

HOW DOES CHARITABLE GIVING RESPOND TO INCENTIVES AND INCOME? NEW ESTIMATES FROM PANEL DATA

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We estimate the elasticity of charitable giving with respect to persistent and transitory price and income changes using a 1979-2006 panel of tax returns. Our estimation procedure allows for anticipation of and gradual adjustment to tax changes, controls for various potential sources of omitted variable bias via fixed effects and income-class specific year dummies, and allows for a flexible non-linear relationship between income and charitable giving. Our most convincing estimates are identified by differences in the time-paths of tax incentives across states, and suggest a persistent price elasticity in excess of one in absolute value.

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I. INTRODUCTION

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, income tax return data lacks information on wealth, and it is likely 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. We estimate price elasticities based on the response of charity to substantial differences in the time-path of price across states, a relatively convincing quasi-experimental source of identification that has been underexploited in the literature. The extensive variation in state and federal taxation during our sample period enables us to control for separate time fixed-effects at different income levels, which removes bias caused by unobservable influences on charity that may be changing in different ways over time for people of different incomes, and to allow the effects of income and all other covariates to differ by income level as well. 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 also try using 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.

Our estimates suggest a large persistent price elasticity of charitable giving, generally in excess of one in absolute value, in specifications where identification for the price effect comes from differences in the time-paths of tax incentives across states. This finding is robust to whether or not we allow for the effects of non-price variables to be heterogeneous across income classes, although the point estimates are somewhat larger when we do. We view these as the most convincing estimates of the elasticity of charitable giving with respect to persistent changes in both federal and state tax prices, because the control group used to construct the counterfactual of how charitable giving would have changed in the absence of a change in tax incentives consists of people with similar incomes living in other states, rather than people with different incomes, who as noted above likely experienced different changes over time in unmeasured influences on charitable giving. Estimates of the persistent price elasticity that derive their identification solely from federal tax variation (removing both the direct effects of state income taxes and their indirect effects through their influence on federal taxes) are small when we constrain the effects of non-price variables to be uniform across income classes, but large when we relax this constraint, suggesting that estimates from the more restrictive specification may be confounding the response to prices with the effects of other influences on giving. When we allow the effects of all variables, including price, to vary across income levels, we do not find strong evidence of differences in price elasticities across income classes. We find evidence that people adjust charitable donations gradually over time to in response to price changes, and that people

change their charitable donations in advance in response to large obvious future changes in federal marginal tax rates, with less conclusive evidence of a response to more subtle sources of future price changes.

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), Randolph (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.

II. EMPIRICAL MODEL

To facilitate comparisons with the previous literature, ease interpretation of the results, and limit the influence of large outlier donations, 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 across federal and state price variation, 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 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 Randolph, Bakija and McClelland (2004) for further discussion of Auten, Sieg and Clotfelter, 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.

$$(1) \quad \ln(charity)_{it} = \alpha_i + \alpha_t + \mathbf{X}_{it}\boldsymbol{\beta}_0 + \beta_1 \Delta \ln P_{it-1} + \beta_2 \Delta \ln P_{it} + \beta_3 \ln P_{it} + \beta_4 \Delta \ln P_{it+1} \\ + \beta_5 \Delta \ln Y_{it-1} + \beta_6 \Delta \ln Y_{it} + \beta_7 \ln Y_{it} + \beta_8 \Delta \ln Y_{it+1} + \varepsilon_{it}.$$

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. Later in the paper, we consider the sensitivity of the estimates to the size of the constant added to charity, and to the use of a Tobit model.

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.² We control for any influences on charity that change in the same way over time for everyone through year effects (α_t). The vector \mathbf{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 ($\ln P$), the log of after-tax income ($\ln Y$), and lagged and future changes in each of those variables. The Δ variables represent first-differences of those variables (e.g., $\Delta \ln P_{it-1} = \ln P_{it-1} - \ln P_{it-2}$).³

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 next year's 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 next year as well.⁴ The effect on giving today of an anticipated increase in price next year is given by β_4 . The effect

² 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.

³ As a sensitivity analysis, we also try using the two-year-ahead changes in price and income, which we report in the web appendix (Bakija and Heim 2010) and which we discuss in the estimates section below.

⁴ Equation (1) above can be re-arranged so that the price variables and their coefficients enter as $\gamma_1 \ln P_{it-2} + \gamma_2 \ln P_{it-1} + \gamma_3 \ln P_{it} + \gamma_4 \ln P_{it+1}$. 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.

on giving today of a transitory increase in price this year that is expected to disappear next year 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 next year's income, and the effect on giving today of a transitory increase in income that goes away next year is given by $(\beta_6 + \beta_7 - \beta_8)$.⁵

Our measure of after-tax income, Y_{it} 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. Thus, following standard practice in the literature, 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

The control variable vector \mathbf{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 $\ln P_salestax = \ln(1/(1+salestax))$, 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

⁵ In the web appendix (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 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.

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:

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

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

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>>.

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.

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 (1999). This discount factor d only applies to $mtrcrg$, because when a taxpayer donates a dollar of an appreciated asset, $mtrcharcg$ must be paid today. We use the anticipated future $mtrcrg_{it+1}$ 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

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.

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

¹⁴ When computing price instruments, first-dollar tax liability, and marginal capital gains tax rate instruments, 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.

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

We try two different methods of incorporating future changes in price and income. One is a “perfect foresight” approach, where the actual value of $\Delta \ln Y_{it+1}$ is included directly in the specification and is treated as exogenous, while the actual first-dollar version of $\Delta \ln P_{it+1}$ is used as an instrument for its last-dollar value. The other is what we call a “predictable tax change instrument” approach, which addresses the concern that what should matter for current charitable giving behavior is one’s *ex ante expectation* of future changes in price and income, rather than one’s *ex post realization* of future changes in price and income. Only the latter is observable (after the fact) in the data. These actual ex post future changes in price and income can be viewed as measurements, with error, of the time t expectation of those future changes.¹⁶ To eliminate this measurement error bias, we 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 instruments which isolate the portion of variation next year’s changes in price and income that should be predictable at time t because the year $t+1$ tax function (that is, the function that transforms pre-tax income into tax liability) can generally be known in advance due to lags between proposal,

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 Randolph (1995) although he treated *current* price as measurements with error of its expected future persistent value; that approach runs into trouble when there are systematic differences between current and expected future prices due to pre-announced changes in tax law.

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).¹⁷

In the “predictable tax change instrument” approach, our instrument for next year’s change in log price is a synthetic log price calculated by applying the actual year $t+1$ tax function to an individual-specific prediction of next year’s pre-tax income (explained below), minus the current actual first-dollar log price. Our instrument for next year’s change in $\ln Y$ is a similarly constructed synthetic value for next year’s change in $\ln(1-ATR_i)$, where ATR_i is the individual’s average tax rate, defined as total income tax liability divided by pre-tax income. This is motivated by the fact that:

$$(3) \quad \ln Y_{it+1} = \ln Y'_{it+1} + \ln[1-ATR_{it}(Y'_{it+1})],$$

where $\ln Y'_{it+1}$ is next year’s log pre-tax income, and $ATR_{it+1}(\cdot)$ is next year’s average tax rate as a function of pre-tax income. The synthetic value ATR_{it+1} is constructed by applying next year’s actual tax function to an individual-specific predicted value of next year’s pre-tax income, and then dividing the resulting tax liability by that predicted pre-tax income. The instrument for future change in after-tax income is then the constructed $\ln(1-ATR_{it+1})$ minus its actual first-dollar year t value. Essentially, this uses predictable future change in tax liability as an instrument for the future change in after-tax income.

¹⁷ So in essence, our “predictable tax change instrument” approach assumes perfect foresight about the income tax function applying next year, but not about next year’s income. Many of the major federal tax reforms during our sample period, such as TRA86, were enacted the year before they were implemented. Other major examples (such as federal tax laws enacted in 1981, 1993, and 2001) were campaign proposals in elections held the year before the reforms would begin to take effect, or were reasonably predictable in advance given policy pronouncements by presidents and legislators. 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.

We use two other instruments to help distinguish transitory from persistent variation in price and income: the year t combined federal-state marginal tax rate on long-term capital gains ($mtrcg_{it}$); and the predictable change in next year's marginal tax rate on long-term capital gains ($\Delta mtrcg_{it+1}$), computed by applying next year's marginal capital gains tax rate function to a predicted value of next year's individual income. Capital gains tax rates are strongly associated with transitory fluctuations in income, as evidenced for example by the 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). An increase in income, and associated decrease in price, in a year like 1986 is especially likely to be transitory, and including the capital gains tax rate variables in the set of first-stage instruments helps to 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.

The prediction of next year's income that is fed into next year's tax function to construct the predictable tax change instruments is based on a regression, using the full sample, where the dependent variable is next year's actual change in log real pre-tax income, and the explanatory variables are exogenous versions of the variables \mathbf{X}_{it} , $\Delta \ln P_{it-1}$, $\Delta \ln P_{it}$, $\ln P_{it}$, $\Delta \ln P_{it+1}$, $\Delta \ln Y_{it-1}$, $\Delta \ln Y_{it}$, $\ln Y_{it}$, $\Delta \ln(1-ATR_{it+1})$, $mtrcg_{it}$, and $\Delta mtrcg_{it+1}$, all of which are also included in the first-stage of 2SLS, plus marital status and age. We omit fixed effects and year dummies from the income prediction equation 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 would otherwise be omitted due to perfect collinearity with the individual and year fixed effects -- are included in their place. The values of $\Delta \ln P_{it+1}$, $\Delta \ln[1-$

$ATR]_{it+1}$, and $\Delta mtrcg_{it+1}$ used in the income prediction equation are constructed by holding an individual's pre-tax income and other inputs into the tax calculation constant at their year t values in real terms (since we don't yet have predicted values of next year's income at this stage). 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.¹⁸

To summarize, in our “predictable tax change instrument” approach, we treat $\Delta \ln P_{it-1}$, $\Delta \ln P_{it}$, $\ln P_{it}$, $\Delta \ln P_{i, future}$, and $\Delta \ln Y_{i, future}$ in equation (1) as endogenous variables, and estimate the equation by conventional two-stage least squares. The instruments excluded from the 2nd stage but included in the 1st stage are first-dollar versions of $\Delta \ln P_{it-1}$, $\Delta \ln P_{it}$, $\ln P_{it}$, and $mtrcg_{it}$, and predicted values of $\Delta \ln P_{it+1}$, $\Delta \ln [1-ATR]_{it+1}$, and $\Delta mtrcg_{it+1}$ constructed by applying next year's actual tax functions to incomes predicted based on exogenous characteristics known at time t . Our forecast of future pre-tax income only contributes to our instrument in that it helps us more accurately calculate 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,

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 \mathbf{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 \mathbf{Z} , we multiply predicted future pre-tax income by the average ratio of that component of \mathbf{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.

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.

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. The log federal price is computed by re-calculating marginal tax rates assuming there is no state or local income tax, which includes setting deductions for state and local income taxes to zero in the federal tax calculations. The log state price is then computed by subtracting the log federal price from the log price that was computed taking federal, state, and local taxes into account. 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. 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.

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.

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

III. 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. 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).

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.

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

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

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 federal and state income taxes (as well as local income taxes, which are henceforth subsumed under “state”). 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 assets, or long term capital gains) by ten cents, calculating the marginal increase in taxes owed, and dividing that by the ten cents. Our computations of tax liabilities and marginal tax rates appropriately account for all relevant interactions between federal and state income taxes, including for example the effects of deductibility of state income taxes from federal income taxes, and vice versa where applicable.²⁴

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 figured by the tax calculator.²⁵ To avoid endogenous sample

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.

²⁴ We account for situations where federal income tax depends on state income tax, and vice versa, through an iterative process. We first compute federal income tax setting state income tax to zero, then compute state tax taking federal tax from previous step as given, then federal tax taking state tax from previous step as given, and so on for five iterations each of federal and state and local income tax calculations.

²⁵ 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

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.²⁶ 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 of our other sample selection criteria noted above with no change in marital status.²⁷ 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 future change 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.

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

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.

²⁶ 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.

²⁷ 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.

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 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.²⁸

²⁸ Full details on the algorithm used to re-allocate carried-over amounts across years are available in the web appendix (Bakija and Heim 2010). Using the two-year carryover window algorithm, we are able to identify at least

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. Later in the paper we discuss estimates from sensitivity analyses suggesting that using a two-year window instead of a five year window to reallocate carryovers does not appreciably affect the estimates.²⁹

Table 1
Descriptive Statistics

| Variable | Description | Mean | Std. Dev. |
|-------------------------------|--|-----------|-----------|
| <i>charity</i> | Total charitable contributions | 125,765 | 1,254,993 |
| <i>lnP</i> | Actual log price of giving (defined in text) | -0.41 | 0.17 |
| <i>lnP₀</i> | First dollar log price of giving (defined in text) | -0.41 | 0.16 |
| <i>Y</i> | 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 |
| <i>married</i> | Dummy equal to 1 if taxpayer is married filing jointly | 0.85 | 0.36 |
| <i>age</i> | Age of primary taxpayer | 52.70 | 12.75 |
| <i>children</i> | Number of children at home | 0.44 | 0.84 |
| <i>other dependents</i> | Number of other dependents | 0.60 | 1.04 |
| <i>lnP_{salestax}</i> | Effect of state retail sales tax on relative price of charity | -0.05 | 0.01 |
| <i>ln(state house price)</i> | Log of state median housing price in 2000, adjusted for real change in FHFA state housing price index | 11.99 | 0.37 |
| <i>state unemployment</i> | State unemployment rate | 0.06 | 0.02 |
| <i>state gov't spending</i> | 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.

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.

²⁹ 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 next year's marginal tax rate. This does not affect our instruments for price, since they are computed setting charitable donations to zero.

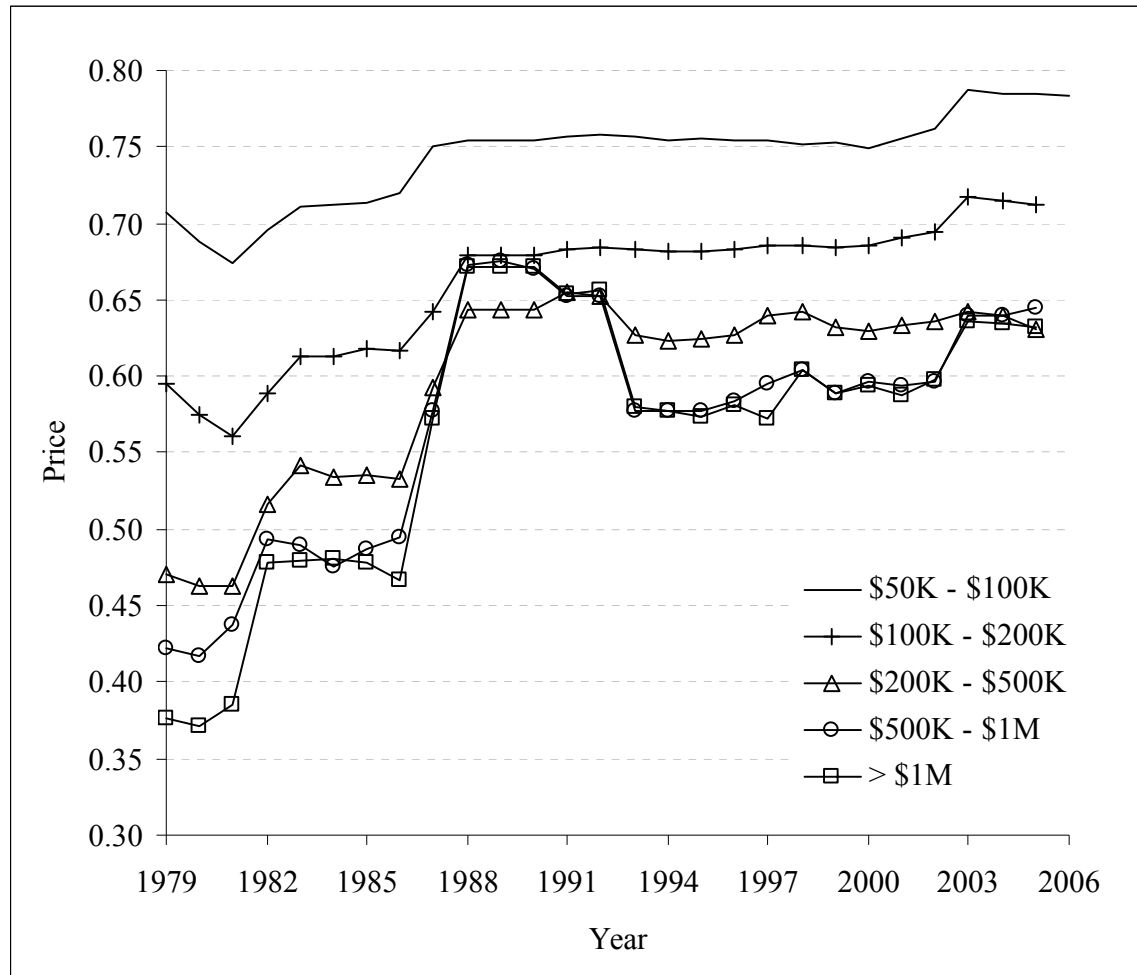
Table 1 presents a description of the variables used in this study along with some descriptive statistics from the unweighted sample. In this sample, the mean amount of charitable giving is over \$125,000 (in 2007 dollars). This large amount of giving is not surprising given the large number of very 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.

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.

In Figure 2 we illustrate the effect that state income taxes have on the price of charitable giving for high-income people in 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-local 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).³⁰

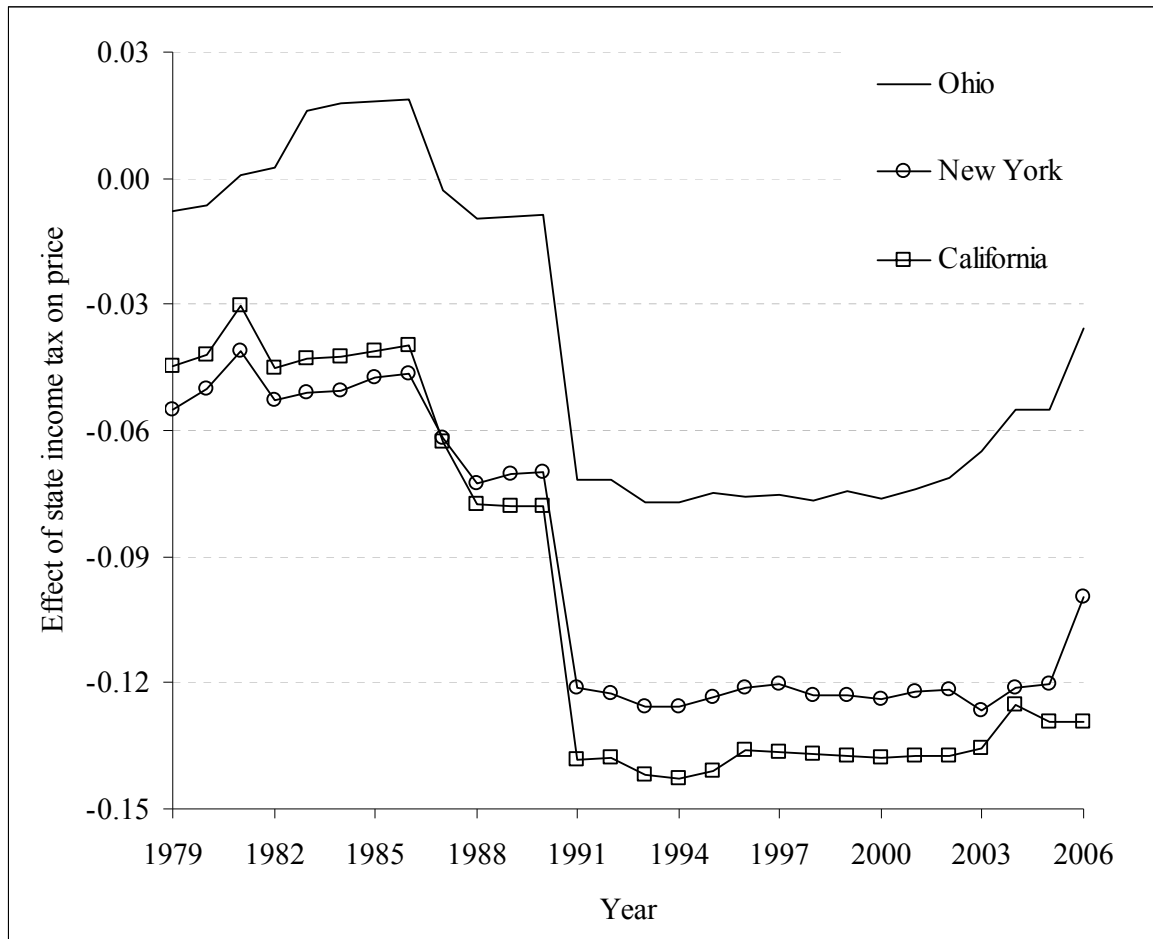
Figure 1
Average Price of Charitable Giving by Income Class, 1979-2006



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.

³⁰ 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.

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 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 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. Among middle-income people, the state price variation is less pronounced, but differences in price changes across states on the order of five cents per dollar of charity were not uncommon.³¹

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 variation in state price, as well as much of the correlation in changes in state price across states, shown in Figure 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-

³¹ Graphs showing the effect of state income taxes on the price of charity for all states, for those with incomes above and below \$200,000, are available in the web appendix to this paper (Bakija and Heim 2010).

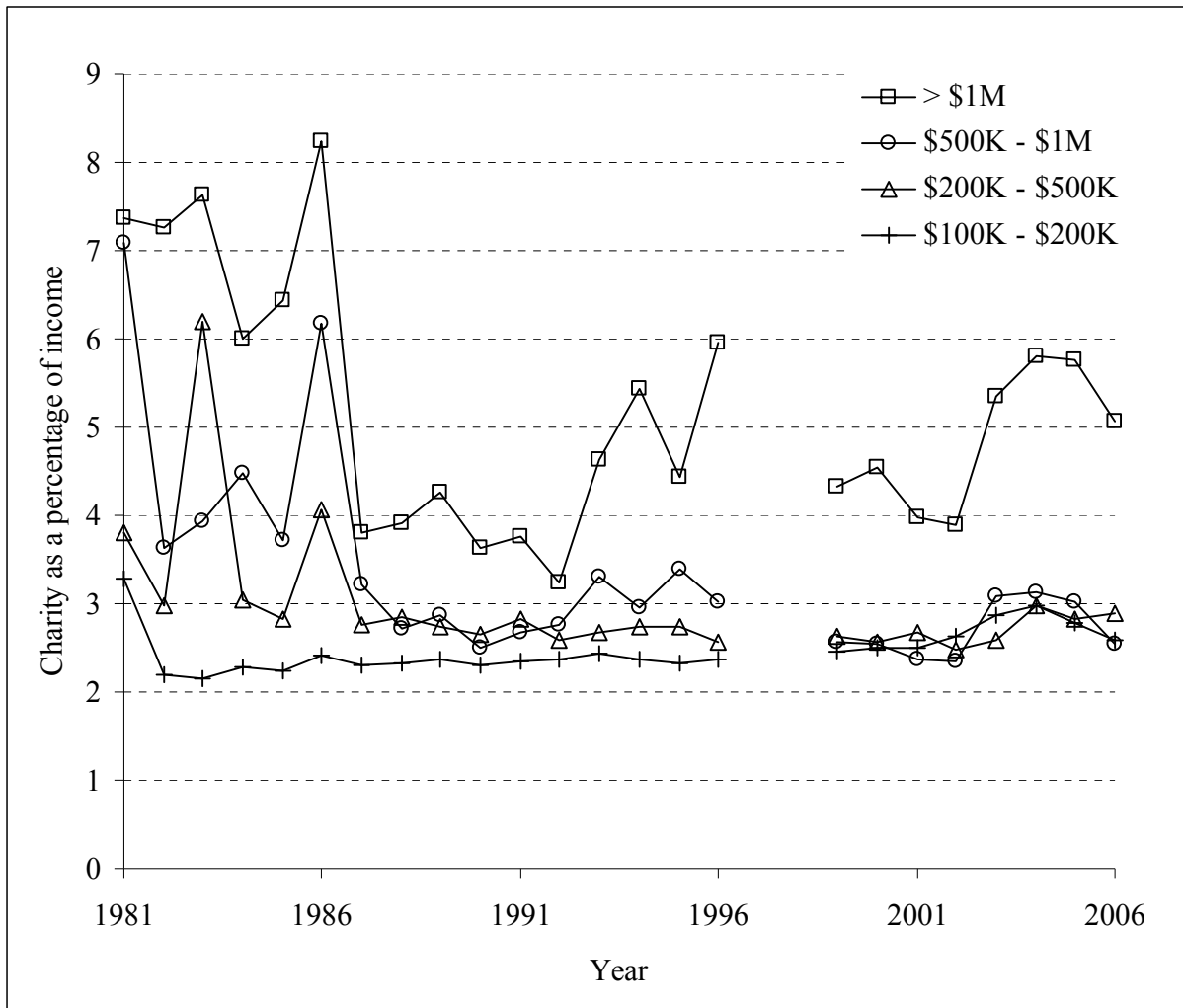
income people had itemized deductions small enough to put them in the second category.³²

Thus, starting in 1991, high-income people in states that operated income 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. In Figure 2, and in our econometric specifications which separate price into federal and state components, the effects on the price of giving caused by interactions between the federal and state income taxes are incorporated into our *state* price variable, since our federal price variable is calculated by setting state and local income taxes to zero.

³² 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.

Figure 3
Charitable Donations as a Percentage of 3-Year Moving Average of Income,
by Income Class, 1981-1996 and 1999-2006



Graph depicts, for each income class, aggregate donations as a percentage of aggregate income (weighted using population weights), based on the estimation sample, except the first two years and last two years of data for each taxpaying unit are included, and 1997 and 1998 are omitted due to very small sample sizes for high income people. 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.

Figure 3 presents data on charitable donations as a fraction of income, by income class, over time. 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. 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 percent in 1986 to 35 percent in 1987 and 28 percent in 1988. For millionaires, a smaller spike in giving in 1993 and 1994 also suggests giving that otherwise would have occurred in 1992 may have been delayed in anticipation of the increase federal marginal tax rates that would begin to apply to high-income taxpayers in 1993.

IV. ESTIMATES

A. Estimates Constraining Coefficients to be Uniform across Income Classes

In columns (1) and (2) of Table 2, we report estimates from a version of equation (1) that breaks price into separate federal and state components, constrains coefficients to be constant across income classes, and instruments for next year's price and income changes using predictable tax changes. Both columns present estimates from a single regression, with separate columns for federal and state estimates. The elasticity of charitable giving with respect to a persistent change in federal price, shown in column (1), is -0.35 with a standard error of 0.16. By contrast, the elasticity of charitable giving with respect to a persistent change in state price, shown in column (2), is estimated to be -1.16 with a standard error of 0.28.

Table 2
Explaining Log Charitable Giving:
Estimates Assuming Coefficients are Uniform across Income Classes

| | (1) | (2) | (3) | (4) | (5) | (6) |
|--|--|--------------------|--------------------------|--------------------|--|----------------------|
| | <u>Separate federal and state prices</u> | | | | | |
| | <u>Predictable</u> | | <u>Perfect foresight</u> | | <u>Combined</u> | |
| | <u>tax change instruments</u> | | | | <u>federal-state price</u> | |
| | Federal | State | Federal | State | Predictable tax change instruments | Perfect foresight |
| $\Delta \ln P_{it-1}$ | 0.03 (0.05) | 0.17 (0.08)** | 0.02 (0.04) | 0.16 (0.07)** | 0.01 (0.05) | 0.02 (0.04) |
| $\Delta \ln P_{it}$ | 0.18 (0.07)*** | 0.57 (0.12)*** | 0.17 (0.06)** | 0.56 (0.13)*** | 0.19 (0.07)*** | 0.20 (0.06)*** |
| $\ln P_{it}$ [persistent price elasticity] | -0.35 (0.16)** | -1.16 (0.28)*** | -0.39 (0.14)** | -1.13 (0.20)*** | -0.61 (0.18)*** | -0.65 (0.10)*** |
| $\Delta \ln P_{i,t+1}$ | 0.44 (0.19)** | 0.25 (0.38) | 0.37 (0.16)** | 0.29 (0.30) | 0.18 (0.20) | 0.15 (0.05)*** |
| $\Delta \ln Y_{it-1}$ | -0.05 (0.01)*** | | -0.05 (0.01)*** | | -0.06 (0.01)*** | -0.06 (0.01)*** |
| $\Delta \ln Y_{it}$ | -0.14 (0.01)*** | | -0.14 (0.01)*** | | -0.15 (0.01)*** | -0.16 (0.01)*** |
| $\ln Y_{it}$ [persistent income elasticity] | 0.51 (0.11)*** | | 0.53 (0.02)*** | | 0.60 (0.12)*** | 0.54 (0.02)*** |
| $\Delta \ln Y_{i,t+1}$ | 0.03 (0.14) | | 0.06 (0.01)*** | | 0.13 (0.16) | 0.05 (0.01)*** |
| Transitory price elasticity | -0.61 (0.06)*** | -0.85 (0.15)*** | -0.53 (0.05)** | -0.90 (0.11)*** | -0.60 (0.06)*** | -0.60 (0.05)*** |
| Transitory income elasticity | 0.34 (0.03)*** | | 0.33 (0.01)*** | | 0.32 (0.04)*** | 0.34 (0.01)*** |

All columns also control for individual fixed effects, year dummies, $\ln P_salestax$, $(age/100)^2$, $children$, $other\ dependents$, $\ln(state\ house\ price)$, $state\ unemployment\ rate$, and $state\ gov't\ spending$. Robust standard errors, clustered by state and income class, are in parentheses. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

In this specification, identification for the federal persistent price elasticity estimate comes from differences in the time path of federal marginal tax rates across income classes, as well as the non-linear effects of idiosyncratic shocks to income (i.e., those that differ from sample average changes over time and over the life cycle) on price. As Figure 1 demonstrated, the tax price of charitable giving increased dramatically over our sample period for high-income people, and increased only modestly over time for middle-income people. The fairly small federal price elasticity estimate in this specification is largely telling us that the relative decline

in charitable giving for high-income people compared to middle-income people shown in Figure 3 was not that large compared to the dramatic relative increase in price shown in Figure 1. However, it could be that this estimate is conflating the effects of federal price changes with the effects of omitted factors that would have caused the charity of high-income people to increase more over time than did the charity of middle-income people in the absence of tax changes. Consistent with this, we show later that the federal persistent price elasticity estimate becomes much larger when we allow the effects of non-price influences to vary by income. We would expect persistent price elasticities identified by state variation may be less subject to this problem, because this variation is more independent of income.

The coefficients on future and lagged price change variables in columns (1) and (2) suggest that the speed with which people adjust to price changes, and the degree to which they respond to future changes in price, may depend on how salient the price changes are. The elasticity of current charitable giving with respect to an anticipated increase in next year's federal price is sizable at 0.44, and reasonably statistically significant with a standard error of 0.19, while the future state price elasticity is smaller, at 0.25, with a standard error of 0.38. This is suggestive evidence that people may increase their charitable giving this year in response to a 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, as highlighted in Figure 3 above. But 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 between state taxes and complicated federal provisions. The very different coefficients on lagged federal and state price changes also seem consistent with a difference in salience, at least in the short-term until people gradually learn. The

coefficient on the change in *state* price between $t-1$ and t is large, at 0.57, with a standard error of 0.12; the coefficient on the change in state price between $t-2$ and $t-1$ is 0.17 and statistically significant with a standard error of 0.08. This implies that if the state price increases by one percent, the change in charitable giving in the first year in which the price change applies is only $-1.16 + 0.57 = -0.59$ percent. In the absence of any further price changes, the effect grows to $-1.16 + 0.17 = -0.99$ percent in the second year the price change is in effect, and to a 1.16 percent decline after two years. This suggests that the tax changes that provide the identifying variation in our state price variable are particularly difficult to learn about, but that people do apparently learn about them within one to two years after they are implemented. The coefficient on the change in federal price between $t-1$ and t is 0.18 with a standard error of 0.07, while the coefficient on the prior year's change is small and statistically insignificant. This suggests that the longer-run response to a federal price change is modestly larger than the immediate response, but that the adjustment occurs more quickly, consistent with the idea that federal marginal rate changes are more salient than changes arising from state taxation and complicated federal-state interactions.

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 next year. As noted above, this is derived from the sum of the coefficients on $\Delta \ln P_t$ and $\ln P_t$, minus the coefficient on $\Delta \ln P_{future}$. The elasticity of giving with respect to a transitory federal price change is estimated to be -0.61 with a standard error of 0.06, and the elasticity with respect to a transitory state price change is estimated to be -0.85 with a standard error of 0.15. For federal price changes the transitory price change is larger than the persistent price change, which is consistent with re-timing in anticipation of future price changes

outweighing gradual adjustment to past changes, while the opposite is true for state price changes.

The estimates of income elasticities in columns (1) and (2) 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 0.51 with a standard error of 0.11. The point estimate for the elasticity of current giving in response to a future income change caused by a predictable change in future tax liability is 0.03, but is imprecisely estimated with a standard error of 0.14. The coefficient on $\Delta \ln Y_t$ is -0.14 with a standard error of 0.01, and the coefficient on $\Delta \ln Y_{t-1}$ is -0.05 with a standard error of 0.01. We similarly find negative and significant effects of lagged income changes in all other specifications reported in the paper. If there is a mean-reverting income process, then the negative and significant coefficients on lagged income changes suggest that charitable giving is more responsive to persistent than to transitory changes in income. *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 elasticity of charity with respect to a transitory income change, which combines information from the coefficients on $\Delta \ln Y_t$, $\ln Y_t$, and $\Delta \ln Y_{future}$ in a manner analogous to the transitory price elasticity, is estimated to be 0.34 with a standard error of 0.04, which is smaller than the response to a persistent income change, but statistically significant.

Columns (3) and (4) of Table 2 show estimates from a regression similar to that shown in columns (1) and (2), but which assumes perfect foresight about next year's price and income changes. The estimates are very similar to those in columns (1) and (2), but are more precisely estimated, and so corroborate the points about federal and state price variation noted above. The most notable difference is that in the perfect foresight specification, there is a small but statistically significant 0.06 percent increase in current charitable giving in response to a one percent increase in next year's income. The strong similarity in the estimates of persistent price and persistent income elasticities between the perfect foresight and predictable tax change instrument specifications suggests that any bias arising from the perfect foresight assumption is likely to be small.

In column (5) of Table 2, we show estimates of equation (1) when combined federal-state price variables are used, under the predictable tax change instrument approach. The estimated persistent price elasticity is -0.61 with a standard error of 0.18, part way between the federal and state estimates. Other estimates are largely similar, with a notable exception being a relatively small point estimate of the future price elasticity, at 0.18, with a standard error of 0.20. The perfect foresight version of this specification in column (6) produces similar estimates of the key parameters of interest with smaller standard errors; one notable difference is that the response to future price change is again statistically significant with a coefficient of 0.15 and standard error of 0.5.

B. Estimates Allowing Non-Price Coefficients to Differ across Income Classes

The large difference between federal and state persistent price elasticities in Table 2 suggests omitted variable bias may be a problem. There is no obvious reason why we should expect the true long-run responsiveness of charitable giving to tax incentives should be so much larger if the changes in tax incentives are created by state taxes and their interactions with complicated federal provisions than if they come from simple federal marginal rate changes. To investigate this further, Table 3 shows elasticity estimates from specifications that allow coefficients on all non-price variables and time effects to vary across income classes. These include separate year dummies for each income class, which remove the large differences in time paths of federal taxes between income classes as a source of identification for price effects. Identification now comes from differences in the time paths of state prices and federal prices across people in similar broad income categories. Thus, middle-income people are no longer serving as a control group for upper-income people. By allowing the effects of income and other variables to vary freely across income classes, we are also imposing less restrictive assumptions about the functional form of the demand equation. In all specifications reported in Table 3, we are able to reject the equality of coefficients across income classes for all year dummies, the persistent income elasticity, and age squared at conventional standards of statistical significance, but usually cannot reject equality of coefficients across income classes for other variables.³³

³³ We tried specifications that only allowed heterogeneity across income classes for the coefficients on year dummies, income variables, and age squared, and constrained other variables to have uniform coefficients across income classes. The coefficients of interest and standard errors were extremely close to those in the specifications reported in the paper. Estimates from these alternative specifications are reported in the web appendix (Bakija and Heim, 2010).

Table 3

Estimated Price and Income Elasticities of Charitable Giving: Estimates Allowing Coefficients on All Non-Price Variables to Differ Across Income Classes

| | | (1) | (2) | (3) | (4) | (5) | (6) |
|-----------------------------------|-----------------|---------------------------------------|--------------------|--------------------|--------------------|--|----------------------|
| Separate federal and state prices | | | | | | | |
| Elasticity | Income class | Predictable tax change instruments | | Perfect foresight | | Combined federal-state price | |
| | | Federal | State | Federal | State | Predictable tax change instruments | Perfect foresight |
| Persistent price | All | -0.92 (0.44)* | -1.53 (0.58)*** | -0.86 (0.13)*** | -1.40 (0.20)*** | -1.10 (0.45)** | -0.96 (0.14)*** |
| Future price | All | 0.12 (0.45) | -0.27 (0.66) | 0.14 (0.06)** | -0.10 (0.07) | -0.04 (0.47) | 0.09 (0.05) |
| Transitory price | All | -0.72 (0.10)*** | -0.78 (0.18)*** | -0.68 (0.08)*** | -0.80 (0.11)*** | -0.72 (0.10)*** | -0.71 (0.08)*** |
| Persistent income | < \$100K | 0.60 (0.21)*** | | 0.44 (0.04)*** | | 0.61 (0.21)*** | 0.44 (0.04)*** |
| | \$100K - \$200K | 0.46 (0.15)*** | | 0.42 (0.04)*** | | 0.47 (0.15)*** | 0.42 (0.04)*** |
| | \$200K - \$500K | 0.32 (0.11)*** | | 0.38 (0.04)*** | | 0.33 (0.11)*** | 0.39 (0.04)*** |
| | \$500K - \$1M | 0.30 (0.11)*** | | 0.42 (0.04)*** | | 0.32 (0.11)*** | 0.44 (0.04)*** |
| | ≥ \$1M | 0.56 (0.14)*** | | 0.62 (0.03)*** | | 0.58 (0.14)*** | 0.64 (0.02)*** |
| | < \$100K | 0.31 (0.34) | | 0.02 (0.02) | | 0.33 (0.34) | 0.02 (0.02) |
| | \$100K - \$200K | 0.11 (0.30) | | 0.05 (0.02)*** | | 0.13 (0.30) | 0.05 (0.02)*** |
| Future income | \$200K - \$500K | -0.09 (0.21) | | 0.05 (0.02)*** | | -0.08 (0.21) | 0.05 (0.02)*** |
| | \$500K - \$1M | -0.35 (0.21)* | | 0.01 (0.01) | | -0.34 (0.21) | 0.02 (0.01) |
| | ≥ \$1M | -0.01 (0.17) | | 0.06 (0.02)*** | | -0.001 (0.18) | 0.06 (0.02)*** |
| | < \$100K | 0.22 (0.11)** | | 0.32 (0.04)*** | | 0.21 (0.11) | 0.32 (0.04)*** |
| Transitory income | \$100K - \$200K | 0.29 (0.14)** | | 0.31 (0.03)*** | | 0.27 (0.14)** | 0.30 (0.03)*** |
| | \$200K - \$500K | 0.24 (0.11)* | | 0.19 (0.04)*** | | 0.24 (0.11)** | 0.19 (0.04)*** |
| | \$500K - \$1M | 0.45 (0.10)*** | | 0.26 (0.03)*** | | 0.46 (0.10)*** | 0.26 (0.03)*** |
| | ≥ \$1M | 0.41 (0.04)*** | | 0.40 (0.02)*** | | 0.41 (0.04)*** | 0.41 (0.02)*** |
| | < \$100K | 0.22 (0.11)** | | 0.32 (0.04)*** | | 0.21 (0.11) | 0.32 (0.04)*** |
| | \$100K - \$200K | 0.29 (0.14)** | | 0.31 (0.03)*** | | 0.27 (0.14)** | 0.30 (0.03)*** |

All columns also control for $\Delta \ln Y_{it-1}$, $\Delta \ln Y_{it}$, $\ln P_{\text{salestax}}$, $(\text{age}/100)^2$, children , other dependents , $\ln(\text{state house price})$, $\text{state unemployment rate}$, $\text{state gov't spending}$, and year dummies, each interacted with dummies for each income class, along with fixed effects, $\Delta \ln P_{it-1}$, and $\Delta \ln P_{it}$. Robust standard errors, clustered by state and income class, are in parentheses. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

Columns (1) and (2) of Table 3 show estimates from a single regression using the “predictable tax change instrument” approach, splitting price into federal and state components, and allowing all other variables to have heterogeneous effects across income classes. The elasticity of charitable giving with respect to a persistent change in federal price is now estimated to be -0.92 with a standard error of 0.44, compared to a federal persistent price elasticity estimate of only -0.35 in the specification from column (1) of Table 2 that did not allow different coefficients across income classes on non-price variables. This suggests more clearly that estimates based on purely federal price variation are rather sensitive to how one controls for income and omitted time-varying influences that differ by income class. About half of the difference is due to controlling for separate year dummies by income class; in a specification identical to that in columns (1) and (2) except that coefficients on year dummies are constrained to be the same across income classes (not reported in Table 3), the federal persistent price elasticity is -0.61 with a standard error of 0.26. Turning to column (2) of Table 3, the elasticity of charitable giving with respect to a persistent change in state price is estimated to be -1.53 with a standard error of 0.58. While this is larger than the -1.16 estimate from the corresponding specification in Table 2, it is nonetheless true that when identification comes from differences in the time path of price across states, there is evidence of a responsiveness to tax incentives that is large from a policy perspective under both the more restrictive and less restrictive methods of controlling for other influences.

The coefficients on future price changes are now small but with very wide confidence intervals, which is not surprising given that including year dummies for each income class effectively controls separately for most of the large, obvious, and easily predictable changes in taxation, leaving the future price coefficient identified only by comparatively subtle and arguably

less salient future changes; evidence from Table 2 suggested that it takes a while for taxpayers to learn about such changes, in which case they'd be less likely to respond in advance. The transitory price elasticity is now -0.72 with a standard error of 0.10 for a federal price change, and -0.78 with standard error of 0.18 for a state price change. Both are similar to each other and are smaller than their corresponding persistent price elasticities, which is consistent with gradual adjustment to the rather subtle changes in taxation that are identifying price elasticities in this specification. Persistent income elasticities show a U-shaped pattern in income, with estimates of about 0.6 in the lowest and highest income groups and lower elasticities in between. Transitory income elasticities are substantially smaller than persistent price elasticities, but still significant, and tend to increase with income. Evidence on responsiveness of charity to future changes in income caused by predictable changes in tax liability is inconclusive in this specification.

Columns (3) and (4) of Table 3 depict estimates from the “perfect foresight” version of the specification in columns (1) and (2). This specification largely corroborates the estimates from columns (1) and (2), with similarly large but much more precisely estimated state persistent price elasticity (-1.4 with a standard error of 0.2) and federal persistent price elasticity (-0.86 with a standard error of 0.13). The most notable differences are a somewhat smaller persistent income elasticity of -0.44 in the lowest income category, and evidence of small, statistically significant positive responses of charitable giving to future income changes in most income classes, in contrast to inconclusive estimates of these effects when predictable tax change instruments are used.

Column (5) of Table 3 uses the predictable tax change instrument approach and combined federal-state prices, while allowing the effects of other variables to differ by income. The persistent price elasticity estimate, -1.10 with a standard error of 0.45, is considerably larger

than the -0.61 estimate from the analogous specification in column (1) of Table 2 that constrained all effects to be constant across income classes, and is more similar to the estimates based on state price variation shown in Table 2. In column (6) the “perfect foresight” version of this specification corroborates the findings with smaller standard errors.

The overall impression suggested by Table 3 is that the persistent price elasticity is large, in the vicinity of -1 and perhaps larger than -1 in absolute value. Of the various estimates of the persistent price elasticity presented in the paper, we view the higher-end estimates based on state price variation shown in columns (2) and (4) of Table 3 as the most convincing estimates of the responsiveness to both federal and state tax incentives, because they are based on what we view as a more plausible set of treatment and control groups, and because they control for potential sources of omitted variable bias in the most flexible way.

C. Estimates Allowing Price Elasticities to Differ across Income Classes

Table 4 presents estimated elasticities of charitable giving with respect to persistent and future price changes from specifications analogous to those in Table 3, except that we now allow coefficients on all variables, including price, to vary by income class. The bottom row shows p-values from chi-square tests where the null hypothesis is equality of persistent price elasticities across income classes. We are unable to reject uniformity of persistent price elasticities at the 10% significance level in any case except for the state price elasticity in the predictable tax change instrument approach, where the p-value is 0.067.

those with incomes below \$200,000, persistent price elasticity estimates in the predictable tax change instrument specifications are small, but with confidence intervals too wide to reject persistent price elasticities of either 0 or -1. This largely reflects the rather demanding nature of the “predictable tax change instrument” specifications – identification in these specifications requires tax reforms that cause large, predictable discrete changes in marginal tax rates and average tax rates that differ substantially from each other, and there were few such reforms affecting middle-income people during the sample period, which makes it difficult to use this approach to estimate differences in price elasticities across income classes.

Evidence that persistent price elasticities probably do not differ substantially across income classes comes from the perfect foresight specifications shown in Table 4. For example, column (6), which assumes perfect foresight about next year’s income and price changes and combines federal and state price into one, shows persistent price elasticities ranging from -0.82 to -1.03 that are highly statistically significant for all income classes. In the perfect foresight estimates shown in column (4), there is a tendency for the state persistent price elasticity point estimates to increase with income, with elasticities ranging from -0.86 for the lowest income class to -1.58 for the highest income class. However, while all are highly statistically significant in their differences from zero, they are not statistically significant in their differences from each other. There are some statistically significant estimates of responsiveness to future federal price changes among millionaires in the perfect foresight specifications, but as in Table 3, controlling for separate year dummies for each income class appears to absorb most of the strong signals of future price changes, leaving inconclusive evidence regarding responsiveness to more subtle future price changes. Persistent income elasticities (not shown in the table) are almost identical to those shown in Table 3 for the perfect foresight specifications. In the predictable tax change

instrument specifications, there is a similar U-shaped pattern of persistent price elasticities, with somewhat higher estimates for middle-income people and somewhat lower estimates for high-income people. Overall, we think that the evidence from the specifications in Table 4 does not substantially alter the conclusions we drew based on Table 3.

D. Sensitivity Analyses

All estimates reported above add a constant of \$10 to charity before taking logs. In Table 5 we display the sensitivity of estimates to the size of the constant added to charity for selected specifications. Point estimates of persistent price elasticities, and especially persistent income elasticities, do exhibit some sensitivity to adding a large constant, such as \$1,000, to charity. For each of the specifications in Table 5 where coefficients are constrained to be constant across income classes, we statistically tested the equality of persistent price and income elasticities with the corresponding elasticities when \$10 is added to charity. We could not reject equality at conventional significance levels except in the case of the federal persistent price elasticity when \$1,000 is added. Our main finding that persistent price elasticities are large when identified by differences in the time path of state prices remains robust when any of these constants is used. For example, in the predictable tax change instrument specification that allows heterogeneity across income classes in the coefficients on non-price variables and separates price into federal and state components, the persistent price elasticity identified by state price variation ranges from -1.6 with a standard error of 0.64 when \$1 is added to charity, to -1.3 with a standard error of 0.48 when \$1,000 is added to charity.

In the web appendix to this paper (Bakija and Heim 2010), we report results from a wide range of other sensitivity analyses, 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 -0.99 with a standard error of 0.15, and an income elasticity of 0.92 with a standard error of 0.02, 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.

Specifications that include fixed effects but omit lagged and / or lead changes in price and income suggest that omitting the lagged changes biases the estimated persistent price elasticity downward in absolute value, while omitting future changes biases it upwards in absolute value; omitting either or both biases estimates of the persistent income elasticity downwards.

Estimates of the persistent price elasticity are similar whether one uses charitable deduction, donations computed with a two year carryover window, or donations computed with a five year carryover window. Persistent income elasticity estimates are relatively insensitive to how we measure charity when coefficients are constrained to be uniform across income classes, but when we allow heterogeneity across income classes we find that using current charitable deduction instead of donation biases income elasticity estimates upward for lower income classes and downward for upper income classes. 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 price elasticities is broadly similar, but there is a tendency towards larger persistent and future income elasticities. We tried including two-year-ahead changes in price and income in place of

next year's changes. These specifications suggest broadly similar conclusions to those reported here, albeit with considerably larger standard errors in the predictable tax change instrument specifications.

Table 5
Sensitivity of Persistent Price Elasticity and Persistent Income Elasticity Estimates to Constant Added to Charity, Selected Predictable Tax Change Instrument Specifications

| | (1) | (2) | (3) |
|--|---------------------------|--------------------|--------------------|
| | Constant added to charity | | |
| | \$1 | \$100 | \$1,000 |
| <i>All coefficients except price heterogeneous across incomes, separate federal and state prices</i> | | | |
| State persistent price elasticity | -1.60 (0.64)** | -1.45 (0.53)*** | -1.30 (0.48)*** |
| Federal persistent price elasticity | -1.01 (0.49)** | -0.82 (0.39)** | -0.72 (0.34)** |
| Persistent income elasticity | < \$100K | 0.51 (0.26)** | 0.66 (0.17)*** |
| | \$100K - \$200K | 0.62 (0.18)* | 0.56 (0.13)*** |
| | \$200K - \$500K | 0.26 (0.12)** | 0.41 (0.12)*** |
| | \$500K - \$1M | 0.29 (0.121)** | 0.35 (0.10)*** |
| | ≥ \$1M | 0.57 (0.16)*** | 0.58 (0.13)*** |
| | | | |
| <i>All coefficients uniform across income classes, separate state and federal prices</i> | | | |
| State persistent price elasticity | -1.16 (0.30)*** | -1.15 (0.27)*** | -0.99 (0.28)*** |
| Federal persistent price elasticity | -0.39 (0.19)** | -0.26 (0.14)* | -0.01 (0.12) |
| Persistent income elasticity | 0.43 (0.12)*** | 0.61 (0.10)*** | 0.72 (0.11)*** |
| <i>All coefficients uniform across income classes</i> | | | |
| Persistent price elasticity | -0.63 (0.20)*** | -0.55 (0.17)*** | -0.35 (0.16)** |
| Persistent income elasticity | 0.50 (0.13)*** | 0.72 (0.12)*** | 0.87 (0.13)*** |

Table depicts estimates of selected specifications from Tables 2 and 3, changing the constant added to charity. Robust standard errors, clustered by state and income class, are in parentheses. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.

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 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.

V. CONCLUSIONS

The evidence in our paper suggests that peoples’ decisions about how much to donate to charity are influenced significantly by tax incentives. Our most convincing estimates, which are identified by differences in the time-path of the price of giving across states, imply an elasticity of charitable giving in response to a persistent change in price that is in excess of -1 (in absolute value), and this finding is robust to whether we allow coefficients on year dummies, income, and other variables to vary by income class. Estimates based on federal tax variation, by contrast, are sensitive to how one controls for time-varying influences that differ by income, with the most flexible specifications also suggesting a large responsiveness to price. We do not find strong evidence of differences in persistent price elasticities across income levels. There is evidence of gradual adjustment to tax changes, and of re-timing of giving in response to especially salient predictable future changes in federal taxation, but evidence of responsiveness to subtle and complicated future changes in taxation is inconclusive.

³⁴ Examples of first stage regression estimates, 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).

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