0.200)	(0.204)	(0.173)

Bootstrapped standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1