Capital Gains Tax Realizations and Tax Rates: New Evidence From Time Series

March 1, 2000

Matthew Eichner
Office of Tax Analysis
Room 4217B MT
U.S. Department of the Treasury
Washington, DC 20220
and NBER
Matthew.Eichner@do.treas.gov

and

Todd Sinai
University of Pennsylvania
308 Lauder-Fischer Hall
256 South 37th Street
Philadelphia, PA 19104-6330
and NBER
sinai@wharton.upenn.edu

ABSTRACT

Using data from the 1986 through 1997 period, we update the time series evidence on the response of capital gains realizations to tax rates. In general, we find higher long-run elasticities than reported in many previous studies, but the estimates decrease substantially when the influence of 1986 is effectively removed. We explore several explanations for a diminished behavioral response in the period following fundamental tax reform, finding some suggestive evidence that the response may be dulled in part by a succession of rate changes in a relatively short period and the increasing role of mutual funds in households' portfolios.

For several decades, economists have debated the effect on capital gains realizations of tax rate changes. At issue is the revenue impact of lowering the capital gains rate: if realizations are sufficiently elastic, a tax rate reduction could actually lead to a rise in revenue. Combined with the increase in investment and economic growth that a lower capital gains rate is perceived to bring, this "something for nothing" argument is compelling for many policymakers. Indeed, the post-Tax Reform Act era has witnessed a number of capital gains tax rate reductions, most recently in 1997. Even recently Congress has considered another decrease, to 15 percent from the current 20 percent top rate.[1]

Despite the attention this topic has received in the tax literature, we feel it is worth revisiting for several reasons in addition to its current policy relevance. First, considerable uncertainty still surrounds the long run responsiveness of realizations to tax changes. The existing literature reaches consensus that the transitory capital gains elasticity is high -- since households have leeway in the timing of their realizations, one expects and finds significant increases in capital gains realizations before or after a tax change.[2] However, estimates of the long-run or permanent elasticity vary widely.[3] Aggregate time series studies such as CBO (1988), Auerbach (1988), and Gillingham and Greenlees (1992) find long run elasticities ranging from -0.05 to -1.78, although with a mass centering around -0.5 to -0.9. Micro data studies, such as Burman and Randolph (1994), find low long-run elasticities, or ones not significantly distinguishable from zero [Auten and Clotfelter (1982)]. Second, we suspect that some developments in recent decades may contribute to a lower response of realizations to the tax rate. The share of household equity held in mutual funds has risen, moving more assets out of the hands of individual investors and into the control of fund managers who may not have the same incentive to be tax efficient with respect to capital gains realizations. Additionally, the frequent tax changes of the last two

decades may have encouraged people to realize what gains they had, leaving fewer gains to be unlocked by a future decrease in the relevant rates. This potential for the amount of realizations to be dependent on the sequence of previous tax changes has not been previously investigated.

We address these issues by estimating aggregate time series realizations regressions, augmenting previous work by incorporating new data reflecting the many tax changes of the last dozen years. A longer time series should help, among other things, to more precisely isolate long-run elasticities.[4] Thus it is interesting and important to see how and whether the parameters estimated from time series models, which have guided the policy process over the last decade, shift with the addition of new data reflecting the recent regime changes. We find a higher long-run realization elasticity than many previous time-series studies, typically between -0.8 and -1.3, depending on the richness of the specification and the instrumenting strategy.[5] However, like Auerbach (1989) and Gillingham and Greenlees (1992), our estimate is sensitive to the inclusion of 1986, a year when there was a significant upswing in gains realizations, surely due to the fact that the rate increases in the Tax Reform Act of 1986 were preannounced.[6] In fact, if we exclude 1986, our baseline estimated elasticity is cut almost in half to -0.45. When we attempt to more completely model the dynamics of realizations, and the effect of anticipated changes in the capital gains tax rate in particular, we find a long-run elasticity of -0.74

Focusing on explanations for potentially lower responsiveness in the post-1986 period, we find that capital gains realizations increase with the share of household equity held in mutual funds, suggesting that fund managers tend to realize more gains than would individual taxpayers. There is also some evidence that a higher mutual fund share lowers the sensitivity of realizations to the gains rate, consistent with the idea that fund managers are not tax efficient. However, the key estimated parameters in this

regression are not statistically identifiable from zero. When we look for a dependence of realization behavior on the prior sequence of tax changes, we again find consistent evidence.

The rest of this paper proceeds in the following manner. Section one uses time series data to provide updated and more precise estimates of long-run capital gains realization elasticities as well as evidence concerning the non-tax factors that may affect these parameters. In section two, we apply those elasticities to the task of predicting the effect of the capital gains tax rate reductions in the Taxpayer Relief Act of 1997 on aggregate revenues, finding that the Act may have lowered revenues slightly, but could have increased them if the true elasticity was greater than -0.97. Lastly, section three briefly concludes.

Time series estimates of capital gains realizations elasticities

We have three goals for our time series estimates of capital gains realizations elasticities. First, a number of years and tax reforms have passed since the last time series studies were conducted. The additional variation now available may help identify long-run realization elasticities. Second, we hope to see whether the trend towards mutual fund ownership in the U.S. has affected capital gains realizations as control over sales of appreciated assets may be leaving taxpayers' hands for those of fund managers. Finally, we would like to determine whether there is evidence of path dependence in the response of capital gains realizations to changes in the tax rate. That is, a rate reduction shortly after the Tax Reform Act of 1986 may not generate the same realization response as a comparable rate reduction in 1997 because taxpayers realized so many gains in 1986 before TRA86 took effect in 1987 that they would have had few additional gains to realize if the rate were lowered shortly thereafter.

While time series studies of capital gains suffer from some well-known problems, including aggregation bias and the difficulty in constructing one national rate to represent the entire tax schedule, we believe that time series analysis is the best way to estimate long-run realization elasticities. Taxpayer-level panel data sets do not encompass a long enough time period to be able to separate out long run from transitory elasticities or to estimate path dependence effects. Also, unlike in the time series, it is difficult with microdata to identify behavioral responses using tax changes. Typically, panel data studies use cross sectional variation in tax rates, such as across states [Bogart and Gentry (1994), Burman and Randolph (1994)] or across taxpayers [Auten and Clotfelter (1982)], to mimic changes in the long-run capital gains tax rate. However, the cross-state differences in tax rates may not affect taxpayers' behavior in the same way as a change in the tax rate, especially if the state taxes are correlated with other characteristics of the state residents or if capital gains realizations are not in equilibrium.

With several significant capital gains tax rate changes having taken place since 1985, we begin by examining whether this new variation sheds any additional light on the long-run capital gains realizations elasticity. Table 1 reports the results of estimating some basic regressions for the period through 1985 and also up through 1997. The left-hand-side variable is the logged aggregate amount of long-term gains net of short-term losses. On the right-hand-side, besides the weighted average capital gains tax rate, we include the GNP deflator as a measure of the price level, the real value of corporate equities held by households as a proxy for the stock of unrealized capital gains, and GNP and GNP growth to reflect economic conditions. We chose these specifications to be identical to some in Auerbach (1988) to maximize the comparability of our results with those in previous work.

The data in these regressions are derived from the aggregate capital gains realizations and the weighted average marginal capital gains tax rate series reported by CBO (1988) for 1954 through 1985. We extend the data to 1997 using the IRS Statistics of Income public use microsample and unpublished data from Treasury. The data are described more fully in the appendix.

As Auerbach (1988) points out, realizations, GNP, and corporate equities may not be stationary variables and may be trending together over time. In fact, augmented Dickey-Fuller tests cannot reject the hypothesis that the variables in our regressions have a unit root, even when we account for a linear time trend. However, similar tests also cannot reject a null of no cointegration in the data. Since taking first-differences eliminates the unit root, we estimate all specifications using differenced data.

Table 1 shows that the estimated capital gains realizations elasticity is substantively different when the data are updated to include recent tax law changes. For the 1954 to 1985 period, the estimated realizations elasticity is a moderate -0.64 (with a standard error of 0.36) when evaluated at the sample mean capital gains tax rate.[7] When we extend the time frame through 1997, the estimated realizations elasticity rises to -0.81 (0.26).[8] The other estimated coefficients are virtually unchanged when the most recent 12 years of data are included. A one percent increase in the price deflator corresponds to nearly a two percent rise in realizations. If the value of households' corporate equities were to rise by 10 percent, realizations would increase by slightly more than six percent. Also, a higher level of GNP leads to more realizations, but this effect is not statistically significant.

Since extending the sample increases the estimated realizations elasticities, one naturally wonders if the results are unduly influenced by one observation. In particular, the period around

TRA86 was marked by unusual realizations dynamics. Since the capital gains tax rate increase that took effect in 1987 was announced in advance, taxpayers had the opportunity to shift their realizations a few months earlier in time and pay the lower 1986 gains tax rate. After realizing a record $165.5 billion of gains in 1985, taxpayers went on to realize $317 billion in 1986. In 1987, when tax rates were higher, realizations fell back to $142 billion. To the extent that some of the growth in realizations in 1986 was due to taxpayers timing the tax change, our estimated elasticity will not measure the long-run responsiveness to the tax code very well. For example, shifting realizations that would have taken place in 1987 forward one year to 1986 would make it appear that low-tax rate periods have high realizations while high-rate periods have low realizations when all that has occurred is a reshuffling of when realizations occur with no effect on the aggregate amount.

The least restrictive way of dealing with this issue is to include a dummy variable for 1986, effectively removing that year from the regression. When we do exactly that for the differenced specification in the first column of table 2a, the estimated realization elasticity is cut almost in half to -0.45 (0.21). Thus, if we exclude this one year from the analysis, adding recent history to the regression *lowers* the estimated responsiveness of realizations to the tax rate, an effect consistent with the view that the importance of 1986 is due, at least in part, to the shifting into 1986 gains that would otherwise be realized in subsequent years. This sensitivity is limited to 1986. Including additional indicator variables for 1985, 1987, or both has no effect beyond that obtained with the 1986 dummy. Unfortunately, removing 1986 from the regression is not a panacea since the data point may convey important information regarding capital gains elasticities. Instead, the sensitivity to the inclusion of 1986 suggests that we are failing with our base specifications to properly capture the dynamics of realizations. Table 3

will address this issue further.

Another year that may be disproportionately affecting the results is 1997, when the top capital gains tax rate fell from 28 to 20 percent. Although the change did not take effect until May, we assign the new, lower tax rate to all realizations in 1997, overstating the tax rate reduction. Thus, the amount of realizations will be too low relative to our measured tax decrease, a mismeasurement that will bias our estimates of the realization elasticity towards zero. The data bear this hypothesis out. In the second column of table 2a, including a dummy variable for 1997 increases the estimated realization elasticity to -1.04 (0.34). However, when 1986 is excluded, removing 1997 as well has no additional effect on the estimated capital gains elasticity. While relating all realizations in 1997 to the lower tax rate is surely problematic, the alternatives to this approach are equally unappetizing.[9]

The construction of the tax rate variable potentially creates an econometric problem. Since the average tax rate is weighted by predicted gains, in years where overall gains are greater we will overweight the top tax brackets if the gains are not distributed proportionally across income classes. Thus higher realizations might lead to a larger measured tax rate if high-income taxpayers have a disproportionate increase in gains, inducing a positive correlation between the tax rate variable and realizations that will bias our estimated coefficient towards zero.

In table 2b, we tackle this issue by instrumenting with the top marginal tax rate on capital gains. When we use the entire sample, the estimated capital gains elasticity in the instrumental variable regression is -1.21 (0.32), much larger than the -0.81 estimated using OLS. However, this increase in elasticity may not be due to solving the endogeneity problem; rather, by instrumenting with the top marginal tax rate we may be enhancing the fit in the years when the tax change primarily affects high-

income, relatively elastic, taxpayers and reducing the fit otherwise, thus increasing the influence of the years when realizations were most responsive. Since we cannot distinguish between these two cases, we will continue to report estimates from both OLS and IV regressions. Removing 1986 or 1997 from the sample has the same qualitative effect as when we used OLS. Absent 1986, the estimated realizations elasticity falls to -0.75 (0.25). If we eliminate 1997, the elasticity estimate rises to -1.75 (0.45). Removing both 1986 and 1997 yields an intermediate estimate of -1.01 (0.40).

The dramatic effect of 1986 on the estimated realization elasticity suggests that our baseline regression may be misspecified. When taxpayers realized that capital gains rates would go up the following year, they increased their realizations in response. In essence, we attribute an effect to the relatively low prevailing rates in 1986 that, in fact, is due to the knowledge that higher rates will come in 1987. Auerbach (1988, 1989) included the change in tax rate between the current year and the next as an explanatory variable to capture such expectation-driven timing effects. In addition, this regressor also proxies for the incentive to delay realizations a year if lower rates are expected. The coefficient on the current tax rate in such specifications measures the "permanent" or long-run responsiveness.

Table three adds these variables reflecting changes in rates relative to adjacent periods, both prior and subsequent. Following Auerbach, lagged realizations are added to the explanatory variables in an effort to capture changes to the stock of unrealized gains. The estimated long-run realizations elasticity rises to -1.31 (0.50) from -1.04. Unlike in Auerbach (1988), the long-run response is significantly different from zero. As anticipated, when the tax rate is expected to increase the next year, realizations are estimated to increase in the current year in the OLS regressions in column 1. An increase in tax rates since the previous year is estimated to raise, not lower, current realizations.

However, neither of the estimates of these timing effects are statistically significant. When we instrument using the current top marginal tax rate on capital gains and the change in the top rate from the previous year and to the next year, we obtain the results in column 2. The long-run realizations elasticity is almost exactly the same. An expected increase in rates encourages shifting realizations forward in time, and unlike in the previous column, an increase in tax rates from last year leads to higher realizations this year. None of these point estimates are statistically distinguishable from zero.

This expanded specification does not completely control for the impact of 1986, however. In results not reported here, adding an indicator variable for 1986 to the OLS specification in table 3 still reduces the estimated realizations elasticity considerably, to -0.80 (0.38). In the IV regression, the estimated elasticity falls a bit less, to -0.94 (0.52). This pattern may persist because our measure of expected change in tax rates, which is the actual change, may be poor since several recent changes in capital gains tax rates were not widely anticipated, and other regime changes which were expected failed to materialize. Our results would then estimate too large of a timing effect when the tax change was not announced in advance and too small when it was, leaving room for the 1986 dummy to have an effect.[10]

To address this issue, the third column of table 3 decomposes the expected change in capital gains tax rates into potential increases and decreases. Since tax increases during our sample period were generally preannounced while tax decreases were enacted retroactively, the two types of tax changes could generate different behavioral responses and pooling them in the regression could mask their effect. Indeed, we find a large effect of anticipated tax increases and no effect for decreases. Our estimated coefficient on the change in tax rate between the current period and the next, if positive, is

6.45 (1.44), indicating that an expected 8 percentage point increase in the weighted average marginal tax rate, such as what occurred between 1986 and 1987, would lead to a 52 percent rise in realizations in the year prior to the change. Separating increases from decreases in this way also reduces the estimated current tax elasticity to -0.74 (0.39). However, given the relative paucity of tax rate increases during our sample period, incorporating the expected change in taxes if an increase may just proxy for the 1986 dummy variable. One indication that this hypothesis may be correct is that when we exclude 1986 from the regression in column three, the estimated coefficient on the change in tax rate if positive falls to a statistically insignificant 2.68 (3.98) while the estimated current tax elasticity is virtually unchanged.[11]

In the last two decades, a new phenomenon has potentially affected the responsiveness of capital gains realizations to the tax rate: the proportion of household equity held in mutual funds has risen from 5 percent in 1980 to 28 percent in 1997.[12] Since fund shareholders cannot choose when their funds realize gains and fund managers may not have incentives to minimize capital gains taxes, this portfolio shift may lead to an increase in overall realizations and a decrease in the sensitivity to capital gains rates. On the other hand, shareholders may choose tax-managed funds or enter and exit fund ownership in a tax efficient way, reducing the effect on realizations.[13]

We investigate the effect of the rise in mutual fund holdings on capital gains realizations in table 4. In the first column, we add the proportion of household equity held in mutual funds to reflect the amount of the portfolio that may be outside the household's control with respect to tax strategy. The positive and significant coefficient, 4.21 (1.97), suggests that when the proportion of equity in mutual funds rises by one percentage point, from 20 to 21 percent for example, capital gains realizations will

increase by more than four percent. Since one percentage point in this example translates into a five percent increase in the mutual fund share of equity, the estimated elasticity would be around 0.8. These results suggest that mutual funds indeed are realizing more capital gains than individuals would have if they were managing their own portfolios directly. However, it does not appear that the growth in mutual fund ownership was creating a spurious correlation with the capital gains tax rate variable as the estimated realizations elasticity is basically unchanged when the mutual fund variable is added.

To test the hypothesis that aggregate realizations are less responsive to tax changes when the mutual fund share is greater, we interact the proportion of equity in mutual funds with the capital gains tax rate. Unfortunately, in the time series collinearity between the interaction term and the tax and mutual fund share variables causes the standard errors to increase tremendously. However, the point estimates are still interesting. The estimated realizations elasticity if no equity were held in mutual funds is -1.02, higher than the -0.85 estimated without the interaction term. As the proportion of equity in mutual funds increases, the realizations elasticity declines. If we were to extrapolate out-of-sample that all equity were held in mutual funds, the realizations elasticity would fall to -0.14. It takes a 20 percent mutual fund share to obtain the -0.85 elasticity obtained earlier. This is one possible reason why, absent the 1986 blip, the estimated realizations elasticity falls when we extend the sample. Between 1954 and 1985, the proportion of equities in mutual funds was only 5.8 percent. After 1985, the average mutual fund share was 22.8 percent, raising the sample average to 9.9 percent. This increase could have accounted for 4 percentage points of the decline in elasticity. In addition to being less responsive to tax changes, investors still realize more gains when they own more mutual funds – a one percentage point increase in the mutual fund share is estimated to yield an 3.35 percent increase in realizations.

Another potentially important factor affecting the response of capital gains realizations to the tax rate is the amount of extant gains. Although Gillingham and Greenlees (1992) find that a measure of unrealized gains has a positive effect on realizations but has little impact on the realization elasticity, the literature has not made much of this issue possibly because no policy instrument is thought to directly control the amount of unrealized gains in the economy.

However, tax rate changes themselves may affect the aggregate level of unrealized gains. In a model where there is a cost to rebalancing one's portfolio, namely the capital gains tax, a mass of assets may build up just below the threshold where investors would be willing to sell them and pay the gains tax. A change in the tax rate, such as a decrease or an announced increase, may trigger a windfall of realizations. Once assets are sold, they are marked to market, not only reducing the aggregate amount of unrealized gains, but also shifting the mass of assets away from being on the margin of being sold. Thus a subsequent tax change might have less of an unlocking effect because there is both less unrealized gain in the economy and fewer portfolios in need of rebalancing. This effect would be especially important in the 1980s and 1990s when tax rate changes were frequent.

A large portion of this effect could be captured if we could accurately measure unrealized gains. However, that is difficult to do convincingly and such a strategy would miss the effect of changes in the distribution of "out-of-balance" portfolios due to previous movements in the gains rate. Instead, in table 5 we present some suggestive evidence that the sequencing of tax changes has an effect on the amount of realizations. This strategy should capture the influence of the stock both of appreciated assets and of out-of-balance portfolios on the realization of gains, although it does not distinguish between these effects. In the first column, we add the number of years since the most recent statutory tax change. If

the act of changing the gains rate did not affect the distribution or aggregate amount of capital gains beyond what would be expected from the new rate itself, the length of time since the tax change should have no additional effect. Instead, the estimated coefficient is 0.04 (0.02), indicating that realizations increase as the tax change moves further into the past. This result is consistent with capital gains unlocking that diminishes with the frequency of tax changes.

Column two provides a check on the reasonableness of the results by exploiting our expectation that only decreases in gains taxes should unlock gains and reduce the level of future potential realization windfalls. When we divide the number of years since the last statutory change into two categories -- one when the last tax change was a tax increase and the other where the tax rate was lowered -- we find that the level of realizations is not at all affected by the length of time since the last tax increase but realizations rise over time after a tax decrease.[14]

Finally, we attempt a more direct test of the path dependence hypothesis. If a tax change encourages people to unlock their gains, leaving less to realize at the next rate reduction, we should find that decreasing the tax rate soon after another change should yield less of an increase in realizations than if there had been a longer spell in between. We test whether the response to a decline in the capital gains tax depends on the length of time since the last tax change by adding an indicator variable for the year after a tax decrease, a variable that measures the length of time between the most recent tax decrease and the previous tax change, and the interaction between the two. If there is no path dependence, we would expect a zero coefficient on the interaction – the length of time since the last statutory tax change should have no effect on the windfall from the current tax change. A positive coefficient indicates that the effect on realizations increases as the stock of capital gains is rebuilt. The

last column of table 5 shows that there is some suggestive evidence for path dependence. The coefficient on the interaction term is positive and significantly different from zero, supporting the idea that a longer time between tax changes leads to bigger windfalls. However, the coefficient on the capital gains tax rate variable goes away completely in this specification, suggesting that the interaction term is highly correlated with the tax rate variable for some reason – perhaps because tax rate changes are greater if rates have not varied in a while.

The predicted effects of TRA97 on realizations and revenue

One useful application of our results is to predict the revenue cost of a capital gains tax reform. While our time series results describe the effect of a tax change on the amount of realizations, they are insufficient for computing revenue because while realizations depend on the marginal tax rate, revenue is determined by the amount of realizations times the *average* tax rate.[15] While decreases in marginal rates surely increase realizations, this effect is not necessarily sufficient to offset the inframarginal loss on realizations that would have occurred without the change in the tax regime but which are now taxed at a lower rate.

In this section, we evaluate whether the capital gains tax decrease in TRA97, from a weighted average marginal tax rate of 27 percent in 1996 down to 18 percent at the end of 1997, was costly or increased revenue.[16] We use a range of estimated realization elasticities that bracket most of our results in order to provide bounds on the possible effects. Also, we simplify the exercise by assuming in effect that every household faces the national average marginal and average gains rates.

Unambiguously, the capital gains rate reduction in TRA97 should have increased capital gains

realizations. We begin with our baseline case from Table 1 where the estimated realizations elasticity is -0.81. Multiplying the change in marginal gains tax rate between 1996 and 1997 by its estimated coefficient of -4.14 predicts that gains realizations should have increased from $252 billion to $340 billion were no other factors to change between those two years. However, the average tax rate, weighted by predicted 1996 realizations, fell from 23.4 percent to 16.5 percent due to TRA97. This leads to a loss of $17.3 billion of revenue from 1996's estimated $59 billion of gains tax receipts. However, that revenue drop is mostly offset by the $14.5 billion in taxes received on the $88 billion in additional gains from the decline in marginal rates. The net revenue loss would have been $2.8 billion per year, almost 5 percent of the 1996 capital gains revenue.[17]

Naturally, the predicted effect on revenue depends on the realizations elasticity one uses.[18] The lower bound of our estimated parameters is the case of -0.45 elasticity, which assumes that the realizations bulge in 1986 is all due to timing of gains and no net new realizations were created. In that case, TRA97 would have increased realizations by $48 billion for a revenue loss of $9 billion per year. Although using the specifications in table 3 to measure the revenue effect is slightly more complicated since they predict that the effect on realizations may vary over time, we compute the present value of revenue gains or losses discounted at the one-year Treasury bill rate of 5.63 percent. Using the parameters from the first column of table 3 we predict that realizations in 1997 would be 28 percent higher than if there had been no tax decrease and in 1998 realizations would be 52 percent greater. After 1998, annual realizations quickly converge to at a level 47 percent above what would have been the case absent the tax change. However, the present value of the revenue gain from the tax change is only $1.3 billion since the lower average tax rate post-TRA97 nearly completely offset the increase in

realizations.

Conclusion

The present project seeks to ascertain the effect of an additional twelve years of data, spanning the 1986 through 1997 period, on the time series evidence concerning the behavioral response to the capital gains tax rates. For a variety of reasons, this twelve year period might be expected to provide interesting insights: During the period, behavior readjusted after the perturbations caused by TRA86, easily the most comprehensive tax reform of the post-war era. In addition, the nineties saw a long bull market, which drew much new money into the equity markets either directly through investment in individual stocks or through purchase of mutual fund shares.

In fact, lengthening the sample period does appear to significantly modify the results reported by Auerbach (1988). Including the additional data increases the magnitude of the implied elasticity obtained using the benchmark differences specification from -0.64 to -0.81. However, this change is driven entirely by the pivotal year of 1986. Effectively excluding this single year from the analysis reduces the elasticity to -0.45. When we attempt to better model anticipated changes in the capital gains tax rate, we find a long-run elasticity of -0.74.

This result motivated further analysis to investigate this evident decrease in responsiveness to tax rates. One hypothesis involves the path dependence of rate responses. In particular, one might believe that successive changes in the taxation of capital gains have diminishing effects, as the stock of gains which may be realized, either in anticipation of a rate increase or following a rate reduction, decreases. For example, anticipation of the 1987 rate increase motivated taxpayers to realize gains in 1986, leaving

a smaller overhang of unrealized gains to be "unlocked" by subsequent tinkering with the tax code. In a political environment where further decreases in the tax rate applied to long-term capital gains is often cited as a means to increase tax revenue in the short term, this effect may be important not only from the standpoint of pure intellectual interest. Our efforts to find evidence of this path dependence were suggestive but not definitive. The number of years since the most recent decrease in rates has the expected positive and statistically significant effect on realizations, suggesting that the stock of unrealized gains accumulates over time. However, attempts to isolate this effect more precisely using more intricate specifications lead to inconclusive results.

A second possible explanation for the decrease in responsiveness estimated using the augmented time series (when excluding 1986) lies in the growth of mutual funds as an investment vehicle. Investing through mutual funds, at least before the very recent focus on tax efficiency, effectively shifts control over realizations from the taxpayer to the fund manager whose objective function may place a low weight on the tax consequences to shareholders. Thus we hypothesize that an increase in the percentage of household equity held through mutual funds will blunt the response to tax rate changes.

Again, the evidence at this stage is suggestive but far from definitive. Adding to the benchmark regression the percentage of equity held through mutual funds produces a positive and significant coefficient, implying that this holding vehicle tends to increase realizations. The estimated coefficient on an interaction between the percentage of equity held through mutual funds and the tax rate is also positive, although not statistically distinct from zero.

On the whole, due to the sensitivity of our results to how we model 1986, the project has

reinforced our view that the highest marginal benefit to future research will come from utilizing micro data in a more structural framework to model realizations dynamics. We plan to take a step in that direction by looking at individual realization decisions in detail using the 1985-forward SOCA panel. Unfortunately, the political establishment did not take into account the timing of SOCA when it produced fundamental tax reform only a year after the start of that panel and, in particular, before adequate evidence on pre-TRA86 patterns had been collected. Therefore we eagerly await additional data concerning the rate changes instituted in 1997 to pursue this and related issues further.

Endnotes

We are grateful to Alan Auerbach, Jerry Auten, Chris Mayer, James Poterba, participants in the NBER's 1999 Conference on the Economic Effects of Taxation, and two anonymous referees for helpful comments and suggestions. Donghoon Lee provided excellent research assistance, while James Cilke and Gordon Wilson provided invaluable assistance with the tax data. The Smith-Richardson Foundation and the NBER provided research support. The views expressed are those of the authors alone, and do not necessarily reflect the positions of the U.S. Department of the Treasury.

References

Auerbach, Alan. "Capital Gains Taxation in the United States: Realizations, Revenue, and Rhetoric." *Brookings Papers on Economic Activity* No. 2 (1988): 595-631.

Auerbach, Alan. "Capital Gains Taxation and Tax Reform." *National Tax Journal* 42 No. 3 (September, 1989): 391-401.

Auerbach, Alan, Leonard Burman, and Jonathan Siegel. "Capital Gains Taxation and Tax Avoidance: New Evidence from Panel Data," NBER Working Paper No. 6399. Cambridge, MA: National Bureau of Economic Research, 1998.

Auten, Gerald, and Charles Clotfelter. "Permanent versus Transitory Tax Rate Effects and the Realization of Capital Gains." *Quarterly Journal of Economics* 97 No. 4 (November, 1982): 613-32.

Auten, Gerald, and David Joulfaian. "How Income Taxes Affect Capital Gains Realizations: Evidence from a Long Panel." Office of Tax Analysis, U.S. Department of the Treasury. Mimeo, 1998.

Bogart, William and William Gentry. "Capital Gains Taxes and Realizations: Evidence from Interstate Comparisons." *Review of Economics and Statistics* 77 No. 2 (May, 1995): 267-82.

Burman, Leonard and William Randolph. "Measuring Permanent Responses to Capital-Gains Tax Changes in Panel Data." *American Economic Review* 84 No. 4 (September, 1994): 794-809.

Burman, Leonard, Kimberly Clausing, and John O'Hare. "Tax Reform and Realizations of Capital Gains in 1986." *National Tax Journal* 47 No. 1 (March, 1994):1-18.

Burman, Leonard, and Peter Ricoy. "Capital Gains and the People Who Realize Them." *National Tax Journal* 50 No. 3 (September, 1997): 427-451.

Chevalier, Judith, and Glenn Ellison. "Risk Taking by Mutual Funds as a Response to Incentives." *Journal of Political Economy* 105 No. 6 (December, 1997): 1167-1200.

Constantinides, George. "Capital Market Equilibrium with Personal Tax." *Econometrica*, 51 No. 3 (May, 1983): 611-636.

Constantinides, George. "Capital Market Equilibrium with Transaction Costs." *Journal of Political Economy* 94 No. 4 (October,1986): 842-62.

Cook, Eric and John O'Hare. "Capital Gains Redux: Why Holding Periods Matter." *National Tax Journal* 65 No. 1 (March, 1992): 53-76.

Dickson, Joel and John Shoven. "Taxation and Mutual Funds: An Investor Perspective." In *Tax Policy and the Economy 9,* edited by James M. Poterba, 151-80. Cambridge: MIT Press, 1995.

Dickson, Joel and John Shoven. "A Stock Index Mutual Fund Without Net Capital Gains Realizations." NBER Working Paper No. 4717. Cambridge, MA: National Bureau of Economic Research,1994.

Feldstein, Martin, Joel Slemrod, and Shlomo Yithaki. "The Effects of Taxation on the Selling of Corporate Stock and the Realization of Capital Gains." *Quarterly Journal of Economics* 94 No. 4 (June, 1980): 777-91.

Gillingham, Robert and John Greenlees. "The Effect of Marginal Tax Rates on Capital Gains Revenue: Another Look at the Evidence." *National Tax Journal* 65 No. 2 (June, 1992): 167-77.

Kiefer, Donald. "Lock-in Effect Within a Simple Model of Corporate Stock Trading." *National Tax Journal* 63 No.1 (March, 1990): 75-94.

Poterba, James. "How Burdensome are Capital Gains Taxes?" *Journal of Public Economics*, 33 No. 2 (July, 1987): 157-72.

Stiglitz, Joseph. "Some Aspects of the Taxation of Capital Gains." *Journal of Public Economics* 21 No. 2 (June, 1983): 257-94.

U.S. Congressional Budget Office. *How Capital Gains Tax Rates Affect Revenues: The Historical Evidence*. Washington, D.C., 1988.

Table 1: Extending the Sample to 1997 Yields a Higher Realizations Elasticity

	1955-85	1955-97
Marginal capital gains tax rate (CBO)	-3.60 (2.04)	-4.14 (1.35)
CG tax elasticity (at sample mean)	-0.64	-0.81
CG tax elasticity (at 19.6%)	-0.70	-0.81
Log GNP deflator	1.74 (1.11)	1.71 (1.53)
Log real value of household equity	0.60 (0.13)	0.66 (0.18)
Log real GNP	3.01 (1.42)	3.70 (1.93)
First difference of log real GNP	0.79 (0.91)	0.75 (1.29)
Constant	-0.09 (0.09)	-0.12 (0.11)
Adjusted R^2	0.5385	0.4058
Durbin-Watson	2.63	2.60

1. Standard errors in parentheses.
2. All variables are in first differences.
3. Left-hand side variable is log capital gains realizations.
4. The sample mean capital gains tax rate for 1955-85 is 17.9 percent; for 1955-1997 it is 19.6 percent.

Table 2a: OLS Results are Sensitive to Excluding 1986 and 1997

Year(s) excluded:	1986	1997	1986 and 1997
Marginal capital gains tax rate (CBO)	-2.28 (1.07) [-0.45]	-5.28 (1.72) [-1.04]	-2.18 (1.44) [-0.43]
Log GNP deflator	1.50 (1.14)	1.37 (1.56)	1.53 (1.19)
Log real value of corporate equity	0.53 (0.14)	0.67 (0.18)	0.53 (0.14)
Log real GNP	3.15 (1.45)	3.59 (1.93)	3.16 (1.47)
First difference of log real GNP	1.04 (0.97)	0.86 (1.29)	1.03 (0.98)
1986 indicator	0.59 (0.11)		0.59 (0.11)
1997 indicator		-0.26 (0.25)	0.02 (0.19)
Constant	-0.16 (0.10)	-0.10 (0.11)	-0.09 (0.08)
Adjusted R^2	0.6659	0.4080	0.6565
Durbin-Watson	2.14	2.50	2.15

1. Standard errors in parentheses.
2. Left-hand side variable is log capital gains realizations.
3. Elasticities evaluated at the sample mean capital gains tax rate of 19.6 percent are in square brackets.
4. Sample period is 1955-1997.
5. All specifications are in differences.

Table 2b: IV Results are Sensitive to Excluding 1986 and 1997

Year(s) excluded:	None	1986	1997	1986 and 1997
Marginal capital gains tax rate (CBO)	-6.16 (1.61) [-1.21]	-3.80 (1.29) [-0.75]	-8.91 (2.31) [-1.75]	-5.13 (2.05) [-1.01]
Log GNP deflator	1.50 (1.57)	1.37 (1.18)	0.72 (1.67)	1.06 (1.27)
Log real value of corporate equity	0.64 (0.19)	0.53 (0.14)	0.64 (0.20)	0.54 (0.15)
Log real GNP	3.59 (1.99)	3.12 (1.49)	3.33 (2.05)	3.05 (1.56)
First difference of log real GNP	0.91 (1.33)	1.12 (1.00)	1.16 (1.37)	1.21 (1.04)
1986 indicator		0.54 (0.11)		0.49 (0.13)
1997 indicator			-0.58 (0.29)	-0.24 (0.24)
Constant	-0.11 (0.11)	-0.08 (0.08)	-0.05 (0.11)	-0.06 (0.09)
Adjusted R^2	0.3701	0.6474	0.3348	0.6152
Durbin-Watson	2.55	2.28	2.26	2.14

6. Standard errors in parentheses.
7. Left-hand side variable is log capital gains realizations.
8. Elasticities evaluated at the sample mean capital gains tax rate of 19.6 percent are in square brackets.
9. Sample period is 1955-1997.
10. All specifications are in differences.
11. Instrumental variable is the top marginal tax rate.

Table 3: Extending Data Through 1996 Leads to Different Dynamics

	OLS	IV	OLS
Marginal capital gains tax rate (CBO)	-6.66 (2.52) [-1.31]	-6.53 (3.62) [-1.29]	-3.77 (1.98) [-0.74]
Change in capital gains tax rate from previous period	2.62 (2.34)	-2.56 (4.02)	1.54 (1.87)
Change in capital gains tax rate to next period ahead	0.21 (1.46)	0.57 (1.84)	
Change in tax rate to next period ahead if an increase			6.45 (1.44)
Change in tax rate to next period ahead if a decrease			-0.73 (1.41)
Log GNP deflator	1.54 (1.61)	0.65 (1.87)	1.90 (1.26)
Log real value of corporate equity	0.63 (0.19)	0.65 (0.22)	0.59 (1.49)
Log real GNP	5.38 (2.37)	2.53 (3.07)	4.22 (1.87)
First difference of log real GNP	0.08 (1.50)	1.60 (1.83)	0.82 (1.18)
Lagged log capital gains realizations	-0.23 (0.18)	0.03 (0.24)	-0.08 (0.14)
Constant	-0.14 (0.12)	-0.03 (0.14)	-0.13 (0.09)
Adjusted R^2	0.3704	0.1857	0.6181
Durbin-Watson	2.09	2.18	1.96

12. Standard errors in parentheses.
13. Left-hand side variable is log capital gains realizations.
14. Elasticities evaluated at the sample mean capital gains tax rate of 19.7 percent are in square

brackets.

15. All specifications are in differences.
16. Sample period is 1956-1996.
17. The instrumental variable is the top marginal tax rate on capital gains.

Table 4: Greater Mutual Fund Holdings Reduce the Tax Sensitivity of Realizations

	-4.31	-5.18
	(1.30)	(3.52)
Marginal capital gains tax rate (CBO)	[-0.85]	[-1.02]
	2.54	2.52
Log GNP deflator	(1.51)	(1.53)
	0.74	0.75
Log real value of corporate equity	(0.18)	(0.19)
	3.93	3.98
Log real GNP	(1.85)	(1.88)
	0.79	0.76
First difference of log real GNP	(1.23)	(1.25)
	4.21	3.35
% of equity in mutual funds	(1.97)	(3.77)
% of equity in mutual funds * capital gains tax rate		4.48
		(16.67)
	-0.19	-0.19
Constant	(0.11)	(0.11)
Adjusted R^2	0.4579	0.4435
Durbin-Watson	2.75	2.74

18. Standard errors in parentheses.
19. Left-hand side variable is log capital gains realizations.
20. Elasticities evaluated at the sample mean capital gains tax rate of 19.6 percent are in square brackets.
21. All specifications are in differences.
22. OLS regressions.

Table 5: Some Evidence for Path Dependence in Capital Gains Realizations

Marginal capital gains tax rate (CBO)	-5.68 (1.61)	-2.61 (2.00)	2.15 (3.02)
CG tax elasticity (at sample mean)	-1.19	-0.55	0.45
CG tax elasticity (at 19.6%)	-1.11	-0.51	0.42
Years since most recent statutory tax change	0.04 (0.02)		
Years since most recent positive statutory tax change		0.01 (0.04)	
Years since most recent negative statutory tax change		0.13 (0.07)	
Last tax change was negative indicator		-0.01 (0.34)	
Years between most recent and previous stat. tax changes (GAP)			-0.24 (0.08)
Indicator for year after decline in statutory tax rate (POSTDEC)			-0.09 (0.13)
Interaction of GAP*POSTDEC			0.17 (0.07)
Log GNP deflator	0.67 (2.03)	0.41 (1.91)	1.09 (2.04)
Log real value of corporate equity	0.51 (0.22)	0.39 (0.22)	0.47 (0.23)
Log real GNP	4.58 (2.61)	2.86 (2.55)	3.79 (2.51)
First difference of log real GNP	1.23 (1.93)	1.69 (1.83)	0.95 (1.86)
Constant	-0.09 (0.14)	-0.03 (0.14)	-0.07 (0.14)
Adjusted R^2	0.4382	0.5119	0.5037
Durbin-Watson	2.26	2.04	1.64

Notes: Standard errors in parentheses. Left-hand side variable is log capital gains realizations. All specifications are in differences. Sample period for the first two regressions is 1968-1997 and 1969-1997 for the last regression. All regressions are OLS.

Appendix: Data Construction and Definitions

Aggregate capital gains realizations and the weighted average capital gains tax rates for 1954 through 1985 are obtained from CBO (1988). For the more recent years, we used the Statistics of Income public-use microsample for 1986 through 1995 and unpublished data from the Treasury Department for 1996 and 1997. Aggregate realizations in 1986-1997 were estimated by totaling the weighted amount of long-term gains net of short-term losses across all observations in the samples.

To estimate the weighted average capital gains tax rates for 1986-1997, we replicated CBO's (1988) methodology. We began by computing the total long-term gains net of short term losses, adjusted gross income excluding gains, and interest and dividend income for each of the income brackets used in the pre-1986 Statistics of Income publications. (In the post-1986 printed SOI publications, the income bracket definitions were changed and long-term gains net of short term losses was no longer reported. Thus we constructed tables similar to the pre-1987 ones using the micro data.) We compute the average taxable income in each bracket by taking average AGI, assuming every family is married with two children, and everyone itemizes with deductions equal to 20 percent of AGI. The marginal capital gains tax rate is assigned to each income bracket using the average taxable income in the bracket and assuming that the taxpayers are married filing jointly. Finally, we predict capital gains realizations by income bracket in each year by regressing net long term realizations on AGI excluding gains and dividend income and computing the fitted value. The weighted average marginal capital gains tax rate is computed using the predicted amount of realizations by each income bracket as weights.

This construct clearly is a noisy measure of the true tax rate -- income bracket definitions are in nominal dollars and so move down the real income distribution over time, the density of taxpayers in

each group varies over time, the coarseness of the income bracket boundaries means that some phase-outs and notches are not captured in our aggregate tax rate, and family structure varies across the income distribution. While we easily could have constructed less noisy measures using the micro data, several considerations kept us from doing so. First, the micro data is only available annually back to 1970 and biannually to 1960. We did not think that provided a long enough time series. Given that, we wanted to make our new series as consistent as possible with the CBO series both so we could utilize their data and also so our results were comparable and thus we adopted their methodology. Second, we think that any error we are introducing is dwarfed by the fact that we are creating one capital gains tax rate for the entire economy when many exist. We are confident that our tax rate series reflects the gross changes in the tax level on capital gains.

One year that requires highlighting is 1997. Unlike previous capital gains tax changes, the Taxpayer Relief Act of 1997 took effect midway through the year. Since we observe capital gains realizations only annually, a question arises as to what tax rate to assign to 1997. We chose to apply the new, lower capital gains rates imposed by TRA97 to the entire year's realizations under the hypothesis that much of the realizations would have been deferred to the latter half of the year in anticipation that the lower tax rates Congress was debating would be enacted.

The top capital gains tax rate is the marginal rate on the highest income bracket. It assumes that the highest income filer is no longer subject to deduction and exemption phase-outs. We consider the overall statutory capital gains tax rate to have changed when the top statutory rate changes.

The remaining variables are obtained from standard sources. Household equity and mutual fund holdings are end-of-year values obtained from the Federal Reserve Board's Flow of Funds. All dollar

values are expressed as real amounts in the regressions, deflated by the GNP deflator. This was done for consistency with earlier papers.

Appendix Table A1: Capital Gains Realizations, Tax Rate, and Equity Data

Year	Nominal Realizations ($ billions)	Weighted Average Marginal Capital Gains Tax Rate	Top Capital Gains Tax Rate	End-of-Year Equity Holdings by Households ($ billions)	Proportion of Household Equity in Mutual Funds
1954	7.0	0.173	0.25	198.8	0.030
1955	9.7	0.177	0.25	248.2	0.030
1956	9.6	0.180	0.25	271.0	0.032
1957	8.2	0.172	0.25	244.5	0.034
1958	9.3	0.173	0.25	322.3	0.039
1959	12.9	0.171	0.25	357.3	0.042
1960	11.7	0.167	0.25	359.8	0.045
1961	15.7	0.171	0.25	443.2	0.049
1962	13.6	0.168	0.25	431.2	0.046
1963	14.5	0.169	0.25	469.9	0.050
1964	17.0	0.162	0.25	544.1	0.050
1965	20.8	0.161	0.25	616.1	0.053
1966	21.8	0.162	0.25	548.3	0.058
1967	27.3	0.167	0.25	682.1	0.059
1968	35.8	0.186	0.27	815.3	0.057
1969	32.6	0.188	0.28	587.4	0.066
1970	21.3	0.195	0.30	572.5	0.066
1971	28.2	0.199	0.33	650.9	0.069
1972	36.1	0.201	0.35	813.7	0.059
1973	35.8	0.195	0.35	597.5	0.060
1974	30.0	0.195	0.35	373.4	0.070
1975	30.7	0.201	0.35	499.0	0.064
1976	39.2	0.219	0.35	637.4	0.054
1977	44.4	0.222	0.35	542.5	0.062
1978	48.9	0.227	0.34	550.3	0.062
1979	71.3	0.181	0.28	674.9	0.055
1980	70.8	0.186	0.28	894.3	0.049
1981	78.3	0.168	0.24	800.7	0.055
1982	87.1	0.148	0.20	858.3	0.063
1983	117.3	0.144	0.20	969.3	0.083
1984	135.9	0.140	0.20	898.7	0.104
1985	165.5	0.139	0.20	1106.7	0.152
1986	317.0	0.157	0.20	1394.0	0.193
1987	141.8	0.237	0.28	1359.0	0.219
1988	152.0	0.272	0.28	1619.0	0.199
1989	139.5	0.264	0.28	1942.5	0.195
1990	114.1	0.261	0.28	1778.3	0.208
1991	98.2	0.241	0.28	2554.4	0.187
1992	112.2	0.255	0.28	2895.5	0.201
1993	138.8	0.250	0.28	3190.8	0.237
1994	141.4	0.258	0.28	2990.4	0.260
1995	162.6	0.253	0.28	3994.8	0.241
1996	251.8	0.269	0.28	4528.4	0.259
1997	356.1	0.186	0.20	5333.2	0.278

1.*Wall Street Journal*, "Archer Proposes Cut in Capital-Gains Tax," July 8, 1999. The proposed rate reduction included a proportional decrease in rate for taxpayers that do not face the highest marginal tax rate.

2.Burman, Clausing, and O'Hare (1994).

3.Auten and Joulfaian (1999) provide a nice summary of the existing literature.

4.Without a doubt, a long panel data set would be preferable. However, it is not clear how many years such a panel needs to be able to separate permanent (long-run) and individual transitory effects. Burman and Randolph (1994) finesse the short length of their panel data by using state taxes as an instrument for the permanent tax rate. Auten and Joulfaian (1998), in preliminary work, use a 13-year panel with the permanent tax rate denoted as the final statutory tax rate after any phase-in.

5.Namely, higher than CBO (1998) and Auerbach (1988, 1989), but lower than Gillingham and Greenlees (1992).

6.The evidence for some strategic element to the high realizations in 1986 is strong. Burman, Clausing, and O'Hare (1994) note that many of the gains were realized at the end of 1996, after the announcement but before the tax increase.

7.Our results are close to those of Auerbach (1988) when we use the same specifications and data, but we cannot match them exactly due to data revisions in the household equity and GNP series.

8.Some of the increase in estimated elasticity is due to the sample mean tax rate rising to 19.6 percent from 17.9 percent. When evaluated at a constant (19.6 percent) tax rate, the estimated elasticity rises to -0.81 from -0.70 with the addition of the post-1985 data.

9.We considered taking the average tax rate for the year, weighted by the proportion of the year each rate was in effect. This strategy yields an estimated coefficient on the current tax rate of -4.90 (1.51), corresponding to an elasticity of -0.96. Since we expect more realizations in the second half of the year when the rate was lower, this approach would have been equally ad hoc. We are unable to weight by actual realizations since we do not know when during the year the realizations occur. However, the true elasticity probably lies between one estimated assuming all 1997 realizations occur after the tax rate change and one estimated using the time-weighted average 1997 tax rate.

10.Auerbach (1988) proposes instrumenting for the forward difference with lagged exogenous variables since the true change in rates will be a mismeasured estimate of the expectation. Our experiments with this yield qualitatively similar results with large standard errors, so we do not report them here.

11.We have also tried distinguishing between positive and negative tax changes from the prior year to the current one. The estimated coefficients are statistically indistinguishable from each other and from zero and have little effect on the variable measuring a positive tax change between the current year and the next. The estimated current gains elasticity falls to -0.43.

12.Source: Federal Reserve Board, *Flow of Funds*. See Appendix table A.

13.Dickson and Shoven (1994, 1995) provide some suggestive evidence that mutual fund managers aren't as tax efficient as they could be. They show that many mutual funds are tax inefficient, in that they realize and distribute too many capital gains. They also demonstrate that there is a potential, at least for an index fund, to be more tax efficient. Chevalier and Ellison (1997) demonstrate that there are agency problems between mutual fund managers and their fund's investors. This is not to say that individual investors are necessarily tax efficient. While Constantinides (1983, 1986) and Stiglitz (1983) demonstrate how, in the absence of transactions costs, capital gains can be avoided, Poterba (1987) and Auerbach, Burman, and Siegel (1997) show that most taxpayers are not successful at avoiding gains tax for long.

14.If we omit the insignificant "Last tax change was negative indicator" variable, the estimated coefficients on "years since most recent positive statutory tax change" and "years since most recent negative statutory tax change" are unchanged and the standard errors fall to 0.02 and 0.04, respectively.

15.Under the assumption that the average and marginal tax rates are equal, a realizations elasticity of -1 implies that capital gains tax changes are revenue neutral.

16.We will pretend, for the sake of exposition, that the rate reduction in TRA97 took effect January 1 so it was in effect for the entire calendar year.

17.If we allow the increase in realizations to raise families' tax liabilities, rather than holding their taxable income constant at 1996 real levels, the revenue loss declines to $2.0 billion.

18.TRA97 would have been revenue neutral if the realizations elasticity were -0.97, pretty close to the common rule of thumb of -1.