How Does Charitable Giving Respond to Incentives and Income? Panel Estimates with State Tax Identification, Predictable Tax Changes, and Heterogeneity by Income

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We estimate the elasticity of charitable giving with respect to persistent and transitory price and income changes, allowing for re-timing in response to predictable future tax changes and gradual learning, using a 1979-2006 panel of tax returns. Fixed-effect estimates of the persistent price elasticity are around -0.6, but exceed -1.1 when identification comes from differing time paths of marginal tax rates across states, or when we allow heterogeneity across incomes in the effects of non-price variables and the time paths of unobservable influences. When we allow for heterogeneous price elasticities, estimates are robust for very high-income people in particular.

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Income taxation policies in the United States provide a substantial price subsidy for charitable donations, and the degree to which people respond to this subsidy is a matter of considerable policy interest. The federal income tax and most state income taxes allow a deduction for charitable contributions, which effectively reduces the price of those contributions relative to non-deductible consumption to one minus the marginal income tax rate for those who itemize deductions. The opportunity to avoid capital gains taxes on charitable gifts of appreciated assets reduces the price of charity still further. In general, the case for providing tax incentives for charitable giving is stronger when charitable giving decisions are more responsive to the incentives. Saez (2004) demonstrates this in a formal optimal tax model where charitable donations are treated as a consumption good with positive externalities.

The responsiveness of charitable giving to incentives is generally summarized by the price elasticity of charitable giving – that is, the percentage change in donations caused by a one percent change in price. There are many challenges to credibly estimating this critical parameter. A particularly fundamental difficulty is distinguishing the causal effect of price on charitable giving from the effects of income and unobservable influences. The identifying price variation in most prior studies has come from differences across people and across time in marginal federal income tax rates, which are largely a non-linear function of income. As result, both price and income elasticity estimates could be biased if income has some arbitrary non-linear relationship with charitable giving but the appropriate non-linear functions of income are omitted from the specification (as emphasized by Feenberg, 1987), or if there are omitted variables that influence charity and that have a non-linear relationship with income. Ties to community, innate altruism, religiosity, education, and alumni ties may influence charity and may have systematic non-linear relationships with income, but many or all of these are unobserved in data typically used to estimate the price elasticity of charity. One possible response is to exploit the fact that federal tax reforms have changed marginal tax rates dramatically over time for high-income people, but not much for middle-income people, effectively using high-income people as the treatment group and middle-income people as the control group and comparing changes over time in price and charity in each group. But other unobservable influences on charity may be changing in different ways over time for high-income people compared to middle-income people, confounding such a comparison. For example, in income tax return data we lack information on wealth, and we can expect that dramatic changes in asset prices over time affected high-income and middle-income people differently; social attitudes, religiosity, and social capital could well be changing in different ways over time at different points in the income spectrum as well. Moreover, responsiveness to tax incentives may differ systematically across income groups.

Another critical question is how to disentangle long-run responses to persistent changes in price and income from short-run timing, consumption-smoothing, or learning behavior. For example, if we find that people give more to charity when they face high tax rates, that might mean the tax incentive is effective in promoting long-run giving, or it might mean that people are moving charitable giving into that year from other years with lower tax rates in order to increase their tax savings, possibly without changing the long-run amount of giving at all. Transitory differences between current and expected future price can arise because of a temporary fluctuation in income that pushes the taxpayer into a different tax bracket, or because of changes in tax law, which are typically proposed and announced before the year in which they begin to apply. As a consequence, differences between current and expected future prices of charitable giving are ubiquitous, creating many opportunities to reduce tax liability through re-timing of giving. Transitory fluctuations in pre-tax income and predictable changes in tax law also create differences between current and expected future after-tax incomes, which may matter for current charitable giving decisions as well, depending on the degree to which people try to smooth charitable and non-charitable consumption over time. A related consideration, emphasized by Chetty (2009), is that tax law is complicated and costly to understand, so as a result rational taxpayers may not invest in learning about new tax laws and may fail to re-optimize when tax law changes. Under such conditions, we might expect relatively little response in advance to future changes that are particularly hard to understand, and see gradual adaptation to the changes in tax incentives over time as taxpayers learn.

In order to address all of the challenges noted above, we exploit a large panel of individual income tax returns spanning the years 1979 through 2006 that heavily oversamples high-income people, in conjunction with a federal-state income tax calculator developed by Bakija (2009). As is typical in panel data studies, we control for individual-specific fixed-effects, eliminating bias from any time-invariant influences on charity that differ across individuals, and year fixed-effects, eliminating bias from any influences on charity that are changing in the same way over time for everyone. But we can go beyond this, because we demonstrate below that among high-income people, the price of charitable giving changed in substantially different ways over time depending on one's state of residence, largely due to interactions between federal tax reforms and state income taxes. This allows us to implement demanding identification strategies that rely on this more convincing quasi-experimental source of variation. We estimate price elasticities where the identification comes mainly from differences in the time-path of price across states. We also estimate a model that allows for separate time fixed-effects at different income levels, which controls for unobservable influences on charity that may be changing in different ways over time for people of different incomes, and we allow the effects of income and all other covariates to differ by income level as well. In addition, we test the sensitivity of our estimates to allowing for heterogeneous price elasticities across income levels. To distinguish transitory from persistent variation in prices and incomes, and to allow for gradual adjustment and learning in response to tax changes, we include lagged and future changes in price and income in the specification. We use predictable future changes in federal and state marginal tax rates and tax liabilities as instruments for unobservable expectations of future changes in price and income.

When we constrain time fixed-effects and all other parameters to be constant across income groups, we estimate a persistent price elasticity around -0.6. When identification for the price elasticity comes from differing time paths of marginal tax rates across states, the estimated persistent price elasticity increases to -1.2, and when we allow heterogeneity across incomes in the effects of non-price variables and the time paths of unobservable influences, the persistent price elasticity is estimated to be -1.1. These higher estimates are arguably more convincing because they rely largely on price variation that is more independent of income. When we additionally allow for heterogeneous price elasticities across income classes, we find robust evidence of large persistent price elasticity among very high-income people, particularly millionaires. Price elasticity estimates for those with incomes below $200,000 are inconclusive when we use very demanding identification strategies, because good quasi-experimental variation in tax incentives is absent for those people. We find evidence that people adjust gradually to changes in the tax price of giving, and evidence in some specifications of re-timing giving in response to large, salient, predictable future tax changes, particularly among those with very high incomes. But the evidence on re-timing is inconclusive when we rely on more subtle future tax changes for identification.

There have been many prior empirical studies of the price elasticity of charitable giving, but none have addressed all of the challenges emphasized above at the same time. Early cross sectional studies typically estimated large price elasticities; Clotfelter (1985) reports -1.2 as a typical estimate. Feenberg (1987) estimated a price elasticity of charitable giving of -1.63 where the identification came exclusively from cross-sectional differences in state marginal tax rates. Subsequent studies using panel data, including for example Broman (1989), Randloph (1995), Barrett, McGuirk, and Steinberg (1997), Bakija (2000), Auten, Sieg, and Clotfelter (2002), and Bakija and McClelland (2004), have used various methods to try to distinguish responses to transitory and persistent price and income variation, and have found more mixed results. Auten, Sieg, and Clotfelter's estimates generally suggest large persistent price elasticities, usually in excess of -1, and small transitory price elasticities. Randolph's study, by contrast, reports an elasticity of giving with respect to a persistent price change of -0.5, and a -1.5 elasticity of giving with respect to a one-period transitory price change. The other panel studies, which were based on a small public-use panel of taxpayers with few high-income people, generally find relatively modest persistent price elasticities. All of these studies relied heavily on differences in the time path of federal income tax rates across income levels for identification, and none (except for Bakija and McClelland) used state tax variation or allowed for the possibility of omitted influences on charity that might be changing in different ways over time at different income levels. Neither Randolph nor Auten, Sieg, and Clotfelter allowed for future persistent price changes that are anticipated in advance. But Auten, Cilke, and Randolph (1992) demonstrate (and we corroborate below) that there was a large spike in giving in 1986 among very high-income taxpayers, apparently in anticipation of the following year's implementation of the Tax Reform Act of 1986 (TRA86), suggesting that response to anticipated future persistent changes in price may be an important consideration.[1] Karlan and List (2007) performed a randomized field study on donors to a particular non-profit foundation, and found that varying the rate at which contributions were matched by an anonymous donor, which is economically similar to varying the price (but framed very differently), had no effect on contributions among those offered a match. This exacerbates concerns that prior observational estimates of the price elasticity of charitable giving may have been driven by omitted variable bias. By exploiting state tax variation and relaxing various identifying restrictions imposed in the previous literature, we provide estimates that are more robust to these concerns.

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[1] Randolph omits "transition years" when federal tax law created a clear difference between current and future tax rates, which helps reduce this problem, but also sacrifices a particularly credible way of identifying re-timing behavior. Moreover, re-timing of giving implies that giving in transition years would be shifted to or from other years, so omitting transition years may not solve the problem. For more detailed reviews of the literature, see the earlier NBER working paper version of our paper (Bakija and Heim 2008), and Brown (1997). See Bakija (2000) for further discussion of Randloph (1995), Bakija and McClelland (2004) for further discussion of Auten, Sieg and Clotfelter (2002), and the web appendix to this paper (Bakija and Heim, 2010) for clarification of how ignoring future persistent shocks to price that are anticipated in advance can bias estimates.

Empirical model

Following most of the previous literature, we estimate a log-log demand equation for charitable giving, so that coefficients on price and income are directly interpretable as elasticities. We begin by describing a basic specification which constrains effects to be constant across income classes, and then later explain how we relax these constraints. In equation (1) below, we modify the traditional log-log specification in a variety of ways in order to address various empirical challenges.

$$(1) \qquad ln(charity)_{it} = \alpha_i + \alpha_t + \mathbf{X_{it}\beta_0} + \beta_1 \Delta lnP_{it-1} + \beta_2 \Delta lnP_{it} + \beta_3 lnP_{it} + \beta_4 \Delta lnP_{i,future} + \beta_5 \Delta lnY_{it-1} + \beta_6 \Delta lnY_{it} + \beta_7 lnY_{it} + \beta_8 \Delta lnY_{i,future} + \varepsilon_{it}.$$

In equation (1), *i* indexes individuals and *t* indexes years. The dependent variable $ln(charity)_{it}$ is the log of charitable donations plus $10 (to deal with the 3.7 percent of tax returns in the estimation sample with $0 of reported donations).[2] To control for unobserved influences on charity that differ across individuals but are constant over time, we include fixed effects (α_i) for each unique taxpaying unit.[3] We control for any influences on charity that change in the same way over time for everyone through year effects ($\alpha_{t,}$). The vector **X** is a set of control variables that will be explained further below, and ε_{it} is an error term. The primary variables of interest are the log of the price of charitable giving (lnP), the log of after-tax income (lnY), and lagged and future changes in each of those variables. The Δ variables with time subscripts represent first-differences of those variables (e.g., $\Delta lnP_{it-1} = lnP_{it-1} - lnP_{it-2}$). The $\Delta lnP_{i,future}$ and $\Delta lnY_{i,future}$ variables represent future values of price and income minus their current year *t* values. For these future changes in price and income, we use the change over the next one year

[2] Later in the paper, we examine the robustness of the estimates to different methods of dealing with the observations with $0 reported donations.

[3] A unique taxpaying unit is defined here as a primary taxpayer, and if married his or her spouse, during a span of time when there is no change in marital status on that taxpayer's returns.

(that is, the *t+1* values of *lnP* and *lnY* minus their year *t* values), but also show the sensitivity of estimates of equation (1) to using the change over the next two years (that is, the *t+2* values of *lnP* and *lnY* minus their year *t* values).

In equation (1), the effect on long-run giving of a persistent increase in price is given by β_3. Intuitively, β_3 estimates the effect of a one percent increase in price holding two lagged changes in price and the future change in price constant, which happens when there has been an increase in price that has persisted over three years and is expected to persist into the future as well.[4] The effect on giving today of an anticipated future increase in price is given by β_4. The effect on giving today of a transitory increase in price this year that is expected to disappear in the future is given by ($\beta_2 + \beta_3 - \beta_4$). Analogously, β_7 is the response to a persistent increase in income, β_8 is the response to an anticipated increase in future income, and the effect on giving today of a transitory increase in income that goes away in the future is given by ($\beta_6 + \beta_7 - \beta_8$).[5]

Y_{it} is after-tax income, and is defined as pre-tax income less federal and state income tax liability computed setting charitable giving to zero, converted to constant year 2007 dollars using the CPI-U. This is standard in the literature. Intuitively, we are treating after-tax income computed setting charitable giving to zero as the available budget, and incorporating the benefits of tax deductibility of charitable giving into its price rather than after-tax income.[6]

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[4] Equation (1) above can be re-arranged so that the price variables and their coefficients enter as $\gamma_1 \ln P_{it-2} + \gamma_2 \ln P_{it-1} + \gamma_3 \ln P_{it} + \gamma_4 \ln P_{i,future}$. β_3 from equation (1) is equivalent $\gamma_1 + \gamma_2 + \gamma_3 + \gamma_4$ in that alternative specification, so β_3 estimates the effect of a uniform percentage increase in price that has already persisted for three years and is expected to persist into the future. An analogous re-arrangement can be performed with the income variables.

[5] In the web appendix to this paper (Bakija and Heim 2010), we clarify the conditions under which our econometric specification is a consistent estimator of the elasticity of charitable giving with respect to permanent and transitory shocks to price and income.

[6] Our measure of pre-tax income is defined to be as consistent as possible over time and across individuals given information available in our tax return data. Income equals: adjusted gross income (AGI) + (total adjustments) + (excluded capital gains) + (excluded dividends) - (social security in AGI) + (unemployment benefits excluded from AGI) - (1/2 of self-employment taxes) - (state tax refunds) + (partnership and S-corporation losses). Following previous studies on this subject, we remove social security benefits from income, because information on social security

The control variable vector **X** includes life cycle and demographic factors including age squared, number of children living at home, and number of other dependents.[7] We also control for some state characteristics that may affect charitable giving. We include a variable *lnP_salestax = ln(1/(1+salestax))*, where *salestax* is the state statutory retail sales tax rate, to control for the effect of state retail sales tax on the relative price of charitable giving.[8] We also include the log median house price in each state in the 2000 census (U.S. Bureau of the Census 2004), grown backwards and forwards to other years by the FHFA (2009) state-specific constant quality home price index, and converted to constant year 2007 dollars using the CPI-U. We control for state and local government spending as a share of personal income in each year, to allow for the possibility that public provision of public goods "crowds out" private contributions, and also control for state-year specific unemployment rates.[9]

We define the price of charitable giving, P_{it}, as:

(2) $$P_{it} = 1 - mtr_{it} - n_{it} * s_{it} * a(d * mtrcg_{it+1} - mtrcharcg_{it})$$

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benefits is not available for taxpayers with incomes below the threshold where they become taxable, and are not available at all before 1984. We add back in partnership and S-corporation losses because these largely represent passive losses (frequently related to tax shelters) that were disallowed following the Tax Reform Act of 1986, and that arguably misrepresented true economic losses before 1986.

[7] The combination of individual fixed-effects and year fixed-effects effectively control for age. Marital status is time-invariant for an individual given our sample selection method, described below, and so is controlled for by the individual-specific fixed effects.

[8] State sales tax rates are taken from the University of Michigan Office of Tax Policy Research *World Tax Database* <http://www.bus.umich.edu/otpr/otpr/default.asp> for years through 2002, and then from Research Institute of America's *All States Tax Handbook* for later years.

[9] *State unemployment rate* is from the U.S. Bureau of Labor Statistics website <http://www.bls.gov>. *State gov't spending* is direct current expenditures of state and local governments as a share of state personal income, obtained from the Urban-Brookings Tax Policy Center State and Local Government Finances database <http://www.taxpolicycenter.org/taxtopics/statelocalgovernment.cfm>.

Following the previous literature, our price variable incorporates both the tax savings from the charitable deduction, and the extra tax savings from avoiding a taxable realization of capital gains, but we make some refinements. In equation (2), mtr_{it} is the combined federal-state marginal tax rate on charitable giving (defined as the reduction in tax liability caused by a $1 increase in charitable gift), $mtrcg_{it+1}$ is the marginal tax rate on long-term capital gains, and $mtrcharcg_{it}$ is the marginal tax rate on unrealized capital gains on donations of appreciated property, which were included in the base of the federal alternative minimum tax (AMT) from 1987 through 1992, and also in some state AMTs.[10] The n_{it} represents the actual value of non-cash donations as a share of total charitable donations for the taxpaying unit in year *t*. The s_{it} is an income-specific measure of the typical share of non-cash donations that represent stocks or real estate, derived from Ackerman and Auten (2008).[11] The *a* represents the gain-to-value ratio for non-cash donations of stock and real estate, and *d* is a discount factor to reflect the fact that the alternative to donating an appreciated asset may be to hold on to it and not realize the gain until many years in the future, reducing the present value of tax liability. We have estimated *a* to be 0.59, on average, based on AMT returns from 1989-1992.[12] For *d,* we choose a value of 0.7, based on our extrapolations from an empirical study of the distribution of the timing of asset sales conducted by Ivkovic, Poterba, and Weisbenner (2005) and data on holding periods for sales of capital assets from Auten and Wilson

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[10] The $mtrcharcg_{it}$ term is non-zero only for returns that are subject to the federal or state AMT in a year when it taxed unrealized gains on donations.

[11] Specifically, we compute s_{it} as the share of non-cash contributions that represent donations of stock or real estate for each of six income classes in 2004 from Table 3 of Ackerman and Auten (2008), with values ranging from 0.028 for those with incomes below $75,000 to 0.956 for those with incomes above $1 million. We assign the average values to everyone in the lowest and highest income classes, and for the four intermediate income classes we assign the share reported in Ackerman and Auten to the midpoint income in the range, and linearly interpolate values for others. Ackerman and Auten show that the vast majority of other non-cash donations represent household items and vehicles that are unlikely to involve capital gains.

[12] To avoid sample selection bias, we computed this mean using only returns that would have been subject to the AMT even if they had not donated any appreciated assets.

(1999). This discount factor *d* only applies to *mtrcg*, because when a taxpayer donates a dollar of an appreciated asset, *mtrcharcg* must be paid today. We use the anticipated future $mtrcg_{it+1}$ because the likely alternative to current donation of an appreciated asset is realization of the capital gain at some point in the future.[13]

Price is endogenously related to current charitable giving, because a large charitable deduction can push the taxpayer into a different tax bracket. To address this, we construct "first-dollar" instruments for all the price variables that re-compute the prices setting charity to zero, a common practice in the literature.[14] We also follow the previous literature by treating n_{it} as endogenous. For example, gifts of appreciated assets tend to be large and lumpy, so n_{it} may be particularly large in years when large gifts are made. Therefore, in the instruments for price variables we replace n_{it} with an exogenous value, the average value of *n* in our sample, 0.17.[15]

A critical challenge in estimating equation (1) is that theoretically, what should matter for current charitable giving behavior is one's *ex ante expectation* of future changes in price and income, but what we observe in the data is one's *ex post realization* of future changes in price and income. Actual future changes in price and income can be viewed as measurements, with error, of the time *t* expectation of those future changes.[16] So we

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[13] Further details on how we compute all of the elements of our price variable are included in the web appendix to the paper (Bakija and Heim 2010).

[14] When computing price instruments and first-dollar tax liability, we also set to zero a class of miscellaneous alternative minimum tax preferences (including things like accelerated depreciation, but not the more common preferences such as itemized deductions). This is necessary because this class of AMT preferences includes unrealized capital gains on donations of appreciated assets in some years, and the data do not always enable us to separate this out.

[15] We use the sample mean of *n* when constructing our instruments because for our sample as a whole, we did not find much variation across income classes in the average value of *n* (although there was a positive correlation in the early years of the sample), and because year-to-year variation in *n* appears to be contaminated by endogenous responses to timing incentives (for instance, *n* was unusually large in 1986, apparently in anticipation of how TRA86 would change incentives in the future).

[16] This is related to the approach used by Randloph (1995) although he treated *current* price as measurements with error of its expected future persistent value; that approach runs into trouble

need instruments for the future changes of price and income that are correlated with the taxpayer's time *t* expectation of those future changes, and are uncorrelated with the forecast (measurement) error. Our strategy is to construct what we call "predictable tax change instruments," which isolate the portion of variation in future changes in price and income that should be predictable at time *t* because the near-future tax function (that is, the function that transforms pre-tax income into tax liability) can generally known in advance, due to lags between proposal, enactment, and implementation of tax reforms, and because of the way our other exogenous explanatory variables known at time *t* interact with the knowable future tax functions (for example, predictable life-cycle variation in taxable income has implications for taxes). We assume that taxpayers know about any federal tax reform that has already been enacted in year *t*, and also know about any reform that will take effect starting in year *t+1*. So for example, we assume that taxpayers in 1986 know about TRA86 because it was enacted before the end of the year, and they knew what effect it will have in 1987 and 1988. However, we assume that people did not anticipate TRA86 in 1985. This rule also means that we assume that people in 1992 already know about the federal tax changes enacted in 1993, and in 2002 already know about the federal tax changes that would be enacted in 2003. For state tax reforms, we assume that people know about any changes in state tax parameters that will begin to apply next year, but do not know about changes that begin to apply two years or more in the future.[17]

We construct an instrument for the future change in log price by applying the predictable future tax function, as defined above, to a predicted value of future pre-tax income (computed in a manner described below), in order to construct a predicted future log price, and then subtracting the current actual first-dollar log price. The

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when there are systematic differences between current and expected future prices due to pre-announced changes in tax law.

[17] We investigated a sample of state tax reforms and found that they are usually enacted in the calendar year before they begin to apply, but did not attempt a comprehensive study of enactment dates of all changes in state tax law.

instrument for future change in *lnY* is constructed by computing a future value of one's average tax rate (ATR), defined as the individual's total income tax liability divided by pre-tax income, by applying the predictable future tax function to a predicted future value of pre-tax income and then dividing by that predicted pre-tax income. The instrument for future change in after-tax income is then the change in *ln(1-ATR)* between time *t* and the future year. This is motivated by the fact that:

$$(3) \qquad lnY = lnY' + ln[1\text{-}ATR(Y')],$$

where *lnY'* is log pre-tax income, and *ATR*(.) is the average tax rate as a function of pre-tax income. Essentially, this uses the predictable future change in tax liability as an instrument for the future change in after-tax income.[18]

We also use two other excluded instruments in the first stage in an effort to help distinguish transitory from permanent variation in price and income. The additional instruments are the year *t* combined federal-state marginal tax rate on long-term capital gains for the individual, and the difference between future and current marginal tax rate on long-term capital gains, with the future change computed in analogous manner to the instruments for future changes in price and income described above. There is evidence that anticipated differences between current and future capital gains tax rates cause

[18] To calculate the future marginal tax rate and future average tax rate, one must know not only the future tax law and the future value of pre-tax income, but also the values of the vector **Z** of other individual characteristics that affect the transformation of pre-tax income into tax liability, such as components of income and deductions. To impute the future values of each of the dollar-valued components of **Z**, we multiply predicted future pre-tax income by the average ratio of that component of **Z** to pre-tax income for that individual over the previous three years (*t-2*, *t-1*, and *t*). So for instance, if long-term capital gains realizations were 10% of pre-tax income for the individual, on average, in the past three years, we set long-term capital gains realizations to 10% of predicted future pre-tax income when we calculate the future tax rates and tax liabilities used to construct our instruments. We also assume that age of taxpayer and spouse are known in advance with certainty, that changes in the number of children and the number of other dependents are known one year in advance, and that marital status is not expected to change (since our sample selection criteria exclude people with changes in marital status), and we set charitable giving to zero in the calculation of the instruments.

transitory fluctuations in realized income. For instance, there was a very dramatic spike in capital gains realizations in 1986, in anticipation of an increase in the tax rate on gains that would begin to take effect in 1987 (Burman, Clausing, and O'Hare 1994). We may expect that an increase in income, and the associated decrease in price, in a year like 1986 is especially likely to be transitory, and putting the capital gains tax rate variables in the first stage excluded instrument set helps account for that. The capital gains tax rates should affect current charitable giving only through their effects on the price of giving and income, in which case it is valid to exclude them from the second stage regression.

As noted above, to compute the future marginal and average tax rates used to construct our instruments for future change in price and income, we apply the predictable future tax function to predicted values of future pre-tax income. In order to do this, we construct a predicted value for future pre-tax income one year or two years hence, for each individual in each year, based on a regression which uses the full set of exogenous instruments, with some modifications, as explanatory variables. The dependent variable in that regression is the actual change in future log real pre-tax income over the next one or two years, and the explanatory variables include the set of explanatory variables in equation (1), with the following changes. First, year dummies and time dummies are excluded, because including them would presume perfect foresight about mean income for the individual and about the mean change in future income for the sample as a whole. Marital status and age -- which had been omitted from equation (1) due to perfect collinearity with the individual and year fixed effects -- are included in their place. Second, past and current price variables are replaced with their exogenous first-dollar values. Third, future change *lnP* is replaced with a predicted change in log price, and future change in *lnY* is replaced with predicted change in *ln(1 – ATR)*, both calculated using the predictable future tax function and holding an individual's pre-tax income and other inputs into the tax calculation constant at their year *t* values in real terms. Fourth, we include the current value of marginal tax rate on long-term capital gains, and the future change in that tax rate again calculated holding pre-tax income and other inputs into the tax calculation constant at their year *t* values in real terms. The rationale for including all of these exogenous tax variables in the income prediction equation is to allow for the relationship between past income and future income to change over time as a result of exogenous tax reforms, for example due to a taxable income elasticity and re-timing of income in response to anticipated reforms. We then calculate the instruments for future change in price and income as described above by applying the predictable future federal and state tax functions to the predicted future pre-tax income; that is, our forecast of future pre-tax income only contributes to our instrument in that it helps us more accurately calculated the anticipated future change in marginal and average tax rates. Our identifying assumptions are that these instruments for predicted future changes in price and income are correlated with the expected future changes in these variables, have no independent effect on giving except through price and income, and are uncorrelated with the forecast error, which is plausible because the predictions are based entirely on information that should be knowable at time *t*. Since the non-tax variables used to forecast income are all controlled for separately in our specification, the independent variation in the instruments is all coming from taxes.

To summarize, we treat ΔlnP_{it-1}, ΔlnP_{it}, lnP_{it}, $\Delta lnP_{i,future}$, and $\Delta lnY_{i,future}$ in equation (1) as endogenous variables, and estimate the equation by conventional two-stage least squares. The instruments for these variables included in the first stage regression are first-dollar versions of ΔlnP_{it-1}, ΔlnP_{it}, and lnP_{it}, predicted values of $\Delta lnP_{i,future}$ and $\Delta ln[1-ATR]_{i,future}$ constructed as described above, current marginal tax rate on long-term capital gains, and expected future change in marginal tax rate on long-term capital gains, along with the exogenous explanatory variables from equation (1).

In order to estimate price elasticities where the identification comes from different time paths of price across states, we estimate an equation that is similar to equation (1) except that all price variables are split into separate federal and state components. To allow for heterogeneous effects of non-price variables, we estimate a version of equation (1) where the log income variables, the year dummies, and the components of $\mathbf{X}_{it}$ are all interacted with dummies for each of five pre-tax income classes: less than \$100,000, \$100,000 to \$200,000, \$200,000 to \$500,000, \$500,000 to \$1 million, and over \$1 million, measured in constant year 2007 dollars.[19] To allow responsiveness to price to vary by income class, we take the specification just described and additionally interact all of the price variables with the income class dummies, allowing the price elasticity to vary freely across income classes. We also show the sensitivity of this specification to different methods of controlling for unobservable time-varying influences on charitable giving. In all specifications allowing heterogeneity by income class, we also allow parameter heterogeneity by income class on all variables in the regression to predict future pre-tax income changes that we use to construct our instruments for future price and income changes.

In all specifications, we compute robust standard errors that are clustered by state and average income group, to allow for arbitrary forms of correlation among the errors in each income group / state cluster, and to allow arbitrary forms of heteroskedasticity across the clusters. [20]

Data

We assemble a panel of individual income tax returns covering the years 1979 through 2006 from several different confidential Treasury department data sets. The main components are three large panel data sets that were selected using a stratified random sampling technique, where the probability of being sampled rose with income, so that the panels contain a disproportionately large number of high-income taxpayers.

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[19] The income class dummies are based on year *t* pre-tax income, except in the case of the lagged change variables, which use pre-tax income from the year at the beginning of the change.

[20] See Bertrand, Duflo, and Mullainathan (2004). We implement our econometric specification using xtivreg2 in Stata (Schaffer, 2007). The clustering procedure requires that an individual taxpaying unit stay in the same cluster over time, so we assign each taxpaying unit to a cluster based on the state it resided in for the largest number of years and mean income over time. We use the same five income classes defined in the text for the clustering, except based on the individual's mean rather than current income..

The first spans the years 1979 through 1995; Randolph (1995) and Auten Sieg and Clotfelter (2002) both used shorter versions of this panel. The second component is the "Family Panel" that was collected from 1987 through 1996.[21] The third component is the "Edited Panel" that was collected from 1999 through 2006.[22] For 1997 and 1998, we use a small non-stratified random sample of returns (selected based on the last four digits of the social security number) that were included in the 1997 and 1998 IRS Statistics of Income cross-section files and that were also followed in the other panels (we eliminate any duplicate returns).

Marginal tax rates and tax liabilities in this study were calculated using the comprehensive income tax calculator program described in Bakija (2009), and include both state and federal income taxes. The calculator incorporates such details as the minimum and alternative minimum taxes, maximum tax on personal service income, and income averaging in the years when these were applicable.[23] Marginal tax rates were calculated by incrementing each variable (either charitable contributions, unrealized capital gains on donations of appreciated asses, or long term capital gains) by ten cents, calculating the marginal increase in taxes owed, and dividing that by the ten cents.

To create the estimation sample, several cuts were made. All dependent filers and all taxpayers under the age of 25 were dropped from the sample, as were married taxpayers who filed separately and taxpayers with missing state data (in cases where we were not able to infer state from nearby years of data). To remove returns with internally inconsistent data, we dropped any returns where the federal income tax liability reported on the return was not sufficiently close to federal income tax liability

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[21] For more information on Treasury's Family Panel, see Cilke et al. (1999, 2000).

[22] For more information on the 1999-2005 Edited Panel, see Weber and Bryant (2005).

[23] For some returns in 1979-95 panel, we used an iterative process to back out certain items needed for income averaging and AMT computations from the reported liabilities for those taxes. We also include approximations of local income taxes in all years – see Bakija (2009) for details.

figured by the tax calculator.[24] To avoid endogenous sample selection, we then cut the data to include only "exogenous itemizers," defined as those for whom real federal itemized deductions, recomputed with charitable giving set to zero, exceeded the largest real federal standard deduction or zero bracket amount during the sample period.[25] We also exclude all returns with pre-tax income less than the sum of applicable standard deduction or zero bracket amount and personal exemptions. To maintain a comparable sample over time and limit the sample to those with sufficiently long consecutive time series to allow us to estimate our dynamic model, we only include returns that are in the midst of a spell of at least six consecutive years of meeting all our other sample selection criteria noted above with no change in marital status.[26] Finally, when we estimate our full econometric specification, the first two years and last two years of data for each taxpaying unit are omitted from the estimation sample, because we include two lagged changes and one- or two-year lead changes in price and income, and because as explained below, two years of future data are needed to compute our charitable donations variable. The resulting sample consists of 330,396 returns: 51,017 from the 1979-95 panel, 183,509 from the 1987-96 panel, 5,702 from the 1997 and 1998 cross-sections, and 90,168 from the 1999-2005 panel. 60,657 unique taxpaying units are represented.

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[24] Specifically, we cut observations if the federal tax liability before credits and minimum taxes computed by the tax calculator differs from the amount reported in the dataset by more than $10,000. Also note that before doing this, we made extensive efforts to resolve internal inconsistencies in the data by inferring values of problematic variables from information available elsewhere on the return. For our final estimation sample, the computed tax liability before credits and minimum taxes came very close to the corresponding amounts in the dataset, with a correlation that rounds to 1.000 for the entire sample.

[25] The year of the largest real standard deduction or zero bracket amount was 1979 for single filers, 2004 for heads of household, and 2003 for married taxpayers filing jointly.

[26] If a primary taxpayer is in the sample unmarried for at least six consecutive years and also in the sample married for at least six consecutive years, then both spells are included in the estimation sample, but the primary taxpayer is treated as belonging to different taxpaying units in the two spells for purposes of fixed effects analysis.

Information on charitable contributions comes from the amounts reported on Schedule A of the federal income tax return. For itemizers, the amount of charitable *deduction* can differ from the amount of charitable *donation* because the deductible amounts of charity are limited to various percentages of a taxpayer's adjusted gross income (AGI), depending on the type of giving, and the total deduction may not exceed 50 percent of AGI. The amount of giving deducted in a particular year will exclude any portion of giving that is above those limits, and may include amounts carried over from a previous years in which the taxpayer gave in excess of a limit. Joulfaian (2001), in a study examining the charitable giving reported on the income tax returns of wealthy taxpayers in the few years before death, notes that the actual amount of donations can far exceed the amount that is deductible for such taxpayers. For example, in his sample, between 1991 and 1996 the average contribution actually made was almost two and a half times the amount of the deduction claimed. His results also show that, particularly for those with estates in excess of $100 million, year to year variation in the amount actually given is substantially larger than the variation in the amount deducted.

As Joulfaian (2001) notes, most previous analyses of tax return data have used the current charitable *deduction* as the dependent variable, but we instead follow Joulfaian by constructing a variable that more closely approximates donations made in the current year. Tax return data reports the amount of the charitable deduction and the amount of carried-over prior year donations that are claimed and deducted in each year, but not the year from which these carried-over amounts originated. Our measure of charitable donation starts with the deductible amount in year *t*, subtracts any prior year donations that are carried over and claimed in year *t*, and then identifies any carryovers claimed in the next two years that are likely to have been originally donated in year *t* and adds them to the donation amount for year *t*. To identify the probable original source years of carried-over contributions, we use information on whether the total charitable deduction, non-cash donations, or cash donations are at or above any of the relevant percentage of AGI limits in that year, and whether any carryovers are deducted in that year.[27]

Charity in excess of the limits can be carried over for up to five years, but carryovers beyond two years are rare, and constructing the charitable donation variable in this manner requires dropping all observations that are not present in all of the future years used to find carryovers. So using a five-year window would dramatically shrink our sample. We report estimates from a sensitivity analysis that suggest that using a two-year window instead of a five year window to reallocate carryovers does not appreciably affect the estimates.[28]

Table 1 presents a description of the variables used in this study along with some descriptive statistics from the unweighted sample. In this sample, the mean amount of charitable giving is over $125,000 (in 2007 dollars). This large amount of giving is not surprising given the large number of very high-income taxpayers in this sample. The mean after-tax income in the sample is well in excess of $1 million. Almost 85% of the sample consists of married taxpayers, and the average age of the primary taxpayer is 52.

To better illustrate where identification of the coefficients of interest comes from in our sample, Figures 1 through 3 present time paths of the price and charitable giving variables used in the study, broken out by various groupings.

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[27] Full details on the algorithm used to re-allocate carried-over amounts across years are available in an appendix. Using the two-year carryover window algorithm, we are able to identify at least one probable source year for 5,188 of the 6,961 carryovers reported in our estimation sample. The remaining 1,773 observations with carryovers that we could not allocate to one of the two previous years represent less than one percent of all observations in our final estimation sample. Among taxpayers in our sample who have five future years of data available, we find that 0.17 percent are up against the 50% of AGI limit in each of the subsequent five years, and thus unable to ever deduct their marginal contributions; these taxpayers make unusually large contributions though, accounting for 12.6 percent of unweighted contributions in the sample.

[28] Another complication is that if deductible charity in the current year reaches 50% of AGI, then no further current-year donations of any kind may be deducted this year; rather they must be carried forward to a future year. At that point, the relevant marginal tax rate is from some future year. In these cases, when constructing the current "actual" price variable, we replace this year's marginal tax rate with an expectation of next year's marginal tax rate. This does not affect our instruments for price, since they are computed setting charitable donations to zero.

Figure 1 presents the average price of charitable giving by income class over time. Most of the variation in this graph comes from federal tax reforms. The effect of major federal tax acts in 1981 and 1986 are striking, particularly for those with incomes above $200,000. For example, among millionaires, the price of giving $1 to a charity rose from $0.37 in 1979 to $0.67 by 1988. Also noticeable in this graph are the effects of a 1993 federal tax increase, which reduced the average price of giving for the highest three income groups, and federal tax cuts enacted in 2001 and 2003, which increase the price of giving for the highest two income groups. For those with incomes below $200,000, the effects of the various tax reforms on the price of giving are much less pronounced.

State tax variation is also quite important for identifying our price coefficients, so in Figure 2 we illustrate the effect that state income taxes have on the price of charitable giving for high-income people three selected large states: California, New York, and Ohio. Each of these states operated a large and progressive income tax throughout the sample period. California and New York allowed deductions for charitable contributions, and Ohio did not. The graph depicts, for people in each of these states with incomes above $200,000 (in constant year 2007 dollars), an estimate of the difference between the average combined federal-state tax price of charitable giving, and what that price would be for similar individuals in a state without an income tax (such as Texas, Florida, or Washington).[29] Figure 2 demonstrates that high-income people living in states with large income taxes had substantially different time-paths for the price of charity over the sample period, compared people in states with no income taxes. For instance, by the mid-1990s the price of giving $1 to charity was reduced by $0.14 by

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[29] To prevent differences in income distributions across states and years from confounding the effects arising purely from variations in tax law, these average prices were calculated by drawing a random 10 percent sample of returns with incomes above $200,000 (in 2007 dollars) from the 1985 SOI public-use cross section, and then use this same set of taxpayers to calculate the marginal impact of a charitable donation on combined federal-state tax liability, with and without state income taxes, in each state and year, holding taxpayer characteristics constant in real terms. We then compute weighted averages of the effect of the state income tax on price for each state-year cell, where the weights are designed to match the income distribution in our full estimation sample.

the California income tax and $0.12 by the New York income tax, compared to just $0.03 in both states in 1981. The Ohio state income tax slightly increased the price of giving $1 to charity in the early 1980s, but reduced it by about $0.06 by the mid-1990s. These patterns produce a quasi-experimental source of variation in price, where high-income people in states with large income taxes are like a treatment group and high-income people in states without income taxes are like a control group.

How a state income tax affects the price of charitable giving depends on the state income tax itself, and its interactions with the federal income tax. State tax reforms caused many modest changes in price. Moreover, federal reforms often had disparate effects on price across states depending on the size of state income tax, which accounts for much of the correlation in price over time for the three high-tax states in Fig. 2. A particularly large source of variation arises because of an interaction between state income taxes and a federal limitation on itemized deductions that began to apply in 1991 (and that persisted through the rest of the sample period). This accounts for the large drop in relative price in high-tax states evident in Figure 2 starting in 1991. Among people for whom itemized deductions were large as a share of income, this limitation was essentially a tax on AGI at the margin and had little or no impact on the price of charity. But if itemized deductions were small enough as a share of income, the effect of the limitation changed so that only 20% of charitable donations were deductible from the federal tax at the margin, dramatically increasing their price. In states with income taxes, those taxes essentially always made itemized deductions large enough to put people in the first category. But in states without income taxes, a substantial minority of high-income people had itemized deductions small enough to put them in the second category.[30] Thus, starting in 1991, high-income people in states that operated income

[30] For example, in our sample we estimate that from 1991 through 2005, the proportion of Texans with incomes above $200,000 who had their price of giving increased by the itemized deduction limitation ranged from 6 percent to 28 percent depending on the year, with the differences largely driven by how heavily the sample was weighted towards very high-income people in that year. Although those are relatively small proportions, the impact on the price for those it affects is large enough that it shows up strikingly even in the averages.

taxes avoided a large increase in the price of charitable giving that ended up applying to many high-income people in states without income taxes.

Other federal-state interactions also loom large in Figure 2. Most importantly, because of the deductibility of state taxes from the federal income tax, a state deduction for charity causes a much larger reduction in the combined federal-state price of giving when federal marginal tax rates are low than when they are high. As federal marginal tax rates changed over time, this substantially changed the incremental effect of state income taxes on the overall price of giving; but no similar changes happened in states without income taxes or that did not allow deductions for charity. The increasing prevalence of the AMT over time also has disparate impacts on the price of giving across states, because people in high-tax states are far more likely to have to pay the AMT, which has a different pattern of marginal tax rates than the ordinary federal tax, and the AMT eliminates the deductibility of state taxes for those who are on it, which increases the incremental impact of state taxes on the price of giving.

To examine time patterns in the dependent variable during the sample period, Figure 3 presents charitable donations as a fraction of income, by income class.[31] For the highest income groups, the time series pattern does seem broadly consistent with a responsiveness of charitable giving to persistent price variation -- charitable giving was typically a larger share of income early in the period when marginal tax rates were much higher. In addition, the time series evidence in Figure 3 displays elements that are consistent with people re-timing giving in response to anticipated future changes in price, although those effects appear to be confined largely to the very highest-income groups. For those with incomes above $500,000, there is a dramatic spike in giving in 1986, which makes sense given that in 1986 it was announced that the top federal marginal tax rate would drop from 50% to 28% by 1988. For millionaires, a smaller spike in giving in 1993 and 1994 is also consistent with timing behavior. Bill Clinton

[31] In Figure 3, a three year moving average of income was used, with capital gains realizations replaced by 6% of capitalized dividends, to smooth out the confounding effects of transitory fluctuations in income across years.

won the Presidential election in 1992 and had promised to raise marginal tax rates on the rich, which he did; early in 1993 a law was enacted that increased the top marginal rate from 31% to 39.6% starting in 1993. A rich taxpayer anticipating this in 1992 could save taxes by delaying gifts that otherwise would have happened in 1992 until 1993 or 1994. Meanwhile, people with incomes between $200,000 and $500,000 had only slightly smaller incentives to re-time giving around the 1986 and 1993 tax changes (as illustrated in Figure 1), yet the time series patterns in Figure 3 reveal little or no re-timing of giving in response to these incentives. This corroborates our suspicion that heterogeneity of responsiveness across income classes may be important.

Estimates

Table 2 presents estimates of equation (1), along with some sensitivity analyses to demonstrate how certain aspects of the specification affect the estimates.[32] In column (1) of Table 2, we report estimates from a version of equation (1) which uses the changes in price and income between year *t* and year *t+1* as our measures of future price and income changes, and which instruments for these future changes using the "predictable tax change" strategy described above. The elasticity of charitable giving with respect to a persistent increase in price is estimated to be -0.607, and is highly statistically significant with a standard error of 0.179. The elasticity of current giving with respect to a future price increase is estimated to be just 0.180 with a standard error of 0.198. The positive sign on this coefficient is consistent with individuals timing charitable contributions to exploit differences in prices across years, but the standard error in this specification is too large to say anything conclusive about timing.

A positive and statistically significant coefficient on the lagged change in price suggests that people only gradually change their giving in response to a change in price. We consistently find positive and significant coefficients on lagged price changes in

[32] In this table, we present the coefficients from the price and income variables from equation (1). Coefficients from the full set of regressors, including state and demographic variables, are available in the web appendix (Bakija and Heim 2010).

specifications reported throughout the paper. In column (1) of Table 2, the 0.189 estimate on the one-year lagged change in log price implies that if price goes up by one percent this year, there is a -0.607 + 0.189 = -0.418 percent change in charitable giving, whereas if the price went up by one percent last year and stayed at that level this year (so that ΔlnP_t was zero), then other things equal there would be a -0.607 percent change in charity relative to its level two years ago. Thus, the impact of the price change is estimated to be larger in the second year it is in effect than in the first year, which would be consistent with gradual adjustment, perhaps because it takes time learn about the law or to change habits and commitments.

At the bottom of the table, we report a "transitory price elasticity," which in this study represents the effect on current charity of an increase in this period's price relative to last year that is expected to go away in the future. As noted above, this is derived from the sum of the coefficients on ΔlnP_t and lnP_t, minus the coefficient on ΔlnP_{future}. We estimate the transitory price elasticity to be -0.597 with a standard error of 0.064. That this estimate is roughly the same size as the persistent price elasticity of -0.607 suggests that any re-timing behavior that there may be (as indicated by the positive coefficient on future price change) is roughly offset by gradual adjustment to tax changes in the first year they occur. The fact that timing behavior does not show up strongly for the sample as a whole should perhaps not be surprising when we consider the time series patterns of giving for different income classes depicted in Figure 3. Evidence of timing behavior there was largely confined to those with incomes above $500,000. Auten, Sieg, and Clotfelter similarly find the transitory price elasticity to be smaller than the persistent price elasticity in most specifications. Nonetheless, we cannot rule out the existence of moderate re-timing effects in this specification due to wide confidence intervals on the future price coefficient.

The estimates of income elasticities in column (1) of Table 2 suggest that charity is more responsive to persistent changes in income than to transitory changes. We find the elasticity of charity with respect to a persistent income change to be 0.602 with a standard error of 0.120. The point estimate for the elasticity of current giving in response to a predicted future income change is 0.132, but is inconclusive with a standard error of 0.158. The negative and significant coefficients on lagged income changes are also consistent with the permanent income hypothesis if there is a mean-reverting income process. *Ceteris paribus*, if income today is higher than it was last year or two years ago, then part of that increase probably reflects a transitory upward blip in income that is expected to go away in the future. Thus, when the lagged changes in income are positive, less is given to charity today than would be if the lagged changes were zero, because in the former situation high current income reflects transitory income, whereas in the latter situation a high current income reflects more persistent variation in income. The coefficient on ΔlnY_t of -0.153 with a standard error of just 0.008, for example, is highly consistent with this story, as is the negative and significant but smaller coefficient on ΔlnY_{t-1}. The elasticity of charity with respect to a transitory income change, which combines information from the coefficients on ΔlnY_t, lnY_t, and ΔlnY_{future} in a manner analogous to the transitory price elasticity, is estimated to be 0.317, which is smaller than response to a persistent income change, although this effect is highly statistically significant with a standard error of 0.037.

In column (2) of Table 2, we present estimates from a specification similar to that shown in column (1), except that we now assume perfect foresight about future price and income changes; that is, we use the actual change in first-dollar log price as an instrument for future change in log price, and use actual future change in log after-tax income without instrumenting.[33] The estimates using the perfect foresight approach are broadly similar to those using the predictable tax change instrument approach, but with smaller standard errors. For example, in this specification there is statistically significant evidence of small responses to future changes in price and income; the elasticity of current giving with response to a one percent increase in next year's price is 0.145 with a standard error of 0.046, and the elasticity of current giving in response to a one percent increase in future income is estimated at 0.049 with a standard error of 0.008. The

[33] This specification also omits the capital gains marginal tax rate instruments, but is otherwise similar to the specification in column (1) of Table 2.

persistent price elasticity is slightly larger and the persistent income elasticity slightly smaller than in the predictable tax change instrument specification.

In columns (3) and (4), we report estimates from regressions that are similar to those reported in columns (1) and (2), respectively, but that use the two-year-ahead changes in price and income instead of the changes over the next year. The estimates are largely similar to those using the one-year future changes, but the standard errors in the predictable tax change instrument specification become much larger. Because using two-year ahead changes with the predictable tax change instruments reduces power and precision without substantially changing the point estimates, in the remainder of the paper we will focus on specifications using changes in price and income over the next year.

In column (5) of Table 2, we show estimates from a model that includes lagged changes in price and income, but omits future changes in price and income, to show the consequences of ignoring forward-looking behavior. The coefficients on lnP_t and lnY_t still represent "persistent" price and income elasticities in the sense that they estimate the change in giving in response to a change in price or income that has persisted for three years, but they ignore the possibility of anticipated future changes. In this specification, the persistent price elasticity increases somewhat to -0.768, and the persistent income elasticity decreases to 0.506, suggesting that failing to incorporate the possibility of anticipated future price and income changes tends to bias the persistent price elasticity upwards in absolute value, and tends to bias the persistent income elasticity downwards, but by modest amounts. Finally, in column (6) of Table 2, we remove the lagged changes in prices and income as well. Here, the price elasticity is estimated at -0.629, but the income elasticity drops to just 0.381. The low income elasticity is what we would expect if people respond more to persistent variation in income than to transitory fluctuations in income, as the income elasticity in this specification is measuring responses to a mix of transitory and persistent changes in income.

A large part of the identification for the estimates of persistent price elasticities in Table 2 comes from differences in the time path of federal marginal tax rates across income classes, as highlighted in Figure 1, as well as the non-linear effects of idiosyncratic shocks to income (i.e., those that differ from average changes over time and the life cycle) on price. As noted earlier, these estimates could be biased if there are omitted influences on charity that are changing in different ways over time at different income levels, or if we've misspecified the functional form of the effect of income on giving. Table 3 take two approaches to addressing these problems, which each yield similar estimates of the persistent price elasticity.

First we allow all non-price parameters and time effects to be heterogeneous across income classes, but constrain price elasticities to be uniform across income classes. In this specification, the persistent price elasticity is primarily being identified by variation in the time path of price across states, since including income-group specific time dummies absorbs much of the time series variation in federal tax rates. By allowing income elasticities and the effects of other variables (e.g., life cycle effects) to vary freely across income classes, we are also relying on less restrictive assumptions about the functional form of the effects of income and other variables on giving. Column (1) of Table 3 depicts the estimated price effects from this exercise, while the estimated income-class specific income elasticities are presented in column (5) of Table 5. In column (1) of Table 3, the persistent price elasticity is substantially larger than it was in Table 2, and is now estimated to be -1.103, with a standard error of 0.453. The coefficient on the lagged price change has also increased to a strongly significant 0.336, with a standard error of .074. The transitory price elasticity has increased as well, but at -0.724, is now substantially below the estimated persistent price elasticity. The coefficient on future price change is near zero but with a wide confidence interval. Persistent income elasticities, shown in column (5) of Table 5, are modest and show a U-shaped pattern in income; future income elasticities are small with large standard errors.

We next allow federal and state prices to have different effects. In the results discussed above, the effect of federal and state tax changes both enter into the regression equation in a single price variable. In columns (2) and (3) of Table 3 we rerun the specification in column (1) of Table 2, but replace each log price variable with two log prices: the log federal price (which is defined as the log price that would apply if state income tax was zero) and the log state price (which is defined as the log price minus the log federal price). In addition, we constrain time effects and other parameters to be constant across income classes. The persistent price elasticity with respect to the federal price (in column (2)), is only -0.346, which may reflect the fact that a lot of the changes in federal price are just non-linear functions of changes in income, and so the federal price elasticity may simply picking up those non-linear effects of income. The persistent state price elasticity (in column (3)) relies largely on differences in the time path of prices across states, as shown in Figure 2, and is estimated to be -1.164 with a standard error of 0.278. This is very similar in magnitude to the results in column (1), which utilized a similar source of identifying variation that is much more independent of income. Interestingly, the future federal price elasticity is sizable at 0.442, and reasonably statistically significant with a standard error of 0.185, while the future state price elasticity is smaller, at 0.250, with a stnadard error of 0.377. This is suggestive evidence that may people respond in advance to future price changes that are big and obvious (like those at the federal level arising from the relatively sharp discrete changes in federal tax rates arising from TRA86), but that it's not clear whether they respond to future price changes that are subtle and complicated (which would characterize most variation in the time path of state prices, which as noted above is often due to interactions with complicated federal provisions).

To examine whether price elasticities vary by income groups, as Figure 1 seems to suggest, in Columns (1) through (4) of Tables 4 and 5, we allow all non-time variables, including the price variables, to have different effects across income classes. In each column, we use a different method for controlling for time-varying unobservable influences on charity, each of which removes a different portion of the identifying variation for the price elasticities. Price elasticities from these specifications are presented in Table 4, and income elasticities are presented in Table 5.

In column (1) of these tables, we include income class-specific year dummies, which control in a flexible way for any omitted influences on charity that are changing in different ways over time in the different income classes; identification for price elasticities in these specifications again comes largely from differences in the time path of state prices. In this specification, the persistent price elasticities for the highest three income groups are large, and are statistically significant for the \$200K-\$500K group and ≥ \$1M group, with persistent price elasticities of -0.913 and -1.403. The estimates for lower income classes are inconclusive in this specification, likely because of weak identification. This is because the kind of variation in the time path of state prices that was apparent for very high-income people in Figure 2 did not other people as much, and the income-specific time dummies absorb most of the time series variation in federal tax rates for these groups. Persistent income elasticities are positive and significant for all income groups, with estimated elasticities decreasing as income-class increases from 0.823 for the lowest income group to 0.253 for the \$500K-\$1M income class, then increasing to 0.487 for the highest income class.

In this specification, confidence intervals on future price elasticities are too large to say anything conclusive about timing behavior. This, too, is likely due to the inclusion of income-class specific year dummies, since these absorb most of the time series variation in federal tax rates that produces the strongest and most obvious signals to people to re-time their giving.

To further examine whether this is the case, we also try two other approaches to account for time effects that restore some of the more obvious price variation at the federal level. In the first approach, we replace the group specific time dummies with one set of time dummies for all observations, assuming uniform time effects across all observations regardless of income. While this still removes the average time-series variation in federal tax rates from identification, it preserves identification arising from the fact that federal tax rates changed in different ways over time for different income groups. In the second approach, we omit year dummies and replace them with an income class-specific quadratic time trend and an income-class specific effect of the log real S&P500. This approach restores identification for price variation coming from the fact that federal tax rates changed over time within an income class in ways that did not conform to a smooth quadratic time trend. Thus, for example, most of the identification arising from the relatively sharp discrete changes in federal tax rates arising from TRA86 and the 1993 federal tax increase are preserved in this specification.

When time effects are constrained to be uniform in column (2), the persistent price elasticities for the three highest income classes are again large and significant, with estimates of -0.802 for the $200K-$500K group, -0.698 for the $500K-1M group, and -0.973 for the ≥ $1M group. Point estimates of the persistent price elasticities are also large and negative for the two lowest income classes, but are not statistically significant due to large standard errors. Persistent income elasticities are also positive and significant, and again decrease with income for all but the highest income classes. Point estimates for future price elasticities are now consistent with some re-timing behavior for most income classes, but standard errors are still too large to say anything conclusive on that.

In column (3), we estimate the same specification as in column (2), but the dependent variable is now the current charitable *deduction* (excluding current donations over the limits and including carryovers from prior years), which is what the previous literature has typically used. The estimates are broadly similar to those we found using a dependent variable that is closer to actual contribution, but one interesting difference is that a strong timing effect is now found among millionaires, with the future price elasticity for this class estimated to be 0.649 (with a standard error of 0.207). A possible explanation is that very high-income people are more willing and able to re-time carryovers across years in order to save taxes than to re-time actual charitable donations.

Finally, in column (4), we allow for an income class-specific quadratic time trend and an income-class specific effect of the log real S&P500 stock index. In this column, strong timing responses to anticipated future change in price are found for the two highest income groups. For taxpayers with average incomes of $1 million or above (column 4), a one percent increase in future price, holding current price constant, is estimated to increase current giving by 0.427 percent with a standard error of 0.147. The persistent price elasticity is still large, at -0.827 with a standard error of 0.113, while the transitory price elasticity is large at -1.079. For taxpayers with average incomes between $500,000 and $1 million, the future price elasticity is estimated to be 0.561, with a standard error of 0.206, wile the persistent price elasticity is smaller at -0.295. Thus, when we allow for heterogeneous response across income classes and preserve most of the identification arising from discontinuous time series variation in federal tax rates, timing phenomena such as the spike in 1986 giving do seem to show up in our estimates.

A drawback of the specification in column (4) is that it does not control for unobservable time varying influences on charitable giving in a very flexible fashion, so that we might worry that, for example, our estimates of the effects of persistent price and income changes could be confounded with the effects of other factors that were changing over time in a fairly non-linear way. At the same time, because we are not controlling for time effects in a completely flexible way, this identification strategy does a good job of pinpointing the times when there was a really large incentive to re-time giving. The estimate of a large response among very high income people to obvious timing incentives around TRA86 and the 1993 tax change seems reasonable -- for instance, there is no other apparent reason for there to be a spike in charitable giving in 1986.

In all of the specifications reported in the paper, we checked the strength of the identification provided by our instruments, by performing the Anderson canonical correlation test and the Cragg-Donald weak identification test on all of our first stage regressions. These tests reject the null hypothesis of weak identification for every regression reported in our paper, with a p-value that rounds to 0.0000. This suggests that small-sample bias arising from weak instruments is unlikely to be a problem.[34] Despite this, it is still true that predictable future changes in tax liability explain a small

[34] The first stage regressions for the 2SLS regression presented in Table 2, column (1), as well as the regressions used to predict income changes that we use to help us construct the predictable tax change instruments, are available in the web appendix (Bakija and Heim 2010).

portion of future change in income, which is probably why our estimates of responsiveness to future income changes in particular have wide confidence intervals and are sensitive across specifications when we use the "predictable tax change" instruments.

Robustness checks

In the web appendix to this paper (Bakija and Heim 2010), we report results from a wide range of robustness checks, which we summarize here. First, we estimate a version of equation (1) that excludes individual-specific fixed effects, uses log of charitable deduction (+$10) as the dependent variable, and omits state characteristics. That specification yields a price elasticity of -0.992 with a standard error of 0.152, and an income elasticity of 0.918 with a standard error of 0.017, both of which are in the same ballpark as the early cross-sectional literature. We find that changing from deduction to donation and adding state covariates has little effect on the estimated price and income elasticities in that specification. We also estimated a Tobit model that explicitly accounts for the censoring using this pooled cross-section approach, and found that this did not have an appreciable effect on estimated price and income elasticities.

All estimates reported above add a constant of $10 to charity before taking logs. We also tested the sensitivity of estimates to the size of the constant added to charity. For the specification in Table 2 Column (1), persistent price elasticity is relatively insensitive to adding $1 or $100 to charity, but adding $1,000 to charity does reduce the persistent price elasticity somewhat to -0.35, and the persistent income elasticity increases substantially to 0.87. However, when the identification for the price elasticity comes from variation in the time path of taxes across states, or when we allow non-price variables to have heterogeneous effects across income classes, as in Table 3, we continue to estimate large (-0.9 to -1) and statistically significant persistent price elasticities even when a constant of $1,000 is added. The sensitivity of the persistent income elasticity is much less pronounced when we allow heterogeneity by income.

The estimates are extremely similar whether one uses charitable deduction, donations computed with a two year carryover window, or donations computed with a five year carryover window. If we modify the specification in column (4) of Table 4 to use either linear or cubic time trends for each income class, the persistent price elasticities tend to be larger, and the high-income response to future price change is significant only with linear trends. In the specifications where we allow heterogeneous price elasticities by income class, when we allow for separate effects of federal and state prices by income class, for high-income groups persistent state price elasticities tend to be bit larger and persistent federal price elasticites tend to be bit smaller than those reported for combined federal-state price in Table 4. We also tried using a simpler instrument in which the future changes in price and income were constructed holding real income and all inputs into the tax calculator constant in real terms at their year *t* values, so that the variation in the instrument is driven entirely by tax reforms. With the alternative instruments, the pattern and significance of persistent price elasticities is broadly similar, but there is a tendency towards larger persistent and future income elasticities, and there is less conclusive evidence of re-timing of giving in response to obvious future price changes among those with very high incomes.

Conclusions

We estimate an elasticity of charitable giving in response to a persistent change in price that is in excess of -1 (in absolute value) when identification comes largely from differences in the time-path of price across states. When we additionally allow for heterogeneity in price elasticities, there is robust evidence of a significant persistent price elasticity for very high-income taxpayers, particularly millionaires, while evidence for those with incomes below $200,000 is inconclusive due to weak identification. There is some evidence consistent with the idea that very high-income people re-time giving in response to especially salient predictable future changes in taxation, but evidence of responsiveness to subtle and complicated future changes is inconclusive.

Table 1 -- Descriptive Statistics

Variable	Description	Mean	Std. Dev.
charity	Total charitable contributions	125,765	1,254,993
lnP	Actual log price of giving (defined in text)	-0.41	0.17
lnP_0	First dollar log price of giving (defined in text)	-0.41	0.16
Y	After-tax income, defined as pre-tax income minus federal and state income tax liabilities, minus tax savings from charitable contributions.	1,345,841	7,017,849
married	Dummy equal to 1 if taxpayer is married filing jointly	0.85	0.36
age	Age of primary taxpayer	52.70	12.75
children	Number of children at home	0.44	0.84
other dependents	Number of other dependents	0.60	1.04
lnP_salestax	Effect of state retail sales tax on relative price of charity	-0.05	0.01
ln(state house price)	Log of state median housing price in 2000, adjusted for real change in FHFA state housing price index	11.99	0.37
state unemployment	State unemployment rate	0.06	0.02
state gov't spending	State and local government spending as a share of state personal income	0.18	0.03

Table depicts unweighted means. All dollar figures are in constant year 2007 dollars, adjusted for inflation using the CPI-U.

Table 2 -- Explaining log charitable giving: fixed effects estimates assuming parameters and time effects are uniform across income classes

	(1)	(2)	(3)	(4)	(5)	(6)
	t+1 leads, predictable tax change instruments	t+1 leads, perfect foresight	t+2 leads, predictable tax change instruments	t+2 leads, perfect foresight	Two lags, no leads	No lags or leads
ΔlnP_{it-1}	0.012	0.021	0.001	0.017	0.031	
	(0.047)	(0.040)	(0.047)	(0.040)	(0.040)	
ΔlnP_{it}	0.189	0.198	0.170	0.189	0.202	
	(0.066)**	(0.064)**	(0.064)**	(0.064)**	(0.064)**	
lnP_{it} *[persistent*	-0.607	-0.651	-0.558	-0.580	-0.768	-0.629
price elasticity]	(0.179)**	(0.097)**	(0.308)	(0.088)**	(0.087)**	(0.058)**
$\Delta lnP_{i, future}$	0.180	0.145	0.181	0.190		
	(0.198)	(0.046)**	(0.316)	(0.042)**		
ΔlnY_{it-1}	-0.061	-0.061	-0.061	-0.060	-0.061	
	(0.008)**	(0.008)**	(0.008)**	(0.008)**	(0.008)**	
ΔlnY_{it}	-0.153	-0.156	-0.154	-0.156	-0.158	
	(0.008)**	(0.007)**	(0.008)**	(0.007)**	(0.008)**	
lnY_{it} *[persistent*	0.602	0.541	0.660	0.554	0.506	0.381
income elasticity]	(0.120)**	(0.018)**	(0.168)**	(0.019)**	(0.016)**	(0.011)**
$\Delta lnY_{i, future}$	0.132	0.049	0.179	0.057		
	(0.158)	(0.008)**	(0.186)	(0.008)**		
Transitory price	-0.597	-0.599	-0.570	-0.581		
elasticity	(0.064)**	(0.054)**	(0.050)**	(0.054)**		
Transitory income	0.317	0.337	0.328	0.341		
elasticity	(0.037)**	(0.010)**	(0.020)**	(0.010)**		

All columns control for individual fixed effects, year dummies, *lnP_salestax*, *(age/100) squared*, *children*, *other dependents*, *ln(state house price)*, *state unemployment rate*, and *state gov't spending*.
Robust standard errors, clustered by state and income class, are in parentheses.
* significant at 5%; ** significant at 1%

Table 3 -- Explaining log charitable giving: fixed effects estimates using predictable tax change instruments and t+1 changes in price and income; assuming uniform price elasticities, but allowing other parameters and time effects to be heterogeneous across income classes; or allowing federal and state prices to have different effects

	(1)	(2)	(3)
	Allowing non-price parameters and time effects to be heterogeneous across income classes	Allowing federal and state prices to have different effects in a single regression, with time effects and other parameters constrained to be constant across income classes	
		Federal	State
ΔlnP_{it-1}	0.116 (0.050)*	0.027 (0.046)	0.170 (0.075)*
ΔlnP_{it}	0.336 (0.074)**	0.181 (0.067)**	0.567 (0.120)**
lnP$_{it}$ *[persistent price elasticity]*	-1.103 (0.453)*	-0.346 (0.164)*	-1.164 (0.278)**
ΔlnP_{it+1}	-0.044 (0.464)	0.442 (0.185)*	0.250 (0.377)
ΔlnY_{it-1}	*See column (5) of Table 5*	-0.054 (0.008)**	
ΔlnY_{it}		-0.141 (0.010)**	
lnY$_{it}$ *[persistent income elasticity]*		0.510 (0.107)**	
ΔlnY_{it+1}		0.034 (0.141)	
Transitory price elasticity	-0.724 (0.097)**	-0.607 (0.063)**	-0.847 (0.149)**
Transitory income elasticity	*See column (5) of Table 5*	0.335 (0.033)**	

All columns control for individual fixed effects, year dummies, *lnP_salestax*, *(age/100) squared*, *children*, *other dependents*, *ln(state house price)*, *state unemployment rate*, and *state gov't spending*. In column (1), all of those variables (except individual fixed effects) are interacted with dummies for each income class. Columns (2) and (3) are from a single regression, where "log federal price" is defined as the log price that would apply if state income taxes were zero, and "log state price" is defined as log price minus log federal price. Robust standard errors, clustered by state and income class, are in parentheses. * significant at 5%; ** significant at 1%

Table 4 – Price elasticities of charitable giving: fixed effects estimates using predictable tax change instruments and t+1 changes in price and income, allowing all parameters to be heterogeneous across income classes

Elasticity	Income class	(1) Heterogeneous time effects	(2) Uniform time effects	(3) Uniform time effects, charitable *deduction*	(4) Heterogeneous quadratic trends and log real S&P 500, no time dummies
Persistent price elasticity	< $100K	0.024 (0.667)	-1.082 (0.679)	-1.091 (0.611)	-0.379 (0.425)
	$100K - $200K	0.002 (0.594)	-0.660 (0.477)	-0.760 (0.374)*	-0.102 (0.287)
	$200K - $500K	-0.913 (0.454)*	-0.802 (0.311)**	-0.782 (0.221)**	-0.456 (0.161)**
	$500K - $1M	-0.833 (0.626)	-0.698 (0.266)**	-0.834 (0.185)**	-0.295 (0.146)*
	≥ $1M	-1.403 (0.432)**	-0.973 (0.216)**	-0.763 (0.202)**	-0.827 (0.113)**
Future price elasticity	< $100K	1.790 (1.067)	0.668 (0.883)	0.006 (0.761)	0.949 (0.699)
	$100K - $200K	1.586 (1.052)	0.743 (0.783)	0.140 (0.524)	0.833 (0.569)
	$200K - $500K	-0.249 (0.619)	0.028 (0.404)	0.209 (0.266)	0.198 (0.286)
	$500K - $1M	0.109 (0.811)	0.284 (0.292)	0.222 (0.238)	0.561 (0.206)**
	≥ $1M	-0.248 (0.434)	0.190 (0.197)	0.649 (0.207)**	0.427 (0.147)**
Transitory price elasticity	< $100K	-1.254 (0.326)**	-1.152 (0.302)**	-0.881 (0.001)**	-1.085 (0.270)**
	$100K - $200K	-1.069 (0.398)**	-0.902 (0.312)**	-0.756 (0.211)**	-0.740 (0.268)**
	$200K - $500K	-0.406 (0.228)	-0.465 (0.179)**	-0.752 (0.131)**	-0.479 (0.168)**
	$500K - $1M	-0.735** (0.259)	-0.749 (0.180)**	-1.081 (0.186)**	-0.768 (0.168)**
	≥ $1M	-0.859 (0.138)**	-0.903 (0.104)**	-1.417 (0.091)**	-1.079 (0.103)**

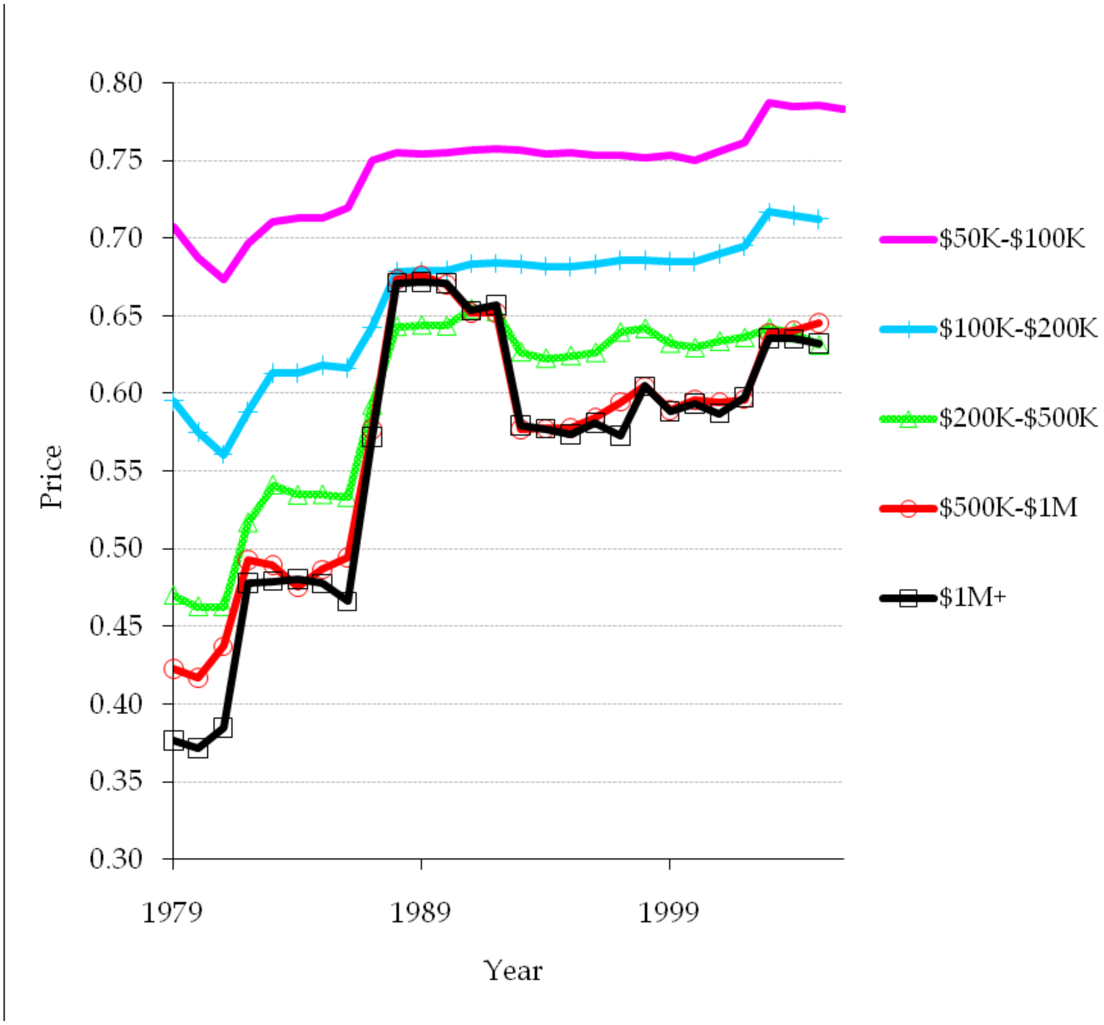
All columns control for *lnP_salestax*, *(age/100) squared*, *children*, *other dependents*, *ln(state house price)*, *state unemployment rate*, and *state gov't spending*, each interacted with dummies for each income class, along with individual fixed effects. Robust standard errors, clustered by state and income class, are in parentheses.
* significant at 5%; ** significant at 1%

Table 5 – Income elasticities of charitable giving: fixed effects estimates using predictable tax change instruments and t+1 changes in price and income, allowing all parameters to be heterogeneous across income classes

Elasticity	Income class	(1) Hetero-geneous time effects	(2) Uniform time effects	(3) Uniform time effects, charitable *deduction*	(4) Hetero-geneous quadratic trends and log real S&P 500, no time dummies	(5) Uniform price effects, other parameters and time effects hetero-geneous
Persistent income elasticity	< $100K	0.823 (0.350)*	0.596 (0.209)**	0.389 (0.170)*	0.342 (0.161)*	0.612 (0.211)**
	$100K - $200K	0.577 (0.243)*	0.515 (0.168)**	0.389 (0.133)**	0.255 (0.135)	0.467 (0.150)**
	$200K - $500K	0.311 (0.141)*	0.411 (0.128)**	0.349 (0.100)**	0.162 (0.115)	0.330 (0.109)**
	$500K - $1M	0.253 (0.094)**	0.381 (0.106)**	0.351 (0.085)**	0.120 (0.103)	0.323 (0.109)**
	≥ $1M	0.487 (0.138)**	0.452 (0.091)**	0.471 (0.082)**	0.302 (0.092)**	0.580 (0.144)**
Future income elasticity	< $100K	0.704 (0.590)	0.645 (0.508)	0.066 (0.410)	0.119 (0.358)	0.330 (0.337)
	$100K - $200K	0.229 (0.524)	0.254 (0.440)	-0.153 (0.369)	-0.311 (0.365)	0.133 (0.302)
	$200K - $500K	-0.170 (0.241)	-0.223 (0.219)	-0.254 (0.206)	-0.513 (0.225)*	-0.076 (0.212)
	$500K - $1M	-0.407 (0.219)	-0.328 (0.177)	-0.234 (0.152)	-0.625 (0.212)**	-0.339 (0.207)
	≥ $1M	-0.128 (0.175)	-0.161 (0.105)	-0.004 (0.096)	-0.343 (0.118)**	-0.001 (0.178)
Transitory income elasticity	< $100K	0.100 (0.167)	-0.022 (0.208)	0.219 (0.170)	0.155 (0.147)	0.208 (0.108)
	$100K - $200K	0.302 (0.231)	0.220 (0.226)	0.422 (0.194)*	0.443 (0.204)*	0.272 (0.136)*
	$200K - $500K	0.308 (0.121)*	0.431 (0.122)**	0.423 (0.113)**	0.466 (0.137)**	0.243 (0.114)*
	$500K - $1M	0.449 (0.120)**	0.498 (0.091)**	0.432 (0.088)**	0.521 (0.113)**	0.456 (0.098)**
	≥ $1M	0.444 (0.039)**	0.448 (0.029)**	0.400 (0.031)**	0.496 (0.035)**	0.411 (0.037)**

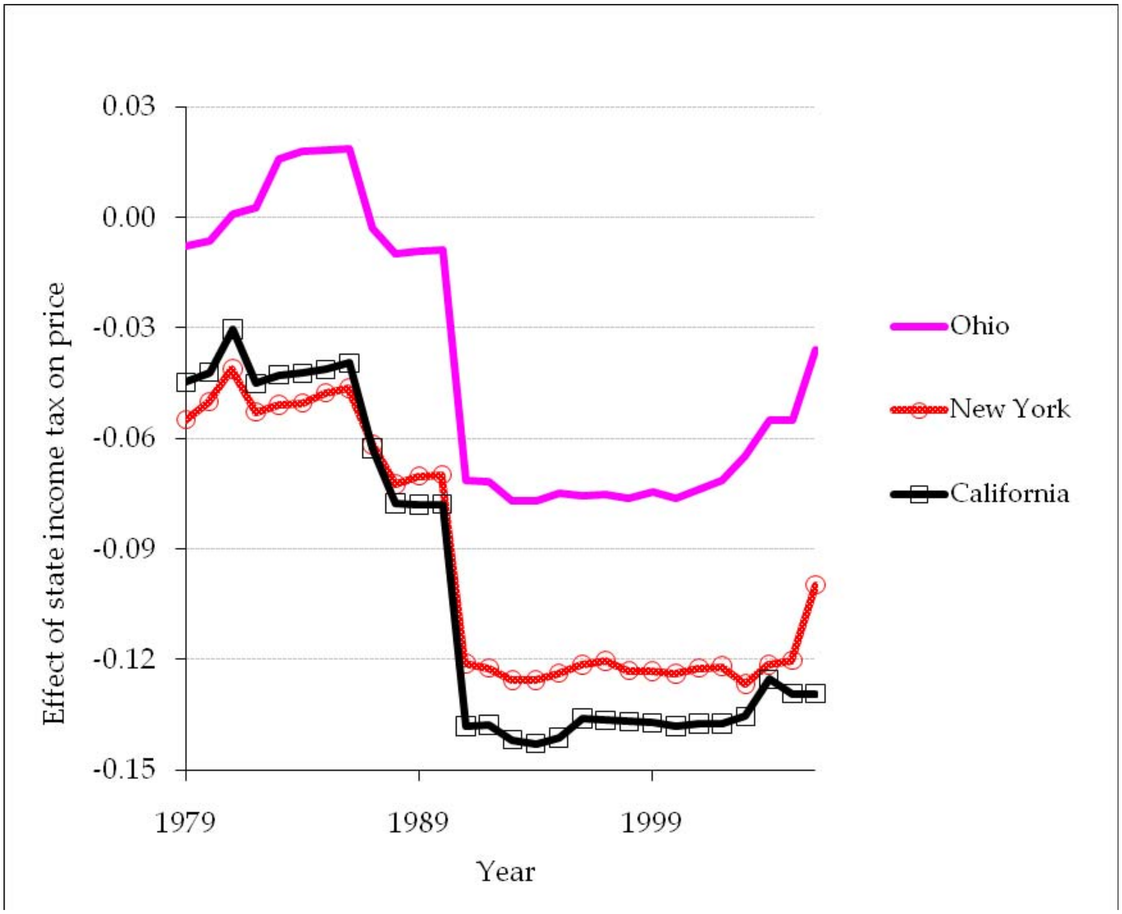
All columns control for *lnP_salestax*, *(age/100) squared*, *children*, *other dependents*, *ln(state house price)*, *state unemployment rate*, and *state gov't spending*, each interacted with dummies for each income class, along with individual fixed effects. Robust standard errors, clustered by state and income class, are in parentheses. * significant at 5%; ** significant at 1%

Figure 1 -- Average price of charitable giving by income class, 1979-2006



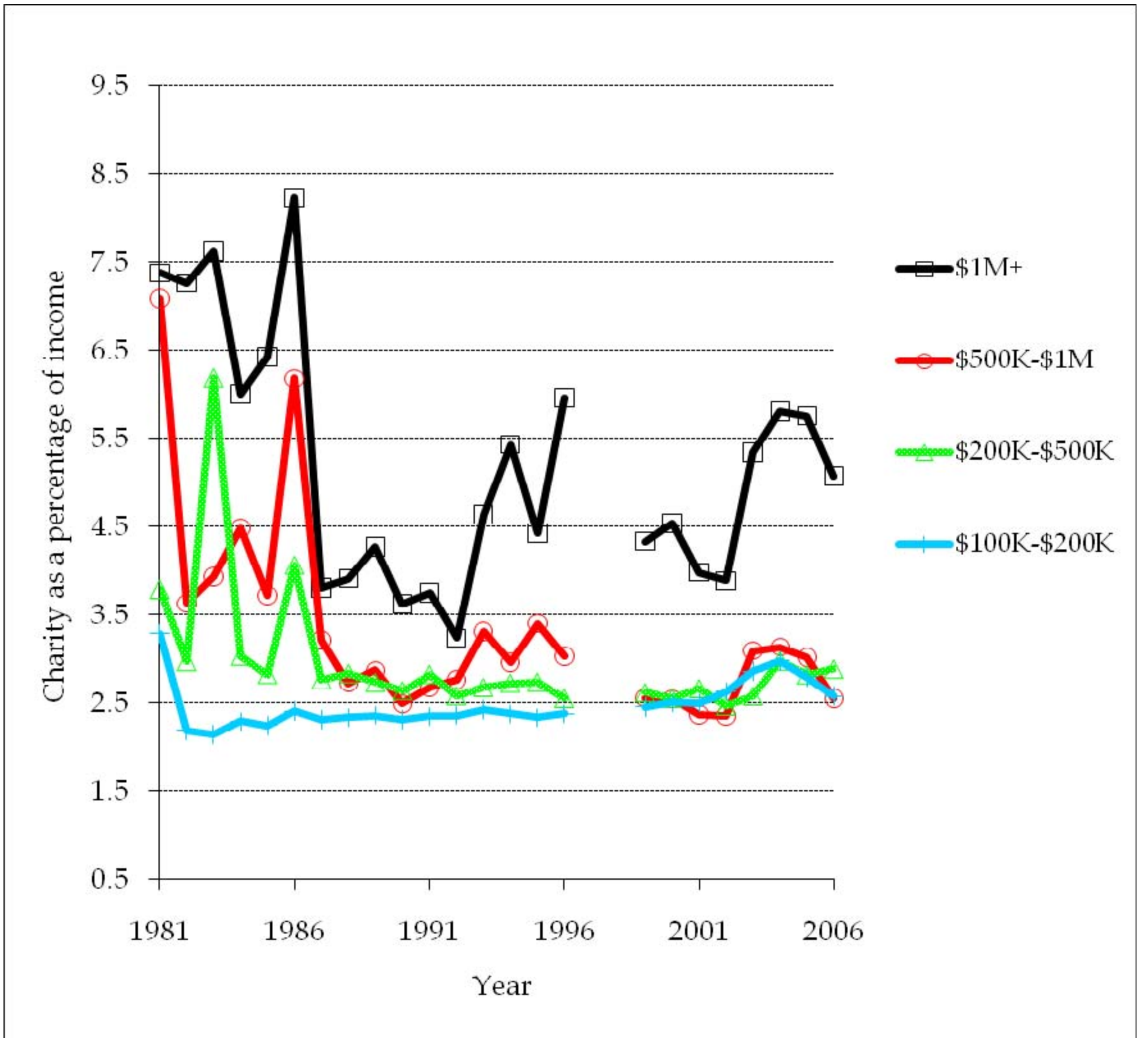
Graph depicts the "first dollar" price (calculated setting charity to zero). The sample is the same as estimation sample, except the first two years and last two years of data for each taxpaying unit are not removed. Taxpayers are classified into income categories based on current income in constant year 2007 dollars, replacing realized capital gains with 6% of capitalized dividends.

Figure 2 -- Effect of state income tax on price of charitable giving for taxpayers with incomes above $200,000, selected states, 1979-2006



Graph depicts the price of charitable giving minus the price that would apply in the absence of the state's income tax. Tax rates are calculated on a random sample of taxpayers with incomes above $200,000 from the 1985 SOI public-use cross section. The same set of taxpayers are used to calculate tax rates for each state, and their characteristics except for state taxes are held constant in real terms across states and years.

Figure 3 -- Charitable donations as a percentage of 3-year moving average of income, 1981-1996 and 1999-2006, by income class



Sample used is the same as the estimation sample, except first two years and last two years of data for each taxpaying unit are not removed, and data for 1997 and 1998 are omitted from the figure due very small sample sizes for high income people in those years. A moving average of current and up to two lags of income (when available) is used, in constant year 2007 dollars, replacing realized capital gains with 6% of capitalized dividends to smooth fluctuations in realized gains. In the graph (but in none of the analysis in the text), the measure of contributions for 1995, 1996, 2005, and 2006 includes less than two years of future carryovers for a large share of observations, and so should be interpreted with caution.

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