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CAPITAL GAINS TAXES AND REALIZATIONS: EVIDENCE FROM INTERSTATE COMPARISONS

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ABSTRACT

Despite numerous studies of the relation between income taxes and capital gains realizations, the revenue consequences of reducing capital gains tax rates remain unclear. However, an important source of cross-sectional variation has been neglected in this line of research: since both the tax base and the tax rate vary among states, the marginal tax rate on capital gains differs among otherwise identical individuals located in different states. The interstate variation in the tax consequences of realizing capital gains implies that the incentive to realize gains varies across states.

This paper documents the interstate variation in capital gains taxation and examines the relation between capital gains taxes and aggregated state-level realizations. For each state, we construct marginal tax rates on capital gains for the highest state income tax bracket for 1982 through 1990. Using state-level aggregated data rather than data on individual taxpayers alleviates the problem that the marginal tax rate is endogenous to the amount of capital gains realized. Panel estimates indicate that capital gains realizations are negatively related to capital gains tax rates. The estimated elasticity is smaller than that found by most researchers using panel data, with a point estimate of - 0.67 in our basic specification.

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1. Introduction

Over the last decade, few issues in Federal tax policy have been as controversial as the relation between capital gains tax rates and revenues. Despite extensive research, the debate continues as to whether cutting the tax rate on capital gains increases or decreases revenues. Since capital gains are taxed only upon realization, a crucial component of this debate is the extent to which higher tax rates discourage the realization of capital gains. Previous research on the realization question has used a variety of econometric approaches, including the analysis of aggregate time-series data and individual cross-sectional and longitudinal data. However, most research has neglected an important source of variation in taxpayers' marginal tax rates; namely, in addition to Federal income taxes, many taxpayers pay state income taxes on realized capital gains.[1] This paper remedies this omission by examining the relation between aggregate state-level capital gains realizations and the marginal tax rate on capital gains in the 50 states (plus Washington, D.C.) between 1982 and 1990.

The incentive effects of state income taxes cannot be ignored after the sweeping changes in Federal tax rates in the 1980s. While the marginal Federal income tax rate for the highest income households fell from 70 percent in 1980 to 28 percent (ignoring the "bubble") in 1990, states have increased their reliance on income taxes.[2] The reduction in Federal tax rates has drastically increased

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[1] The most prominent exceptions to this rule are Auten, Burman, and Randolph (1989) and Burman and Randolph (1992), who include state tax information in their analyses of a panel of individual taxpayers. Auten et al. (1989) find little evidence that state tax systems are an important source of variation. One reason for this finding is that during the time period they analyze (1979-1983) state income tax rates were much lower compared to Federal income tax rates than was the case by the late 1980s. Burman and Randolph (1992) use the top combined state and Federal tax rate as an instrument to help identify permanent and transitory effects of tax rate changes.

[2] Though states have increased their reliance on income taxes, they have not necessarily increased marginal income tax rates. See Gold (1991) for a summary of recent changes in state government finances.

the share of the total marginal income tax rate that arises from state income taxes. For example, for a taxpayer facing a 5 percent marginal state income tax rate and a 70 percent Federal income tax rate in 1980, the state tax system only accounted for 2 percent (0.6%/28.6%) of the marginal capital gains tax rate.[3] By 1990, the same 5 percent state income tax rate (with no exclusion for long-term capital gains at either the state or Federal level) constituted 11.4 percent (3.6%/31.6%) of the total tax rate. This growth in the relative importance of state taxes suggests that individuals may now pay more attention to the incentive effects of state taxes.

There are three reasons for focusing on the variation in the total tax rate on capital gains induced by state tax rates. First, the interstate variation in tax rates is as large as some proposals for reducing the Federal tax on capital gains. That is, an individual moving from a state with a high income tax rate to a state without an income tax experiences a decrease in the total marginal tax rate on capital gains income of the same order of magnitude as some proposed reforms of Federal tax policy.[4] Second, assuming that individuals do not make location decisions solely on the basis of state income tax rates and that the rate on capital gains is not the determinant (at the margin) of state tax rates, the state tax rates can be treated as an exogenous source of variation. Third, the fact that states do not often make drastic changes to their tax systems (see Gold, 1991) implies that the relative tax rates in different states are a "permanent" difference. The identification of permanent, rather than transitory, effects of tax rate differences has been a major controversy addressed by previous research.

Following most of the previous literature, we focus on estimating the elasticity of capital gains

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[3] After Federal deductibility and assuming that 60 percent of the capital gain is excluded, the state tax increases the total tax rate from 28 percent to 28.6 percent (i.e., 0.70*(1-0.6) + 0.05*(1-0.6)*(1-0.70)). Therefore, the state tax system adds 0.6 percentage points, which is 2 percent of the total tax rate. For non-itemizers, the state tax system would account for 6.6 percent of the total tax rate in 1980 and 15.2 percent in 1990. Assuming that most capital gains are realized by itemizers is consistent with all available evidence.

[4] In 1990, the total state and Federal marginal tax rate on capital gains income ranged from 28 percent to 35.2 percent, a range of 7.2 percentage points. A recent proposal to exclude 30 percent of some capital gains income would result in these capital gains being taxed at a rate of 19.6 percent at the Federal level, a decrease of 8.4 percentage points.

realizations with respect to the marginal tax rate on capital gains income. The issue receiving the most academic and popular interest has been whether this elasticity is larger or smaller than 1 in absolute value. The elasticity is expected to be negative, since the marginal tax rate represents a price of realizing capital gains. An elasticity less than -1 implies that decreasing the capital gains tax rate would result in an increase in realizations sufficient to increase revenue from capital gains taxation, while an elasticity greater than -1 implies the opposite.[5] We find that the elasticity equals -0.67 in our basic specification (all returns 1982-1990, random effects model) and is greater than -1 at the 2 percent significance level. Since several alternative specifications do not allow rejection of an elasticity less than -1 at a 5 percent significance level, we cannot categorically reject the hypothesis that reducing capital gains tax rate will increase revenue collected from capital gains taxes. It is important to emphasize that our findings, like those in the bulk of the literature, are reduced form in nature. Structural interpretations of the estimated coefficient on the tax rate may be inappropriate.

The paper proceeds as follows. Section 2 discusses the advantages and disadvantages of using state-level aggregate data relative to previous approaches. Section 3 describes our data and the construction of marginal tax rates for each state and year. Section 4 presents our econometric results along with sensitivity analysis and implications for tax policy. Section 5 concludes.

2. The Advantages of State-level Analysis

Since recent papers (for example Auerbach, 1988; Auten, Burman, and Randolph, 1989; and Auten and Cordes, 1991) provide excellent surveys of the debate on capital gains tax rates and

[5] This so-called "static revenue calculation" is arguably not the most important issue for considering a change in the capital gains tax rates. For example, a permanent decrease in capital gains tax rates is likely to induce investors to adjust their portfolios to include more assets yielding capital gains. This will have implications for both the amount of capital gains taxes collected and the amount of income taxes collected, not to mention the effects on capital market equilibrium. See Cook and O'Hare (1987) or Auerbach (1988) for a discussion of some of these issues.

revenues, we only briefly review previous research. The two main previous empirical approaches are analyzing aggregate time series data and analyzing either a single cross-section or panel of individuals. While no single approach is likely to yield universally accepted results, we argue that several pitfalls associated with earlier techniques are avoided by using state-level aggregate data.

Analyzing aggregate time series of capital gains realizations has two advantages over analyzing data on individual taxpayers. First, time series data are available for a longer period of time than individual data. Second, since the variation in tax rates used in the aggregate time series regressions is primarily from legislated changes in the tax system, one can interpret the coefficient on the tax rate as representing taxpayers' response to a permanent change in the tax rate. The disadvantages of aggregate time series analysis of realizations include: (1) compressing a complex tax system into a single tax rate for each year; (2) defining a parsimonious specification of other variables that might affect the level of realizations; and (3) overcoming common problems in time series analysis (e.g., nonstationarity, expectations about future tax rates, and aggregation bias). The typical time series study estimates an elasticity between -0.5 and -0.9 (Auten and Cordes, 1991), with a range of estimates from -0.06 to -1.51 (Auten, Burman, and Randolph, 1989).

Data on individuals have their own advantages and disadvantages. Data on individual households allow for a much richer model of other characteristics that might affect realizations behavior (such as age or personal wealth). Unlike time series data, data on individuals do not require restrictive aggregation assumptions. Also, it is possible to measure the tax rate facing each household rather than having a single rate for each year. With longitudinal data (panel data), it is possible to distinguish between "temporary" and "permanent" behavioral changes, due to the ability to separate both individual income and individual marginal tax rates into these two components (see Auten and Clotfelter, 1982; Burman and Randolph, 1992).

One disadvantage of data on individuals is that they typically span a shorter time period and

thus fewer legislative changes in tax rates than the aggregate time series data. At one extreme is the case of data on individuals for a single year. Such data are subject to the criticism that the variation in the tax rate is completely determined by income, since each taxpayer faces the same tax system at any point in time. The biggest problem in estimating realizations behavior from data on individuals is that an individual's tax rate is endogenous to their behavior. With a progressive system of tax rates, large capital gains realizations can push individuals into a higher tax bracket. Furthermore, if tax rates fluctuate from year to year (that is, an individual's tax bracket changes over time), then individuals can time their realizations such that realizations are high when their tax rate is low. This endogeneity can induce spurious correlation between tax rates and realizations. Studies using data on individuals have produced an even broader range of realization elasticities than the aggregate time series. Estimates using cross-sections range from -0.44 to -3.75, short-run elasticities estimated using panel data range from -0.91 to -3.46, and long-run elasticities estimated using panel data range from -0.36 to -2.20 (Auten, Burman, and Randolph, 1989).

One common problem with both the time series and individual approaches is constructing a tax rate. The state-level approach offers an alternative means of estimating tax rates. Unlike the time series approach which describes the entire U.S. tax system at a point in time with a single tax rate, the state-level approach uses 51 tax rates in any year. Assuming that individuals do not locate on the basis of marginal capital gains tax rates, then the state-level variation introduces an exogenous source of variation in tax rates.[6] Unlike the individual data, the state-specific tax rate is not endogenous to individual behavior. Aggregating taxpayers within a state also eliminates the endogeneity induced by

[6] It is unlikely that taxes on capital gains are pivotal for migration decisions since interstate differences in income taxes are largely offset by interstate differences in either other taxes or the level of government expenditures. To the extent that individuals coordinate the timing of their capital gains realizations with a non-tax motivated relocation (for example, a retired couple moving from a high income tax state to a state without an income tax (Florida) may delay the realization of capital gains on their stock portfolio), the elasticity of realizations with respect to tax rates would be larger in absolute value. Thus, the bias created by the timing of migration and realizations favors the hypothesis that capital gains tax cuts are self-financing.

taxpayers having temporarily high or low tax rates for individual-specific reasons. Specifically, if we think of the tax rate facing taxpayer i as $\tau + \varepsilon_i$, where ε_i is white noise, then aggregating across all i is expected to eliminate the random tax rate component.

In addition to the differences in the specification of the tax rate, state level data have several other advantages. First, the data span a number of years (1982-1990 in our main specification) that include several changes in the overall tax level because of changes in the Federal tax code. Second, as we noted earlier, the variation in marginal tax rates resulting from differences in state tax rates represents a considerable fraction of the total variation among taxpayers. Third, since these differences persist over time, investor expectations of future tax rates cause less of a problem for identifying how realizations respond to tax rates.

While state-level analysis has some advantages over previous approaches, it has its own problems and shares some of the obstacles of other approaches. While the ordering of state tax rates is relatively permanent, the realizations behavior still includes some temporary (or transitional) responses to changes in Federal and state tax codes. If these temporary reactions to changes in Federal tax policy are consistent across states, then panel regression techniques that control for year-specific effects that affect all states mitigate the influence of these temporary effects. As with the other approaches, the state-level approach requires controlling for other factors that affect realizations. As discussed below, we borrow from both the time series and individual approaches for choosing control variables.

3. Data

This project requires three types of data: (1) state-level capital gains realization data; (2) non-tax determinants of capital gains realizations that vary by state or by year; and (3) Federal and state

tax rates. The data appendix details the data sources.

Capital gains realizations

For capital gains realizations, we use the net gain less loss from sales of capital assets from the Internal Revenue Service's Individual Master File (IMF) for 1982-1990.[7] For 1978-81, we augment the IMF data with data from the IRS's Statistics of Income (SOI); however, the SOI data are not disaggregated by income class. We normalize each state's capital gains realized by the number of Federal tax returns filed by residents of the state.

We focus on results obtained using all returns. Some previous research (beginning with Feldstein, Slemrod, and Yitzhaki, 1980) focuses on high income individuals and finds differences in realizations behavior across income groups. In order to compare our results to this research, we report results for high income individuals, defined as those people in the highest reported income class.

There are three advantages in concentrating on the highest income group, which in the IMF tabulations consists of households with over $50,000 of adjusted gross income (AGI). First, for high income households, it is easier to calculate the total state and Federal tax rate on capital gains income. As discussed below, exact measures of marginal tax rates for different income groups would be complicated by interactions between the state and Federal tax brackets and codes. Second, this income group accounted for over 80 percent of the net capital gains reported for 1982-1990 Federal taxes. Third, lower income groups might have less discretion in the timing of their capital gains realizations.

While focusing on high income households has these advantages, it also creates some problems. First, the number of high income households depends on capital gains realizations; states

[7] The data include all capital asset transactions. While ideally one would like to disaggregate by type of transaction (such as sales of corporate stock, personal residences, bonds) and distinguish between gains and losses, such data are not available. Taxable capital gains realizations prior to 1987 were grossed up by the reciprocal of the fraction of long-term gains subject to tax (for example, if 60 percent of long-term gains were excluded, so that 40 percent of the gains were taxable, then reported taxable realizations were multiplied by 2.5). This assumes that all gains were long-term. In fact, nearly all gains are long-term (see Auerbach, 1988).

with many returns with large capital gains are likely to have a higher fraction of returns with AGI over $50,000. This endogeneity of income class and realizations behavior is a criticism (see Auerbach, 1988) of Lindsey's (1987) work that creates panel data from the different AGI groupings and Federal tax rates. Since this criticism remains valid, we do not create a panel of different AGI groups for each state. Second, since most demographic variables are only available for the entire state population instead of by income group, it is harder to control for other determinants of capital gains realizations for high income households.

Table 1 presents descriptive statistics for the capital gains per return across states for 1982-90. These averages are taken across the values for the different states without weighing by population, so they may differ from national averages. The values in the table are, however, the statistics for the variables in the regression analysis. Also, the entire analysis uses data in nominal dollars for each year, since the U.S. government taxes nominal capital gains. The first row of the table has the capital gains per return for all returns. Over the nine year period, the average state has about $1,333 of net capital gains realizations per return. The second row of table 1 reports the average across states of the ratio of net capital gains for returns with more than $50,000 of AGI to the total number of returns with over $50,000 of AGI in the state. For the nine years, the average across states is about $12,769 in capital gains per return with AGI over $50,000.

Non-tax determinants of capital gains realizations

Previous research suggests numerous non-tax factors that influence the decision of whether to realize capital gains. These factors control for two types of information: (1) differences in the stock of unrealized capital gains and (2) differences in the propensity to realize capital gains. Studies using aggregate time series data have controlled for macroeconomic variables that affect aggregate capital gains realizations: inflation (since nominal capital gains are taxed), business cycle conditions (as demonstrated by the level and change in gross national product), and changes in the stock of

outstanding unrealized capital gains (such as changes in stock market indices). Cross-sectional and panel studies include a number of variables likely to affect an individual's decision to realize capital gains, such as income (permanent and transitory components), wealth, marital status, age, family size, and region of the country.

The state-level aggregate data fall somewhere between national data and individual data. Hence, in choosing non-tax determinants of capital gains realizations, we borrow from both types of analyses. The time series analyses of realizations control for cyclical conditions in the economy. We measure varying business cycle conditions across states and over time by including the state unemployment rate for the current year. If high unemployment indicates that business conditions are poor so that capital assets are not appreciating, one would expect that high unemployment would be associated with low capital gains realizations.[8] Also, the lagged regional inflation rate is included for each state in each year to capture changes in the nominal value of the stock of assets.[9]

As suggested by studies of individual realization behavior, we include measures of income per return from sources other than realized capital gains, age distribution within the state, home ownership within the state, housing wealth in the state, and stock ownership within the state. We break the non-capital gains income per return into two parts: (1) other capital income (dividends plus interest received) and (2) non-capital income (total AGI less capital gains, interest and dividends). If capital gains realizations are positively correlated with other forms of capital income, one would expect a positive relation between dividends and interest and capital gains. Capital gains realizations may be

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[8] The link between state business cycle conditions and the performance of state residents' portfolios is not entirely clear-cut. To the extent that residents can diversify their portfolio beyond the state, we should expect to find no link. However, a large part of most peoples' portfolios consists of the equity in their house. The return to property ownership is usually related to overall economic conditions in the state. See Browne (1992).

[9] The inflation measures for the four regions are highly correlated with each other and with national inflation. We use regional rather than national inflation assuming that individuals hold portfolios that specialize, to some degree, in assets from the region in which they live. While this assumption may be suspect for investments in the stock market, it is probably realistic for real estate investments.

positively or negatively correlated with non-capital income.

Our measure of age distribution of the state is the fraction of the state's population that is older than sixty-four years old. If the elderly are more likely to realize capital gains because of life-cycle dissaving, then one would expect the relation between the state's fraction elderly and capital gains realizations to be positive. On the other hand, constructive realization at death[10] combined with a bequest motive for asset accumulation could imply a negative relation.

The home ownership variable is the fraction of households that own their homes. This variable controls for differences in portfolio composition across states. Owner-occupied housing is a special type of asset for a number of reasons: (1) housing capital gains receive favorable tax treatment through roll-over and exclusion provisions;[11] (2) houses are less liquid than other assets, such as corporate stocks; (3) the lock-in effect is less likely to be important because the transactions costs of moving are high; and (4) the mix between dividends (consumption flow of housing services) and capital appreciation (or depreciation) might be different for houses than other assets. Overall, the effect of a higher fraction owner-occupied housing on capital gains realizations is not clear, but it may be important to control for differences across states regardless of the direction of the effect.

Housing wealth in the state is represented by the median house value for owner-occupied non-business-related housing in 1990 and 1980. Since this variable is from the decennial Census, annual observations are not available. As with the fraction of homeowners, these median house value figures possibly capture a number of effects. House values may be positively correlated with total wealth and with the stock of unrealized capital gains. On the other hand, house values are negatively correlated

[10] The basis of capital assets is "stepped-up" to market value if they are not realized before a person dies. Hence, capital gains escape income taxation if the asset is bequeathed.

[11] Capital gains from the sale of owner-occupied housing are excluded from Federal taxation if a house of the same or higher value is purchased within two years (the roll-over provision). There is also a one-time exclusion of $125,000 of capital gains from the sale of owner-occupied housing available once a person reaches age 55.

with the fraction of households that own their own homes.

Stock ownership data by state is taken from a New York Stock Exchange (NYSE) survey for 1985. From a random survey of individuals, the NYSE estimates the incidence of stock ownership by state. We normalize the NYSE estimates by the state population in 1985. Stock ownership is probably positively correlated with wealth. Moreover, since stocks are a relatively liquid asset, tax-motivated trading (or lack of trading) may be more prevalent in states where a high proportion of households own stock.

Table 1 presents descriptive statistics on these control variables. For all returns, the average wage income (defined as AGI less dividends, interest and net capital gains) is $20,111; conditional on AGI exceeding $50,000, average wage income is $69,656. For all returns, average capital income is $2,166; for high income returns, average capital income is $10,723. The elderly represent 11.9 percent of each states' population, and the average proportion that is elderly rose from 11.3 percent in 1982 to 12.4 percent in 1990. The fraction homeowners stays roughly constant over the nine years at 65.83 percent. The unemployment rate averaged 6.91 percent. The average state median house value in 1990 was $84,210, up from $48,867 in 1980 (without an adjustment for inflation). The average fraction of the state population that owns stock is 18.8 percent.

Calculation of marginal tax rates

The total marginal tax rate on capital gains depends on the state and Federal tax rates and other provisions in the state and Federal tax codes. We simplify the interactions of state and Federal tax rates and tax rules using three assumptions. First, we calculate the tax rate assuming the taxpayer is in the top statutory Federal and state tax bracket (neglecting the Federal "bubble" rate of 33 percent in 1988, 1989, and 1990). While this assumption may yield a relatively high estimate of the marginal tax rate, it is a fairly accurate assumption since most capital gains are realized by people with high incomes. Furthermore, since most state tax systems reach the highest marginal tax bracket at relatively

low levels of income, this assumption does not affect the interstate variation in tax rates.[12] Second, we calculate the tax rate assuming that all taxpayers deduct state taxes from Federal taxable income (that is, taxpayers choose to itemize rather than take the standard deduction) and deduct Federal taxes from state taxable income when allowed by the state tax code. This assumption reduces the interstate variation in tax rates, but it is realistic for taxpayers with AGI over $50,000.[13] Third, for states with widespread use of local government income taxes computed as a surtax on state income taxes, we included the "typical" local tax rate.

While one could quibble with each of these assumptions, it should be noted that they resolve the controversy of identifying the relevant marginal tax rate for any given individual. We have already noted that one criticism of using cross-sectional data is that taxpayers face different marginal tax rates but still face the same schedule of marginal tax rates. Since the tax system has graduated rates, taxpayers simultaneously choose a level of capital gains realizations and a marginal tax rate. To compensate for this endogeneity, researchers have relied on constructed marginal tax rates.[14] One example is the so-called "first-dollar" tax rate, the marginal tax rate that would apply to the first dollar of capital gains income. Since the decision on whether or not to realize capital gains is made simultaneously with other decisions affecting the amount and composition of income (hence the marginal tax rate), another measure is the "expected first-dollar" tax rate that calculates expected income from other sources. Finally, there is the "last-dollar" tax rate that would apply taking as given an individual's actual behavior.

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[12] Of the 41 states with a broad-based income tax in 1990, 34 had maximum tax brackets beginning at levels less than $50,000. Burman and Randolph (1992, p.34) state "...the top tax rate [instrument] captures most of the important interstate variation in tax schedules."

[13] For returns with AGI over $50,000, 84.4% had itemized deductions in 1990 down from 94.9% in 1982 (calculated from the IRS's IMF data). For all returns, this assumption is more suspect since many fewer returns had itemized deductions: 35.3% in 1982 and 29.1% in 1990.

[14] Slemrod and Shobe (1990) discuss the problems in constructing and interpreting marginal tax rates.

We are unable to identify for each individual (since we use aggregate data) the income net of capital gains. This means that our calculated tax rate is formally a "last-dollar" tax rate. By assigning all individuals to the top tax bracket, though, we implicitly assume that their tax rate is independent of their realizations of capital gains. This makes our calculated tax rate akin to a "first-dollar" tax rate.

We characterize state tax systems as one of four types based on how the state tax liability is calculated. The data appendix details the construction of the state tax rates. Denote the various Federal and state tax rates as follows:

f = Federal marginal tax rate on earned income

s = state marginal tax rate on earned income (or state surtax rate for Type 3 states)

f_g = Federal marginal tax rate on capital gains income

s_g = state marginal tax rate on capital gains income

t = combined state and Federal tax rate.

Then, the combined state and Federal tax rate for each type of state tax system can be written:

Type 0 $t = f_g$ (no state income tax)

Type 1 $t = f_g + s_g - s_g f$ (Federal tax not deductible from state income tax)

Type 2 $t = (f_g + s_g - s_g f - s f_g) / (1 - sf)$ (Federal tax deductible from state income tax)

Type 3 $t = f_g(1 + s) / (1 + sf)$ (state income tax a fraction of Federal tax liability)

Appendix A presents two tables summarizing all of the state tax systems between the years 1978 and 1990.[15] In the first table (table A-1), the state capital gains tax rate (s_g) is reported along with the type of state tax system (0, 1, 2, or 3). In the second table (table A-2), the combined marginal tax rate on capital gains income (t) is reported for each state in each of the years 1978 through 1990. These are the tax rates included in the regressions that follow.

[15] Below, we focus on data from 1982 through 1990 but include data from 1978 through 1981 in our sensitivity analysis.

Our tax rates are imperfect measures of the true tax rate of all individuals within a state. For individuals in the highest state and Federal tax brackets who do not itemize, our tax rate understates the actual tax rate. On the other hand, our estimates may overstate the tax rate for three reasons. First, not everyone is in the top statutory state and Federal tax brackets. Second, there is the standard concern that realizing capital gains can place an individual in a higher tax bracket than otherwise would be the case. Third, we do not consider the effects of either the alternative minimum tax or the Federal "bubble" rates (in 1988, 1989, and 1990); adding the alternative minimum tax or the "bubble" would increase the tax rate for all states but would not greatly affect the interstate variation in the tax rates. Despite these imperfections, we believe that our tax rates capture the interstate variation in the tax incentives to recognize capital gains. However, random variation of actual marginal tax rates around the estimated tax rates we use will bias the coefficient on the tax rate towards zero.

4. Results

In examining the effect of state tax rates on aggregate state capital gains realizations, we estimate the following regression equation for 1982-1990:

$$\begin{aligned} LN(CGR_{i,t}) = \alpha &+ \beta_1 * LN(wages_{i,t}) + \beta_2 * LN(capinc_{i,t}) + \beta_3 * elderly_{i,t} + \beta_4 * homeowners_{i,t} \\ &+ \beta_5 * unemployment_{i,t} + \beta_6 * LN(house90_i) + \beta_7 * LN(house80_i) \\ &+ \beta_8 * stocks_i + \beta_9 * infreg_{i,t-1} + \beta_{10} * taxrate_{i,t} \end{aligned} \quad (1)$$

where $CGR_{i,t}$ is capital gains realizations per return, $wages_{i,t}$ is wage income per return, $capinc_{i,t}$ is capital income (other than capital gains) per return, $elderly_{i,t}$ is the fraction over age 65, $homeowners_{i,t}$ is the fraction of owner-occupied housing, $unemployment_{i,t}$ is the unemployment rate, $house90_i$ is the 1990 median house value, $house80_i$ is the 1980 median house value, $stocks_i$ is the incidence of stock

ownership in 1985, $infreg_{i,t-1}$ is the lagged regional inflation rate for state i's region, and $taxrate_{i,t}$ is the combined Federal and state marginal tax rate for high income households. The subscript i denotes states and the subscript t denotes years. The variables that are not in logarithmic form are expressed as either percentages or fractions. This specification is "semi-logarithmic" in the tax rate.[16]

From the tax rate coefficient, we calculate the elasticity of capital gains realizations with respect to the tax rate at the mean tax rate. This elasticity determines whether cutting the capital gains tax rate increases or decreases revenues from looking solely at the realization decision.[17] If the elasticity is less than -1 (greater than 1 in absolute value), lower capital gains tax rates increase revenues; on the other hand, an elasticity greater than -1 implies that cutting capital gains tax rates decrease tax revenues. For the semi-logarithmic specification, the elasticity equals β_{10} times the mean tax rate.

Equation (1) can be estimated using several econometric techniques. One important concern for being able to interpret the results as permanent, rather than temporary, responses to policy changes is to control for year-specific effects that are not captured by changes in the control variables. These year-specific effects include changes in macroeconomic conditions and expectations about changes in future Federal taxes that affect taxpayers in all states. Two panel econometric techniques for controlling for these year-specific events are: (a) a fixed effects model, which is equivalent to adding year dummy variables; and (b) a random effects model, which is a generalized least squares (GLS)

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[16] Burman and Randolph (1992, p.14) discuss the advantages of a semi-logarithmic specification relative to other possible specifications and conclude that it is the most desirable specification.

[17] Technically, this elasticity comparison is only valid for is a flat rate income tax. If the tax system is progressive, changes in average tax rates can also affect revenues (see, for example, Auerbach, 1988). Despite this caveat, we follow previous work in comparing this elasticity to the benchmark of -1 in order to determine whether decreasing the capital gains tax rate increases capital gains tax revenues. Of course, capital gains taxes may affect revenues from other income depending on the responsiveness of investment and tax shelters. Consistent with previous work, we do not consider these indirect revenue effects.

specification that allows for a year component in the error term.[18] A Hausman specification test between the fixed effects and random effects models suggests using the random effects model.

Table 2 presents the random effects estimates for equation (1). Columns (1) and (3) are the coefficients from estimating equation (1) for all returns and for returns with AGI over $50,000. Since the reduction in Federal tax rates after the Tax Reform Act of 1986 increased the relative importance of state taxes, columns (2) and (4) have the coefficients from estimating equation (1) for 1987-1990.

In all four versions, the estimated coefficient on the total tax rate is less than zero, suggesting that realizations are negatively correlated with the tax rate. The more controversial issue is whether this negative relation between realizations and tax rates is strong enough to produce a negative relation between revenues from taxing capital gains and tax rates. For all returns, the estimated elasticity of realizations with respect to the tax rate is -0.67 in the specification using 1982-1990 data (the "basic" specification) and -0.85 using 1987-1990 data. For the high income returns, the estimated elasticities are -0.82 using 1982-1990 data and -0.66 using 1987-1990 data. The evidence on the question of whether the elasticity is greater than or less than -1 is mixed. Two of the specifications reject the hypothesis that the elasticity is less than -1 at less than the 5 percent level, one at the 20 percent level, and the last at the 42 percent level.

The empirical model of capital gains realizations fits fairly well. In most versions of the model, the variables other than the tax rate are highly statistically significant. The adjusted R^2 is about 0.54 for the versions using returns with AGI over $50,000 (1982-1990 data and 1987-1990 data), 0.41 for the version using 1982-1990 data for all returns, and 0.73 for the version using 1987-1990 data for all returns. Most of the signs of the estimated coefficients are consistent with intuition of how different state characteristics might affect realizations. States with relatively high levels of other

[18] Panel estimates that use individual data on realizations typically specify a fixed effects model (see Auten, Burman and Randolph, 1989).

capital income tend to have more capital gains as well. High unemployment rates lower realizations, consistent with time series evidence that cyclical conditions affect realizations. States with a high fraction of owner-occupied housing have fewer realized capital gains, suggesting that housing might appreciate less quickly than other assets (perhaps because a considerable fraction of the return from owning housing comes in the form of consumption flows). Median house values in 1990 are positively correlated with capital gains realizations and median house values in 1980 are negatively correlated with capital gains realizations. These findings suggest that rising house values indicate higher values of state wealth and unrealized capital gains.

The negative relation between the fraction of the state's population over 65 years old and capital gains realizations is somewhat counterintuitive. However, there is a significant positive simple correlation between the fraction elderly and both capital income and realized capital gains. The negative coefficient on the fraction elderly can be interpreted to mean that holding the level of dividend and interest income constant, older people recognize fewer capital gains. This behavior is consistent with older people postponing capital gains realizations in order to benefit from constructive realization at death. Likewise, the statistically significant negative relation between stock ownership and realized capital gains is counterintuitive; again, however, the simple correlation between stock ownership and capital gains is positive.

Sensitivity Analysis

Since economic theory does not dictate the exact specification of the realizations regression, we examine other specifications. Table 3 presents the elasticities for several variants of equation (1). Panel A of the table reports several changes from table 2 within the framework of modelling a random year-specific effect; panel B investigates the importance of correcting for year-specific effects. The sensitivity analysis helps to identify some important assumptions underlying the results in table 2.

The specifications in panel A are GLS estimates of variants of columns (1) and (3) of table 2.

The first variant uses the levels of capital gains, wages, capital income and house values rather than the logarithms; the results are similar to those in table 2. The second variant weights observations by the total number of returns in the state. Weighting by state size increases the influence of more populous states in the regression, but does not greatly affect the results.

The third and fourth variants in panel A change the sample of returns used in table 2. The third variant increases the sample period to 1978-1990. The data from earlier years (1978-81) are not perfectly consistent with the later data and are not disaggregated by income class. Nonetheless, the results are similar to those in the main regression. The fourth variant estimates equation (1) for returns with AGI less than $50,000. In this case, the estimated elasticity is positive but imprecisely estimated. Since the tax rate variable is calculated assuming that taxpayers are in the highest tax bracket, this result should be interpreted with caution. It is, however, consistent with previous research (Feldstein, Slemrod, and Yitzhaki, 1980) that finds that realizations behavior varies with income.

Panel B of table 3 explores different econometric techniques for estimating equation (1). The first three variants address controlling for year-specific unobservable events. The first variant in panel B is the OLS (pooled cross-section) estimate of the elasticity without correcting for year effects. For all returns and high income returns, the estimated elasticities are -1.69 and -1.66, respectively. The second variant is the between estimator of the elasticity which uses the state averages (from 1982-1990) for all of the variables in equation (1). The between estimator is an alternative way to control for year-specific events since it uses the averages over all years. The estimated elasticities are less than -1, but the between estimator does not incorporate information from the time series pattern of realizations. The third variant includes year dummy variables (fixed effects for years) and has estimated elasticities that are close to the results in table 2. Lagrange Multiplier tests indicate that the model with year dummies fits the data better than the pooled cross-section model. Hausman specification tests reject the fixed effects model in favor of the random effects specification in table 2.

The last two variants in panel B control for unobserved heterogeneity among states. The fourth variant includes a dummy variable for each state (state fixed effects model) but does not control for year effects. Since this model has a dummy variable for each state, the time-invariant state characteristics are excluded to avoid multicollinearity. The estimated elasticities are -2.55 for all returns and -2.03 for high income returns. The fourth variant includes both dummy variables for each state and each year (state and year fixed effects model). In this case, the elasticities are -0.15 for all returns and 0.11 for high income returns. Lagrange Multiplier tests indicate that the fourth variant is better than the third. While this suggests that the elasticity is close to zero, models with state dummy variables create a problem for interpreting the results. These models rely on differences in how states reacted to changes in the their tax rate over time: the tax rate coefficient reflects whether states had different reactions to changes in the Federal tax rate. Thus, while the state and year fixed effects model explains more of the variation in capital gains realizations than the model in table 2, there is a trade-off between controlling for unobserved state heterogeneity and using the interstate variation in the tax rates to measure the elasticity of realizations.

Overall, the sensitivity analysis suggests that the estimates of the realization elasticity in table 2 are robust to some changes in specification, but they are quite sensitive to alternative estimation techniques. Statistically, it is important to control for year specific events that have a common influence on all states. While it may be important to control for unobserved heterogeneity among states, statistical models that include state effects diminish the chance of measuring the responsiveness of capital gains realizations to tax rate changes.

5. Conclusion

This paper offers a new look at a persistent question for U.S. tax policy: what is the relation between capital gains tax rates and capital gains realizations? Rather than use either aggregate time series data or individual level data, we use state-level data for 1982-1990. Using state-level aggregate data alleviates the problem of the endogeneity of the marginal tax rate for individual taxpayers identified in earlier studies, while still allowing for the use of panel econometric techniques. Our estimates indicate that capital gains realizations are negatively related to capital gains tax rates: our basic equation suggests an elasticity of realizations with respect to tax rate is -0.67 and is greater than -1 at the 2 percent significance level. While our estimate is within the range of previous estimates from both aggregate time series and individual data, it is larger (closer to zero) than many of the previous estimates.

In general, our estimates cast doubt on the popular justification that cutting the tax rate on capital gains income would be self-financing. However, we add three reasons for caution for policy interpretation of our results. First, the result is sensitive to the econometric specification of year effects and, for some specifications, it is not statistically significant. Second, as do most previous studies of capital gains, we estimate a reduced form equation that does not account for indirect revenue effects of changing the capital gains tax rate. For example, a lower capital gains tax rate might either induce corporations to pay fewer dividends or increase tax shelter opportunities for individuals. Third, our results reflect only on the direct revenue consequences of the capital gains tax rates rather than addressing many of the other arguments for and against cutting the capital gains tax rate: in addition to the revenue consequences, equity and economic efficiency might be important for choosing a capital gains tax rate. In future work, we will use state-level data to investigate other arguments for and against changing the tax treatment of capital gains income.

References

Auerbach, A. (1988). "Capital Gains Taxation in the United States: Realizations, Revenue, and Rhetoric -- A Review." *Brookings Papers on Economic Activity* 2:595-631.

Auerbach, A. (1989). "Capital Gains Taxes and Tax Reform." *National Tax Journal* 42:391-401.

Auten, G., L. Burman, and W. Randolph (1989). "Estimation and Interpretation of Capital Gains Realization Behavior: Evidence from Panel Data." *National Tax Journal* 42:353-374.

Auten, G., and C. Clotfelter (1982). "Permanent Versus Transitory Tax Effects and the Realization of Capital Gains." *Quarterly Journal of Economics* 97:613-632.

Auten, G., and J. Cordes (1991). "Cutting Capital Gains Taxes." *Journal of Economic Perspectives* 5:181-192.

Browne, L. (1992). "Why New England Went the Way of Texas Rather Than California." *New England Economic Review* Jan/Feb:23-41.

Burman, L., and W. Randolph (1992). "Measuring Permanent Responses to Capital Gains Tax Changes in Panel Data." Unpublished paper.

Cook, E., and J. O'Hare (1987). "Issues Relating to the Taxation of Capital Gains." *National Tax Journal* 40:473-488.

Feenberg, D., and H. Rosen (1986). "State Personal Income and Sales Taxes, 1977-1983." In H. Rosen (ed.) *Studies in State and Local Public Finance*, Chicago: University of Chicago Press. 135-179.

Feldstein, M., J. Slemrod, and S. Yitzhaki (1980). "The Effects of Taxation on the Selling of Corporate Stock and the Realization of Capital Gains." *Quarterly Journal of Economics* 94:777-791.

Gold, S. (1983). "Recent Developments in State Finances." *National Tax Journal* 36:1-29.

Gold, S. (1991). "Changes in State Government Finances in the 1980s." *National Tax Journal* 44:1-19.

Lindsey, L. (1987). "Capital Gains Rates, Realizations, and Revenues." In M. Feldstein (ed.) *The Effects of Taxation on Capital Accumulation.* Chicago: University of Chicago Press. 69-97.

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

Slemrod, J., and W. Shobe (1990). "The Tax Elasticity of Capital Gains Realizations: Evidence from a Panel of Taxpayers." Working Paper #3237. Cambridge, MA: National Bureau of Economic Research.

Data Appendix

1. *Aggregate state tax data.* The *Statistics of Income Bulletin* (Fall 1990 for 1986-88, Winter 1991 for 1989, Summer 1992 for 1990) reports tabulations of various tax collection data disaggregated by state and adjusted gross income (AGI) class. We are grateful to Barry Windheim of the IRS for providing unpublished data for 1982-85. These data are from the Internal Revenue Service's Individual Master File (IMF) that records data from all individual tax returns. The key variables for our research are: (1) number of returns and the number of returns with AGI over $50,000; (2) total AGI and total AGI for returns with AGI over $50,000; (3) dividends and interest received for all returns and those with AGI over $50,000; and (4) net gain less loss from the sale of capital assets for all returns and for returns with AGI greater than $50,000. From these data, we construct non-capital income (AGI less dividends, interest and net capital gains) per return, net capital gains per return, and other capital income (dividends plus interest received) per return. We augment this data with state-level estimates from the IRS Statistics of Income (SOI) for 1978-81. The SOI stopped reporting state-level estimates in 1981. The SOI has the same variables as the IMF except the data are not disaggregated by AGI class. While the IMF tabulates data from all returns, the SOI data are estimates from a sample of returns.

2. *Other determinants of capital gains realizations.* Measures of other state characteristics that might influence capital gains realizations are from a variety of sources. In addition to the tax data from the IMF, we have (1) the state unemployment rate from the May issues of *Employment and Earnings*, U.S. Bureau of Labor Statistics, as a measure of state business conditions; (2) to measure differences in the age distribution across states, the percentage of the population that is over 64 years old from *Current Population Reports, Series P-25*; and (3) the fraction of owner-occupied housing from "Homeownership Trends in the 1980s" from the U.S. Census Bureau (1991). State-specific homeownership rates are only available for 1984-90. We extrapolate values for 1978-83 using a regression of state-specific values on a time trend and regional homeownership rates (4 Census regions) that are available for 1978-90. While the 1980 Census provides estimates of state-specific homeownership rates for 1980, the Census methodology is inconsistent with the survey methodology for the 1984-90 data. These data are both state- and year-specific. Two variables are state-specific but time-invariant: (1) the median house value in 1980 and 1990 for non-business related owner-occupied housing with less than ten acres from the *Census of Population and Housing Summary of Population and Housing Characteristics* (by state) and (2) number of stock owners from *Shareownership 1985* by the New Stock Exchange. As a measure of inflation, we calculate the percentage change in the regional consumer price index for each of the four Census regions taken from the *Statistical Abstract of the United States* (original source: U.S. Bureau of Labor Statistics, *CPI Detailed Report*). States within the same Census region are assigned the same inflation rate.

3. *Construction of tax rates.* Our data sources were the *1989 State Tax Guide* by Commerce Clearing House (Chicago: Author) for detailed information on state tax systems and *Significant Features of Fiscal Federalism* (1976-1991) by the Advisory Commission on Intergovernmental Relations (Washington, D.C.: Author) for tax rates and deductibility of Federal taxes. Feenberg and Rosen (1986) was used to help determine changes in state marginal tax rates for those years that the ACIR did not provide this information (1977, 1978, 1979, 1981). Gold (1983) also provided information on state tax rate changes between 1979 and 1981.

One can characterize state tax systems as one of four types. The type of tax system in a state can change from year to year. We report the state tax system in 1990 in the appendix table A-1 and footnote any changes during the period 1978-1990. First, there are the states that levy no taxes upon

income, including capital gains income. There are 9 such states in 1990, and they are labeled as type 0 states. Second, there are states that do not allow Federal income taxes to be deducted from the state income tax. There are 30 such states in 1990, labeled as type 1. Third, there are states that allow Federal income taxes to be deducted from state income taxes. There are 9 such states in 1990, labeled as type 2. Finally, there are 3 states in 1990 that calculate state income tax liability as a specified fraction of the Federal income tax liability. These states are labeled as Type 3.

A number of states allow local governments to impose income taxes. We included these local taxes for three states (Maryland, Iowa, and Indiana) where they seemed to be fairly uniform and fairly widespread. We only include states where local government income taxes were calculated as a surtax on the state taxable income base. For the period 1978-1982, no source described these local taxes in detail. We used the 1983 local rates when calculating the state rates for those years.

Note that if the state is Type 3 then the tax rate reported in table A-1 is applied to the Federal tax liability rather than to a state-defined taxable income. Also, a number of states provide the taxpayer with a number of options for calculating taxes, such as one rate applied to the Federal tax liability or another rate applied to a taxable income measure. The rate reported in the table is the lowest marginal tax rate available to the taxpayer. This does not guarantee the lowest total tax bill for any given taxpayer, but our results should not be greatly affected by this procedure.

The Federal tax rate used for capital gains income is the rate applied to long-term gains during the period (1978-1985) in which there were different tax rates depending on the time period that an asset was held. The Federal tax rate used in calculating the effects of deductibility was the highest statutory tax bracket (not including the alternative minimum tax or the "bubble" after 1986).

Table 1: Summary Statistics, 1982-90
(dollar figures are in thousands of dollars)

	Mean (stand dev.)	Minimum	Maximum
Capital gains per return, All returns	1.333 (0.752)	0.456 WV, 1990	5.583 FL, 1986
Capital gains per return, AGI > 50K	12.769 (7.711)	1.143 KS, 1983	59.925 FL, 1986
Wage income per return, All returns	20.111 (3.928)	10.930 SD, 1982	33.854 CT, 1990
Wage income per return, AGI > 50K	69.656 (7.001)	54.382 VT, 1985	91.577 CT, 1989
Dividends + Interest per return, All returns	2.166 (0.477)	1.055 AK, 1987	4.121 FL, 1990
Dividends + Interest per return, AGI > 50K	10.723 (3.236)	3.902 AK, 1986	25.858 FL, 1982
Elderly	11.85 (2.17)	2.9 AK, 1982-83	18.3 FL, 1990
Homeowners	65.83 (6.78)	34.6 DC, 1986	77.54 WV, 1982
Unemployment	6.91 (2.47)	2.2 NE, 1990	18.0 WV, 1983
Regional Inflation Rate (1980-89, 4 obs./year)	0.0556 (0.0353)	0.011 Midwest, 1987	0.147 West, 1980
Tax Rate	0.259 (0.052)	0.20 many, 1981-86	0.352 HI, 1988-90
Time Invariant Variables:			
Fraction Share Owners in 1985	0.188 (0.0500)	0.096 MS	0.339 DC
Median House Value (1980 Census)	48.867 (16.984)	31.1 AR	134.5 HI
Median House Value (1990 Census)	84.210 (42.590)	45.2 SD	245.3 HI

Standard deviations of the means are in parentheses. Since these are unweighted means across observations for each state, these means may differ from national averages.

Table 2: Interstate Variation in Realized Capital Gains

Dependent variable →	Ln(Capital Gains Per Return)			
Set of returns →	All Returns 1982-90	All Returns 1987-90	AGI > 50K 1982-90	AGI > 50K 1987-90
Constant	1.104** (0.495)	1.563* (0.498)	2.356*** (1.397)	1.146 (1.315)
Ln(Wages per return)	0.280** (0.117)	-0.371** (0.160)	-0.351 (0.269)	-0.259 (0.276)
Ln(Dividends + Interest per return)	0.941* (0.076)	0.933* (0.094)	1.066* (0.079)	1.130* (0.084)
Elderly	-0.039* (0.008)	-0.030* (0.009)	-0.028* (0.009)	-0.026* (0.009)
Homeowners	-0.018* (0.002)	-0.013* (0.003)	-0.008** (0.003)	-0.007** (0.003)
Unemployment	-0.052* (0.006)	-0.061* (0.009)	-0.015** (0.008)	-0.046* (0.009)
Ln(Median House Value) (1980)	0.013 (0.069)		-0.156*** (0.091)	
Ln(Median House Value) (1990)	0.063 (0.052)	0.400* (0.066)	0.399* (0.064)	0.362* (0.060)
Stock Owners (1985)	-1.043* (0.344)	-1.085** (0.430)	-1.049** (0.446)	-1.812* (0.433)
Lagged Regional Inflation Rate	1.015 (1.785)	-5.165 (3.176)	-2.962 (2.437)	-2.412 (3.420)
Tax Rate	-2.579* (0.621)	-2.720* (0.615)	-3.168* (0.834)	-2.101* (0.642)
Adjusted R^2	0.408	0.732	0.537	0.537
Elasticity	-0.667	-0.854	-0.820	-0.660
Probability that Elasticity is < -1	0.02	0.42	0.20	0.05
Observations	459	204	459	204

Asterisks denote coefficients that are significantly different from zero: (*) denotes significance at the one percent level; (**) denotes significance at the five percent level; and (***) denotes significance at the ten percent level. Standard errors in parentheses. Equations are estimated using GLS accounting for random year effects.

Table 3: Alternative Specifications

Specification Variation from columns (1) and (3) of Table 2 1982-90 unless noted otherwise	Set of Returns	Adj. R^2	Elasticity	Prob. Elast. < -1
Panel A: Variants on Random Year Effects Model (Table 2)				
Levels of capital gains, wages, capital income, and house value	All	0.321	-0.767	0.15
	AGI > 50K	0.404	-0.837	0.24
Weighted by total number of returns in each state	All	0.435	-0.719	0.04
	AGI > 50K	0.537	-0.841	0.23
1978-1990 (663 observations)	All	0.417	-0.704	0.06
Low income returns (AGI < 50K)	AGI < 50K	0.156	0.192	0.00
Panel B: Alternative Econometric Estimation Techniques for Equation (1)				
No control for year effects: Pooled Cross-Section (OLS)	All	0.618	-1.686	1.00
	AGI > 50K	0.630	-1.659	1.00
Between-States Estimator (51 observations)	All	0.810	-1.120	0.62
	AGI > 50K	0.745	-1.137	0.62
Fixed effects rather than random effects (OLS with year dummies)	All	0.822	-0.650	0.02
	AGI > 50K	0.776	-0.796	0.18
State fixed effects but no time-invariant variables or year effects	All	0.772	-2.548	1.00
	AGI > 50K	0.732	-2.025	1.00
State and year fixed effects but no time-invariant variables	All	0.937	-0.152	0.00
	AGI > 50K	0.839	0.111	0.00

Alternative specifications to equation (1). For all returns, the results should be compared to column (1) of table 2. For returns with AGI over $50,000, the results should be compared to column (3) of table 2. The third variant in panel A using 1978-1990 data does not distinguish between AGI class (see data appendix). The fourth variant in panel A summarizes the results for equation (1) for returns with AGI < $50,000. The final column gives the significance level of the test of the hypothesis that the elasticity is less than -1.

Appendix A - Tax Rates

Table A-1: State Tax Systems and Tax Rates
(Alphabetically by Type of Tax System in 1990)

State	Name	State Type 1990*	State 1978 Rate	State 1979 Rate	State 1980 Rate	State 1981 Rate	State 1982 Rate
AK	Alaska	0	7.25%	0.00%	0.00%	0.00%	0.00%
FL	Florida	0	0.00%	0.00%	0.00%	0.00%	0.00%
NV	Nevada	0	0.00%	0.00%	0.00%	0.00%	0.00%
NH	New Hampshire	0	0.00%	0.00%	0.00%	0.00%	0.00%
SD	South Dakota	0	0.00%	0.00%	0.00%	0.00%	0.00%
TN	Tennessee	0	0.00%	0.00%	0.00%	0.00%	0.00%
TX	Texas	0	0.00%	0.00%	0.00%	0.00%	0.00%
WA	Washington	0	0.00%	0.00%	0.00%	0.00%	0.00%
WY	Wyoming	0	0.00%	0.00%	0.00%	0.00%	0.00%
AZ	Arizona	1	4.00%	3.20%	3.20%	3.20%	3.20%
AR	Arkansas	1	7.00%	7.00%	7.00%	7.00%	7.00%
CA	California	1	5.50%	4.40%	4.40%	4.40%	4.40%
CO	Colorado	1	4.00%	3.20%	3.20%	3.20%	3.20%
CT	Connecticut	1	2.80%	2.80%	2.80%	2.80%	2.80%
DE	Delaware	1	9.90%	5.40%	5.40%	5.40%	5.40%
DC	District of Columbia	1	5.50%	4.40%	4.40%	4.40%	4.40%
GA	Georgia	1	3.00%	3.00%	2.40%	2.40%	2.40%
HI	Hawaii	1	5.50%	4.40%	4.40%	4.40%	4.40%
ID	Idaho	1	3.75%	3.75%	3.00%	3.00%	3.00%
IL	Illinois	1	1.25%	1.00%	1.00%	1.00%	1.00%
IN	Indiana	1	1.50%	1.08%	1.16%	1.60%	1.60%
ME	Maine	1	4.00%	4.00%	4.00%	4.00%	4.00%
MD	Maryland	1	3.75%	3.00%	3.00%	3.00%	3.00%
MA	Massachusetts	1	4.50%	3.60%	3.60%	4.30%	4.30%
MI	Michigan	1	2.30%	1.84%	1.84%	1.84%	1.84%
MN	Minnesota	1	7.50%	6.40%	6.40%	6.40%	6.40%
MS	Mississippi	1	4.00%	4.00%	4.00%	5.00%	5.00%
NE	Nebraska	1	15.00%	17.00%	17.00%	18.00%	18.00%
NJ	New Jersey	1	2.50%	2.50%	2.50%	2.50%	3.50%
NM	New Mexico	1	4.50%	3.60%	3.60%	2.40%	2.40%
NY	New York	1	7.50%	6.00%	5.60%	5.60%	5.60%
NC	North Carolina	1	7.00%	7.00%	7.00%	7.00%	7.00%
OH	Ohio	1	1.75%	1.40%	1.40%	1.40%	2.00%
OK	Oklahoma	1	3.00%	2.40%	2.40%	2.40%	2.40%
OR	Oregon	1	5.00%	4.00%	4.00%	4.00%	4.00%
PA	Pennsylvania	1	2.20%	2.20%	2.20%	2.20%	2.20%
SC	South Carolina	1	7.00%	7.00%	7.00%	7.00%	7.00%
VA	Virginia	1	2.88%	2.30%	2.30%	2.30%	2.30%
WV	West Virginia	1	4.80%	3.84%	3.84%	3.84%	3.84%
WI	Wisconsin	1	5.00%	4.00%	4.00%	4.00%	4.00%
AL	Alabama	2	5.00%	5.00%	5.00%	5.00%	5.00%
IA	Iowa	2	7.02%	5.62%	5.62%	5.62%	5.62%
KS	Kansas	2	4.50%	3.60%	3.60%	3.60%	3.60%
KY	Kentucky	2	3.00%	2.40%	2.40%	2.40%	2.40%
LA	Louisiana	2	3.00%	2.40%	2.40%	2.40%	2.40%
MO	Missouri	2	3.00%	2.40%	2.40%	2.40%	2.40%
MT	Montana	2	5.50%	4.40%	4.40%	4.40%	4.40%
UT	Utah	2	3.88%	3.10%	3.10%	3.10%	3.10%
ND	North Dakota	3	5.00%	7.50%	7.50%	7.50%	7.50%
RI	Rhode Island	3	17.00%	17.00%	19.00%	19.00%	21.90%
VT	Vermont	3	25.00%	23.00%	23.00%	24.00%	24.00%

Table A-1: State Tax Systems and Tax Rates (continued)
(Alphabetically by Type of Tax System in 1990)

State	State Type 1990*	State 1983 Rate	State 1984 Rate	State 1985 Rate	State 1986 Rate	State 1987 Rate	State 1988 Rate	State 1989 Rate	State 1990 Rate
AK	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
FL	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
NV	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
NH	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
SD	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
TN	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
TX	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
WA	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
WY	0	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
AZ	1	3.20%	3.20%	3.20%	3.20%	3.20%	3.20%	8.00%	7.00%
AR	1	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%
CA	1	4.40%	4.40%	4.40%	4.40%	9.30%	9.30%	9.30%	9.30%
CO	1	3.20%	3.20%	3.20%	3.20%	5.00%	5.00%	5.00%	5.00%
CT	1	2.80%	2.80%	2.80%	2.80%	2.80%	2.80%	7.00%	7.00%
DE	1	5.40%	4.28%	4.28%	3.52%	8.80%	7.70%	7.70%	7.70%
DC	1	4.40%	4.40%	4.40%	4.40%	10.00%	9.50%	9.50%	9.50%
GA	1	2.40%	2.40%	2.40%	2.40%	6.00%	6.00%	6.00%	6.00%
HI	1	4.40%	4.40%	4.40%	4.40%	10.00%	10.00%	10.00%	10.00%
ID	1	3.00%	3.00%	3.00%	3.00%	3.28%	3.28%	8.20%	8.20%
IL	1	1.20%	1.20%	1.00%	1.00%	2.50%	2.50%	3.00%	3.00%
IN	1	1.60%	1.60%	1.60%	1.60%	4.20%	4.40%	4.40%	4.40%
ME	1	4.00%	4.00%	4.00%	4.00%	10.00%	8.00%	8.50%	8.50%
MD	1	3.00%	3.00%	3.00%	3.00%	4.50%	4.50%	4.50%	4.50%
MA	1	4.00%	4.00%	4.00%	4.00%	5.00%	5.00%	5.00%	6.00%
MI	1	2.54%	2.14%	2.04%	1.84%	4.60%	4.60%	4.60%	4.60%
MN	1	6.40%	6.40%	3.96%	3.96%	9.00%	8.00%	8.00%	8.00%
MS	1	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
NE	1	20.00%	19.00%	19.00%	19.00%	5.90%	5.90%	5.90%	6.41%
NJ	1	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%	3.50%
NM	1	3.12%	3.12%	3.12%	3.40%	8.50%	8.50%	8.50%	8.50%
NY	1	5.60%	5.60%	5.40%	5.40%	8.50%	8.00%	7.50%	7.88%
NC	1	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%	7.00%
OH	1	2.00%	3.80%	3.61%	3.42%	6.90%	6.90%	6.90%	6.90%
OK	1	2.40%	2.40%	2.40%	2.40%	6.00%	6.00%	6.00%	7.00%
OR	1	4.00%	4.00%	4.00%	4.00%	9.00%	9.00%	9.00%	9.00%
PA	1	2.45%	2.35%	2.35%	2.16%	2.10%	2.10%	2.10%	2.10%
SC	1	7.00%	7.00%	2.80%	2.80%	7.00%	7.00%	7.00%	7.00%
VA	1	2.30%	2.30%	2.30%	2.30%	5.75%	5.75%	5.75%	5.75%
WV	1	5.20%	5.20%	5.20%	5.20%	6.50%	6.50%	6.50%	6.50%
WI	1	4.00%	4.00%	3.16%	3.16%	2.77%	2.77%	2.77%	2.77%
AL	2	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%	5.00%
IA	2	5.62%	5.62%	5.62%	5.62%	4.31%	4.31%	10.78%	10.78%
KS	2	3.60%	3.60%	3.60%	3.60%	9.00%	6.10%	5.95%	5.95%
KY	2	2.40%	2.40%	2.40%	2.40%	2.40%	2.40%	2.40%	2.40%
LA	2	2.40%	2.40%	2.40%	2.40%	6.00%	6.00%	6.00%	6.00%
MO	2	2.40%	2.40%	2.40%	2.40%	6.00%	6.00%	6.00%	6.00%
MT	2	4.40%	4.40%	4.40%	11.00%	11.00%	11.00%	11.00%	11.00%
UT	2	3.10%	3.10%	3.10%	3.10%	7.75%	7.35%	7.20%	7.20%
ND	3	9.00%	9.00%	9.00%	10.50%	14.00%	14.00%	14.00%	14.00%
RI	3	26.75%	24.90%	23.15%	22.21%	23.46%	22.96%	22.96%	22.96%
VT	3	26.00%	26.00%	26.50%	26.50%	25.80%	23.00%	25.00%	28.00%

Note: Type 0 states have no state income tax. Type 1 states do not allow Federal tax payments to be deducted from state tax liability. Type 2 states allow the deduction of Federal tax payments. Type 3 states calculate state tax liability as a fraction of Federal tax liability. See text and data appendix for details.

* Alaska was a Type 1 state in 1978, Arizona was a Type 2 state from 1978-1985, Colorado was a Type 2 state from 1978-1986, Minnesota was a Type 2 state from 1978-1985, Nebraska was a Type 3 state from 1978-1986, and North Dakota was a Type 2 state in 1978.

Table A-2: Combined State and Federal Tax Rates
(Sorted as in Table A-1)

State	State Type 1990	Total 1978 Rate	Total 1979 Rate	Total 1980 Rate	Total 1981 Rate	Total 1982 Rate	Total 1983 Rate
AK	0	37.18%	28.00%	28.00%	20.00%	20.00%	20.00%
FL	0	35.00%	28.00%	28.00%	20.00%	20.00%	20.00%
NV	0	35.00%	28.00%	28.00%	20.00%	20.00%	20.00%
NH	0	35.00%	28.00%	28.00%	20.00%	20.00%	20.00%
SD	0	35.00%	28.00%	28.00%	20.00%	20.00%	20.00%
TN	0	35.00%	28.00%	28.00%	20.00%	20.00%	20.00%
TX	0	35.00%	28.00%	28.00%	20.00%	20.00%	20.00%
WA	0	35.00%	28.00%	28.00%	20.00%	20.00%	20.00%
WY	0	35.00%	28.00%	28.00%	20.00%	20.00%	20.00%
AZ	1	35.80%	28.71%	28.71%	21.30%	21.30%	21.30%
AR	1	37.10%	30.10%	30.10%	23.50%	23.50%	23.50%
CA	1	36.65%	29.32%	29.32%	22.20%	22.20%	22.20%
CO	1	35.80%	28.71%	28.71%	21.30%	21.30%	21.30%
CT	1	35.84%	28.84%	28.84%	21.40%	21.40%	21.40%
DE	1	37.97%	29.62%	29.62%	22.70%	22.70%	22.70%
DC	1	36.65%	29.32%	29.32%	22.20%	22.20%	22.20%
GA	1	35.90%	28.90%	28.72%	21.20%	21.20%	21.20%
HI	1	36.65%	29.32%	29.32%	22.20%	22.20%	22.20%
ID	1	36.13%	29.13%	28.90%	21.50%	21.50%	21.50%
IL	1	35.37%	28.30%	28.30%	20.50%	20.50%	20.60%
IN	1	35.45%	28.32%	28.35%	20.80%	20.80%	20.80%
ME	1	36.20%	29.20%	29.20%	22.00%	22.00%	22.00%
MD	1	36.13%	28.90%	28.90%	21.50%	21.50%	21.50%
MA	1	36.35%	29.08%	29.08%	22.15%	22.15%	22.00%
MI	1	35.69%	28.55%	28.55%	20.92%	20.92%	21.27%
MN	1	36.54%	29.45%	29.45%	22.64%	22.64%	22.64%
MS	1	36.20%	29.20%	29.20%	22.50%	22.50%	22.50%
NE	1	36.43%	29.28%	29.28%	21.65%	21.65%	21.82%
NJ	1	35.75%	28.75%	28.75%	21.25%	21.75%	21.75%
NM	1	36.35%	29.08%	29.08%	21.20%	21.20%	21.56%
NY	1	37.25%	29.80%	29.68%	22.80%	22.80%	22.80%
NC	1	37.10%	30.10%	30.10%	23.50%	23.50%	23.50%
OH	1	35.53%	28.42%	28.42%	20.70%	21.00%	21.00%
OK	1	35.90%	28.72%	28.72%	21.20%	21.20%	21.20%
OR	1	36.50%	29.20%	29.20%	22.00%	22.00%	22.00%
PA	1	35.66%	28.66%	28.66%	21.10%	21.10%	21.23%
SC	1	37.10%	30.10%	30.10%	23.50%	23.50%	23.50%
VA	1	35.86%	28.69%	28.69%	21.15%	21.15%	21.15%
WV	1	36.44%	29.15%	29.15%	21.92%	21.92%	22.60%
WI	1	36.50%	29.20%	29.20%	22.00%	22.00%	22.00%
AL	2	36.01%	29.12%	29.12%	22.05%	22.05%	22.05%
IA	2	36.44%	29.26%	29.26%	22.31%	22.31%	22.31%
KS	2	35.91%	28.80%	28.80%	21.47%	21.47%	21.47%
KY	2	35.60%	28.53%	28.53%	20.97%	20.97%	20.97%
LA	2	35.60%	28.53%	28.53%	20.97%	20.97%	20.97%
MO	2	35.60%	28.53%	28.53%	20.97%	20.97%	20.97%
MT	2	36.12%	28.98%	28.98%	21.80%	21.80%	21.80%
UT	2	35.78%	28.68%	28.68%	21.26%	21.26%	21.26%
ND	3	36.01%	28.60%	28.60%	20.72%	20.72%	20.86%
RI	3	36.60%	29.28%	29.41%	21.74%	21.97%	22.36%
VT	3	37.23%	29.66%	29.66%	22.14%	22.14%	22.30%

Table A-2: Combined State and Federal Tax Rates (continued)
(Sorted as in Table A-1)

State	State Type 1990	Total 1984 Rate	Total 1985 Rate	Total 1986 Rate	Total 1987 Rate	Total 1988 Rate	Total 1989 Rate	Total 1990 Rate
AK	0	20.00%	20.00%	20.00%	28.00%	28.00%	28.00%	28.00%
FL	0	20.00%	20.00%	20.00%	28.00%	28.00%	28.00%	28.00%
NV	0	20.00%	20.00%	20.00%	28.00%	28.00%	28.00%	28.00%
NH	0	20.00%	20.00%	20.00%	28.00%	28.00%	28.00%	28.00%
SD	0	20.00%	20.00%	20.00%	28.00%	28.00%	28.00%	28.00%
TN	0	20.00%	20.00%	20.00%	28.00%	28.00%	28.00%	28.00%
TX	0	20.00%	20.00%	20.00%	28.00%	28.00%	28.00%	28.00%
WA	0	20.00%	20.00%	20.00%	28.00%	28.00%	28.00%	28.00%
WY	0	20.00%	20.00%	20.00%	28.00%	28.00%	28.00%	28.00%
AZ	1	21.30%	21.30%	21.60%	29.97%	30.30%	33.76%	33.04%
AR	1	23.50%	23.50%	23.50%	32.31%	33.04%	33.04%	33.04%
CA	1	22.20%	22.20%	22.20%	33.72%	34.70%	34.70%	34.70%
CO	1	21.30%	21.30%	21.30%	31.08%	31.60%	31.60%	31.60%
CT	1	21.40%	21.40%	21.40%	29.72%	30.02%	33.04%	33.04%
DE	1	22.14%	22.14%	21.76%	33.41%	33.54%	33.54%	33.54%
DC	1	22.20%	22.20%	22.20%	34.15%	34.84%	34.84%	34.84%
GA	1	21.20%	21.20%	21.20%	31.69%	32.32%	32.32%	32.32%
HI	1	22.20%	22.20%	22.20%	34.15%	35.20%	35.20%	35.20%
ID	1	21.50%	21.50%	21.50%	30.02%	30.36%	33.90%	33.90%
IL	1	20.60%	20.50%	20.50%	29.54%	29.80%	30.16%	30.16%
IN	1	20.80%	20.80%	20.80%	30.58%	31.17%	31.17%	31.17%
ME	1	22.00%	22.00%	22.00%	34.15%	33.76%	34.12%	34.12%
MD	1	21.50%	21.50%	21.50%	30.77%	31.24%	31.24%	31.24%
MA	1	22.00%	22.00%	22.00%	31.08%	31.60%	31.60%	32.32%
MI	1	21.07%	21.02%	20.92%	30.83%	31.31%	31.31%	31.31%
MN	1	22.64%	21.62%	21.98%	33.54%	33.76%	33.76%	33.76%
MS	1	22.50%	22.50%	22.50%	31.08%	31.60%	31.60%	31.60%
NE	1	21.74%	21.74%	21.74%	31.63%	32.25%	32.25%	32.62%
NJ	1	21.75%	21.75%	21.75%	30.15%	30.52%	30.52%	30.52%
NM	1	21.56%	21.56%	21.70%	33.23%	34.12%	34.12%	34.12%
NY	1	22.80%	22.70%	22.70%	33.23%	33.76%	33.40%	33.67%
NC	1	23.50%	23.50%	23.50%	32.31%	33.04%	33.04%	33.04%
OH	1	21.90%	21.81%	21.71%	32.24%	32.97%	32.97%	32.97%
OK	1	21.20%	21.20%	21.20%	31.69%	32.32%	32.32%	33.04%
OR	1	22.00%	22.00%	22.00%	33.54%	34.48%	34.48%	34.48%
PA	1	21.18%	21.18%	21.08%	29.29%	29.51%	29.51%	29.51%
SC	1	23.50%	21.40%	21.40%	32.31%	33.04%	33.04%	33.04%
VA	1	21.15%	21.15%	21.15%	31.54%	32.14%	32.14%	32.14%
WV	1	22.60%	22.60%	22.60%	32.00%	32.68%	32.68%	32.68%
WI	1	22.00%	21.58%	21.58%	29.70%	30.00%	30.00%	30.00%
AL	2	22.05%	22.05%	22.05%	30.26%	30.63%	30.63%	30.63%
IA	2	22.31%	22.31%	21.51%	28.83%	28.96%	33.76%	33.76%
KS	2	21.47%	21.47%	21.47%	32.13%	31.22%	31.14%	31.14%
KY	2	20.97%	20.97%	20.62%	28.45%	28.53%	28.53%	29.25%
LA	2	20.97%	20.97%	20.97%	30.72%	31.16%	31.16%	31.16%
MO	2	20.97%	20.97%	20.62%	30.72%	31.16%	31.16%	31.16%
MT	2	21.80%	21.80%	24.66%	33.09%	33.88%	33.88%	33.88%
UT	2	21.26%	21.26%	21.55%	32.77%	33.29%	34.19%	34.19%
ND	3	20.86%	20.86%	21.00%	30.29%	30.72%	30.72%	30.72%
RI	3	22.21%	22.07%	22.00%	31.71%	32.35%	32.35%	32.35%
VT	3	22.30%	22.34%	22.34%	32.04%	32.36%	32.71%	33.23%