The Tax Elasticity of Capital Gains in the 21st Century

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PRELIMINARY AND INCOMPLETE.
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INTRODUCTION

Even a casual look at the data suggests that capital gains realizations fluctuate with changes in the tax rates on those gains. For example, in Figure 1., realizations sharply increased prior to the increase in tax rates in 1987, and relatively high marginal tax rates accompany relatively low levels of realizations, even as the S&P 500 index rises, between 1987 and 1996. Of course, many other factors contribute to the rise and fall of capital gains realizations, such as changing asset prices, the circumstances of individual investors, the increase in the variety of financial products and the increased amount of income attributable to partnerships and S corporations. The figure nevertheless suggests a relationship between realizations and the rate at which they are taxed.

An early econometric estimate of the response of capital gains to their tax rate was reported by Feldstein, Slemrod, and Yitzaki (1980). Using a sample of tax returns from 1973, they estimated that taxpayers with substantial holdings of corporate stock would increase their realizations in response to a capital gains tax rate reduction by enough to raise their total taxes paid.[1] The study sparked a flurry of other estimates. Some also used cross-section data on individuals, while others relied on aggregate time-series data. Auten and Cordes (1991) note that cross-section estimates using data on individual observations tended to estimate elasticities below -1,

[1] Feldstein, Slemrod, and Yitzhaki reported their results in an NBER Working Paper in 1978. It 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.

while time-series estimates using aggregate data tended to find elasticities 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. Only a small fraction of taxpayers realize gains in any year, and 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 consistently estimate models of those decisions. Finally, the relatively small number of taxpayers realizing gains means that micro data from a random sample of taxpayers contains few gains, while samples stratified towards high income taxpayers require the use of weights for consistent estimation. Applying different solutions to those problems and examining different time periods can lead to substantially different estimates.

In 1994, Burman and Randolph (BR hereafter) offered evidence that the disparity in estimated elasticities was caused by whether taxpayers viewed the changes in tax rates as permanent or transitory. Using panel data (but not panel data methods, such as fixed effects or random effects models) for the years 1979-1983, they estimate an elasticity of 'permanent' tax rates at -0.18 and an elasticity on 'transitory' rates of -6.42. In their analysis, permanent rates are imputed using an array of variables, including exogenous or predetermined tax rates. The effect of transitory rates is derived from the effects of current and prior tax rates.

To account for the sample selection inherent in capital gains realizations and to control for the unobserved factors influencing both the decision to realize gains and the amount to realize, BR use the estimation method of Heckman (1978). They also compare elasticities from weighted and unweighted estimation and find that the two provide similar answers. However, their estimates are very imprecise, so that their permanent elasticity of -0.18 is insignificantly different from both 0 and -1.00. One likely cause of that imprecision is their use of the same set of explanatory variables to model both the decision to realize capital gains and the amount of gains to be realized. That may lead to a very high correlation between explanatory variables such as the permanent tax rate and the bias correction term suggested by Heckman, resulting in both imprecise estimation and a sensitivity of the estimates to the exact specification of the model.

The reliance on cross-sectional variation to identify the effect of tax rates on realizations may also bias estimates if there are factors that are correlated with both decisions about capital gains realizations and explanatory variables in the model. For example, the industry in which the taxpayer works, or his or her occupation, may be related to the state of residence – and hence tax rates – and also to the amount of capital gains realized. Auerbach and Siegel (2000) also point out that the BR imputation of the permanent tax variable may not capture important information about permanent rates. They first replicated the BR method on their data from 1986-1993 and found a permanent elasticity of -0.335. They modify the BR formula for the permanent tax rate by replacing the current tax rate with the subsequent year's tax rate. Their

modification results in a permanent elasticity of -1.72, which is 10 standard errors above their initial estimate.

Few studies of the capital gains realizations elasticity have been conducted since those by BR and Auerbach and Siegel, even though there has been a surge of interest about the related taxable income elasticity.[2] Nonetheless, continuing uncertainty about the capital gains realizations elasticity contributes to controversy over the appropriate tax rate for capital gains. Because newer data has become available, a new attempt to narrow the range of uncertainty about the capital gains realizations elasticity seems timely.

In this paper we use the BR model to estimate the responsiveness of capital gains realizations on a panel of taxpayers followed over the period 1999-2008, the most recent, and relevant, period available. Those years include two major tax acts: the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTTRA) and the Jobs and Growth Tax Relief Reconciliation Act (JGTRRA) in 2003. For comparability with the BR study, we concentrate our analysis on personal capital gains realizations reported on line 8 of Schedule D: most capital gains realizations in the 1980's and early 1990's were personal realizations, rather than gains from passthrough entities or from mutual funds. We also examine total realizations, as well as realizations from pass-

[2] The elasticity of labor supply to after-tax compensation has long been studied, but Feldstein (1995) argues that because of issues such as tax avoidance and tax evasion the elasticity of taxable income is a more relevant measure for the analysis of tax policy. Since Feldstein's influential study a large body of research on the elasticity of taxable income has developed. See Saez, Slemrod and Giertz (2009) for a review. Typically, those analyses focus on labor income and omit the realization of long run capital gains from the definition of income.

through entities and mutual funds. To the extent possible we estimate coefficients and elasticities using the BR method. We improve the precision and reduce the fragility of their method by adding variables to the equation modeling the decision to realize gains. We test for omitted variables by using dummy variables for industry and occupation, and we separately estimate permanent elasticities using the formula of Auerbach and Siegel (2000). Our resulting elasticities vary from -0.814 to -1.10, although capital gains from pass through entities are much more sensitive to permanent tax rates (permanent elasticity of -1.718), and capital gains from mutual funds are much less sensitive (permanent elasticity of -0.225).

In the remainder of the paper we first review the taxation of capital gains and its response; describe the BR model; describe our data and analysis, and conclude with some ideas for future research.

TAX TREATMENT OF CAPITAL GAINS

Accruing a capital gain does not itself incur taxes, because gains are only taxed when they are realized through their sale. Once the gain is realized, under the tax code it is considered to be income, and is subject to taxation. The amount potentially taxable is the difference between the price at which the asset was sold and the price for which it was purchased (minus adjustments for items such as commissions and tax depreciation deductions). Whether the gain is taxed or not and the applicable tax rate depend on factors such as how long the asset was

held, whether or not the asset is an owner-occupied home and whether or not the sale takes place after the death of the owner.[3]

Realizations of long-term capital gains – defined generally as those on assets held for more than a year –are taxed at rates lower than those imposed on regular 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. There are several reasons why it may be more efficient to tax long-term gains at a lower rate.

First, capital gains taxation encourages investors to 'lock-in' to a specific set of assets. While the initial purchase of an asset may be optimal at the moment of purchase, unforeseen events will inevitably call for an investor to rebalance his or her portfolio of assets. Higher marginal tax rates on capital gains realizations create greater disincentives to rebalance that portfolio through the sale of assets, which inevitably leads to some level of inefficiency in the portfolios of taxpayers. Second, lower capital gains tax rates can encourage entrepreneurs to invest time and effort into starting, building up, and selling new businesses. Third, because the taxable amount of realizations is not indexed for inflation, reducing the tax on those realizations also

[3] Starting in 1951, people selling their 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 home. Then starting in 1964, people aged 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 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 2 years and had used it as a primary residence for 2 out of the previous 5 years.

reduces the tax paid on what are nominal gains but real losses. Finally, lower capital gains tax rates encourage savings, which may increase the long-term productivity of the nation.

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 zero 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 2012.

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 rate on capital gains tax rates from 20 percent 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 to $172.0 billion in 1985).[4] Then, in 1987, realizations fell by almost as much, returning to a level comparable to that before the tax increase. These large swings in realizations suggest that investors may be very responsive to rate changes immediately after the change, or before the change if it is known in advance.

[4] U.S. Department of Treasury, 2010.

BURMAN AND RANDOLPH ESTIMATES

The concepts of permanent and transitory tax rates are described in Auten and Clotfelter (1982) as being "analogous to conventional definitions of permanent and transitory income." The marginal tax rate in any given year is the sum of the 'conventional' rate and a transient shock. The transitory tax rate is meant to capture the timing effect mentioned above, suggesting that capital gains realizations react quickly and strongly to changes in those rates. On the other hand, one would expect a smaller response to permanent change. A permanent reduction would lead to a higher steady-state rate of portfolio adjustment rather than the surge of unlocking that would be expected from a temporary rate reduction. In addition, a permanent cut in the capital gains tax rate would encourage investment over consumption, which may increase realizations only after the investment accrues an adequate level of gains. Further, the sales of assets held to accomplish goals with specific deadlines, such as funding college expenses or individual retirement may be timed to accomplish those goals more than to minimize capital gains taxes. In principle, a taxpayer with a specific after-tax target for accumulation may actually reduce realizations in the face of a reduction in the permanent tax rate because less investment is needed to accomplish his or her after-tax goal. Thus, while the elasticity on transient tax rates may be quite high, the elasticity on the permanent rate may be low.

BR start with a semi-log model in which positive capital gains realizations depend on permanent tax rates, the transitory rate (defined as the difference between the current rate and the permanent rate), and the change in rates from the prior year:

$$lng = \gamma_0 \tau_p + \gamma_1(\tau_t - \tau_p) + \gamma_2(\tau_t - \tau_{t-1}) + X\gamma_3 + \varepsilon_2 \quad (1)$$

where the capital gains tax rates are represented by the permanent rate τ_p, the current (endogenous) rate τ_t and the previous year's rate τ_{t-1}. X is a vector of demographic characteristics such as region, age and variables representing unrealized gains and sources of income. γ_3 is a conformable vector of coefficients.

This relationship is estimated in a two-step model described by the following equations:

$$I^* = \alpha_0 \tau_p + \alpha_1 \tau_t + \alpha_2 \tau_{t-1} + X\alpha_3 + \varepsilon_1 \quad (2)$$

$$lng = \begin{cases} \beta_0 \tau_p + \beta_1 \tau_t + \beta_2 \tau_{t-1} + X\beta_3 + \varepsilon_2; \text{if } I^* > 0 \\ 0 \qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad\qquad \text{;otherwise} \end{cases} \quad (3)$$

The indicator *I** is a latent variable representing the decision to realize long run capital gains, and *lng* is the natural log of capital gains, measured as the net long-term gains before prior-year carryover of losses.[5] If cov($\varepsilon_1, \varepsilon_2$)=0, then standard linear methods may be used to estimate the relationship in equation (3). However, there is no reason to believe that stringent assumption holds. As is standard in sample selection models, the inverse Mill's ratio is calculated from equation (2) as $\phi(z)/\Phi(z)$, where $z = \widehat{I^*}/\widehat{\sigma_1}$, and it is added to the model in equation (3). Note that the same explanatory variables are used in the first and second stages. The inverse Mill's ratio is not perfectly collinear with the explanatory variables in the second stage because the

[5] BR point out that the γs and βs are related as follows: $\gamma_0 = \beta_0 + \beta_1 + \beta_2$, $\gamma_1 = \beta_1 + \beta_2$ and $\gamma_2 = -\beta_2$. Thus $\beta_0 = \gamma_0 - \gamma_1$, so that the coefficient on τ_p in equation (2) is the difference in effects between permanent and transitory taxes.

function is nonlinear over a portion of its domain. Nevertheless, it may be strongly correlated with the explanatory variables in (3), producing large sampling variation in the coefficients of and the explanatory variables.

The permanent tax rate τ_p is imputed as the predicted value from a regression of τ_t on the rate in the prior year τ_{t-1}, the maximum combined federal and state tax rate τ_s, and X a vector of variables described below. In principle the permanent rate is exogenous, or approximately so over the short time frame in the data. The current rate τ_t on the other hand, is a function of the current year's capital gains realizations, and so is endogenous. The standard solution, used here, is to use two stage least squares in which the first stage includes the 'first dollar' tax rate – the rate that applies to the first dollar of capital gains realizations – as well as τ_{t-1}, τ_s, and X. The predicted value is then used in place of τ_t in both equations (1) and (2). BR demonstrate the consistency of this innovative combination of instrumental variables and selection models in an unpublished appendix.

The variables in X include demographic and economic variables that may be correlated with capital gains. Permanent income was estimated by regressing the natural log of the average of real positive income over all years on demographic characteristics. Transitory income was measured as the difference between current income (the sum of positive income from all sources except gains) and permanent income.

Two imputations for unrealized capital gains are also included: imputed total wealth and the ratio of stock wealth to total wealth. Total wealth was imputed by regressing estate tax wealth

on variables found in income tax records and applying the estimated coefficients to the appropriate variables in the panel data. Wealth held as stock was imputed in the same fashion and the ratio of stock wealth to total wealth was calculated. The data used was derived from matching 1982 estate tax records with income tax records from the prior year.

Family size is the number of personal and dependent exemptions, and marital status was determined from the filing status of the taxpayer. Dummy variables for whether or not the age of the taxpayer fell into brackets (such as 30-39, 40-49, and so on) were created using an age variable provided from social security records matched to the data. The lagged values of business losses and rent losses were taken from tax data. Dummy variables for region are derived from the state of residence and dummy variables for the filing year are also included.

Permanent elasticities are calculated from the following equation:

$$e = \tau_p[\beta_0 + \beta_1 + \beta_2 + (\alpha_0 + \alpha_1 + \alpha_2)\lambda_i] \quad (4)$$

where λ_i is the inverse Mill's ratio evaluated at $h_i + \sigma_{12}$, the predicted value of the selection equation (2) plus the covariance of the error terms in equations (2) and (3). Transitory elasticities are estimated with analogous equation that excludes permanent and lagged tax coefficients. The covariance is estimated, as usual, as the coefficient on λ_I in equation (3). Note that if the estimated covariance is negative, increases in its absolute value will drive the denominator in the inverse Mill's ratio towards zero.

BR use data from a stratified panel of about 11,000 individual income taxpayers for the years 1979 through 1983. The panel design oversamples high-income taxpayers. Because lagged tax

rates are used, the estimation period is 1980 to 1983. After editing, this left just over 42,000 records. The panel aspects of the data are not used in estimation outside of using the lagged tax rate and the creation of permanent income from averaging current income over time and then regressing it on the variables mentioned above. Any factors that are relatively stable over time and correlated with both dependent and independent variables will thus bias the coefficient estimates.

The estimated coefficients on permanent, current and lagged tax rates are 0.116, -0.145 and 0.0013, respectively. Using the equalities described in footnote 2, they interpret the coefficient on the permanent rate as the difference in impacts between permanent and transitory rates, so that the positive coefficient 0.116 indicates that the effect of a change in permanent rates is much smaller in absolute value than a change in transitory rates. Evaluating the inverse Mill's ratio at the unweighted mean of the explanatory variables and using a permanent rate of 18 percent, BR estimate the elasticity on permanent rates as -0.18 and the elasticity on transitory rates as -6.42. The standard error on the permanent elasticity is 0.48, so that the estimate is insignificantly different from zero or -1.0.[6]

In an unpublished appendix, BR point out that the correct method for estimating the elasticity would be to calculate the elasticity for each record and then calculate a weighted average, where the weights are the product of the sample weights and the amount of realized gains.

[6] The standard error estimate is likely understated because it does not account for randomness from the use of the two-stage least squares procedure in equation (1).

However, they state that the method employed yielded elasticities nearly identical to those created by the correct method.

Their primary regression also does not use the weights that account for the stratification of the sample. Minarik (1984) points out that consistent estimation of the effect of capital gains taxes requires the use of weights because the stratification is based on total income, and so is correlated with capital gains realizations.[7] In a sensitivity analysis, they show that weighted regressions drop the estimated permanent elasticity to -0.06 and the transitory elasticity to -5.63. The standard errors for the weighted regressions are not calculated, but it is reasonable to suspect that the standard errors are larger in this case.

DATA

Our data come from a unique ten-year panel of Federal tax returns over the years 1999-2008 created by the Statistics of Income (SOI).[8] 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 to determine the date of birth of the primary, secondary, and the first four dependents on the file. In addition, we linked the data to a 1999 SOI study of

[7] See Hausman and Wise (1981) for the proof that the use of stratification weights provides consistent estimation of the model.

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

occupation and industry. We use Jon Bakija's tax calculator (Bakija 2009) 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,[9] representing 123 million weighted tax returns. The stratification by income includes sampling rates ranging from 0.05 percent to 100 percent. Each taxpayer and his or her spouse who was on a selected tax return in 1999, or filed late for tax year 1999 in tax processing years 2000 or 2001, is included in the panel each year that they file 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 weight shifts dramatically, we drop all records that experience a marital status change over the 10 year period, about 19,000 returns in 1999, or have a change in the value of their weight of more than 5 percent, 174 returns in 1999.

The left hand panel of Table 1 below shows the sample size 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

[9] Weber (2006) reports that the subsample contains 83,434 returns. For the un-restricted sample we are reporting 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 they have a change in marital status.

capital gains fluctuate considerably over this period from a high of $752 billion in 2007 to a low of $234 billion in 2002. The restricted sample follows the same pattern with a peak in 2007 and a low in 2002. Over the course of the 10 year period of the panel there is approximately 14 percent attrition of the unweighted number of returns in the unrestricted sample and 16 percent in the restricted sample.[10]

The final column in each panel of Table 1 shows the positive long term capital gains realizations from the sale of or exchange of a capital asset, excluding capital gains and losses reported on lines 11-14 of Schedule D. The excluded amounts on lines 11-14 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.[11] 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 are focusing on long-term gains from the sale of capital assets that are personal in nature, such as stock held for investment, or gain from the sale of primary residence in excess of $250,000 ($500,000 in the case of joint return) and are reported on line 8 of Schedule D. As shown in figure 2, personal capital gains realizations made up a significantly larger portion of total realizations in the 1980's

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

[11] The excluded amounts on lines 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. Line 13 excluded amounts are distributions from mutual funds. The line 14 exclusion eliminates capital loss carry forwards from prior years.

and early 1990's. In 1984 and 1985, personal capital gains represented approximately three-quarters of total long term realizations. Therefore, we believe that concentrating on line 8 totals is a better comparison with BR. However, personal capital gains averaged only slightly more than a third of total realizations for the period 1999-2008, with pass-through capital gains realizations experiencing the largest increase -- rising from approximately 10 percent of total capital gains in the late 1980's to almost 30 percent of capital gains in 2008.[12] We therefore examine gains declared on lines 11-14 separately.

The restricted data have a total number of observations across all of the years of 558,525. We further restrict these observations for the following cases: we drop all dependent returns, we keep only those returns with the age of the primary in 1999 between 18 and 120; we drop any return with a calculated total capital gains marginal tax rate less than zero or greater than 0.4; and finally we drop any observation with a missing value (as opposed to a 0) for any of the variables needed in the estimation process. The combination of these restrictions results in a sample with 393,994 observations, with 77,718 reporting a long term capital gain on line 8 of Schedule D.

Table 2 shows the mean values of the variables from the sample of 393,994 observations. As described above, the panel is a stratified sample that oversamples taxpayers with high incomes. Comparing the weighted and unweighted mean long-term gains highlights the effect of the

[12] Source: Author's calculations from tabulations of the 1984-2008 SOI individual income tax cross-section data.

sample stratification. The average long-term gain reported on line 8 of Schedule D is $2,755. However, if we do not use the weights the average jumps to $482,130. Similarly for the sample of observations reporting a long term capital gain, the weighted average among realizers is $36,844 and the unweighted average is almost $2.5 million.

Table 2 also reports the values of three imputed variables and a calculated tax rate: the log of imputed unrealized gains; the log of imputed unrealized gains in stock; and imputed permanent income, and the marginal tax rate on long-term gains. To impute the wealth variables, we use Survey of Consumer Finance (SCF) data for 2001, 2004 and 2007. We create unrealized capital gains from all sources and unrealized capital gains from stocks, bonds and mutual funds with standard code provided by the Federal Reserve Board. 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 on our data.[13] The marginal tax rate is calculated using Bakija's (2009) calculator. The tax calculator has detailed information on the federal tax structure plus each of the 50 states and the District of Columbia. The calculator has information for each year 1999-2007. We use the 2007 values for 2008 tax rates.

Finally, note that the sample of realizers is different than the overall sample. The sample of realizers tends to be higher income, have a higher marginal tax rate, is roughly 10 years older, is

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

more likely to be male and married, but less likely to have children, and less likely to be unemployed than the population of all returns.

ANALYSIS

Our analysis extends the work of BR by applying it to a more current time period. We strengthen the identification of the model by adding variables to the selection equation, as well as by using the Auerbach and Siegel estimator for permanent tax rates and include dummy variables for the occupation of the taxpayer. Finally, we separately estimate the elasticities of capital gains realizations from several different sources.

While we attempted to reproduce the explanatory variables as closely as possible, there are several differences between our variables and those of BR. First, although BR do not specifically state how they address the problem of using the natural log of variables when they take a value of 0, they presumably added a small amount, such as $1 to the value. A better method is to adjust the variable by replacing the natural log with 0 and adding to the regression a dummy variable equal to 1 for all instances when the variable equals 0. As mentioned in the data section, we imputed accrued capital gains using SCF data from 2001, 2004 and 2007, as opposed to a matched estate tax/individual income tax data set. We also added a variable for the sex of the head of household. Region is not defined in BR, but it is presumably the IRS region – the set of states that mail their tax forms to a common location, while we use the

Census definition.[14] In addition, BR were able to identify the state of residence for all returns only in 1981. As a result, BR assume the state of residence in 1981 for those observations whose residence information was not available. In contrast, our state of residence is the actual location each year. As mentioned above, our dependent variable is personal capital gains realizations. We later consider capital gains from other sources.

Our results using an unweighted regression are listed in Table 3. As with BR, the permanent tax variable in the level equation has a positive coefficient while the current tax variable has a negative coefficient, and both coefficients are significantly different from zero. The lagged tax variable is also significant, as is the inverse Mill's ratio. The estimate of the elasticity of permanent tax changes is 0.059, and the transitory elasticity is estimated to be -2.751. The permanent elasticity is insignificantly different from zero, as well as being insignificantly different from the estimate of BR. The transitory elasticity, in contrast, is significantly different from zero and substantially lower than the estimate of BR.

Because the sample is stratified on the basis of total income, including capital gains, weights are required for consistent estimation of the model in equations (2) and (3). The permanent elasticity estimate in this case is around -1 (Table 4), which is closer to the values found in other studies of cross-sectional data, but much higher in absolute value than the estimate of BR.

[14] Census defines 9 regions: New England (CT, ME, MA, NH, VT, RI); Middle Atlantic (NJ, NY, PA); East North Centra (IL, IN, MI, OH, WI)l; West North Central (IA, KS, MN, MO, NE, ND, SD); South Atlantic (DE, DC, FL, GA, MD, NC, SC, VA, WV); East South Central (AL, KY, MS, TN); West South Central (AR, LA, OK, TX); Mountain (AZ, CO, ID, MT, NV, NM, UT, WY); and Pacific (AK, CA, HI, OR, WA).

However, as shown in the first row of Table 4, when weights are used the standard errors in the level equation are also much larger, so that estimate is insignificantly different from zero. The inverse Mill's ratio is also very imprecisely estimated: the estimate is 3.3035, but its standard error is greater than 43.

Using identical sets of explanatory variables in equations (2) and (3) leads to an inverse Mill's ratio that is nearly an exact linear combination of the explanatory variables in equation (3). Ideally, equation (2) will contain explanatory variables that influence the decision to realize capital gains but do not determine the amount of those gains. Those variables would provide variation in λ that is independent of the explanatory variables in equation (3), reducing the collinearity and thus the sampling variation of the estimated coefficients.

Table 5 shows our results when we include four variables in the first stage of equation (3). First, we include a dummy variable representing the presence of a carryover loss from prior years. The presence of the carryover should influence the decision to realize gains because the taxpayer can realize some amount of gains without paying additional taxes. The simple existence of a carryover, however, does not indicate the amount of gains that can be realized without taxation.[15] A dummy variable for the presence of carryover loss therefore seems to satisfy our conditions.

[15] To test the possibility that the inclusion of the amount of carryover losses may be a factor in the level equation we re-estimate the models using the amount of carry over loss in both stages. The carryover variable was always insignificant in the level equation and it had a minimal impact on the coefficients of the other variables.

We also include a dummy variable for the presence of unemployment compensation. It seems likely that taxpayers experiencing a spell of unemployment have an immediate need for funds, and so may sell some of their accrued gains. We also include a dummy variable for the presence of social security benefits. Taxpayers who have invested as a means of retirement savings will start to dis-invest once they retire. Finally, we include a dummy variable for taxpayers who have dependents between the ages of 17 and 22. If taxpayers have invested funds to help pay for the college education of their children, we would expect to see realizations as those children reached college age.

The presence of a carryover loss has a positive and significant effect on the likelihood of realizing a gain. The presence of unemployment benefits is significant, but with a negative coefficient rather than a positive. This may indicate that taxpayers who tend to file for unemployment benefits are also less likely to have accrued capital gains, even after holding income fixed. It also may suggest that the income variable itself is not properly specified: those with very low incomes may have an extremely low likelihood of realizing a gain. The presence of social security benefits has a positive and strongly significant effect on the probability of realizing gains. The presence of college age dependents has a positive and marginally significant effect on the likelihood of realization.

The standard errors of the tax variables in the level equation are now much smaller, although the permanent tax rate variable is still statistically insignificant. But the inverse Mill's ratio becomes statistically significant, as does the permanent elasticity (shown at the bottom of the page).

We next impute permanent tax rates using the method in Auerbach and Siegel (2000). They note that in the BR approach the regression used to impute permanent tax rates does not use the first dollar tax rate but is otherwise identical to the two-stage least squares regression used to address the endogeneity of current tax rates. The authors believe that the first dollar rate may help reduce inaccurate deviations between the permanent and current rate – deviations that would cause some of the variation in permanent rates to be attributed to variation in transitory rates. In addition, future tax rates should in principle play a part in a taxpayer's perception of the permanent tax rate, yet they are omitted. The solution is to impute the permanent tax rate by regressing τ_{t+1} on τ_{t-1}, τ_s, X and the first dollar tax rate. Their permanent elasticity estimate – equal to -.335 when reproducing BR on data from the years 1986 through 1993 – becomes -1.72 using their imputation method. Gravelle (2010) speculates that this substantial move away from zero may be due to the first dollar rate including transitory factors that are being attributed to the permanent rate.

In Table 6, we present estimates from the model used to produce the estimates in Table 5, except that we use the Auerbach and Siegel imputation method. Rather than move away from zero, the permanent elasticity estimate moves towards zero to –0.841, suggesting that the Auerbach and Siegel measure may better capture the permanent rates than the measure of BR. It also suggests that factors other than transitory components in the first dollar tax rate may have played a role in the -1.72 estimate. One possible factor –fragility of the model caused by use of the same variables in the estimation of equations (2) and (3) –has been discussed here.

Because the BR model does not use any type of fixed effects estimation, it is possible that there are omitted characteristics that are correlated with both the tax rates and with capital gains realizations. For example, it is likely that many bond traders, who seem likely to have personal capital gains realizations, live in New York state, which has a relatively high maximum tax rate. To address that concern we follow Auten and Carroll (1999) and include 100 dummy variables for occupations of the primary taxpayer. The results, shown in Table 7, show only minor changes from Table 6, which suggests that omission of occupation information does not seriously bias previous estimates. It also casts some doubt on the relative importance of the time invariant variables as a source of omitted variable bias.

We now apply the model used in Table 7 to three additional types of capital gains realizations. First, we analyze the miscellaneous gains claimed on line 11 of Schedule D. That schedule describes them as "Gains from Form 4797, Part I: long-term gain from Forms 2439 and 6552; and long-term gain of(loss) from Forms 4684, 6781, and 8824". The estimated elasticities of those gains are listed in Table 8. The elasticity of permanent rates is -0.831, nearly identical to the elasticity of personal gains. The transitory elasticity for these miscellaneous gains, however, is -1.726, which is larger in absolute value than the transitory elasticity for personal gains. We also analyze net long-term gain from pass through organizations such as partnerships, S corporations, as well as estates, and trusts from schedule(s) K-1. The resulting permanent elasticity of -1.718 implies a markedly higher sensitivity to tax rates than other types of capital gains. On the other hand, the variable for capital gains distributions from mutual funds has an elasticity of -0.225, which is markedly less sensitive than other types of

gains. The variable, total non-personal gains, has an elasticity that is slightly less than one in absolute value.

The reason for the higher elasticity on gains from passthrough organizations is unclear. We had expected a lower response because of the coordination required among partners to approve a distribution. If the passthrough gains during the panel years are largely from more sophisticated investors, they may be more responsive to tax rates than others. Auerbach and Siegel, however, found that their class of sophisticated investors was less responsive than other taxpayers.

CONCLUSION

In this preliminary work, we have re-estimated and enhanced the models of BR and Auerbach and Siegel using the most current possible data. Our estimated permanent elasticities are much larger in absolute magnitude than those estimated by BR, but they are on the border of the range of estimates found in time series analyses and lower than many estimates using cross sectional data. To reproduce the BR model, we make no use of the panel data methods, such as fixed effects models, or use prior capital gains as an explanatory variable. In future research we hope to address that potential, as well as explore the use of alternative estimation methods.

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Table 1: Descriptive Statistics of Data Used in the Analysis

	Un-Restricted Sample				Restricted Sample			
Year	Number of Returns	Weighted Number of Returns	Total Capital Gains in AGI	Positive LT CG, Schedule D Line 8	Number of Returns	Weighted Number of Returns	Total Capital Gains in AGI	Positive LT CG, Schedule D Line 8
1999	88123	123.0	559.8	289.2	61335	90.4	436.1	220.6
2000	84742	116.9	619.6	375.6	58800	85.6	476.2	289.6
2001	83239	114.0	303.0	194.7	57483	83.1	242.1	155.0
2002	81710	111.3	234.4	140.2	56283	80.8	182.5	111.8
2003	80661	109.3	294.2	149.3	55424	79.2	228.7	116.0
2004	79712	107.7	440.0	225.7	54724	77.9	355.3	182.3
2005	78905	106.2	590.7	276.9	54087	76.8	477.5	226.7
2006	78550	105.7	671.9	304.9	53874	76.4	542.9	251.1
2007	79975	108.7	752.1	338.8	54855	78.6	623.6	282.0
2008	75402	101.2	314.3	175.6	51660	73.1	265.2	150.2

Table 2: Descriptive Statistics of Variables Used in the Model

	All observations		Realizers only	
	Weighted mean	Unweighted mean	Weighted mean	Unweighted mean
Net long-term gains	2,755	482,130	36,844	2,444,175
Net long-term gains (log)	0.583	2.108	7.804	10.685
Current marginal tax rate	13.582	15.193	16.928	19.145
Imputed unrealized gains (log)	11.558	12.170	11.765	13.289
Imputed unrealized gains in stock (log)	2.770	3.890	4.376	6.390
Imputed Permanent Income (log)	10.746	10.783	10.770	10.850
Current Income (exogenous components; log)	10.438	11.411	10.961	13.324
Business losses lagged (log)	0.151	1.188	0.545	3.572
Rent losses lagged (log)	0.406	1.012	1.006	2.087
Age	50.2	52.6	59.4	59.5
Primary taxpayer is male	0.370	0.411	0.463	0.545
Number of dependents	0.865	0.891	0.647	0.836
Primary taxpayer is married	0.055	0.066	0.052	0.064
Presence of carryover loss in excess of $3000	0.035	0.100	0.130	0.207
Received any unemployment compensation	0.072	0.054	0.036	0.013
Received any social security benefits	0.174	0.205	0.369	0.324
Had child between the age of 17 and 22	0.087	0.096	0.085	0.104

Notes: All dollar amounts are in 2008 dollar.

Table 3: Unweighted Model

Dependent Variable: Personal Long Term Capital Gains Realizations (log)

	Level Equation		Criterion Function	
	Coefficient	Standard Error	Coefficient	Standard Error
Permanent marginal tax rate	0.155	0.012	0.005	0.005
Current marginal tax rate	-0.106	0.005	-0.012	0.001
Lagged marginal tax rate	-0.044	0.006	0.006	0.003
Inverse mills ratio	-3.205	0.225	n/a	n/a
Permanent Income (log)	0.460	0.103	0.277	0.027
Transitory income (log)	0.429	0.031	0.175	0.005
Imputed total unrealized gains (log)	-0.077	0.014	-0.015	0.004
Ratio of unrealized gains in stock (log)	-0.469	0.043	0.280	0.003
Lagged Business losses (log)	0.094	0.008	-0.004	0.003
Lagged Business losses (dummy)	-0.636	0.115	0.443	0.030
Lagged rent losses (log)	-0.062	0.014	0.003	0.004
Lagged rent losses (dummy)	0.208	0.138	0.141	0.041
Male (dummy)	-0.188	0.076	0.050	0.018
Number of dependents	0.022	0.014	0.009	0.004
Married (dummy)	0.292	0.111	-0.225	0.023
30<=Age<40 (dummy)	-0.606	0.182	0.353	0.030
40<=Age<50 (dummy)	-1.012	0.215	0.700	0.031
50<=Age<60 (dummy)	-1.356	0.248	0.975	0.033
60<=Age<70 (dummy)	-1.423	0.271	1.228	0.032
Age>=70 (dummy)	-1.666	0.287	1.407	0.031
Constant	6.939	1.110	-2.355	0.267
Number of observations	77,718		393,994	
Permanent elasticity	0.059	0.156		
Transitory elasticity	-2.751	0.141		

Notes: Dummy variables for regions and years are included in the model but are omitted from the table. Data are unweighted. Number of bootstrap replications is 400.

Table 4: Weighted Model

Dependent Variable: Personal Long Term Capital Gains Realizations (log)

	Level Equation		Criterion Function	
	Coefficient	Standard Error	Coefficient	Standard Error
Permanent marginal tax rate	0.007	1.012	-0.027	0.008
Current marginal tax rate	-0.124	0.011	-0.012	0.001
Lagged marginal tax rate	0.070	0.622	0.024	0.005
Inverse mills ratio	3.035	43.673	n/a	n/a
Permanent Income (log)	0.967	9.928	0.300	0.036
Transitory income (log)	0.487	3.881	0.128	0.012
Imputed total unrealized gains (log)	0.320	0.262	0.008	0.007
Ratio of unrealized gains in stock (log)	1.057	13.090	0.389	0.005
Lagged Business losses (log)	0.111	0.193	0.005	0.009
Lagged Business losses (dummy)	0.568	10.192	0.302	0.074
Lagged rent losses (log)	0.107	1.620	0.044	0.010
Lagged rent losses (dummy)	-0.234	6.481	-0.159	0.085
Male (dummy)	0.174	0.896	-0.019	0.022
Number of dependents	-0.064	0.451	-0.014	0.005
Married (dummy)	-0.692	5.347	-0.195	0.033
30<=Age<40 (dummy)	0.263	10.233	0.276	0.033
40<=Age<50 (dummy)	1.134	21.139	0.567	0.036
50<=Age<60 (dummy)	2.004	30.477	0.834	0.038
60<=Age<70 (dummy)	3.058	40.967	1.154	0.037
Age>=70 (dummy)	3.598	49.104	1.398	0.038
Constant	-3.343	90.528	-1.824	0.355
Number of observations	77,718		393,994	
Permanent elasticity	-1.015	7.792		
Transitory elasticity	-2.667	1.932		

Notes: Dummy variables for regions and years are included in the model but are omitted from the table. Data are weighted. Number of bootstrap replications is 400.

Table 5: Additional Variables in the Criterion Function

Dependent Variable: Personal Long Term Capital Gains Realizations (log)

	Level Equation		Criterion Function	
	Coefficient	Standard Error	Coefficient	Standard Error
Permanent marginal tax rate	0.032	0.024	-0.022	0.008
Current marginal tax rate	-0.060	0.007	-0.014	0.001
Lagged marginal tax rate	0.013	0.013	0.022	0.004
Inverse mills ratio	-1.576	0.305	n/a	n/a
Permanent Income (log)	-0.053	0.156	0.311	0.038
Transitory income (log)	0.106	0.050	0.126	0.012
Imputed total unrealized gains (log)	0.336	0.023	0.003	0.007
Ratio of unrealized gains in stock (log)	-0.326	0.093	0.376	0.005
Lagged Business losses (log)	0.094	0.024	0.008	0.009
Lagged Business losses (dummy)	-0.370	0.214	0.254	0.075
Lagged rent losses (log)	-0.048	0.030	0.037	0.010
Lagged rent losses (dummy)	0.285	0.247	-0.110	0.085
Male (dummy)	0.169	0.083	-0.032	0.022
Number of dependents	-0.009	0.022	-0.015	0.006
Married (dummy)	-0.056	0.153	-0.192	0.033
30<=Age<40 (dummy)	-0.867	0.182	0.278	0.033
40<=Age<50 (dummy)	-1.120	0.228	0.552	0.037
50<=Age<60 (dummy)	-1.253	0.278	0.803	0.039
60<=Age<70 (dummy)	-1.306	0.348	0.987	0.040
Age>=70 (dummy)	-1.611	0.397	1.145	0.040
Carryover loss (dummy)	n/a	n/a	0.337	0.018
Unemployment compensation (dummy)	n/a	n/a	-0.111	0.021
Social security benefits (dummy)	n/a	n/a	0.283	0.026
College age dependent (dummy)	n/a	n/a	0.037	0.019
Constant	6.165	1.498	-1.983	0.368
Number of observations	77,718		393,994	
Permanent elasticity	-0.983	0.213		
Transitory elasticity	-1.953	0.171		

Notes: Dummy variables for regions and years are included in the model but are omitted from the table. Data are weighted. Number of bootstrap replications is 400.

Table 6: Auerbach and Siegel Permanent Tax Variable

Dependent Variable: Personal Long Term Capital Gains Realizations (log)

	Level Equation		Criterion Function	
	Coefficient	Standard Error	Coefficient	Standard Error
Permanent marginal tax rate	-0.007	0.019	-0.011	0.006
Current marginal tax rate	-0.050	0.016	-0.010	0.003
Lagged marginal tax rate	0.030	0.005	0.012	0.001
Inverse mills ratio	-1.319	0.162	n/a	n/a
Permanent Income (log)	0.120	0.135	0.290	0.035
Transitory income (log)	0.187	0.026	0.101	0.006
Imputed total unrealized gains (log)	0.328	0.023	0.005	0.007
Ratio of unrealized gains in stock (log)	-0.251	0.051	0.385	0.005
Lagged Business losses (log)	0.097	0.026	0.008	0.010
Lagged Business losses (dummy)	-0.415	0.234	0.278	0.083
Lagged rent losses (log)	-0.038	0.029	0.036	0.011
Lagged rent losses (dummy)	0.266	0.249	-0.096	0.091
Male (dummy)	0.072	0.090	0.003	0.022
Number of dependents	-0.015	0.021	-0.017	0.006
Married (dummy)	(omitted)			
30<=Age<40 (dummy)	-0.773	0.179	0.274	0.036
40<=Age<50 (dummy)	-1.009	0.199	0.547	0.039
50<=Age<60 (dummy)	-1.079	0.220	0.803	0.042
60<=Age<70 (dummy)	-1.001	0.235	0.989	0.043
Age>=70 (dummy)	-1.238	0.252	1.157	0.044
Carryover loss (dummy)	n/a	n/a	0.354	0.019
Unemployment compensation (dummy)	n/a	n/a	-0.106	0.024
Social security benefits (dummy)	n/a	n/a	0.225	0.017
College age dependent (dummy)	n/a	n/a	0.045	0.020
Constant	4.642	1.394	-1.815	0.361
Number of observations	70,227		340,047	
Permanent elasticity	-0.841	0.116		
Transitory elasticity	-1.333	0.286		

Notes: Dummy variables for regions and years are included in the model but are omitted from the table. Data are weighted. Number of bootstrap replications is 400.

Table 7: Dummy Variables for Occupation

Dependent Variable: Personal Long Term Capital Gains Realizations (log)

	Level Equation		Criterion Function	
	Coefficient	Standard Error	Coefficient	Standard Error
Permanent marginal tax rate	-0.007	0.019	-0.010	0.007
Current marginal tax rate	-0.048	0.016	-0.010	0.003
Lagged marginal tax rate	0.028	0.005	0.012	0.001
Inverse mills ratio	-1.214	0.169	n/a	n/a
Permanent Income (log)	0.171	0.138	0.306	0.035
Transitory income (log)	0.185	0.027	0.102	0.007
Imputed total unrealized gains (log)	0.317	0.024	-0.014	0.007
Ratio of unrealized gains in stock (log)	-0.221	0.050	0.363	0.006
Lagged Business losses (log)	0.094	0.026	0.003	0.010
Lagged Business losses (dummy)	-0.382	0.234	0.282	0.082
Lagged rent losses (log)	-0.044	0.029	0.035	0.011
Lagged rent losses (dummy)	0.322	0.245	-0.095	0.096
Male (dummy)	0.055	0.090	-0.014	0.022
Number of dependents	-0.014	0.021	-0.019	0.007
Married (dummy)	(omitted)			
30<=Age<40 (dummy)	-0.578	0.178	0.294	0.036
40<=Age<50 (dummy)	-0.779	0.200	0.568	0.038
50<=Age<60 (dummy)	-0.803	0.223	0.820	0.040
60<=Age<70 (dummy)	-0.722	0.237	0.980	0.043
Age>=70 (dummy)	-0.948	0.251	1.088	0.041
Carryover loss (dummy)	n/a	n/a	0.332	0.019
Unemployment compensation (dummy)	n/a	n/a	-0.071	0.025
Social security benefits (dummy)	n/a	n/a	0.213	0.019
College age dependent (dummy)	n/a	n/a	0.046	0.022
Constant	4.472	1.505	-1.990	0.372
Number of observations	70,227		340,047	
Permanent elasticity	-0.814	0.118		
Transitory elasticity	-1.286	0.285		

Notes: Dummy variables for regions and years are included in the model but are omitted from the table. Data are weighted. Number of bootstrap replications is 400.

Table 8: Other Types of Gains

Gains Variable	Permanent elasticity	Transitory elasticity
Misc.	-0.831	-1.726
	(0.253)	(0.562)
Pass through	-1.718	-2.035
	(0.321)	(0.927)
Mutual Funds	-0.225	-0.768
	(0.093)	(0.182)
Total non-personal gains	-0.971	-1.709
	(0.112)	(0.260)

Notes: Bootstrapped standard errors are in parentheses.
Number of bootstrap replications is 400.

Figure 1: Capital Gains Realizations, Tax Rates, and the S&P Index

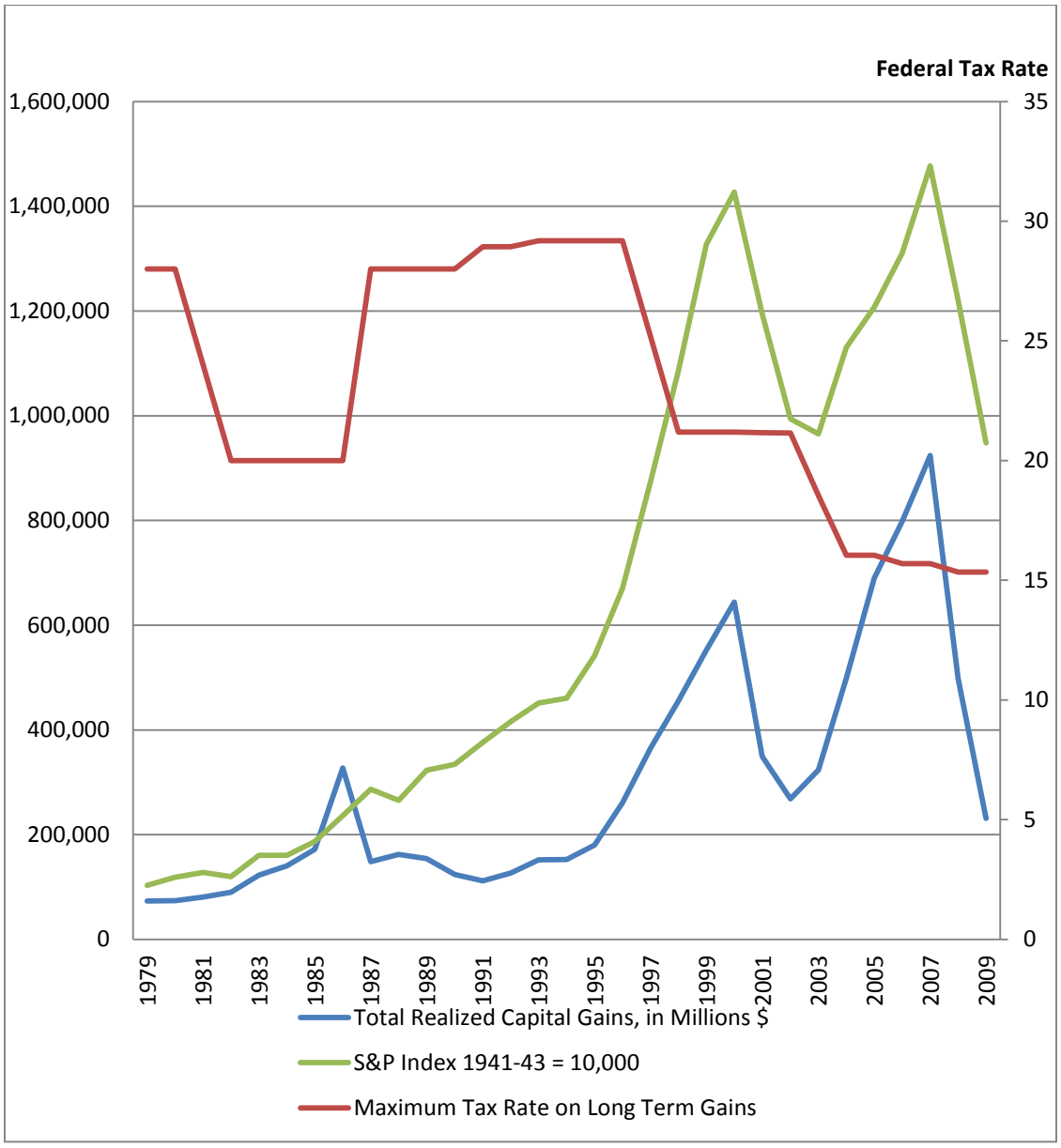

Figure 2: Long-Term Capital Gains or Losses Reported on Tax Returns, in Billions