NBER WORKING PAPER SERIES

THE TAX ELASTICITY OF CAPITAL GAINS REALIZATIONS: EVIDENCE FROM A PANEL OF TAXPAYERS

Joel Slemrod

William Shobe

Working Paper No. 3237

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
January 1990

Helpful comments on an earlier draft were received from Alan Auerbach, Jeffrey Mackie-Mason, and Gary Solon. This paper is part of NBER's research program in Taxation. Any opinions expressed are those of the author not those of the National Bureau of Economic Research.

NBER Working Paper #3237
January 1990

THE TAX ELASTICITY OF CAPITAL GAINS REALIZATIONS: EVIDENCE FROM A PANEL OF TAXPAYERS

ABSTRACT

This paper examines a newly available six-year panel of tax return data to see what light it sheds on the tax elasticity of capital gains realizations. Panel data are a particularly valuable source of evidence for this question, because they can help to distinguish short-run from long-run effects and because they track the behavior of individuals when faced with varying tax systems. We find consistent, although not overwhelming, support for an inverse response of capital gains realizations to changes in their rate of taxation. The response to deviations from past tax rates generally exceeds the response to persistent tax changes. The estimated magnitude of the realization response is large enough to substantially mitigate the revenue loss that a tax reduction would otherwise cause and may, especially in the short run, be large enough to generate an increase in revenues. These results, however, must be qualified by their nonrobustness to specification changes along a number of dimensions and by the fact that a more general dynamic specification does not yield plausible results.

Joel Slemrod
Department of Economics
University of Michigan
Ann Arbor, MI 48109

William Shobe
Department of Economics
University of North Carolina
Greensboro, NC 27401

1. Introduction

The appropriate taxation of capital gains depends, in part, on how responsive capital gains realizations are to the tax imposed on them. For this reason, a large literature analyzing this responsiveness has sprung up, drawing primarily on aggregate time-series and cross-sectional data. In a useful survey of this literature, Auerbach (1988) concludes that the short-run responsiveness has been clearly established, but the long-run impact of taxes on capital gain realizations remains unproven. These conclusions, though, are by no means universally shared.

This paper examines a newly available six-year panel of tax return data to see what light it sheds on the tax elasticity of capital gains realizations. Panel data are a particularly valuable source of evidence for this question, because they can help to distinguish short-run from long-run effects and because they track the behavior of individuals when faced with varying tax systems. We find consistent, although not overwhelming, support for an inverse response of capital gains realizations to changes in their rate of taxation. The response to deviations from past tax rates generally exceeds the response to persistent tax changes. The estimated magnitude of the realization response is large enough to substantially mitigate the revenue loss that a tax reduction would otherwise cause and may, especially in the short run, be large enough to generate an increase in revenues. These results, however, must be qualified by their nonrobustness to specification changes along a number of dimensions and by the fact that a more general dynamic specification does not yield plausible results.

The remainder of the paper is organized as follows. Section 2 briefly reviews the historical evidence. Section 3 discusses the econometric problems that arise in micro-econometric studies, and emphasizes the potential value of panel data in dealing with these problems. Section 4 discusses the panel data set. In Section 5 we present the results of our analysis of this data, and Section 6 concludes.

2. Review of Earlier Analysis

2.1. Time-Series Analysis

Figure 1 plots the movements of real aggregate long-term capital gains realizations[1] (using the GNP deflator to convert nominal into real) from 1954 to 1985. This value grew fairly steadily until 1968. There were sharp declines in 1969 and 1970 and no sustained increases until 1976, when the real quantity of gains began to increase steadily as it has, with a pause in 1979-82, ever since. Figure 2 shows nominal realizations as a fraction of nominal GNP. This graph suggests dividing 1954 to 1985 into three periods: (i) an upward trend characterizing the period up to 1968; (ii) large declines in 1969 and 1970 followed by no growth until 1978; and (iii) rapid growth beginning in 1979, pushing the 1985 ratio of gains to nominal GNP to an all-time high. Gains in 1986, not shown on the figures, were nearly twice as high again as the previous record level set in 1985, continuing the strong upward trend.

It has been duly noted that the three periods of capital gains realizations correspond very closely to eras of capital gains taxation.[2] Slemrod and Feldstein (1978) associated the sharp decline in realizations beginning in 1970 to the increased taxation that began in that year. Feldstein, Slemrod, and Yitzhaki (1984) regarded the increase in realizations beginning in 1979 as

evidence for the response of realizations to the tax reductions that took effect in 1979 and 1981. The sharp increase in realizations for 1986 has been widely described as a reaction to the tax increase scheduled to begin in 1987. Figure 3 plots the ratio of long-term gains to GNP against a weighted average of the marginal tax rate on long-term gains computed by the Congressional Budget Office (1988). It suggests a negative relationship between gains and tax rates, although the relationship is not very tight. Of course, Figure 3 does not account for nontax influences on realizations. Time-series analyses of the whole period which do account for other influences on realizations have generally confirmed an inverse relationship between tax rates and realizations. (See, for example, Congressional Budget Office (1988) and Darby, et al. (1988)). Researchers have not, however, reached a consensus yet about whether this inverse relationship is strong enough so as to indicate an inverse relationship between capital gains tax revenues and tax rates,[3] or about whether the relationship will persist in the long run.

2.2. Cross-Sectional Analysis

Unlike the aggregate time-series evidence, the cross-sectional evidence cannot be neatly summarized as in Figures 1 and 2. For the most part, in a given year all taxpayers face the same tax schedule.[4] Therefore, the analyses of cross-sectional data have tried to associate capital gains realization behavior to where (that is, at what marginal tax rate) on this tax schedule a taxpayer is located, holding other influences constant. The cross-sectional relationship between capital gains and marginal tax rates is complicated by the problem that the capital gain itself will often push the taxpayer into a higher tax bracket, causing a positive relationship between the tax rate and realization which does not reflect a behavioral response. Because

of the endogeneity of the observed marginal tax rate, much research has focused on the relationship between capital gains realizations and either (i) the marginal tax rate that applies to the first dollar of capital gains[5] or (ii) a predictor of the last-dollar marginal tax rate that does not depend directly on the actual amount of capital gains.

Feldstein, Slemrod, and Yitzhaki (1980), hereafter FSY, investigated cross-sectional data on common stock realizations in 1973 and found a tax elasticity large enough to produce an inverse relationship between tax rate changes and revenue changes, at least for small tax changes. This conclusion was challenged by Minarik (1981, 1984) and defended in FSY (1984). Auten and Clotfelter (1982) used panel data on all capital gains (i.e., not just common stock) from 1969 to 1973 in an attempt to separately identify the transitory from the permanent response of realizations to tax changes. Their analysis indicated the presence of both types of effect and found the transitory effect to be generally larger and more often statistically significant than the permanent effect. It did not, however, strongly support an inverse relationship between revenues and tax rates.

3. Some Econometric Problems in Cross-Sectional Analysis

The econometric analysis of the tax elasticity of capital gains realizations encounters some problems which are fairly common to econometric analysis and others which are specific to the problem at hand. Auerbach (1988) has explored many of the problems as they apply to the aggregate time-series analyses. In what follows we focus on some problems of cross-sectional analysis, with an eye on the potential contribution of panel data in dealing with these problems.

3.1. A Simple Model of Capital Gains Realization Behavior

In order to provide a framework for interpreting the alternative empirical analyses, we begin by presenting a simple model of capital gains realization behavior. It is designed to capture the most important elements of this decision.

(1) $R_t = R(T_t, T_t - E_t(T_F), S_t, O_t, U_t)$

(2) $S_{t+1} = (S_t - R_t)(1 + g) + P_t$

Here R_t denotes realizations of capital gains in year t. T_t denotes the marginal tax rate on gains and $E_t(T_F)$ denotes the expected value as of year t of future marginal tax rates, so that $T_t - E(T_F)$ is (minus) the expected change in tax rates. S_t is the stock of appreciation of capital gains at the beginning of time t, O_t represents observed other influences on capital gains, and U_t represents unobserved other influences. The usual presumption is that $R_1 \leq 0$, $R_2 \leq 0$, and $R_3 \geq 0$, where R_i denotes the partial derivative of realizations with respect to the ith argument of $R(\cdot)$.

Equation (2) recognizes that the stock of realizable capital gains carried into the next year depends on current realizations. Here P_t denotes capital gains earned on assets purchase in year t, and g is the rate of increase of realizable capital gains, assumed to be constant for expositional simplicity.

3.2. Distinguishing Short-Term from Long-Term Elasticities

Much attention has been paid to whether the immediate response of realizations to a tax rate change is likely to persist over time. The framework of equations (1) and (2) helps to clarify the issues involved in sorting out the permanent from the transitory effect or, as it is sometimes referred to, the long-run from the short-run effect of capital gains taxation.

First consider the response to a change in the tax rate on capital gains that is unanticipated but perceived to be permanent. Thus by assumption the change in $T_t - E_t(T_F)$ is zero. Then the first-year impact on realizations per unit of the tax change is equal to R_1. The effect in subsequent years must be modified to account for the fact that the stock of accumulated taxable gains carried into the next year, S_{t+1}, will be different than otherwise by $(1 + g)R_1$, so that the total effect in the second year will be $(R_1 - (1 + g)R_3R_1)$, which is less (in absolute value) than R_1. In the third year the effect will be $R_1 - (1 + g)R_3 [(1 + g)R_1 + (R_1 - (1 + g)R_3R_1)]$, and so on. Thus the first-year change in realizations is dampened through time as the induced realizations affect the future stock of realizable gains.[6]

Now consider the response to an unanticipated tax change that is perceived to be temporary, so that $E_t(T_F)$ is unchanged and T_t and $T_t - E_t(T_f)$ change equally. A temporarily low tax rate is like a sale, an opportunity to realize capital gains at a low price that won't last. A temporarily high tax rate is a high price to be waited out. In this situation the immediate impact is $R_1 + R_2$, which is greater (in absolute value) than the response to the permanent tax change. What happens in the next year depends on whether the tax change turns out in fact to be temporary, and what the perceptions of future changes are. If the tax rate does in fact return to its original level, and is expected to remain at that level, the second-year impact is equal to $-(1 + g) R_3 (R_1 + R_2) > 0$, due to the changed stock of gains.

The realization response to a tax rate change may begin before it is effective, if the change is anticipated. An anticipated tax increase will cause increased realizations of $- R_2$ per unit of the tax increase and anticipated reductions will cause taxpayers to postpone realizations by R_2.[7]

The total effect of a tax rate change on realizations must consider all of these effects. The result will depend not only on the magnitude of the tax rate change, but also on to what extent it was anticipated and to what extent it is perceived to be temporary. The total revenue impact of a tax rate change must consider all of these effects and weight the induced changes in realizations by the tax rate in effect at the time of the response.

Ideally, we would like to obtain separate estimates of R_1, R_2, and R_3. This information would enable us to calculate the first-year and subsequent year effects of both permanent and temporary tax changes.

With cross-sectional data, the investigator has measures of T_t, S_t, and O_t, but does not have $T_t - E_t(T_F)$ (and, by definition, not U_t). As long as T_t is uncorrelated with $T_t - E_t(T_F)$, the estimated coefficient on T_t from a cross-sectional regression of R_t on T_t, S_t, and O_t should yield an unbiased estimate of R_1, ignoring for the moment other econometric problems. This measures the first-year response to a permanent tax change, is an overestimate of the response to a permanent tax change in subsequent years, but is an underestimate of the first-year response to a temporary tax change.

One scenario in which T_t would be uncorrelated with $T_t - E_t(T_F)$ is a long-run equilibrium where each individual's tax rate is the same as it has been for a long time and is not expected to change. In this case $T_t - E_t(T_F)$ is zero for everyone. This is not, however, a reasonable description of any given year's data. Somewhat more plausible is that the tax rate follows a random walk, so that the best (but imperfect) prediction of T_F is T_t, so that $T_t - E(T_F)$ is zero.

When T_t and $T_t - E(T_F)$ are correlated, then the estimated coefficient of T_t will be a biased estimate of R_1 equal to $R_1 + R_2\, r(T_t, T_t - E_t(T_F))$, where r denotes the correlation coefficient. Thus the direction and magnitude of

the bias depends on the correlation between T_t and $E_t(T_F)$. Consider the case where each individual has a permanent tax rate known to him or her, but that any given year's tax rate differs from the permanent rate by a random transitory component. In this case there is a positive but not perfect correlation between T_t and $T_t - E(T_F)$, because the individual expects a high tax rate to be followed by a decline to its permanent level. The estimated coefficient of T_t would then be somewhere between the first-year impact of a permanent tax change (R_1) and the first-year impact of a temporary tax change ($R_1 + R_2$).

None of these simple stories is likely to completely characterize the relationship between T_t and $E_t(T_F)$. The key message is that, in general, the estimated coefficient on T_t in a cross-section will not be an unbiased estimate of R_1 or $R_1 + R_2$. Having panel data is helpful in this respect because the availability of several consecutive years of data enables us to construct measures of how likely the current year's tax rate is to persist, that is of $T_t - E_t(T_F)$. Two alternative measures are discussed in Section 5.5 of this paper.

3.3. Distinguishing Tax From Income Effects

The income of a taxpayer may have an impact on the decision to realize capital gains, independent of the marginal tax rate. What that impact is depends on the concept of income. Real permanent income may, by affecting the taxpayer's level of risk aversion, affect portfolio behavior. Cash flow income may affect the need to sell assets for consumption. The separate effects on realizations of tax and income are difficult to identify separately in a cross-section of tax return data because of the close relationship between taxable income and marginal tax rate in a graduated income tax system. Other things being held equal, one has a higher marginal tax rate because one has higher taxable income. How is it possible then to determine whether observed

behavior is due to high marginal tax rates or the high taxable income that causes the high marginal tax rates? It would be completely impossible to determine if income and tax rate were perfectly correlated. They are not, however, perfectly correlated. First of all, taxable income differs from real annual income because of many adjustments and deductions which arguably do not reduce the measure of real income upon which economic decisions are based.[8] Second, marital status affects marginal tax rates for a given taxable income. Other factors, such as income averaging and the presence of loss carryovers, also change the relationship between taxable income and the marginal tax rate.

Panel data can help to unravel the tax elasticity from the income elasticity of capital gains in two ways. First, they can be used to construct measures of permanent real income. An average of several years' income is presumably closer than annual income to the permanent income concept which would affect economic decisions through its effect on, for example, risk aversion. It is also less correlated with the current year's tax rate, thereby minimizing the problem of collinearity. Second, panel data spanning 1979 to 1984 are particularly valuable because they include years in which the tax treatment of capital gains changed. Because of this, a taxpayer whose real income stayed completely constant would likely have experienced several different marginal tax rates over the years. The tax law changes thus add an important source of independent variation between real income and tax rates which helps to separate their effects on capital gains realizations.

3.4. Heterogeneity Bias

It is likely that realization behavior is influenced by factors that are not observed by the econometrician. In the model of equation (1) this is recognized by including U_t as an influence on R_t. For example, some individuals

are undoubetedly "churners" by nature, while others prefer to buy and hold assets. In this case the propensity to churn is unobservable. Real wealth, also unobserved, is likely to affect realizations both by its effect on S_t and its effect on risk aversion.

It is well known that the presence of unobserved explanatory variables can lead to inconsistent or meaningless estimates of parameters. In particular, if the unobserved influence on realizations behavior is correlated with any included variable, the resulting parameter estimates will be biased. If being a churner or being wealthy is correlated with income, the estimated coefficient on income will be biased, as will all other coefficients (especially those, like the tax rate, which are themselves correlated with income).

If the unobserved influences are individual-specific, it is possible with panel data to minimize or avoid the heterogeneity bias. The simplest and most commonly used specification is the fixed-effects model, in which the heterogeneity is assumed to be individual-specific and time-invariant, and to affect the level of the dependent variable but not its relationship to any independent variable. An appropriate estimator in this case, called the covariance (or "within") estimator, eliminates the heterogeneous intercept by relating the deviation from average behavior of an individual in a given year to the deviation from average of the influences on that behavior. This is discussed in more detail in Section 5.4.

4. A New Panel of Tax Returns

Since 1979, the U.S. Internal Revenue Service (IRS) has been collecting information from the tax returns of a randomly selected but unchanging group of taxpayers. This panel, known as the Continuous Work History File, was

developed for internal use, but the IRS has made this longitudinal data set available to academic researchers through a special arrangement with the Office of Tax Policy Research at the University of Michigan, in conjunction with the Arthur Young Tax Research Database. The panel now spans 1979 to 1984, with 1985 and 1986 expected soon. This panel is an unusually rich source of individual level data for those researchers interested in the effects of taxes on behavior.[9]

4.1. Characteristics of the Panel

The panel is a non-stratified random sample chosen on the basis of the last four digits of the primary taxpayer's social security number. All returns that have the selected four-digit endings are included in the sample. In 1979 through 1981 five four-digit endings were selected, resulting in sample sizes of 45,786, 46,513, and 46,675, respectively. The last three years of the panel show a substantial drop in the number of observations due to budgetary limitations at the IRS: 9235 in 1982, 19,185 in 1983, and 9783 in 1984. In 1982 and 1984 returns with only one four-digit ending were selected; in 1983 returns with two four-digit endings were included. Pooling all observations in the panel gives a sample size of 177,177. Due largely to the relatively small number of observations in 1982 and 1984, the number of individuals present in all six years of the panel is limited to 6,152 taxpayers. The information contained in each observation is a subset of the information on the standard forms filed by the taxpayer, and varies only slightly from year to year.

Attrition from the panel may occur for a number of reasons unrelated to deliberate change in the sample size, including death, a change in marital status, income below the minimum that would trigger filing, late filing, or

simply the choice of which spouse (between two married, joint filers) is listed first on the tax form (and therefore becomes the "primary" taxpayer). It is not unreasonable to suspect that a panel consisting of information from the taxpayers whose returns we can locate in all six years may exhibit some drift relative to the population as a whole. Although each year's taxpayers in the panel may be representative of the entire taxpayer population, the sampling method may cause a "survivorship bias" among those observations present in more than one year of the panel. Christian and Frischmann (1988) concluded that certain characteristics of the sample of 6,152 taxpayers present in all six years shows statistically significant variation from population averages. For example, average income is higher and married couples are more numerous. Also, the average age of members is increasing relative to the population as a whole. This survivorship bias is a source of bias in regression analysis only if the dependent variable is correlated with the probability of being in the sample. In what follows we assume that there is no such correlation.

Detailed information about capital gains realizations is available for most years of the panel. For 1981 through 1984, the net amounts of short-term gains and long-term gains are separately identified. For 1979 and 1980, only the sum of net short-term and net long-term gains, the amount of net capital gains included in adjusted gross income, and the amount of long-term capital gains excluded from adjusted gross income, are known. This is not enough information to extract short-term and long-term gains separately without making some possibly incorrect assumptions.

Although the panel data contain six consecutive years of tax return information for 6,152 tax filing units, the analysis that follows is limited to a 5% subsample of these returns, or 307 taxpayers. These are the tax-payers

who have the highest values of real positive income[10], not including capital gains, averaged over the six-year period. Focusing on the highest income taxpayers is motivated by two considerations. Note that most capital gains realizations are made by upper-income taxpayers, and most lower-income taxpayers have no realizations at all. For this panel, net capital gains of the 5% subsample of taxpayers comprise 52% of total net capital gains. They report nonzero net capital gains in 46% of the possible 1,842 (6 x 307) tax years. Compare this to the remaining 5,845 taxpayers, who realize some capital gain or loss in only 9% of the 35,070 (6 x 5845) tax years in the data.

The active realization behavior of the top 5% taxpayers reduces the potentially serious econometric problem of estimating a regression equation for which a large fraction of the observations on the dependent variable are zero. In this case a linear model of realizations is untenable and the standard assumption of a normally distributed disturbance term is clearly violated. Our focus on the top 5% allows us to maintain the linearity of the model and the normality assumption with a relatively minimal effect on our results.[11] This focus also allows us to skirt the issue of whether higher income taxpayers exhibit a different sensitivity to taxes than low-income taxpayers (see Auten and Clotfelter (1982)). This study is only about the former group, who are responsible for about half of all realizations of net capital gains.

The marginal tax rates are calculated using the tax simulator program developed at the Office of Tax Policy Research of the University of Michigan.[12] This program can calculate tax liability in any year of the panel for any set of income sources, adjustments, deductions, etc. The first-dollar marginal tax rate on long-term capital gains is computed by first determining the taxpayer's hypothetical tax liability in the absence of any capital gains,[13]

determining the tax liability if $100 of long-term gains was reported, and dividing the incremental tax liability by $100. This procedure takes full account of the impact of such special features as the alternative minimum tax, the "add-on" minimum tax, and income averaging.

In a few cases this method of calculating a marginal tax rate is problematic, and further comment is required. The Economic Recovery Tax Act of 1981 provided for a maximum tax rate of 20% on long-term capital gains realized after June 9, 1981. The maximum tax rate on gains realized in 1981 before June 9 was, in general, 40% of the marginal tax rate on ordinary income which, including the general rate reduction provided by ERTA, was 0.2765 for the taxpayers in the top bracket. Thus the marginal tax rate on gains depends on the within-year timing of the gain. Unfortunately, the data do not indicate the exact period in which realizations occurred, although whether any gains qualified for the 20% rate is known. In the absence of this information, we proceed as follows. For individuals whose marginal tax rate (call it t) on ordinary income in 1981 would, in the absence of capital gains, exceed 50%, we calculate the marginal tax rate on long-term gains to be a weighted average of 0.4 x t and 0.2, where the weights are the fraction of the year each rate was applicable. This procedure is followed regardless of whether the taxpayer realized any gains, and regardless of whether any of the gains actually realized qualified for the 20% rate.

The procedure to calculate marginal tax rates is also problematic in the presence of a loss carryover. If the carryover exceeds the loss limitation, current year tax liability would be unaffected by a small increase above zero in capital gains realizations. Thus our procedure would generate a marginal tax rate of zero. Realizing a gain does, however, increase the present value of tax payments because it reduces the amount of loss that can be offset

against other income at some time in the future. For this reason, in the presence of long-term loss carryovers we calculate the marginal tax rate to be $0.5t\ (1+r)^{-N}$, where t is the marginal tax rate on ordinary income, r is the after-tax nominal rate of interest (assumed to be 0.07 for all years),[14] and N is the predicted number of years until the loss carryover will be exhausted, equal to modulus $(\frac{C_L}{6000})$,[15] where C_L is the long-term carryover. The 0.5 factor reflects the fact that one-half of losses can be deducted against ordinary income. If there are short-term loss carryovers, these must be used up first, so that the first-dollar marginal tax rate becomes $t(1+r)^{-N}$, where N is now modulus $(\frac{C_L}{6000} + \frac{C_S}{3000})$, and C_S is the short-term carryover. N still represents the number of years in the future that a realized gain will result in a reduced loss, although in this case a long-term gain reduces the future loss dollar for dollar, so that the 0.5 factor does not apply.[16]

5. Data Analysis

5.1. The Robustness of Regression Results: A Caveat

Before proceeding to the regression analysis, it is important to mention that the estimated tax responsiveness of capital gains realizations can be quite sensitive to the exact specification of the empirical model. In fact a specification search whose sole objective was to disprove the existence of a lock-in effect could be successful, as could a specification search designed to establish a large and significant lock-in effect. In this sense the data do not speak with one voice.

In view of the sensitivity of results to specification, it is important to be clear about our procedure for reporting our results. We begin by replicating the specifications of important earlier work. Modifications are clearly

noted, and implemented only when strongly suggested by differences in data availability between the original study and ours. When we move to our own methodological innovations, we retain as much as possible of the original specification so as to isolate the impact of the innovation. In most cases it is apparent that the results are sensitive to reasonable changes in specification.[17] However, we do not claim to have conducted a systematic sensitivity analysis of the results reported here. Therefore, the robustness of our conclusions has not been established.

5.2. Replication of Feldstein-Slemrod-Yitzhaki

As a first step we replicate using the panel data a slightly modified version of the model estimated by FSY (1980). The dependent variable is long-term gains or losses divided by the sum of dividends and interest receipts.[18] The independent variables are the first-dollar tax rate on long-term gains, the logarithm of real (in 1984 dollars) adjusted gross income (AGI) net of reported capital gains plus an average amount of capital gains for a taxpayer in the appropriate income net of gains class, and the logarithm of dividends plus interest received.[19] Because the sample is already restricted to highincome individuals, the FSY exclusion of taxpayers with less than $3,000 in dividends is not followed in the base case, although we report below the sensitivity of results to a modified version of the FSY sample restriction.

The results of a pooled OLS regression covering the years 1981 through 1984 are presented in the first two columns of Table 1. The estimated coefficient on the tax rate in equation 1.1 is negative, although it is significantly different from zero only at the 90% confidence level.[20] The estimated coefficient of -4.74 corresponds to an elasticity of -1.45 when evaluated at the mean values of tax rate, realizations, and average dividends plus interest.[21]

Equation 1.2, in the second column of Table 1, shows that further restricting the sample to taxpayers who averaged more than $3,000 in real dividends plus interest over the period 1979-84 slightly reduces the absolute value of the tax rate coefficient, to the point where it fails the 90% confidence test. Changing the sample in this way also has a large impact on the estimated effect of both income and dividends plus interest, increasing the coefficients on both variables. The estimated tax responsiveness of capital gains realizations in equations 1.1 and 1.2 is quite a bit smaller than that estimated by FSY using data from 1973 for common stock only.[22] This is undoubtedly due in part to the coverage of all assets in this data, as other evidence suggests that realizations of common stock are more sensitive to taxation than other assets. (See U.S. Treasury, 1985, p. 164) It is also probably due in part to the coverage of different years, as Auten (1982, p. 4-10) has found that the estimated tax elasticity of common stock realizations is higher for 1973 data than for adjacent years.

In order to include the experience of 1979 and 1980, the analysis was rerun over the period 1979 through 1984. This required using as the numerator in the dependent variable the amount of capital gains included in adjusted gross income, since long-term gains were not available separately for 1979 and 1980. The estimated tax coefficients, shown in the third and fourth columns of Table 1, indicate a larger responsiveness of capital gains realizations for the full sample and a similar responsiveness when the sample is restricted.[23]

5.3. Replication of Auten-Clotfelter

Because it examines only contemporaneous influences on realization behavior, the pooled cross-section analysis reported above does not exploit the potential of panel data to separately identify the short-run and long-run

effects of tax policy. This is possible using the panel because several years' data help the researcher identify when tax rates (and income) are temporarily low or high.

We begin by estimating a regression equation similar to one estimated by Auten and Clotfelter (1982), henceforth A&C. In particular, a new variable (called the "permanent" tax rate in year t by A&C) is defined as the average of observed tax rates in years t, t-1, and t-2. The "transitory" tax rate is then defined as the difference between the tax rate in time t and the permanent tax rate. Permanent and transitory income are defined in an analogous way. Transitory and permanent measures of both income and tax rate, plus some other independent variables including year dummies, are then included in a pooled cross-sectional regression analysis.

With this formulation, the predicted path of response to a persistent unit change in tax rates is $\frac{2}{3}\beta_T + \frac{1}{3}\beta_P$ in the first year, $\frac{1}{3}\beta_T + \frac{2}{3}\beta_P$ in the second year and β_P in all subsequent years, where β_T is the estimated coefficient on the transitory tax rate and β_P is the estimated coefficient on the permanent tax rate. The response to a one-year change in the tax rate would be $\frac{2}{3}\beta_T + \frac{1}{3}\beta_P$ in the year of the change, $\frac{-1}{3}\beta_T + \frac{1}{3}\beta_P$ in the second and third years, and zero thereafter.

Note that although the term "permanent" implies something about the future course of tax rates, the A&C measure of permanent tax rate is entirely backward looking. Thus, if it is meant as a forecast of future tax rates, it does not account for information available to the taxpayer other than the past average of tax rates that would help forecast the future course of tax rates. It may be a reasonably good forecast if each taxpayer is endowed with an unchanging permanent tax rate, around which there are temporary disturbances.

The procedure implies that all changes in an individual's tax rate cause a gradual updating of taxpayers' expectations about future tax rates, regardless of the circumstances surrounding the change in the tax rate. Given this model of the formation of expectations, the coefficient on the transitory tax rate is an estimate of $R_1 + R_2$ and the coefficient on the permanent tax rate is an estimate of R_1. Thus the difference between the two coefficients is an estimate of R_2, or the response to anticipated changes in tax rates.

Table 2 displays the results of keeping the same dependent variable as above and using a slightly modified version of the A&C independent variables. The results of estimating equations 3.1 and 3.2 suggest that there is both a permanent and transitory negative impact of capital gains taxes on long-term gains, with the transitory effect exceeding the permanent effect in magnitude. The estimated coefficient on the permanent effect is never significantly different than zero at a 95% level of confidence. According to equation 2.1, the transitory effect is more than 50% greater than the size of the permanent effect, though the latter is still large. The first-year response to a tax change has an elasticity of -2.38 and the long-term response to a persistent tax change has an elasticity of -1.75. When, in equation 2.2, the sample is restricted to high capital income recipients, both the permanent and transitory effects are much lower (a first-year elasticity of -0.99 and a long-run elasticity of -0.89) and neither is significantly different from zero.

These results are broadly consistent with the results reported by Auten and Clotfelter, who found a large and statistically significant transitory tax effect and a smaller and insignificant permanent tax effect. The two sets of results are not directly comparable, however, becauae A&C investigated four different dependent variables. Equations 2.3 and 2.4 replicate A&C's equation 2.3, where the dependent variable is the ratio of long-term gains or losses to

income net of included capital gains. As in A&C, the sample is restricted to those cases where the denominator exceeds $5,000. In this case only the estimated permanent tax effect is negative and significantly different from zero, while the transitory effect is negative but not significantly different than zero. Thus these results have quite different implications than both equations 2.1 and 2.2 and what A&C found.

5.4. Eliminating Heterogeneity Bias: The Covariance Estimator

As mentioned in Section 3.3, taxpayers may differ in unobserved ways that affect realization behavior and which are correlated with observable explanatory variables such as age, income, or tax rate. This heterogeneity, if not accounted for, can seriously bias the estimated coefficients.

Under the assumptions that (i) the unobserved propensity to realize gains differs across individuals but stays constant over time for a given individual and that (ii) it affects the level of realizations, but not the responsiveness of realizations to tax rate or other factors, a simple procedure exists for correcting the potential heterogeneity bias. Instead of relating each individual's annual realization behavior to that year's tax rate (T_{it}), income (Y_{it}) and other factors (D_{it}), the procedure relates the individual's annual realization behavior relative to his average realization behavior to that year's tax rate relative to his average tax rate, income relative to his average income, etc. In symbols, while the OLS regression equation is

$$(3) \quad G_{it} = a_o + e_i + a_1 T_{it} + a_2 Y_{it} + a_3 D_{it} + u_{it},$$

where e_i is the unobservable individual effect, instead one estimates

$$(4) \quad G_{it} - \bar{G}_i = (e_i - \bar{e}_i) + a_1 (T_{it} - \bar{T}_i) + a_2 (Y_{it} - \bar{Y}_i) + a_3 (D_{it} - \bar{D}_i) + (u_{it} - \bar{u}_i),$$

where a bar indicates an across-year average for a given individual. Since,

by assumption, e_i does not vary over time, e_i equals e_i and thus the first term of the right-hand side of expression (4) is equal to zero. The point is that while individual-specific effects may contaminate cross-individual estimates of the level of capital gain realizations, they will not contaminate estimates of year-to-year variations in individual behavior.

Table 3 presents the results of applying the covariance estimator to the same four specifications represented by equations 1.1 through 1.4.[24] The estimated influence of income is not much changed from Table 1, with a significant negative effect found only in equation 3.1. The estimated impact of dividends and interest on realization behavior does change, though, with a significant positive effect on realizations in all four equations. This suggests that there exists an unobserved personal characteristic, correlated with dividends and interest receipts, that affects realization behavior. Morever, its effect on realization behavior is of the opposite sign to its correlation with dividends and interest, thus causing a spurious negative bias to the estimated coefficient on dividends and interest in the pooled cross-sectional results.[25]

Of principal interest are the tax rate coefficients in the covariance estimator. In three of four equations, the tax rate coefficient is larger in absolute value than its counterpart in Table 1, and in one case (equation 3.3), it is only slightly smaller. In all cases the tax rate coefficients lie within one standard deviation of the other. This suggests that the negative tax rate coefficients of Table 1 are not the result of heterogeneity bias inherent in the pooled cross-sectional analyses. To the extent that bias exists, it appears to make the coefficients smaller in absolute value.

This conclusion must be qualified, though, for at least two reasons. First, the information content (signal to noise ratio) of the deviations from

individual means may be lower than the information content of differences across individuals. Consider, for example, real income. Differences across individuals in adjusted gross income (AGI) net of capital gains are likely to reflect differences in real income. However, the change in a given taxpayer's AGI from one year to the next is unlikely to be as highly correlated with changes in real income, and may reflect in part voluntary tax-motivated timing decisions. Similarly, differences across individuals in dividend and interest receipts may be highly correlated with wealth differences, but year-to-year changes probably are more reflective of portfolio shifts than wealth changes. As Solon (forthcoming) has emphasized, the covariance estimator may, be reducing the signal-to-noise ratio of some explanatory variables, worsen the overall bias of estimates by exacerbating the errors-in-variables bias at the same time as it alleviates omitted variables bias.

Furthermore, the correct interpretation of the tax rate coefficient obtained from the covariance estimator may differ from the interpretation of the coefficient from the OLS estimator. For example, assume that each taxpayer has a permanent tax rate, from which there are transitory annual deviations. In this case there is a perfect correlation between the tax rate variable and the omitted $T_t - E_t(T_P)$ variable, and the estimated coefficient of T_t should be interpreted as an estimate of $R_1 + R_2$, or the first-year realization response to a temporary tax change. Thus another explanation for the observed negative tax coefficients from the covariance estimator is that the effect of eliminating heterogeneity bias is offset by the tendency for the coefficient to now measure the (greater) response to a temporary tax change.

5.5. General Models of Expected Future Tax Rates

Our next step was to examine more general specifications of how expectations of future tax rates are formed. Two alternatives were investigated. In

the first, the actual realized value of the next year's tax rate is used as the measure of its expected value in the current year. This procedure is exactly correct if taxpayers are endowed with perfect foresight. In the absence of perfect foresight, it has the advantage of accounting for the information about the future course of tax rates that is known to the taxpayer but unobserved by the econometrician. Its disadvantage is that the taxpayer's forecast error will be correlated with the realized future tax rate, thus imparting bias to the estimated coefficients. In the second procedure we estimate a model of the next year's tax rate, using as explanatory variables current and past values of factors that may influence expectations. This procedure eliminates the problem of bias, but it undoubtedly sacrifices much predictive power because it relies only on values observed in the data set, whereas any given taxpayer undoubtedly possesses much more information about his or her own situation that would help to predict future tax rates.

Unfortunately, both procedures yielded results that are inconsistent with the theory of realizations. In particular, the point estimate of the coefficient on $T_t - E_t(T_F)$ is always positive, although in theory it should be negative. In most specifications the positive coefficient is not, however, significantly different from zero.

The failure of more general representations of the formation of expectations of future tax rates to yield plausible results casts doubt on the interpretation of the Auten and Clotfelter estimates of the short-run and long-run impact of taxes. At a minimum, it highlights the value of further research based on developing dynamic models of realizations behvior that carefully treat the formation of expectations.

6. Conclusions

The analyses reported here provide consistent, although not overwhelming, support for an inverse response of capital gains realizations to changes in their rate of taxation. Although the point estimates indicate an elasticity of response that often exceeds one, in many cases the standard errors of the estimates are high enough so that the coefficients are not, in a statistical sense, significantly different from zero. This estimated response does not appear to be the result of heterogeneity bias. The response to deviations from past tax rates generally exceeds the response to persistent tax changes. The estimated magnitude of the realization response is large enough to substantially mitigate the revenue loss that a tax reduction would otherwise cause and may, especially in the short run, be large enough to generate a revenue increase.

A number of important caveats must be attached to these conclusions. First of all, they are based on an analysis of the behavior of only 307 upper-income taxpayers over a six-year period. Second, it is clear that the estimated tax elasticity of capital gains realizations is extremely sensitive to many dimensions of specification. Some empirical specifications, which are perfectly consistent with economic theory, do not support the presence of a lock-in effect. Other specifications point to a lock-in effect even greater than those reported here. The fragility of these results suggests great caution in drawing policy conclusions from these and similar exercises. Finally, our failure to obtain sensible results from some initial attempts to model a more general dynamic specification makes clear that more research is needed to identify the short-run and long-run response of capital gains realizations to taxation.

Table 1

FSY REPLICATION RESULTS

	Eq. 1.1	Eq.1.2	Eq. 1.3	Eq. 1.4
Method of Estimation	OLS	OLS	OLS	OLS
Sample	Full Sample	High Capital income only	Full Sample	High Capital income only
Period	1981-4	1981-4	1979-84	1979-84
Dependent Variable	LGDI	LGDI	IGDI	IGDI
Independent Variables				
TFD	-4.74 (3.32)	-3.99 (3.39)	-5.58 (1.62)	-1.46 (1.07)
LNAGI	-0.639 (0.176)	-0.0565 (0.159)	-0.186 (0.0901)	-0.0441 (0.0531)
LNDI	0.0874 (0.0851)	0.315 (0.168)	0.0735 (0.370)	(0.119) (0.0437)
AGE	-0.728 (0.553)	-0.714 (0.493)	-0.237 (0.245)	-0.225 (0.142)
Intercept	8.27 (1.93)	-0.803 (2.11)	2.81 (0.950)	-0.0108 (0.629)
Mean of dependent variable	0.858	0.665	0.278	0.286
Number of observations	1228	700	1842	1050
R^2	0.0126	0.00902	0.0157	0.0112

Variable Definitions:

LGDI: Long-term gains or losses divided by the sum of dividends and interest received
IGDI: Capital gains included in AGI divided by the sum of dividends and interest received
TFD: First dollar marginal tax rate on long-term capital gains
LNAGI: Logarithm of real AGI minus actual included capital gains plus average capital gains
LNDI: Logarithm of real dividends plus interest
AGE: Equal to one if an age exemption is taken between 1979 and 84; zero otherwise

Note: Standard errors in parentheses.

Table 2

AUTEN & CLOTFELTER REPLICATION RESULTS

	Eq. 2.1	Eq.2.2	Eq. 2.3	Eq. 2.4
Method of Estimation	OLS	OLS	OLS	OLS
Sample	Full Sample	High Capital income only	Full Sample, Income net of CG>5000	High Capital income only, Income net of CG>5000
Period	1981-4	1981-4	1981-4	1981-4
Dependent Variable	LGDI	LGDI	LGIN	LGIN
Independent Variables				
TFD-AVG	-5.84 (4.56)	-2.67 (4.61)	-1.40 (0.385)	-1.57 (0.611)
TFD-TRA	-9.32 (5.35)	-3.53 (5.47)	-0.325 (0.449)	-0.269 (0.719)
LNAGI-AVG	-0.183 (0.241)	-0.153 (0.213)	0.0591 (0.0376)	0.0307 (0.0564)
LNAGI-TRA	-1.00 (0.242)	0.0116 (0.224)	0.0392 (0.0728)	0.0540 (0.107)
LNDI	0.0406 (0.0850)	0.335 (0.171)	0.0263 (0.00698)	0.0764 (0.0224)
AGE	-0.666 (0.550)	-0.716 (0.496)	(0.0547) (0.0433)	0.00364 (0.0609)
CARRY	6.87 (1.68)	-0.240 (1.99)	0.195 (0.135)	0.230 (0.240)
D81	-0.694 (0.530)	-0.748 (0.594)	-0.00385 (0.0418)	-0.0174 (0.0725)
D82	-0.219 (0.526)	-0.931 (0.590)	-0.0214 (0.0415)	-0.0846 (0.0722)
D83	-0.0827 (0.525)	-0.817 (0.585)	0.0118 (0.0413)	-0.00256 (0.0715)
Intercept	3.80 (2.51)	0.495 (2.45)	-0.567 (0.390)	-0.647 (0.553)

Table 2 continued

Mean of dependent variable	0.858	0.665	0.0755	0.120
Number of observations	1228	700	1210	683
R^2	0.0423	0.0142	0.0347	0.0423

Variable Definitions: (See notes to Table 1 for other variables)

LGIN: Long-term gains or losses divided by AGI net of included capital gains

TFD-AVG: average TFD of current year and two previous years

TFD-TRA: difference between current TFD and TFD-AVG

LNAGI-AVG: average LNAGI of current year and two previous years

LNAGI-TRA: difference between LNAGI and LNAGI-AVG

CARRY: equal to one if loss carryforward is present; equal to zero otherwise

D81, D82, D83: dummy variables for 1981, 1982, and 1983 observations, respectively

Table 3

COVARIANCE ESTIMATOR OF FSY MODEL

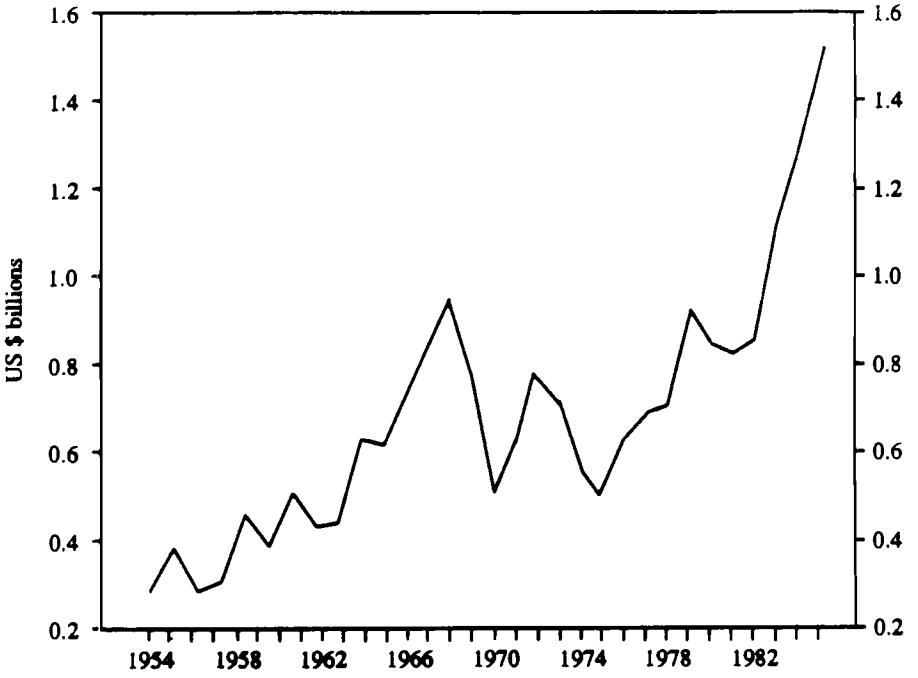
	Eq. 3.1	Eq.3.2	Eq. 3.3	Eq. 3.4
Method of Estimation	CV	CV	CV	CV
Sample	Full Sample	High Capital income only	Full Sample	High Capital income only
Period	1981-4	1981-4	1979-84	1979-84
Dependent Variable[a]	LGDI	LGDI	IGDI	IGDI
Independent Variables[a]				
TFD	-7.65 (4.62)	-5.07 (5.36)	-5.13 (2.10)	-1.73 (1.45)
LNAGI	-0.907 (0.247)	0.0537 (0.253)	-0.328 (0.119)	-0.00453 (0.0732)
LNDI	0.873 (0.200)	2.08 (0.372)	0.322 (0.0768)	0.440 (0.0776)
Number of observations	1228	700	1842	1050
R^2	0.0399	0.0761	0.0223	0.0434

See notes to Table 1.

[a]All the variables are measured as deviations from individual means.

FIGURE 1

REAL LONG TERM CAPITAL GAINS ($billion), 1954-1985



Note: Gains are expressed in 1985 dollars, using the GNP deflator to adjust the units. See text for the precise definition of long-term gains.

FIGURE 2

THE RATIO OF LONG-TERM REALIZATIONS TO GNP (x 10^4), 1954-1985

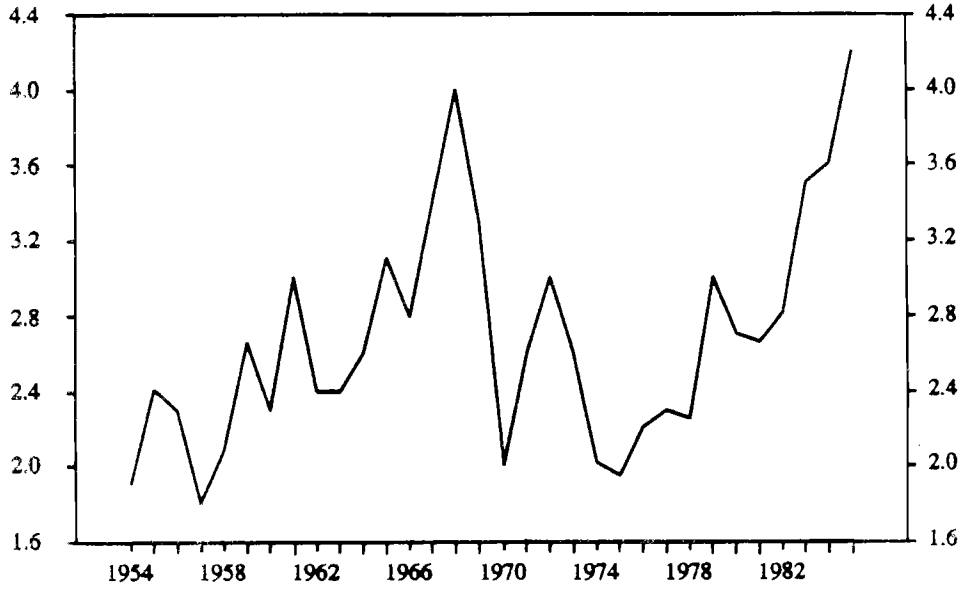
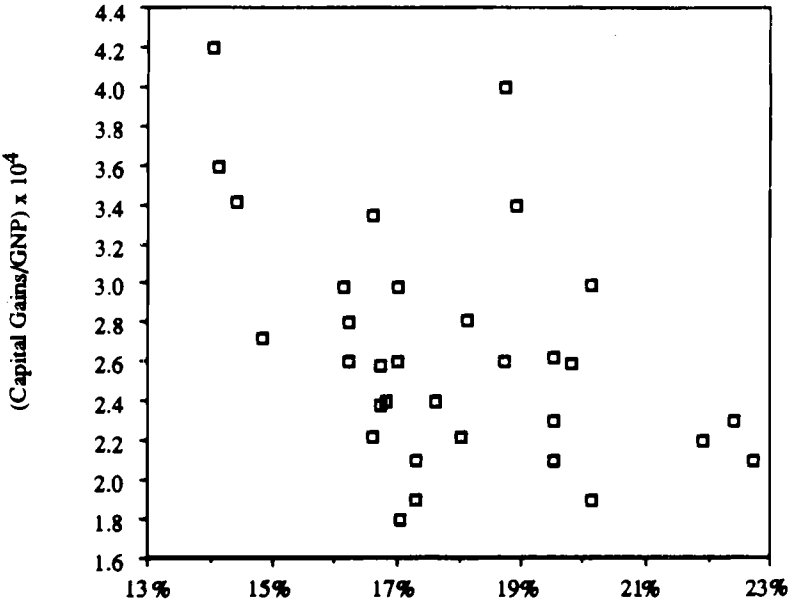


FIGURE 3

LONG-TERM CAPITAL GAINS TO GNP RATIO, PLOTTED AGAINST AVERAGE MARGINAL TAX RATE

1954-1985



Data Source: Auerbach (1988).

FOOTNOTES

1. The precise measure of long-term gains is long-term gains net of short-term losses, plus long-term gains appearing directly on form 1040.

2. Eyeballing Figure 1 suggests that the recent period of growth began in 1976. Figure 2 suggests 1979 as the beginning of the third phase.

3. Broadly speaking, this would require the percentage response of realizations to exceed the percentage tax cut. For example, to increase revenues a reduction in tax rate from 20% to 18% would have to cause a more than 10% increase in realizations. This criterion does not account for the difference between average and marginal tax rates nor does it consider the revenue impact of shifts in the timing of realizations between high-tax and low-tax periods.

4. There are exceptions to this statement. The effective tax schedule depends on, for example, the taxpayer's marital status, the presence of loss carry-overs, and the use of income averaging.

5. The "first-dollar" marginal tax rate will itself be endogenous if when taxpayers realize capital gains they also undertake other actions (i.e., incur tax shelter losses) that lower their marginal tax rate.

6. This phenomenon is stressed by Kiefer (1988).

7. Anticipation of the tax increases beginning on January 1, 1987 are the probable cause of the enormous increase in realizations in 1986, and speculation concerning George Bush's proposal to reduce the tax rate on capital gains has probably reduced realizations in 1988 below what they otherwise would have been. Perhaps in an effort to reap the revenue consequences of these anticipation effects, the Congress advertised the tax increase of 1987 well in advance of its effective date. To avert immediate revenue losses, the effective date of the tax reduction of 1981 was made retroactive to June 9, 1981, the date when discussion of this proposal began in earnest.

8. If these adjustments represent factors which themselves affect realizations behavior (e.g., extraordinary medical expenses which precipitate realizations), then the imperfect correlation eliminates the problem of collinearity but introduces a bias if these factors are omitted from the regression analysis.

9. A more detailed treatment of the sampling and linking methodology is contained in Slemrod (1988).

10. "Real" means that income is deflated by the CPI before averaging, using 1984 dollars as the benchmark. "Positive" means that sources of income which have negative values are counted as zero. This procedure is followed because of our suspicion that negative taxable income flows are not indicative of low real income, but instead often reflect tax considerations.

Note that the sampling rule does not directly depend on capital gains realization behavior. If, however, taxpayers simultaneously choose their capital gains realizations and other income sources, then the probability of being in the sample is not independent of capital gains behavior.

11. Note that because net losses are observed, the value of the dependent variable for which the bunching occurs (zero) does not represent an extreme value.

12. The calculator was developed by the authors in collaboration with Joseph Daniel.

13. Capital gains on principal residences and installment sales were not eliminated for the purpose of this calculation, on the ground that these are not likely to be subject to a lock-in effect.

14. Over the period 1979 to 1984, the average interest rate on 6-month Treasury bills was 0.108. Assuming a 35% marginal tax rate yields an after-tax rate of interest slightly over 0.07.

15. Modulus $\left(\frac{C_L}{6000}\right)$ equals zero when C_L is less than \$6,000, equals one when $12{,}000 > C_L > 6{,}000$, etc.

16. A similar problem exists for the small number of taxpayers who report credits that exceed tax liability--our procedure would generate a marginal tax rate of zero, even though additional realizations would increase the present value of tax liabilities. In this case, because the stock of usable credits is unknown, we calculate the marginal tax rate resetting the credit to be equal to the current tax liability.

17. The regression analyses that follow consistently find a large negative impact of tax rates on realizations, although the standard errors are often so large that the coefficients are not significantly different from zero. This result is not supported when either of the following changes are made: (i) 1984 is eliminated from the sample, (ii) the marginal tax rate is calculated at a point including actual short-term gains or losses, or including an average amount of long-term gains or losses based on the sample of 307 taxpayers. The result is robust to other changes such as (i) eliminating outliers from the sample, (ii) eliminating year dummies from the vector of explanatory variables, or (iii) redefining the income variable in incremental ways.

18. In FSY the numerator of the dependent variable is long-term gains or losses on common stock only and the denominator is dividends received. The panel data do not specify the type of asset, so that the FSY analysis of common stock transactions cannot be exactly replicated. The denominator, intended as a measure of wealth, is accordingly expanded to encompass a somewhat wider range of assets.

19. In a case where this value is nonpositive, we assign its logarithm a value of one.

20. Note, however, if there are fixed effects the estimated standard error is inconsistent because of the presence of serially correlated errors.

21. Thus the value of the dependent variable used to calculate the elasticity is the ratio of the means of the numerator and denominator, not the mean of the ratios. This is the appropriate procedure to use when one is ultimately interested in the value of the numerator, which in this case is capital gains.

22. Note that because, the data is drawn from a non-stratified random sample, the suggestion of Minarik (1984) to use a weighted least-squares estimating technique, disputed by FSY (1984) and Auerbach (1988), is not relevant here.

23. Because during this period only 40% of long-term gains were included in taxable income, the same responsiveness of long-term realizations to tax rates (and no response of short-term realizations) would show up as a tax coefficient that was 40% as large as the coefficients in equations 1.1 and 1.2. In fact, the tax rate coefficient in equation 1.3 is greater than that in equation 1.1, though the coefficient in equation 1.4 is approximately 40% of the coefficient in equation 1.2. The estimated elasticity evaluated at the means is -3.23 for equation 1.3 and -0.87 for equation 1.4, compared to -1.45 and -1.26 in equations 1.1 and 1.2, respectively.

    Changing the numerator of the dependent variable to gains included in AGI eliminates large losses from consideration, as the loss in AGI cannot exceed $3,000. This may be appropriate if losses do not respond to taxation in the same way gains do.

24. The AGE dummy variable does not appear because it takes the same value for a given taxpayer in every year.

25. We also applied the covariance estimator to the Auten and Clotfelter specifications of equations 2.1 and 2.2. The effect on the results is broadly similar to what was the case for the FSY specification. The negative tax rate coefficients increase in absolute value, although they are not significantly different from zero when the sample is restricted to high capital income taxpayers. As in the FSY case, the estimated coefficient on LDI increases substantially.

REFERENCES

Auerbach, Alan, "Capital Gains Taxation in the United States: Realizations, Revenue, and Rhetoric--A Review," Brookings Papers on Economic Activity, forthcoming.

Auten, Gerald, "Estimation of the Effects of Capital Gains Taxes on the Realization of Capital Gains," Final report prepared for the U.S. Department of the Treasury, Office of Tax Analysis, 1982.

Auten, Gerald and Charles Clotfelter, "Permanent Versus Transitory Tax Effects and the Realization of Capital Gains," Quarterly Journal of Economics 97 (November 1982), pp. 613-632.

Christian, Charles and Peter Frischmann, "Survivorship Bias in the Statistics of Income Individual Panel Tax Data," Unpublished manuscript, Arizona State University, June 1988.

Congressional Budget Office, How Capital Gains Tax Rates Affect Revenues: The Historical Evidence, March 1988.

Darby, Michael, Robert Gillingham, and John S. Greenlees, "The Direct Revenue Effects of Capital Gains Taxation: A Reconsideration of the Time-Series Evidence," Treasury Bulletin, June 1988.

Feldstein, Martin, Joel Slemrod, and Shlomo Yitzhaki, "The Effects of Taxation on the Selling of Corporate Stock and the Realization of Capital Gains,: Quarterly Journal of Economics 94 (June 1980), pp. 777-791.

Feldstein, Martin, Joel Slemrod, and Shlomo Yitzhaki, "The Effects of Taxation on the Selling of Corporate Stock and the Realization of Capital Gains--Reply," Quarterly Journal of Economics 99 (February 1984), pp. 111-120.

Kiefer, Donald, "The Capital Gains Response to a Tax Rate Change: Is it Overestimated? Congressional Research Service Report, March 18, 1988.

Minarik, Joseph, "Capital Gains," in Henry J. Aaron and Joseph A. Pechman (eds.) How Taxes Affect Economic Behavior, (Washington, D.C.: The Brookings Institution), 1981.

Minarik, Joseph, "The Effects of Taxation on the Selling of Corporate Stock and the Realizations of Capital Gains: Comment," Quarterly Journal of Economics 99 (February 1984), pp. 93-110.

Slemrod, Joel, "The 1979-84 Linked Panel of Tax Return Data: Sampling and Linking Methodology," unpublished manuscript, The University of Michigan, November 1988.

Slemrod, Joel and Martin Feldstein, "The Lock-In Effect of the Capital Gains Tax: Some Time Series Evidence," Tax Notes (August, 1978), pp. 134-135.