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NEW EVIDENCE ON THE TAX ELASTICITY OF CAPITAL GAINS

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This study updates previous research estimating the persistent effect of tax changes on capital gains realizations by using a large panel of tax returns from 1999 to 2008. Similar to earlier studies in the literature, we use the Type II Tobit model to address the sample selection problem and we address the endogeneity problem in the tax variables, but we improve the identification of the tax elasticity by using an exclusion restriction: the presence of carryover loss. The preferred persistent elasticity estimate is –0.72 and is statistically significant and robust to a number of sensitivity tests. We also compare the results of our model to results from the original model applied to contemporary data, and estimate our model on sub-periods. Unlike prior research, this study estimates the tax elasticity of other types of capital gains. We find that pass-through capital gains are highly sensitive to persistent tax changes, but gains from mutual fund distributions are extremely insensitive.

Keywords: capital gains taxation

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I. INTRODUCTION

The relationship between the marginal tax rate and the timing of capital gains realizations has been studied intensely. The long-run effect of capital gains tax rates on realizations has received particular interest, although the most recent study using microdata does not use data after 1993. In this article, we estimate the elasticity of capital gains realizations using the most recent available data: the period from 1999 through 2008. We also strengthen the identification of the Type II Tobit model used in the analysis, and we estimate the elasticities on the sale of personally-held assets as well as those held by pass-through organizations and mutual funds.

An early econometric estimate of the response of capital gains to the tax rate is reported by Feldstein, Slemrod, and Yitzhaki (1980). Using a sample of tax returns from 1973, they estimate that taxpayers with substantial holdings of corporate stock

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have tax elasticities so large that, in response to a capital gains tax rate reduction, those taxpayers would increase their realizations by enough to raise their total taxes paid.[1] The study sparked a flurry of other research, some using cross-section or longitudinal data on individuals, others relying on aggregate time-series data or panel state-level data. Auten and Cordes (1991) note that cross-section estimates of elasticities using data on individual observations tended to be greater than 1.00 in absolute value, but time-series estimates of elasticities using aggregate data tended to be between –0.5 and –0.9.

Although studies of how other forms of income respond to taxes find a similar range of uncertainty, the variability in capital gains estimates may also stem from the issues that complicate its study. Income from capital gains realizations may be timed much more easily than income from salary and wages; in principle, capital gains realizations may be put off indefinitely. In addition, the decision to realize gains and the amount realized may jointly depend on unobservable factors, confounding attempts to generate consistent estimates of the relationship between taxes and realizations. Finally, because relatively few taxpayers realize gains, microdata from a random sample of taxpayers contain few observations with gains, and samples stratified toward high-income taxpayers require weights for consistent estimation. Applying different solutions to those problems and examining different time periods can lead to substantially different estimates.

Burman and Randolph (1994a, 1994b) offer evidence that the disparity in estimated elasticities is caused by whether taxpayers view the changes in tax rates as a long-run "permanent" change or a short-run "transitory" change. Using a Type II Tobit model on data for the years 1979–1983, they estimate an elasticity of capital gains realizations to changes in "permanent" tax rates of –0.18, and an elasticity for "transitory" rates of –6.42. However, their estimates are very imprecise; their estimate of the permanent elasticity of –0.18 is insignificantly different from both zero and –1.

Auerbach and Siegel (2000), who estimate the Type II Tobit model of Burman and Randolph on individual tax data for the years 1986–1993, suggest that imputing the permanent tax variable misses important information about permanent rates. Using the Burman and Randolph imputation, Auerbach and Siegel find a permanent elasticity of –0.34, but with a modified formula they find a permanent elasticity of –1.72.The transitory elasticities are –4.91 and –4.35, respectively.

While much of the recent work has been done using longitudinal data on taxpayers, one notable exception is work done by Bakija and Gentry (2015). They estimate the capital gains elasticity using a panel of state-level data covering the 50-year period from 1957 to 2007 and find an elasticity of –0.6.

The purpose of this article is to estimate the responsiveness of capital gains realizations using a panel of taxpayers followed over the most recent period available: 1999–2008. Those years include two major tax acts: the Economic Growth and Tax Relief Recon-

[1] Feldstein, Slemrod, and Yitzhaki (1980) reported their results in a National Bureau of Economic Research Working Paper in 1978. That study and related work by those authors played a role in the enactment of the capital gains tax rate reductions of 1978. Even before that study, revenue estimators at the Joint Committee on Taxation and the Treasury Department had made smaller ad hoc adjustments to allow some response of realizations to changes in tax rates.

ciliation Act of 2001 (EGTRRA) and the Jobs and Growth Tax Relief Reconciliation Act (JGTRRA) of 2003. Because most capital gains realizations in the 1980s and early 1990s were personal realizations rather than gains from pass-through entities or from mutual funds, we concentrate our analysis on personal capital gains realizations reported on line 8 of Schedule D of the IRS Individual Income Tax Form (Form 1040). These are gains from the sale of capital assets that are directly held by the individual rather than through pass-through entities or mutual funds. Unlike previous analyses, our research also examines total realizations, as well as realizations from pass-through entities and mutual funds.

As in Burman and Randolph (1994a, 1994b) and in Auerbach and Siegel (2000), we separately estimate the elasticities for long-run and short-run tax changes. We also use a Type II Tobit model but improve the identification of the elasticities by adding a variable that affects the decision to realize gains yet not necessarily the level of realization. Using our preferred model specification, the permanent elasticity is estimated to be –0.72 with a standard error of 0.11, and that estimate is robust to a number of sensitivity tests. We also estimate the elasticity of capital gains from other sources. We find that capital gains from mutual fund distributions have an estimated permanent elasticity of only –0.084, while gains realized by partnerships, S corporations, and trusts have an estimated permanent elasticity of –1.694. Finally, we estimate the model of Auerbach and Siegel without additional control variables and the model of Burman and Randolph. The greater elasticities estimated using the Auerbach and Siegel model suggest that our approach reduces omitted variable bias. The Burman and Randolph method results in a lower elasticity when weights are not used in the regression but results in a larger elasticity when they are used.

II. TAX TREATMENT OF CAPITAL GAINS

Accruing a capital gain does not generate a tax liability, because gains are taxed only when they are realized through their sale. When the gain is realized, under the tax code it is considered income and is subject to taxation. The taxable amount is the difference between the price at which the asset was sold and the price at which it was purchased, minus adjustments for items such as commissions and tax depreciation deductions. The gain's taxable status (or lack thereof) and the applicable tax rate depend on factors such as how long the asset was held, whether the asset is an owner-occupied home, and whether the sale takes place after the death of the owner.[2]

[2] Starting in 1951, taxpayers selling one home and buying another were allowed to "roll over" any gain on the first home into the second, as long as the second home was of the same or greater value than the first. Starting in 1964, people age 65 or over were allowed a one-time exclusion of up to $20,000 on gains from the sale of their home. The exclusion amount was raised to $35,000 in 1976 and $125,000 in 1981; the age at which it became available was lowered to age 55 in 1978. Those provisions stayed in effect until legislation in 1997 replaced them with an exclusion of $250,000 (or $500,000 for joint returns) that could be claimed if the seller had owned the home for at least two years and had used it as a primary residence for two out of the previous five years.

Realizations of long-term capital gains — defined generally as those on assets held for more than a year — are taxed at rates lower than rates imposed on ordinary income. Short-term gains — those assets held for a year or less — are taxed at the same rate as ordinary income. States typically treat gains, long or short, as regular income.

From mid-1997 until mid-2003, most long-term capital gains were subject to rates of 10 percent and 20 percent. In mid-2003, JGTRRA reduced the tax rates on capital gains to a bottom rate of 5 percent (0 percent in 2008) and a top rate of 15 percent through December 31, 2008. Public Law 109-222, enacted in 2006, extended the 0 percent and 15 percent rates through December 31, 2010. In 2010, the Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 extended those rates through December 31, 2012. The American Taxpayer Relief Act of 2012 made permanent the 0 and 15 percent rate capital gains brackets for taxpayers with income below $450,000 in the case of a joint return ($425,000 in the case of a head of household return and $400,000 in the case of single return). Starting in 2013, taxpayers with incomes greater than those thresholds were subject to a 20 percent capital gains tax rate.

Over the years, tax structures have been simplified at the state level. For example, in 1986, California had 12 tax brackets and New York had 13 brackets, but by 1999 the numbers had been reduced to six and five brackets, respectively.

Because taxes are paid upon realization of a capital gain rather than as accrued, taxpayers can in effect choose when they pay their capital gains taxes. For instance, the Tax Reform Act of 1986 raised the top statutory tax rate on capital gains from 20 to 28 percent, effective at the beginning of 1987. In anticipation of that increase, investors realized substantial gains in 1986: $327.7 billion in 1986, compared with $172 billion in 1985 (U.S. Department of the Treasury, 2010). Then, in 1987, realizations fell by almost as much, returning to a level comparable to the level before the tax increase. These large swings in realizations suggest that investors were very responsive to rate changes immediately before or immediately after the tax change.

Finally, the treatment of capital losses is different from the treatment of capital gains. Preferential capital gains rates are applied after netting out any short- or long-term losses. Net losses can be used to offset up to $3,000 of ordinary income (because ordinary income is taxed at a higher rate than capital gains, taxpayers have an incentive to use all of the net loss to offset ordinary income rather than capital gains). Any remaining loss may be carried forward to the next taxable year. Thus, net losses up to $3,000 receive a tax subsidy at ordinary tax rates. Moreover, carryover losses from the previous year and current-period losses both may be used to offset current-year gains. The ability to offset gains with losses means that some taxpayers who otherwise would be subject to a positive tax will be able to have a zero tax rate on their gains.

III. EMPIRICAL MODEL

To facilitate comparison with previous empirical studies on the capital gains tax elasticity, we first review the relationship between capital gains realizations described in Burman and Randolph (1994a, 1994b) and Auerbach and Siegel (2000). This relationship is modeled as

$$(1a) \quad \ln g_{it} = \gamma_1(\tau_{it} - \tau_{it-1}) + \gamma_2 \tau_{ip} + \gamma_3(\tau_{it} - \tau_{ip}) + X_{it}\gamma_4 + \varepsilon_{2it},$$

where i indexes individuals, t indexes years, and the γ's are conformable vectors of coefficients. The dependent variable, $\ln g_{it}$, represents the natural log of capital gains (measured as the net long-term personal gains before prior-year carryover losses). The control variable vector X_{it} includes a variety of wealth, income, and demographic variables that will be explained below. The tax variables τ_{it-1} and τ_{it}, are the combined federal and state marginal tax rate on long-term capital gains for their respective time periods.[3] The tax variable τ_{ip} is the long-run, permanent tax rate, and $(\tau_{it} - \tau_{ip})$ is the transitory rate. Auten and Clotfelter (1982) define the permanent rate to be the "normal" marginal tax rate, which they measure using a three-year average of tax rates. Burman and Randolph (1994a, p. 795; 1994b, p. 2) define it as the tax rate on capital gains "purged of individual and aggregate transitory effects." Auerbach and Siegel (2000, p. 2) define the permanent rate as the long-run rate, which "can be thought of as what the taxpayer expects his marginal tax rate to be in a typical year, independent of transitory circumstances." In (1a), the effect on the capital gains realizations of a permanent increase in the tax rate is represented by γ_2. The effect on the capital gains realizations of a transitory increase in the tax rate this year that is expected to disappear next year is given by $\gamma_1 + \gamma_2 - \gamma_3$.

Arguably, the division into permanent and transitory components cannot be meaningfully applied to our data. For example, the combined federal and state tax rates applied to capital gains have shifted so frequently over the last 20 years that it is unclear if investors perceive a normal rate that is paid in a typical year or what rate would exist if purged of aggregate transitory effects. The temporary nature of the tax rates legislated in JGTRRA and Public Law 109-222 further raise doubt about what rate taxpayers would perceive to be permanent. The American Taxpayer Relief Act of 2012, enacted in January of 2013, provided some level of certainty to the taxation of capital gains by making the 0, 15, and 20 percent rate structure permanent.

Nevertheless, the division into permanent and transitory components is not strictly necessary. Rather than describe the tax rate as the sum of permanent and transitory components, one can model the immediate, transitory response to a tax change and the long-run, persistent change as

$$(1b) \quad \ln g_{it} = \gamma_1(\tau_{it} - \tau_{it-1}) + \gamma_2 \tau_{it} + \gamma_3(\tau_{it+1} - \tau_{it}) + X_{it}\gamma_4 + \varepsilon_{2it}.$$

In (1b), the effect on capital gains realizations of a persistent increase in the tax rate is represented by γ_2. The coefficient γ_2 measures the effect of an increase in the tax rate,

[3] The semi-log specification results in a variable elasticity that depends linearly on the tax rate, such that a doubling of the tax rate from 15 to 30 percent doubles the estimated elasticity.

holding changes relative to the previous year and the next year constant. This occurs when there has been an increase in the tax rate that has persisted over the previous year and is also expected to persist into the next year. The effect on the capital gains realizations of a transitory increase in the tax rate this year that is expected to disappear next year is given by $\gamma_1 + \gamma_2 - \gamma_3$.

Note that both (1a) and (1b) can be rearranged such that the tax variables enter the equation as $\beta_1\tau_{it-1}+\beta_2\tau_{it} + \beta_3\tau_{it+1}$. In that specification, the sum of all tax coefficients $\beta_1 + \beta_2 + \beta_3$ is equivalent to the coefficient γ_2 in (1b) and therefore is the effect of a persistent change in tax rate. The coefficient β_2 is equivalent to $\gamma_1 + \gamma_2 - \gamma_3$ in (1b) and therefore is the effect of a transitory change in the tax rates. The three tax variables, τ_{it-1}, τ_{it}, and τ_{it+1}, are likely to be highly correlated, and that correlation is accentuated by the use of instrumental variables to address the endogeneity of τ_{it} and τ_{it+1}. Consequently, the individual coefficient estimates may be both imprecisely estimated and more sensitive to the inclusion or exclusion of other variables. For that reason a transitory elasticity estimate, which relies on only one coefficient, is likely to be more fragile than a persistent elasticity estimate, which relies on all three coefficients.

Following both Burman and Randolph (1994a, 1994b) and Auerbach and Siegel (2000), we take into account the decision to realize capital gains and the amount of capital gains realized. Our full empirical specification is

$$(2) \quad I^*_{it} = \alpha_1\tau_{it-1} + \alpha_2\tau_{it} + \alpha_3\tau_{it+1} + X_{1it}\alpha_4 + \varepsilon_{1it},$$

$$(3) \quad \ln g_{it} = \beta_1\tau_{it-1} + \beta_2\tau_{it} + \beta_3\tau_{it+1} + X_{2it}\beta_4 + \lambda_{it} + \varepsilon_{2it};\ if\ I^*_{it} = 1,$$

where the indicator I^*_{it} is a latent variable representing the decision to realize long-run capital gains, the α's and β's are conformable vectors of coefficients, λ_{it} is the inverse Mills ratio, and the control variable vector X_{2it} is a subset of X_{1it}. This Type II Tobit model allows for the possibility that the effects of regressors are different between the extensive margin of whether to realize capital gains and the intensive margin of the level of gains to be realized.

The progressivity of the individual income tax schedule makes it very likely that the capital gains tax rate variables are affected by the amount of realized capital gains. This endogeneity of the tax rates requires us to find instruments that are strongly correlated with the current and future tax variables, τ_{it} and τ_{it+1}, but are uncorrelated with the level of realized capital gains.[4]

We use the first-dollar marginal tax rate variables (τ_{0it}) and the maximum combined federal and state tax rate variables (τ_{sit} and τ_{sit+1}) as instruments for the two endogenous tax variables. Because those variables do not depend on any characteristic of the taxpayer other than his or her state of residence, they are exogenous.[5] The first-dollar marginal tax rate variable is computed with the amount of realized gains set to zero. However,

[4] The tax rate in the previous year τ_{it-1} is a predetermined variable.

[5] We assume that taxpayers do not move to a low tax state in anticipation of realizing a large gain.

it is still possible that the first-dollar rate is endogenous if taxpayers time their realizations to coincide with large deductions that lower their tax rate. To guard against that problem, we calculate the first-dollar tax variable with the following elements set to zero: state income taxes, property and sales taxes, charitable contributions, and passive and active losses from partnerships and S corporations.

To address the possibility of a selectivity bias caused by taxpayer decisions to realize a capital gain, we employ the generalized Tobit model developed by Lee, Maddala, and Trost (1980), which consists of four steps. First, we regress the two endogenous tax variables τ_{it} and τ_{it+1} on instruments and other regressors to obtain their fitted values $\hat{\tau}_{it}$ and $\hat{\tau}_{it+1}$. Second, we use a Probit model to estimate the decision to realize gains on the full sample (with $\hat{\tau}_{it}$ and $\hat{\tau}_{it+1}$ replacing τ_{it} and τ_{it+1}, respectively). In this step, we also use the predicted values from the Probit estimation to compute the inverse Mills ratio. Third, we use the subsample of realizers to re-estimate the fitted values of tax variables. The regression includes the inverse Mills ratio calculated from the second stage to account for possible sample selection bias. Finally, we use ordinary least squares on the subsample of realizers to estimate the level equation. The regression includes the fitted tax variables computed from the third step and the inverse Mills ratio. Because the asymptotic variance of this estimator is unknown, we calculate the standard errors through the use of a bootstrap, clustered at the taxpayer level, in which each iteration draws a new sample of tax returns.

A taxpayer's decision to realize capital gains reflects economic factors as well as his or her lifecycle savings and consumption decisions. The vector of control variables X_{it} thus includes wealth and income variables as well as variables that reflect demographic characteristics such as age, family size, marital status, and region. In order to account for taxpayers' financial sophistication, we include in the model the number of short-term transactions made by the taxpayer. Some investors are more sophisticated than others and have a better understanding of the tax consequences of their actions. General partners in private equity firms, for example, often choose to receive their income as carried interest (which is taxed as capital gains) rather than as salary. Because frequent traders, who have more experience with the financial system than others, may be similarly sophisticated, we include variables for the number of short-term transactions made each year. Frequent trading does not necessarily indicate greater sophistication, however; it can also be argued that frequent trading indicates less sophistication because frequent buying and selling generates less revenue than simply buying index funds. Dummy variables to indicate various losses (any personal long-term loss realizations, net losses from the sale of a business or business asset, net losses from pass-through entities, and net short-term losses) are also included because those losses may affect the realization decision.[6]

Technically, we do not need an exclusion restriction (a variable that affects the decision to realize gains but has no effect on the level of realization) for the estimate to

[6] Some of these loss variables may reflect components that are endogenous. We perform a sensitivity test of our results by excluding these variables.

be identified. Without the exclusion restriction, identification is based entirely on the functional form imposed by the Probit model.[7] However, if there is not much variation in the independent variables, the inverse Mills ratio could be well approximated by a linear function of X_1. When $X_1 = X_2$, this correlation can introduce severe collinearity among regressors in the second stage, leading to large standard errors of the estimate.

Our preferred model uses a dummy variable in (2) indicating whether the taxpayer recorded a carryover loss. Because a taxpayer may use up to $3,000 of his capital loss carryover to offset against his ordinary income, the presence of a carryover does not provide an incentive to realize capital gains unless the carryover exceeds $3,000. To capture the incentive effect created by loss carryover, we create a dummy variable for the presence of capital loss carryover in excess of $3,000. Because it is an indicator variable, this variable should affect the decision to realize a gain, but it should not affect the level of gains realized. It therefore belongs in the Probit equation but not in the level equation. To the extent that the amount of realized gains is smaller than the amount of loss carryover, this lowers the taxpayer's current year capital gains tax rate to zero; the present value of taxes paid is non-zero since the taxpayer reduces carryover that could be used to offset future year realizations.

A taxpayer who has a carryover loss can use that loss to offset any capital gains that he realizes. While losses in prior years are clearly predetermined and in the current year should be exogenous, losses could be endogenous if realizing a loss in one year and a specific gain in another year is part of a larger multi-year plan. But Constantinides (1984) shows that the tax-minimizing realization strategy realizes losses as they occur while deferring the realization of gains, and Arnott, Berkin, and Ye (2001) show that there are considerable benefits to realizing losses simultaneously with gains. Whether a taxpayer engages in a strategy to harvest all losses as they occur or instead times losses to occur in the same tax year as gains, carryover losses are not endogenous to current period gains realizations. In fact, given uncertainty about the future return to a given investment, it is difficult to identify a situation (other than the $3,000 a year offset of ordinary income) where it is optimal to realize a loss in expectation of realizing a gain in a future year but it is not optimal to realize the gain concurrently with the loss. Nevertheless, we perform a sensitivity analysis with respect to the use of this exclusion restriction.

Following Auerbach and Siegel (2000), we calculate the permanent elasticity as

$$(4) \quad \varepsilon_{pit} = \hat{\tau}_{it+1}[\beta_1 + \beta_2 + \beta_3 + (\alpha_1 + \alpha_2 + \alpha_3)\lambda_{it}],$$

where λ_{it} is the inverse Mills ratio evaluated at $\hat{h}_i + \hat{\sigma}_{12}$, the predicted value of the selection in (2) plus the covariance of the error terms in (2) and (3).[8] We estimate a transitory

[7] See Vella (1998) and Wooldridge (2010) for further discussion of this issue.

[8] See Burman and Randolph (1994b) for the derivation. Auerbach and Siegel (2000) differ from Burman and Randolph in that they use the fitted value of the future tax rate as the permanent variable and thus use it in their elasticity calculation. We follow Auerbach and Siegel's practice in order to facilitate the comparison. We also calculate the elasticity using the average value of the past tax rate, the fitted current tax rate, and the fitted future tax rate. The difference is negligible.

elasticity with an analogous equation that excludes future and lagged tax coefficients. We estimate the elasticity separately for each return and then calculate a weighted mean, using as weights the product of the population weight and the amount of gains realized.

IV. DATA

Our data come from a unique 10-year panel of federal tax returns, over the years 1999–2008, created by the Internal Revenue Service's Statistics of Income (SOI) Division.[9] The data are a stratified random sample of returns selected in tax year 1999. The data include each item on the federal tax form 1040 and their attendant schedules, including Schedule D (capital gains and losses). SOI has linked the data to Social Security Administration records in order to determine the dates of birth of the primary taxpayer, secondary taxpayers, and the first four dependents in the file. In addition, we linked the data to a 1999 SOI study of occupation and industry. We use Bakija's (2009) tax calculator to generate federal and state marginal tax rates by year for each observation.

The panel is a stratified random sample of tax returns that oversamples high-income tax returns. The set of taxpayers is taken from the 1999 cross-section sample, which contained 176,966 returns. The panel subsample contains 88,123 returns from 21 income stratifications,[10] weighted to represent 123 million tax returns. The stratification by income includes sampling rates ranging from 0.05 to 100 percent. Each taxpayer and his or her spouse who were on a selected tax return in 1999 or who filed late for tax year 1999 in tax-processing years 2000 or 2001 are included in the panel for each year that they filed a return. Dependents and new entrants to the panel through marriage are not followed separately from the original panel member. Because of the complexity of the weighting procedures in handling taxpayers whose weighting shifts dramatically over time, we restrict our sample to taxpayers who did not experience a change in marital status over the 10-year period (dropping about 19,000 returns in 1999) or who had a change in the value of their weighting of more than 5 percent from their 1999 weight (dropping 174 returns).[11]

The left-hand panel of Table 1 shows the sample sizes and total capital gains from all sources, including short-term, long-term, and pass-through gains, for the unrestricted sample. As can be seen, there was $559.8 billion in total capital gains realizations in 1999. Realizations of capital gains fluctuate considerably over this period from a low of $234 billion in 2002 to a high of $752 billion in 2007. The restricted sample follows the same pattern with a low in 2002 and a peak in 2007. There is attrition in the sample

[9] See Weber and Bryant (2005) for a detailed description of the stratification and selection process of the 1999 edited panel.

[10] Weber (2006) reports that the subsample contains 83,434 returns. For the unrestricted sample, we report the number of returns after adjusting for split records in the case of divorce in any of the subsequent years by creating duplicate returns in each year prior to the divorce and splitting the weights. This maintains the 1999 income totals. The restricted sample does not include these returns because of the filer's change in marital status.

[11] Because the sample is stratified by income, observations can have a change in their weight as a result of large changes in income from year to year.

Table 1

Descriptive Statistics of Data Used in the Analysis

	Unrestricted Sample				Restricted Sample			
Year	Number of Returns	Weighted Number of Returns (Millions)	Total Capital Gains in AGI ($Billions)	Positive Long-Term Capital Gains in Schedule D, Line 8 ($Billions)	Number of Returns	Weighted Number of Returns (Millions)	Total Capital Gains in AGI ($Billions)	Positive Long-Term Capital Gains in Schedule D, Line 8 ($Billions)
1999	88,123	123.0	559.8	289.2	61,335	90.4	436.1	220.6
2000	84,742	116.9	619.6	375.6	58,800	85.6	476.2	289.6
2001	83,239	114.0	303.0	194.7	57,483	83.1	242.1	155.0
2002	81,710	111.3	234.4	140.2	56,283	80.8	182.5	111.8
2003	80,661	109.3	294.2	149.3	55,424	79.2	228.7	116.0
2004	79,712	107.7	440.0	225.7	54,724	77.9	355.3	182.3
2005	78,905	106.2	590.7	276.9	54,087	76.8	477.5	226.7
2006	78,550	105.7	671.9	304.9	53,874	76.4	542.9	251.1
2007	79,975	108.7	752.1	338.8	54,855	78.6	623.6	282.0
2008	75,402	101.2	314.3	175.6	51,660	73.1	265.2	150.2

Note: AGI = Adjusted Gross Income.

due to reasons including death of the taxpayer, falling below the filing threshold, filing late, and simply failing to file a tax return. Over the course of the panel's 10-year period, there is approximately 14 percent attrition of the unweighted number of returns in the unrestricted sample and 16 percent in the restricted sample.[12]

The final column in each panel of Table 1 shows the positive long-term capital gains realizations from the sale or exchange of a capital asset, excluding capital gains and losses reported on lines 11–14 of Schedule D. The excluded amounts reported on those lines are items from the sale or exchange of a capital asset used in a trade or business, involuntary conversions, amounts received from pass-through entities or mutual funds, and loss carry forwards.[13] Our dependent variable is the positive value of the sum of long-term gains excluding swaps, distributions, partnerships and S corporations, and involuntary conversions. In this paper, we focus on long-term gains from the sale of capital assets that are personal in nature and are reported on line 8 of Schedule D, including stock held for investment or the gain from the sale of primary residence in excess of $250,000 ($500,000 in the case of joint return). As shown in Figure 1, personal capital gains realizations made up a significantly larger portion of total realizations in the 1980s and early 1990s than in later years. In 1984 and 1985, personal capital gains represented approximately three-quarters of total long-term realizations. However, personal capital gains averaged only slightly more than a third of total realizations for the period 1999–2008, with capital gains realizations attributable to pass-through entities experiencing the largest increase — rising from approximately 10 percent of total capital gains in the late 1980s to almost 30 percent of capital gains in 2008. Therefore, we believe that concentrating on line 8 totals provides a better comparison with earlier analyses. For completeness, we also examine gains declared on lines 11–14 of Schedule D separately.

The restricted data have a total of 558,525 observations. We further restrict these observations for the following cases: We drop all dependent returns, we keep only those returns with primary taxpayers who are adults in 1999,[14] we drop any return with a calculated total capital gains marginal tax rate of less than zero or greater than 0.4 (which may occur with phase outs of various deductions), and we drop any observation with a missing value (as opposed to a zero) for any variable needed in the estimation process.[15] The combination of these restrictions results in a sample with 341,793 observations; 70,377 of those observations reported a long-term capital gain on line 8 of Schedule D.

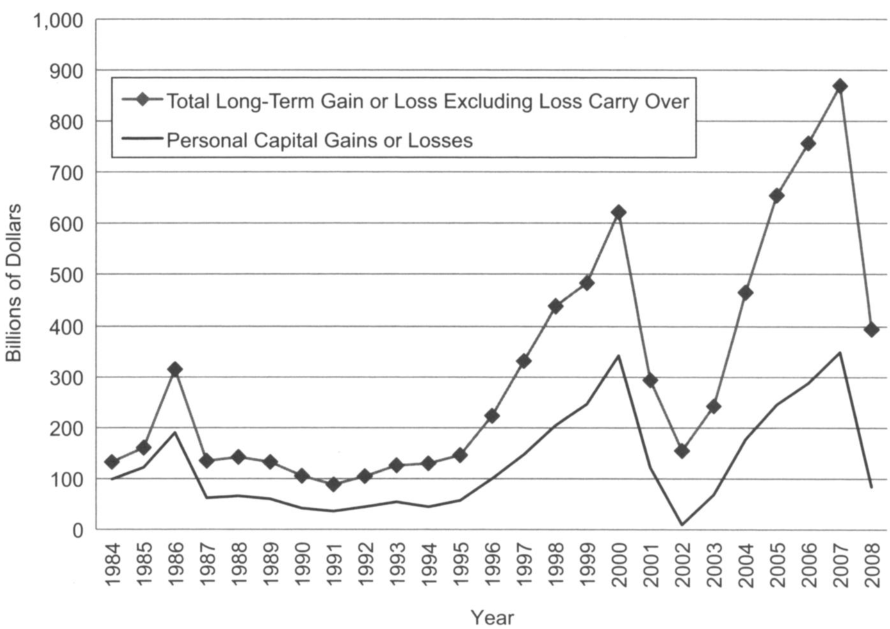
[12] Bryant (2008) reports that there is 15 percent attrition of primary and secondary taxpayers over the period 1999–2005.

[13] The excluded amounts on line 11 are from the sale of property used in a trade or business, amounts from involuntary conversions from loss due to casualty or theft, amounts from swaps and straddles, or like-kind exchanges. The excluded amounts from line 12 are amounts from partnership, S corporation, and other pass-through entities. From line 13, the excluded amounts are distributions from mutual funds. The line 14 exclusion eliminates capital loss carry forwards from prior years.

[14] We also trimmed a small number of observations in which the age was greater than 120. Trimming at lower levels, such as 100, does not appreciably change the results.

[15] About 3 percent of the deletions were due to problems with the tax variables.

Figure 1
Long-Term Capital Gains or Losses Reported on Tax Returns



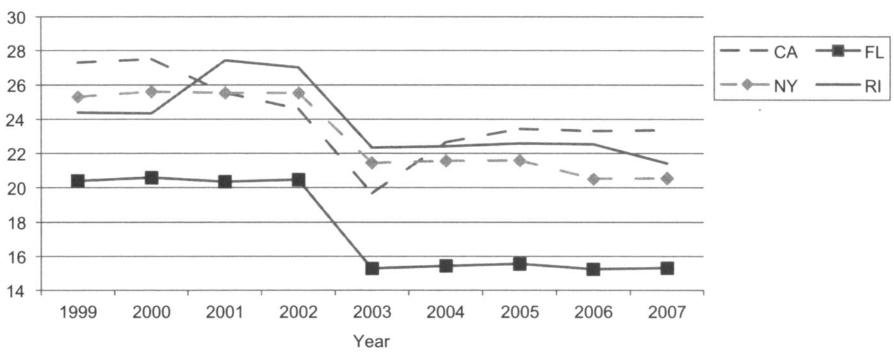
Source: Author's calculations, using tabulations of the 1984–2008 Statistics of Income individual income tax cross-section data

We create the marginal tax rate variables using Bakija's (2009) tax calculator. The tax calculator has detailed information on the federal tax structure and on each of the 50 states and the District of Columbia for each year between 1999 and 2007. We use the 2007 values for 2008 tax rates.

The relationship between realizations and tax rates is identified because of variation in the tax rates. In our data, that variation comes from several sources: changes in federal tax law, such as enactment of JGTRRA; changes in state tax law; and variation in tax rates across states. All three sources are visible in Figure 2, in which we show the combined maximum state and federal tax rate in four states. The national decline in rates due to the enactment of JGTRRA is clearly visible in the decline in tax rates from 2002 to 2003. However, that 5 percentage point drop is less than the 7 percentage point difference in rates between California and Florida in some years. The unique evolution of each state's tax rates provides additional variation. Florida has no income tax, so it follows the maximum federal rate. Rhode Island has a higher combined rate, which starts lower than the rates in New York and California, then rises above both, and ultimately

Figure 2

Combined Federal and State Tax Rates (%) for Four States 1999–2007



settles between the two. New York's rate roughly parallels that of Rhode Island, while California has the highest rate in some years and the second lowest in others.

Figure 2 clearly illustrates that the combined federal and state and local tax rates are influenced by a variety of sources that affect variation within each state and across states. However, for a more rigorous examination, we decompose that variation into variation across taxpayers — our unit of analysis — and for each taxpayer over time. Table 2 documents the standard deviation in the marginal tax rate τ_{it}, the first-dollar tax rate τ_{0it}, and the maximum combined state and federal tax rate τ_{sit}. In addition, Table 2 presents the percent of the variation in those variables attributable to variation across the average rate for each taxpayer and variation over time for each taxpayer.

The marginal tax rate τ_{it} has the most variation of the three variables; about 43 percent is due to variation between taxpayers and the remainder was variation over time for each taxpayer. Consequently, much of the variability in tax rates is unrelated to changes in federal and state tax rates over time. But the progressive nature of many state income tax systems implies the current year tax rates will vary with the amount of capital gains realized across taxpayers, which would bias our estimated responses. We can examine the degree to which that issue is present in our decomposition by looking at the standard deviation and variance decomposition for the first-dollar tax rate τ_{0it}. Recall that the first-dollar tax rate zeroes out capital gains realizations and other endogenous income and tax preference items. Consequently, as expected, the first-dollar tax rate has a smaller standard deviation. Of the first-dollar tax rate variation, 57.9 percent — an even larger proportion than for the current tax rate — occurs across taxpayers. Presumably, the smaller portion attributable to variation across time for each taxpayer is because some of the variation in the current rate over time occurred as taxpayers changed their capital gains realizations. Finally, we examine the maximum state and federal tax rate. That variable is the same for every taxpayer in a given state, so we would expect there to be less variation across taxpayers than for either the current tax rate or the first-dollar tax

Table 2

Variation in Marginal Tax Rates Across and Within Taxpayers

	τ_{it}	τ_{0it}	τ_{sit}
Standard deviation	9.61	8.81	7.42
Percent of variation across taxpayers	43.03	57.88	17.86
Percent of variation within taxpayers	56.97	42.12	82.14

rate. As expected, the standard deviation for the maximum state and federal tax rate is even smaller than for the other two tax rate variables. Moreover, a greater proportion of the variance occurs over time for each taxpayer, as the only variation across taxpayers occurs between taxpayers in different states. In sum, Figure 2 and Table 2 indicate that there is substantial variation in tax rates captured by variation across both states of residence and changes in state rates over time.

The exogenous variables that form the vector X include demographic and economic variables that may be correlated with capital gains.[16] Family size is determined from the number of personal and dependent exemptions, and marital status is determined from the filing status of the taxpayer. We include dummy variables for taxpayer age brackets (such as ages 30–39, ages 40–49, and so on), created from an age variable provided from Social Security records matched to the data. The gender of the head of household is also included. We include dummy variables for region, which are derived from the taxpayer's state of residence.[17] We also include dummy variables for year in order to account for the aggregate shocks that affect all taxpayers in the same way across years.

Burman and Randolph (1994a, 1994b) and Auerbach and Siegel (2000) include proxies for wealth to capture the potential size of accrued unrealized gains and the proportion of wealth held in corporate stock. We follow their approach, using Survey of Consumer Finance (SCF) data for 2001, 2004, and 2007. We use SAS code provided by the Federal Reserve Board to create variables for total unrealized capital gains and unrealized capital gains from stocks, bonds, and mutual funds.[18] The natural logs of these variables are regressed on demographic variables and tax variables common to both the SCF and our panel, and we use the estimated coefficients to impute the log of unrealized gains to our data.[19] (See Table A1 in the appendix for the regression results.) We also include the lagged values of business losses and rent losses, taken from tax data, as measures of business wealth.

[16] In the instances in which explanatory variables in log form take a value of zero, we replace the natural log with zero. We further add to the regression a dummy variable equal to one for all instances when the variable equals zero, and zero otherwise.

[17] We use four regions: Northeast (CT, ME, MA, NH, NJ, NY, PA, RI, and VT); South (AL, AR, DC, DE, FL, GA, KY, LA, MD, MS, NC, OK, SC, TN, VA, WV, and TX); Midwest (IA, ID, IL, KS, MI, MN, MO, ND, NE, OH, SD, and WI); and West (AK, AZ, CA, CO, HI, ID, MT, NM, NV, OR, UT, WA, and WY).

[18] We use bulletin_macro.sas, available at http://www.federalreserve.gov/pubs/oss/oss2/bulletin.macro.txt.

[19] These variables include some that are not used elsewhere in our model. The use of capital income variables, such as dividend income, might bias our results if they are correlated with capital gains realizations. We test that by running an alternative model in which we used various lagged values of the variables in the appendix and find that the resulting elasticity estimates are nearly identical to the original estimates.

As in Burman and Randolph (1994a, 1994b) and Auerbach and Siegel (2000), we estimate permanent income by regressing the natural log of the average of real positive income over all years on demographic characteristics. The regression estimate is then used to impute annual permanent income based on lagged values of the regressors. Transitory income is measured as the difference between current income (the sum of positive income from all sources except gains) and permanent income.

In order to account for the financial sophistication of taxpayers, we include dummy variables for the number of short-term realizations that a taxpayer made in the prior year: 0, 1–34, 35–167, 168–1001, and more than 1001. These brackets are based on the sample distribution of those with positive lagged number of short-term realizations.[20] We also include dummy variables for any long-term loss realization, net losses from the sale of a business or business asset, net losses from pass-through entities, and net short-term losses.

Table 3 shows the mean values of the variables from the sample of 341,793 observations. As described above, the panel is a stratified sample that oversamples taxpayers with high incomes. Comparison of the weighted and unweighted mean long-term gains highlights the effect of the sample stratification. The average long-term gain reported on line 8 of Schedule D is $2,136. However, if we do not use the weights, the average jumps to $466,665. Similarly, for the sample of observations reporting a long-term capital gain, the weighted average among those who realize gains is $36,885 and the unweighted average is almost $2.5 million.

Finally, note that the sample of capital gains realizers is different from the overall sample. Compared with the population of all returns, on average the sample of realizers tends to have higher income, has a higher marginal tax rate, is roughly 10 years older, is more likely to be male and married, and is less likely to have dependent children.

V. RESULTS

We start by estimating our preferred model. That model uses the same instrumental variable approach as Auerbach and Siegel (2000) and includes the same control variables as Burman and Randolph (1994a, 1994b) and Auerbach and Siegel. However, we use the dummy variable that indicates loss carryover as an exclusion restriction in the Probit stage, as well as categorical variables for the number of short-term transactions and dummy variables to indicate various losses that can eliminate the tax for some or the entire amount of realized gains.

A. Estimates Using Our Preferred Capital Gains Variables

The three tax variables (τ_{it-1}, τ_{it}, and τ_{it+1}) constitute the main focus points of our analysis, as the sum of their coefficients capture the effect of permanent changes in the capital gains tax rate. The coefficients on τ_{it-1} and τ_{it} have the anticipated signs: An increase in the current tax rate reduces capital gains realizations, and an increase in the

[20] The second group corresponds to those between 0 and the 75th percentile, the third group corresponds to those between the 75th and 90th percentiles, the fourth group corresponds to those between the 90th and 99th percentiles, and the fifth group corresponds to those above the 99th percentile.

Table 3

Summary Statistics of Variables Used in the Model

	All Observations		Realizers Only	
	Weighted Mean	Unweighted Mean	Weighted Mean	Unweighted Mean
Net long-term gains	2,136	466,665	36,885	2,474,404
Net long-term gains (log)	0.611	2.204	7.813	10.702
Current marginal tax rate	14.26	15.90	17.43	19.67
Imputed unrealized gains (log)	11.63	12.29	11.88	13.49
Imputed unrealized gains in stock (log)	2.632	3.771	4.179	6.281
Imputed permanent income (log)	10.79	10.89	10.93	11.08
Current income (exogenous components; log)	10.48	11.46	10.99	13.34
Business losses lagged (log)	0.133	1.062	0.507	3.335
Rent losses lagged (log)	0.410	1.028	1.003	2.094
Age	49.80	52.20	58.88	59.11
Primary taxpayer is male	0.334	0.371	0.441	0.516
Number of dependents	0.774	0.797	0.584	0.747
Primary taxpayer is married	0.516	0.621	0.683	0.833
South states	0.349	0.328	0.310	0.280
Northeast states	0.197	0.217	0.235	0.275
Midwest states	0.237	0.216	0.245	0.181
West states	0.217	0.239	0.210	0.264
Having carryover loss in excess of $3,000	0.035	0.103	0.130	0.211
Lagged number of short-term realizations	0.965	16.388	5.497	53.603
Having any long-term loss realization	0.086	0.248	0.323	0.605
Having net losses from sale of a business or business asset	0.001	0.019	0.005	0.063
Having net losses from pass-through entities	0.006	0.045	0.026	0.106
Having net short-term losses	0.058	0.184	0.223	0.436

Note: All dollar amounts are in 2008 dollars.

tax rate from the previous time period reduces realizations (recall that the coefficient of τ_{it+1} has the opposite sign as the coefficient of $\tau_{it} - \tau_{it-1}$). The coefficient of τ_{it+1} is statistically insignificant and negative, while theory suggests that the coefficient should be positive. This likely occurs because of the high correlation between the predicted values of τ_{it+1} and τ_{it}, and it implies that estimates of the transitory elasticity — which just use the coefficient of τ_{it} — will be somewhat fragile, while estimates of the permanent elasticity — which use the coefficients of all three tax variables — will not.

The permanent elasticity is estimated using (4). For both the decision to realize a gain and the decision over the amount to realize, the sum of all the tax coefficients measures the effect that an increase in tax rates has on capital gains realizations, holding changes relative to the previous year and the next year constant. Conversely, the effect on capital gains realizations of a transitory increase in the tax rate this year that is expected to disappear next year is measured by the coefficients on the current tax rate $\hat{\tau}_{it}$.

The results are shown in Table 4. We estimate a permanent elasticity of –0.72, with a standard error of 0.11 and a transitory elasticity estimated as –1.19, with a standard error of 0.26. Equation (4) can be decomposed into the elasticity for the decision to realize and the elasticity for the amount realized. Table 3 lists the weighted mean marginal tax rate for those realizing gains, and Table 4 lists the estimated coefficients. Multiplying the sum of the coefficients of the tax variables by the mean marginal tax rate yields an approximation of the elasticity of average realized gains from a permanent tax change. The elasticity of average realized gains is –0.715 and the elasticity of realizations is only –0.001. These results suggest that tax rates influence the amount of gain that taxpayers choose to realize and have essentially no influence on the decision to realize a gain.[21]

The coefficient on the inverse Mills ratio is positive and statistically significant, indicating the possible presence of sample selection bias. Because the coefficient is an estimate of the covariance of the error terms of the two stages, our results suggest that — conditional on the explanatory variables — the larger the gain, the greater the probability that it is realized.

Coefficients on the other control variables generally conform to expectations. Capital gains realizations are significantly and positively related to both permanent and transitory incomes. Imputed unrealized gains have a large and positive effect on the level of realizations, although they have a small negative effect on the criterion function. The share of wealth held in stocks is included in the model because of the ease with which stock can be liquidated relative to other assets, such as real estate. The extremely small standard error of the share in wealth variable in the Probit stage suggests that friction is an important determinant in explaining the realization decision.

[21] Because our estimate of tax rates for tax year 2008 is the actual federal tax rate in 2008 plus the applicable tax rate in each state in 2007, it is possible that we are not accurately capturing the variation in tax rates that taxpayers responded to in 2007. In order to investigate the extent to which this might be affecting our results, we drop the 2007 observations. As shown in Table 6 where we do sensitivity tests, the absolute value of permanent elasticity increases to 0.89 but is still less than one. That suggests that the permanent elasticity was lower in earlier years. We explore that idea more thoroughly in a later section. The transitory drops to –0.82 while its standard error increases from 0.26 to 0.78, meaning that the new estimate is not significantly different from –1.19 in a statistical sense. It is clear, then, that the data for 2008 plays an important role in the precision of the estimate for the transitory elasticity.

Table 4
Generalized Tobit Model
(Dependent Variable: Personal Long-Term Capital Gains Realizations (log))

	Level Equation		Criterion Function	
	Coefficient	Standard Error	Coefficient	Standard Error
$\hat{\tau}_{it+1}$	–0.025	0.018	–0.008	0.006
$\hat{\tau}_{it}$	–0.069	0.016	–0.007	0.004
$\hat{\tau}_{it-1}$	0.053	0.006	0.010	0.001
Inverse Mills ratio	1.648	0.307	NA	NA
Permanent income (L)	0.679	0.204	0.298	0.059
Transitory income (L)	0.320	0.032	0.075	0.006
Imputed total unrealized gains (L)	0.239	0.029	–0.027	0.007
Ratio of unrealized gains in stock (L)	0.405	0.077	0.322	0.005
Lagged business losses (L)	0.102	0.026	0.010	0.010
Lagged business losses (D)	–0.028	0.228	0.198	0.086
Lagged rent losses (L)	0.029	0.031	0.034	0.011
Lagged rent losses (D)	0.162	0.267	–0.070	0.089
Male (D)	–0.048	0.078	–0.068	0.018
Number of dependents	–0.030	0.027	0.016	0.007
Married (D)	–0.286	0.182	–0.165	0.055
$30 \leq$ Age < 40 (D)	–0.063	0.185	0.278	0.033
$40 \leq$ Age < 50 (D)	0.364	0.227	0.567	0.036
$50 \leq$ Age < 60 (D)	0.858	0.267	0.813	0.039
$60 \leq$ Age < 70 (D)	1.477	0.325	1.106	0.038
Age ≥ 70 (D)	1.815	0.377	1.387	0.037
Short-term realizations group 2 (D)	0.910	0.130	0.531	0.013
Short-term realizations group 3 (D)	1.632	0.188	0.697	0.045
Short-term realizations group 4 (D)	2.345	0.196	0.684	0.083
Short-term realizations group 5 (D)	2.299	0.831	0.523	0.302
Having long-term loss realization (D)	1.160	0.058	0.168	0.015
Having net business losses (D)	0.422	0.180	0.055	0.095
Having net pass-through losses (D)	0.384	0.128	0.128	0.038
Having net short-term losses (D)	0.702	0.061	0.162	0.015
Having carryover loss (D)	NA	NA	0.149	0.019
Constant	–1.944	2.052	–2.124	0.592
Permanent elasticity	–0.716	0.111		
Transitory elasticity	–1.194	0.264		
Observations	70,377		341,793	

Notes: Logarithmic variables are indicated by "L." Dummy variables are indicated by "D." Dummy variables for regions and years are included in the model but are omitted from the table. Data are weighted. Standard errors are calculated from 400 bootstrap replications. NA = Not applicable.

The categorical variables for age show that the probability of realizing gains increases with age. In the level equation, the categorical variables for the lagged number of short-term realizations have coefficients of increasing magnitude. Those magnitudes suggest that, up to a point, the more actively one participates in short-term realizations, other things being equal, the larger the gain realized. In the criterion equation, the effect varies less dramatically. The standard errors of the coefficients on the last group are noticeably higher than those of the other groups, possibly because there are too few observations to precisely estimate their effects.

The coefficients on dummy variables for long-term loss realization, net losses from pass-through entities, and net short-term losses are positive and significant in both (2) and (3). The coefficients on the dummy variables indicating net losses from business sales are positive in both stages but are significant only in the level equation — possibly because of too few observations reporting such losses. The statistical significance of those loss variables in the level equation is surprising in that the mere presence of a loss, without regard to size, appears to be correlated with larger average realizations, which might suggest that the significance of the loss variables may be due to endogeneity — taxpayers may be simultaneously deciding to realize relatively large gains and claim a loss. We explore this issue in the sensitivity analysis section. The dummy variable for having carryover loss is positive and significant in the Probit stage.

B. Estimates Using Alternative Capital Gains Variables

Until this point, we have focused on personal capital gains. We now apply our base model specification to alternative types of capital gains realizations. We begin by examining net long-term gains from sales of businesses or business assets. The estimated elasticities of those gains are listed in column 2 of Table 5, which indicates that the permanent elasticity is –0.60.

Table 5

Estimates Using Alternative Capital Gains Variables

	Table 4 Results (1)	Sales of Businesses/ Business Assets (2)	Partnerships, S Corps, Trusts (3)	Capital Gains Distributions (4)	All Capital Gains Less Carryover (5)
Permanent elasticity	–0.716	–0.596	–1.694	–0.084	–0.898
	(0.111)	(0.200)	(0.278)	(0.075)	(0.093)
Transitory elasticity	–1.194	–2.070	–1.772	–0.545	–1.502
	(0.264)	(0.515)	(0.782)	(0.159)	(0.212)
Inverse Mills ratio	1.648	–1.845	0.837	–0.162	1.314
	(0.307)	(0.481)	(1.034)	(0.109)	(0.081)

Note: Standard errors in parentheses are calculated from 400 bootstrap replications.

Net long-term gains from pass-through organizations, such as partnerships, S corporations, and estates and trusts from schedule K-1, have a permanent elasticity of −1.69. This is a markedly higher sensitivity to tax rates than observed for other types of capital gains and is nearly identical to the transitory elasticity. Possibly, these results are associated with partnerships in the finance industry, such as hedge fund managers, that may be extremely sensitive to tax changes.

Conversely, the estimates for capital gains distributions from mutual funds imply a permanent elasticity of −0.08, which is a markedly lower sensitivity than observed for other types of gains, which suggests that mutual funds use criteria other than taxes when determining the timing and amount of gains to distribute. Chen, Kraft, and Weiss (2011) find evidence that mutual fund managers are responsive to changes in the individual long-term capital gains tax rate, and that, in particular, when the tax rate decreases, the cost to the managers of delaying realizations of capital gains declines. This is consistent with an apparent lower level of responsiveness in individual realizations of mutual funds in the period of our analysis. Finally, we consider total net long-term gains, before carryover, which have a permanent elasticity that is slightly less than 0.9 in absolute value.

VI. SENSITIVITY ANALYSES

We explore the robustness of our results to a number of alternative model specifications and assumptions. Table 6 reports the key results.

A. Omit the Inverse Mills Ratio

The significant coefficient of the inverse Mills ratio — which represents the correlation of the errors in the first and second stage — suggests that the decision to realize a gain and the amount realized are not independent. To test for the amount of possible bias in our elasticity estimates, we estimate our model but omit the inverse Mills ratio in the second stage.

Using (3), the elasticity of capital gains realization with respect to the permanent change in the tax rate is −0.62, with a standard error of 0.1. Comparing the permanent elasticities between the two models, the amount of bias in the permanent elasticity estimate appears to be on the order of 0.1. The small amount of elasticity coming from the first stage accounts for the relatively small amount of sample selection bias we find, even though the selection effect is statistically significant.

B. Allowing Heterogeneous Wealth Effects across Time

Aggregate shocks, such as those from changes in the stock market, are likely to have large effects on the stock of unrealized capital gains, and these effects are likely to be heterogeneous for taxpayers with different levels of wealth. Although our model specification includes dummy year variables to control for those aggregate shocks, they are constrained to have similar effects on gains realizations for every taxpayer in the same year. To allow for heterogeneous effects, we interact the imputed unrealized gains

Table 6
Sensitivity Analysis

	Permanent Elasticity		Transitory Elasticity		Inverse Mills Ratio
	Coefficient	Standard Error	Coefficient	Standard Error	
Table 4 results	−0.716	0.111	−1.194	0.264	1.648
Inverse Mills ratio omitted (Double Hurdle model)	−0.623	0.104	−1.021	0.240	NA
Wealth and year interactions	−0.747	0.115	−1.179	0.271	1.765
Loss variables omitted	−0.714	0.110	−1.195	0.256	0.712
Drop τ_{it-1}, τ_{it+1}, τ_{0it}	−0.691	0.243	NA	NA	1.923
Use instruments τ_{sit-1}, τ_{sit}, τ_{sit+1}	−0.592	0.280	−0.849	0.739	1.687
Drop $\tau_{i,t+1}$	−0.732	0.096	−1.843	0.163	1.737
Carryover dummy in 2nd stage	−0.771	0.116	−1.320	0.274	2.490
Carryover categories in 2nd stage	−0.761	0.116	−1.319	0.273	2.459
Dropping 2007–2008 observations	−0.893	0.140	−0.818	0.780	1.618
Unweighted	−0.964	0.064	−1.686	0.137	−0.791
Include state fixed effects	−0.746	0.114	−1.337	0.273	1.642
Drop short-term transactions variables	−0.693	0.108	−1.145	0.255	0.732

Note: Standard errors are calculated from 400 bootstrap replications.

variable with the year dummy variables. As shown in Table 6, the permanent elasticity changes very slightly from the base model without the interaction terms.

C. Possible Endogeneity of the Tax Variables

Gravelle (2010) suggests that the −1.72 elasticity estimated in Auerbach and Siegel (2000) may be due to transitory components in the first-dollar tax rate. Although we define the first-dollar tax rate to minimize that concern, remaining transitory components might still bias our estimates away from zero. We conduct three tests to examine that problem.

First, we re-estimate our model without the first-dollar tax variable, also dropping τ_{it-1} and τ_{it+1}.[22] In this case, the coefficient on τ_{it} is the permanent effect of a tax change, and its instrument, the maximum state and federal tax rate, does not have the endogeneity problem that may affect the first-dollar tax variable. The resulting estimated elasticity of –0.69 is nearly identical to the estimate in Table 4. We then re-estimate our model with τ_{it-1}, τ_{it}, and τ_{it+1}, using as instruments τ_{sit-1}, τ_{sit}, and τ_{sit+1}. Although the instruments are exogenous, their obvious correlation should lead to larger standard errors than in other models. In this case, the elasticity is estimated to be –0.592, and, as expected, the standard error is nearly triple the standard error in our preferred model. Finally, we drop the future rate from the regression. If the future rate and the current rate are correlated, then this could bias our estimate of the transitory elasiticities because the transitory elasticity estimate is based on the coefficient of τ_{it}. The persistent elasticity is estimated to be –0.732, and the transitory is estimated to be –1.843. In sum, the potential endogeneity of the first-dollar tax rate does not appear to be a problem, and our estimate of the persistent elasticity seems stable to these questions of endogeneity. However, the transitory elasticity estimate is more fragile.

D. Possible Endogeneity of the Four Loss Variables

As mentioned previously, the significance of the four dummy-loss variables (indicators for personal long-term losses, net business losses, net pass-through losses, and net short-term losses) in the level equation may be due to their endogeneity. If so, their coefficients are biased, and that endogeneity could bias other coefficient estimates as well. One method for exploring this possibility would be to find exogenous variables correlated with losses and uncorrelated with the error term and then to use two-stage least squares to conduct a Hausman test. However, a simpler threshold test is to check the magnitude of the problem by dropping all the potentially endogenous loss variables from both equations. We include the carryover loss variable in the first stage because it is predetermined. The results show only a minor change in elasticities, suggesting that the possible endogeneity of the loss variables is not a major problem.

E. Including the Dummy Carryover Loss Variable in the Level Equation

The use of identical sets of explanatory variables in (2) and (3) implies that coefficient estimates are identified through the functional form imposed by the Probit model. Ideally, (2) contains explanatory variables that influence the decision to realize capital gains but do not determine the amount of those gains. Those variables would reduce collinearity and thus increase the sampling variation of the estimated coefficients. However, to

[22] We would like to thank William Randolph for suggesting this approach.

further investigate the effects of the loss variables, we examine the exclusion of the carryover loss variable in the level equation.

The results of adding carryover loss in the level equation are shown in the eighth row of Table 6. Although the carryover loss variable is insignificant in the level equation of the double-hurdle model, it becomes significant when the inverse Mills ratio is included.[23] In this model, the permanent elasticity is slightly larger in absolute value than the elasticity in Table 4.

It is possible that taxpayers with relatively large amounts of carryover losses engage in multi-year tax-minimization strategies. This may explain the significance of the carryover loss variable in the level equation. To investigate this issue, we replace the dummy carryover loss variable with two dummy variables for instances in which the carryover loss amount falls into the following groups: $3,000–$15,000 and above $15,000.[24] We find that both dummy variables are positive and significant in the Probit stage, but only the second group's dummy variable (above $15,000) is significant in the level equation. This is consistent with the hypothesis that those with relatively large amount of carryover loss may employ multi-year strategies. Nevertheless, when the two dummy variables are added to the model, the permanent elasticity is virtually identical to the comparable model that has only one dummy variable for carryover loss.

F. Unweighted Estimates

As indicated earlier and highlighted in Table 3, our data come from a stratified random sample of tax returns. The sample design specifically oversamples high-income taxpayers, including those with income from capital gains. The introduction of this sampling process complicates the estimation of capital gains realizations because sampling is endogenous. Hausman and Wise (1981) show that if stratification weights are available, they may be used to consistently estimate a model, even if the sampling is endogenous. Consequently, we use population weights to account for the stratification of the sample. The weights are the inverse of the sampling rate for each of the 21 substrata.

Minarik (1984) points out that consistent estimation of the effect of taxes on capital gains requires the use of weights because the stratification is based on total income and thus is correlated with realizations of capital gains. In a sensitivity analysis, he shows that weighted regressions result in substantially smaller elasticity estimates than are obtained with unweighted regressions.[25]

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[23] The coefficient on the carryover loss variable is 0.26 with standard error of 0.07.

[24] The 70th percentile of the weighted carryover loss distribution among taxpayers with positive amounts of carryover loss is approximately $15,000.

[25] Feldstein, Slemrod, and Yitzhaki (1984) attribute this decline to heterogeneity of elasticities across taxpayers because they suspect that weighted regressions emphasize the responses of low-income taxpayers, who they believe are less sensitive to tax rates than high-income taxpayers. We address the points raised by both Minarik (1984) and Feldstein, Slemrod, and Yitzhaki (1984) by using population weights in the regression analysis and the product of population weights and capital gains realizations in calculating mean elasticities.

Although the estimates derived from unweighted regressions are inconsistent, it is worthwhile to understand the sensitivity of the results to the stratification of the sample. To that end, we report in Table 6 the results from the model used in the previous section, but without the use of weights. The permanent elasticity increases from –0.72 to –0.96 (unweighted) and the standard error is smaller in the unweighted regressions.

G. State Fixed Effects

One concern about our estimation strategy is that we are simply picking up between-state effects. As we have shown, the tax rate variable does not matter much for the decision to realize; rather, it matters for how much is realized. As a result, cross state variation would not likely be the relevant determinant of capital gains realizations. In order to investigate this possibility, we include state fixed effects. As reported in Table 6, the estimated persistent elasticity in this specification including state fixed effects is –0.746.

H. Short Term Transactions

We include several measures of the number of short-term transactions in our model in order to capture the sophistication of the taxpayer. The number of short-term transactions could be a measure of financial sophistication or lack thereof. If the number of short-term transactions effectively captures a measure of sophistication, then we would expect that dropping the variables from the model would result in a larger elasticity in absolute value. As can be seen in the final row of Table 6, dropping the short-term transactions variables from the model does not appreciably change the results.

VII. ADDITIONAL ANALYSES

Because our model extends work by previous authors, we compare our estimates with those obtained applying previous models to contemporary data. We also examine the variation in the elasticity over time and apply our model to alternative types of capital gains realizations.

A. Comparison with Prior Methods

In our analysis of data from 1999 through 2008 the permanent elasticity is –0.72 and the transitory elasticity is –1.19. But as described above, Burman and Randolph (1994a, 1994b) estimate a permanent elasticity of –0.18 and a transitory elasticity of –6.42 for the years 1979–1983. Auerbach and Siegel (2000) use the Burman and Randolph method on data for the years 1986–1993 to estimate a permanent elasticity of –0.34 and a transitory elasticity of –4.91. Using their own modification leads to permanent and transitory elasticities of –1.72 and –4.35. Without determining which method is best, Auerbach and Siegel conclude that the choice of imputation is important.

Our results above may differ from the results of previous analyses for two reasons. First, we include additional variables absent from the previous analyses. Second, behavior may have changed over time. In this section, we apply the previous methods to our data to decompose the differences between their results and ours into differences due to methodology and differences due to data.

Table 7 provides elasticity estimates using the unweighted and weighted versions of those methods. Burman and Randolph's (1994a, 1994b) unweighted method leads to permanent and transitory elasticity estimates of –0.56 and –2.73. Applying weights to their method increases the permanent elasticity to –0.94 while slightly reducing the transitory elasticity to –2.63. However, Table 7 also shows that the weighted estimation method yields a standard error so large that the permanent elasticity estimate is not statistically significant. In Burman and Randolph's study the equivalent use of weights resulted in only a small change in the elasticity estimate.

Applying Auerbach and Siegel's (2000) method leads to permanent elasticities of –1.1 (unweighted) and –0.91 (weighted). In the weighted regressions, both the Burman and Randolph method and the Auerbach and Siegel methods lead to similar elasticities of about one in absolute value, suggesting that there is less sensitivity to the choice of permanent tax imputation in our data than Auerbach and Siegel found in theirs. The additional variables we include in our regressions reduce the estimated elasticity to –0.72. Thus, our attempts to reduce omitted variable bias lower the estimated elasticity.

Table 7

Comparison of Methods on 1999–2008 Data

Method	Permanent	Transitory
Current method Unweighted	–0.964 (0.064)	–1.686 (0.137)
Current method Weighted	–0.716 (0.111)	–1.194 (0.264)
Burman and Randolph Unweighted	–0.556 (0.129)	–2.726 (0.136)
Burman and Randolph Weighted	–0.942 (5.657)	–2.632 (0.334)
Auerbach and Siegel Unweighted	–1.095 (0.071)	–1.875 (0.144)
Auerbach and Siegel Weighted	–0.910 (0.125)	–1.583 (0.295)

Note: Standard errors in parentheses are calculated from 400 bootstrap replications.

It appears to us that the larger permanent elasticity found in our data reflects differences in behavior rather than being due to the additional variables we use. It is possible that the lower transaction costs associated with selling assets has made the persistent changes in the tax rate more salient from taxpayers' point of view. Over the last several decades, transaction costs have diminished significantly. As these costs decline, taxpayers may find that the applicable tax rate is more important in their decisions to realize their capital gains.

Another explanation for the larger permanent elasticity is that more capital gains are being realized by high-income taxpayers, who may be more sophisticated investors and have some control over how they are compensated (the use of carried interest being an example). We show this in Table 8, where we compare results for 1993 (found in Table 13 and Table 14 of Burman and Ricoy (1997)) with comparable calculations on total realizations of long-run capital gains for 2007. In 1993, slightly less than 60 percent of capital gains were realized by those with incomes greater than $200,000. By 2007, 84 percent of capital gains were realized by those with incomes greater than $200,000.

However, we might expect those same taxpayers to be less responsive to transitory changes in capital gains tax rates. In 1993, taxpayers with incomes greater than $200,000 faced an average tax rate of 23.9 percent — and the top rate was 28 percent. In 2007, they faced an average tax rate of 14.8 percent — and the top rate was 15 percent.[26]

Table 8

Taxes Paid on Gains as Percentage of Taxable Gains

	1993		2007	
Income ($Thousands)	Taxes Paid as Percent of Taxable Gains	Percent of Taxpayers	Taxes Paid as Percent of Taxable Gains	Percent of Taxpayers
0–10	11.0	1.2	4.0	0.3
10–20	13.0	2.9	1.7	0.4
20–30	14.8	3.6	2.2	0.5
30–40	16.8	3.6	3.7	0.6
40–50	19.5	3.6	5.0	0.7
50–75	20.9	8.1	7.6	2.4
75–100	21.9	5.5	8.7	2.6
100–200	23.0	13.3	12.4	8.5
>200	23.9	57.9	14.8	84.0

Sources: Burman and Ricoy (1997) and author calculations

[26] Burman and Ricoy (1997, p. 447) point out that the statutory maximum rate is not reached because "... some taxpayers have losses and deductions that lower their taxable income (before capital gains) below the threshold ..." That rate was 28 percent in 1993, and the same reasoning applies to the maximum rate of 15 percent in 2007.

This makes it clear that there are more gains being realized at the top rate in 2007 than in 1993, which is likely due to a lack of opportunity to realize them at a lower rate. In addition, unlike the 1986 rate change, the federal rate reduction in JGTRRA was not known in the year prior to its enactment, giving all taxpayers fewer opportunities to delay realizations until the drop in rates.

B. Estimates Using Sub-Periods

In our main analysis, we use the data from 1999–2008. However, the length of the panel and the large number of taxpayers in the sample allow us to precisely estimate the elasticities over shorter time periods. Accordingly, we examine shorter time periods similar to previous analyses. We break our sample into four sub-periods: 2000–2001, 2002–2003, 2004–2005, and 2006–2007. As shown in Table 9, estimates from the first two sub-periods (2000–2001 and 2002–2003) are similar to the main results using all available years (1999–2008). That similarity demonstrates that our results are not solely a result of the decline in federal capital gains tax rates in 2003. The 2004–2005 period has a much higher permanent elasticity, and the 2006–2007 period has a much lower permanent elasticity. However, the 95 percent confidence interval of the permanent elasticity for all sub-period estimates approximately contains our point estimate from the full period analysis (1999–2008).

Table 9

Estimates Using Sub-Periods

	Full Sample (1)	2000–2001 (2)	2002–2003 (3)	2004–2005 (4)	2006–2007 (5)
Baseline Specification					
Permanent elasticity	–0.716	–0.914	–1.001	–1.405	–0.362
	(0.111)	(0.252)	(0.386)	(0.294)	(0.143)
Transitory elasticity	–1.194	–1.112	–1.192	1.914	–0.677
	(0.264)	(2.539)	(4.591)	(0.966)	(0.135)
Inverse Mills ratio	1.648	3.094	2.393	0.018	1.473
	(0.307)	(0.790)	(1.615)	(0.434)	(0.428)
Burman and Randolph Specification					
Permanent elasticity	–0.862	–0.446	–1.250	–1.429	–0.876
	(0.209)	(2.260)	(5.784)	(0.393)	(0.291)
Transitory elasticity	–1.883	–4.445	–2.374	–1.085	–1.497
	(0.183)	(1.321)	(0.565)	(0.249)	(0.274)
Inverse Mills ratio	–0.679	–3.784	–2.112	–0.305	–0.049
	(0.359)	(8.530)	(14.324)	(0.414)	(0.540)

Note: Standard errors in parentheses are calculated from 400 bootstrap replications.

In order to investigate whether our specification is more stable over time than the Burman-Randolph specification, we also show results for the Burman-Randolph specification (with our exclusion variables and weighted) broken down by sub-periods. First, including our exclusion restriction results in a much more precisely estimated persistent elasticity of –0.862 and reduces the estimated transitory elasticity from –2.632 to –1.883. Second, neither model is particularly stable across time periods. This is not surprising because the sensitivity result in Table 6 indicated that our baseline results are being driven by within-state variation, which is reduced considerably by restricting the number of years.

VIII. CONCLUSION

In this paper, we estimate the elasticities of long-run capital gains with respect to permanent and transitory tax changes. Adapting a model developed by Burman and Randolph (1994a, 1994b) and extended by Auerbach and Siegel (2000), we estimate elasticities of permanent tax changes in the range of –0.59 to –1.40, with most estimates about –0.75. Transitory elasticities almost always exceed one in absolute value but are so fragile that little more can be determined. The decision over how much gain to realize appears to be much more sensitive to tax rates than does the decision to realize a gain. Although we focus our examination on personal capital gains, we also compare the results of our model to results from the original model applied to contemporary data, estimate our model on sub-periods, and estimate our model on other types of capital gains. Two substantial differences between personal capital gains and other types of gains are worth noting: The elasticity of long-run capital gains from partnerships, S corporations, and trusts is much greater than 1 in absolute value, and the elasticity of capital gains distributions from mutual funds is nearly zero.

Our use of existing methods on new data allows for a clear comparison with previous research, but there are disadvantages as well. For example, because those methods use maximum likelihood estimation, the consistency of our estimates relies on distributional assumptions. In addition, our model examines the average effect of tax changes across all income categories, although the effect may vary substantially across those categories, just as it varies across time periods and types of capital gains. In future work, we hope to address those concerns.

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APPENDIX

Table A1

Wealth and Accrued Gains in Stocks

	Wealth		Accrued Stock	
	Coefficient	Standard Error	Coefficient	Standard Error
Age	0.116	0.003	–0.105	0.020
Age-squared	–0.001	0.000	0.001	0.000
Single and female (D)	–0.129	0.031	–1.940	0.191
Married (D)	0.177	0.041	–1.440	0.198
Wages (D)	–3.825	0.082	–10.409	0.530
Wages (L)	0.347	0.007	0.976	0.045
Taxable interest (D)	–0.714	0.041	1.361	0.269
Taxable interest (L)	0.138	0.005	0.116	0.032
Tax-exempt interest (D)	–0.629	0.088	1.294	0.528
Tax-exempt interest (L)	0.083	0.009	0.102	0.052
Dividend income (D)	–1.288	0.046	1.638	0.293
Dividend income (L)	0.220	0.005	0.973	0.034
Alimony (D)	–2.270	0.378	–8.942	2.355
Alimony (L)	0.235	0.044	0.973	0.274
Schedule E income (D)	–2.093	0.071	0.409	0.458
Schedule E income (L)	0.304	0.006	0.046	0.039
Schedule C or F income (D)	–2.033	0.083	–2.285	0.545
Schedule C or F income (L)	0.272	0.007	0.299	0.047
Itemizer (D)	0.679	0.019	3.078	0.133
Home mortgage int deduction (D)	0.180	0.017	0.556	0.112
SCF 2004 observation (D)	0.112	0.019	0.270	0.125
SCF 2007 observation (D)	0.209	0.019	1.785	0.124
2 dependents (D)	0.203	0.033	0.853	0.154
3 dependents (D)	0.336	0.037	0.152	0.186
4 dependents (D)	0.441	0.039	–0.118	0.191
5 dependents (D)	0.584	0.044	–0.218	0.235
6 dependents (D)	0.565	0.057	–0.407	0.341
7 dependents (D)	0.680	0.099	–1.391	0.652
8 dependents (D)	1.047	0.151	2.549	0.932
Dependents ≥ 9 (D)	1.143	0.216	–0.601	1.447
Married filing jointly (D)	0.189	0.032	NA	NA
Pension, annuities, SS income (D)	–0.799	0.134	NA	NA
Pension, annuities, SS income	0.064	0.014	NA	NA
Constant	5.986	0.088	–10.748	0.535
Observations	44,920		62,083	
Pseudo R^2	0.6621		0.1511	

Notes: Logarithmic variables are indicated by "L." Dummy variables are indicated by "D."

Table A2

Current Marginal Tax Rate, τ_{it}

	Entire Population		Realizers	
	Coefficient	Standard Error	Coefficient	Standard Error
Permanent income (L)	–0.017	0.055	2.486	0.339
Transitory income (L)	0.186	0.007	0.712	0.047
Imputed total unrealized gains (L)	–0.170	0.009	–0.047	0.041
Ratio of unrealized gains in stock (L)	–0.055	0.006	1.030	0.124
Lagged business losses (L)	–0.270	0.032	–0.112	0.046
Lagged business losses (D)	1.937	0.259	1.315	0.399
Lagged rent losses (L)	0.058	0.019	0.122	0.047
Lagged rent losses (D)	–0.066	0.164	–0.166	0.415
Male (D)	0.082	0.017	–0.199	0.129
Number of dependents	0.016	0.005	–0.043	0.038
Married (D)	0.093	0.049	–1.480	0.292
$30 \leq$ Age < 40 (D)	–0.012	0.018	0.906	0.274
$40 \leq$ Age < 50 (D)	0.036	0.024	1.750	0.343
$50 \leq$ Age < 60 (D)	0.160	0.027	2.617	0.416
$60 \leq$ Age < 70 (D)	0.340	0.030	3.969	0.505
Age ≥ 70 (D)	0.466	0.034	5.230	0.591
Short-term realizations group 2 (D)	0.270	0.031	1.671	0.210
Short-term realizations group 3 (D)	0.447	0.166	2.004	0.321
Short-term realizations group 4 (D)	1.245	0.260	2.231	0.374
Short-term realizations group 5 (D)	1.565	0.411	1.982	0.646
Having long-term loss realization (D)	–0.022	0.035	0.828	0.094
Having net business losses (D)	–0.139	0.254	–0.363	0.364
Having net pass-through losses (D)	0.107	0.103	0.384	0.200
Having net short-term losses (D)	–0.041	0.042	0.541	0.100
Lagged marginal tax rate	0.072	0.001	0.264	0.009
Maximum federal, state, and local tax rate, τ_{sit}	0.018	0.004	0.209	0.022
First-dollar marginal tax rate, τ_{0it}	0.892	0.002	0.505	0.010
Future maximum federal, state, and local tax rate, τ_{sit+1}	–0.013	0.004	–0.034	0.022
Having carryover loss (D)	–0.804	0.050	NA	NA
Inverse Mills ratio	NA	NA	4.259	0.489
Constant	1.952	0.559	–25.819	3.463
Observations	341,793		70,377	
R^2	0.9049		0.7029	

Notes: Logarithmic variables are indicated by "L." Dummy variables are indicated by "D." Dummy variables for regions and years are included in the model but are omitted from the table.

Table A3

Future Marginal Tax Rate, τ_{it+1}

	Entire Population		Realizers	
	Coefficient	Standard Error	Coefficient	Standard Error
Permanent income (L)	0.618	0.112	1.759	0.413
Transitory income (L)	0.444	0.013	0.649	0.056
Imputed total unrealized gains (L)	0.070	0.016	–0.051	0.052
Ratio of unrealized gains in stock (L)	0.171	0.011	–0.123	0.148
Lagged business losses (L)	–0.142	0.036	–0.116	0.051
Lagged business losses (D)	0.836	0.300	0.426	0.451
Lagged rent losses (L)	0.107	0.028	0.105	0.060
Lagged rent losses (D)	–0.762	0.245	–0.898	0.531
Male (D)	–0.341	0.043	–0.598	0.162
Number of dependents	0.058	0.014	–0.121	0.051
Married (D)	–0.181	0.100	–0.398	0.357
30 ≤ Age < 40 (D)	0.007	0.061	0.364	0.400
40 ≤ Age < 50 (D)	–0.165	0.067	–0.112	0.473
50 ≤ Age < 60 (D)	–0.214	0.069	–0.286	0.554
60 ≤ Age < 70 (D)	–0.047	0.073	–0.113	0.655
Age ≥ 70 (D)	–0.216	0.073	–0.207	0.753
Short-term realizations group 2 (D)	0.143	0.044	–0.249	0.253
Short-term realizations group 3 (D)	0.132	0.174	–0.594	0.385
Short-term realizations group 4 (D)	0.137	0.294	–0.796	0.440
Short-term realizations group 5 (D)	–1.964	0.830	–2.054	0.890
Having long-term loss realization (D)	0.051	0.045	0.270	0.114
Having net business losses (D)	–0.261	0.335	–0.301	0.384
Having net pass-through losses (D)	0.339	0.132	–0.009	0.231
Having net short-term losses (D)	–0.042	0.054	–0.245	0.124
Lagged marginal tax rate	0.166	0.003	0.197	0.010
Maximum federal, state, and local tax rate, τ_{sit}	–0.332	0.009	–0.393	0.026
First-dollar marginal tax rate, τ_{0it}	0.500	0.003	0.397	0.010
Future maximum federal, state, and local tax rate, τ_{sit+1}	0.494	0.010	0.648	0.028
Having carryover loss (D)	–0.231	0.064	NA	NA
Inverse Mills ratio	NA	NA	–0.863	0.591
Constant	–4.933	1.143	–17.028	4.237
Observations	341,793		70,377	
R^2	0.6303		0.6928	

Notes: Logarithmic variables are indicated by "L." Dummy variables are indicated by "D." Dummy variables for regions and years are included in the model but are omitted from the table.

Table A4

Log of Permanent Income

	Coefficient	Standard Error
Age	0.049	0.001
Age-squared	–4.80E-4	5.00E-06
Single and female (D)	0.187	0.004
Married filing jointly (D)	0.962	0.003
Married filing separately (D)	0.295	0.014
Male (D)	0.123	0.004
SCF 2004 observation (D)	0.023	0.004
SCF 2007 observation (D)	–0.022	0.005
2 dependents (D)	0.038	0.004
3 dependents (D)	0.082	0.004
4 dependents (D)	0.126	0.005
5 dependents (D)	0.050	0.010
6 dependents (D)	–0.044	0.021
7 dependents (D)	–0.075	0.028
8 dependents (D)	–0.291	0.057
Dependents ≥ 9 (D)	–0.032	0.092
Constant	9.019	0.013
Observations	497,290	
R^2	0.293	

Notes: Logarithmic variables are indicated by "L." Dummy variables are indicated by "D."