Working Paper Series
Congressional Budget Office
Washington, D.C.

The Impact of the Estate Tax on Capital Gains Realizations: Evidence from the Taxpayer Relief Act of 1997

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Working Paper 2010-08

I am grateful to Janet Holtzblatt, Larry Ozanne, Bill Randolph, and Frank Sammartino from the Congressional Budget Office; Gerald Auten and David Joulfaian from the Office of Tax Analysis of the U.S. Department of the Treasury; Alan J. Auerbach from the University of California, Berkeley; James Poterba from the Massachusetts Institute of Technology; Robert Lemke from Lake Forest College, and John Karl Scholz from the University of Wisconsin–Madison for many invaluable comments and suggestions.

Abstract

This study investigates the effects of the estate tax on decisions to realize capital gains. It identifies the effects on realization decisions through the changes in the estate tax exemption level introduced by the Taxpayer Relief Act of 1997 (TRA97). Using data from the Survey of Consumer Finance (SCF), the analysis focuses on changes in capital gains realization by households that were affected by an increase in the estate tax exemption level. Applying the generalized Tobit procedure that corrects for sample selection and endogeneity in tax variables, the study finds that those households realized significantly lower gains relative to households that were not affected. The study also finds that the capital gains lock-in effects resulting from estate tax changes in TRA97 are likely confined to households that would have had some capital gains income under prior law, and that the effects do not appear to induce more households to sell assets. These findings support the hypothesis that the presence of the estate tax helps unlock capital gains realization. The results are robust to a number of alternative specifications.

1. Introduction

Much attention has focused on the impact of the individual income tax on taxpayers' decisions to realize capital gains. However, the estate tax may also affect those decisions. This study examines the effects of estate taxation on decisions to realize capital gains by analyzing the responses of households' decisions to the Taxpayer Relief Act of 1997 (TRA97), which gradually increased the amount of the estate that is exempt from the tax from $600,000 to $1 million.

Under current law (except in 2010), capital gains that were never realized during the taxpayer's life completely escape income tax. Under those circumstances, ownership of the asset passes to the heir, and its tax basis is increased (or "stepped up") to equal its market value at the time of the taxpayer's death–thus effectively eliminating any income tax liability on the capital gains that accrued from the time the taxpayer obtained the asset to the time of his or her death. The step-up in basis, then, may create an incentive for taxpayers to hold assets until death to avoid taxation–locking in capital gains realizations as a consequence.

By taxing the current value of inherited assets (in excess of the exemption level), the estate tax provides a backstop to the loss in income tax revenues that result from the step-up in basis. For wealthy taxpayers, the estate tax may unlock capital gains by making the sale of assets to finance consumption relatively more attractive than holding those assets as a bequest to heirs. Moreover, when the capital gains tax is viewed as a transaction cost for adjusting portfolios, the estate tax effectively lowers the transaction cost and thus stimulates capital gains realizations.

This study tests whether the rise in the estate tax exemption level from $600,000 to $1 million, resulting from TRA97, increases the capital gains lock-in effects. I use data from the Survey of Consumer Finances (SCF), which contains households headed by individuals who, given their age, would reasonably expect to continue to live for a number of years. That feature of the data could be important, because it is possible that taxpayers engage in estate tax planning—in particular, by adjusting their portfolios and realizing capital gains—well before they near the end of their lives. During the time

period chosen (1989 to 2007), TRA97 would have caused estate tax expectations across the SCF households to change for at least some portion of the population.

This study also addresses several econometric concerns. It is likely that those households that realized capital gains were not randomly selected from the population. In addition, the progressivity of the income tax schedule implies that the capital gains tax rate variable is endogenous to the realization decision. To account for these sample selection and endogeneity problems, I follow Burman and Randolph (1994) by employing a generalized Tobit model. This estimation procedure allows for use of an instrumental variable in place of the capital gains tax rate and allows for the effects of explanatory variables to differ between the decision of whether to realize capital gains and the choice over the amount of gains realized.

The findings of this study support the hypothesis that the presence of estate taxation helps unlock capital gains realizations. Specifically, I find that households that experienced the largest reductions in their estate tax price realized significantly lower amounts of gains relative to the households that were not affected. The capital gains lock-in effects are likely confined to households that would have had some capital gains income under prior law, rather than inducing more households to sell assets and realize capital gains. This finding may be due to differences in the transaction costs associated with portfolio adjustment between the households that had capital gains income and those that did not. Another possible explanation for that finding is that households that would have had some capital gains income, even in the absence of the provision, may be more tax-savvy than other households. The findings are reasonably robust to alternative specifications.

Section 2 discusses related studies. Section 3 describes the background on relevant estate and capital gains tax law. Sections 4 and 5 illustrate model specification, estimation method, and the dataset used in this study. The empirical results and sensitivity analyses are shown in Section 6. Section 7 presents the conclusions.

2. Previous Studies

The extensive empirical literature on the capital gains realization decision has been influenced by the seminal work of Feldstein, Slemrod and Yitzhaki (1980), who studied the effects of taxation on the sale of corporate stock.[1] Using cross-section data which oversampled high-income taxpayers and contained detailed information on asset sales, they found that the capital gains realization of corporate stock is highly responsive to the marginal tax rate.

Since then, many other studies have examined the elasticity of gains realization, using new approaches that yield much lower elasticity estimates than those found in the original study. For example, Burman and Randolph (1994) purged the estimation of intertemporal substitution by using the sum of the maximum federal tax rate and the maximum state tax rate (for a taxpayer's residence) as an instrument for the permanent tax rate. They argued that such an instrument is uncorrelated with transitory variations in individuals' income. Their findings suggest that the long run response to the capital gains tax rate change is much smaller than the transitory response.

More recently, Auerbach and Siegel (2000) allowed for heterogeneity among taxpayers by distinguishing the responses of the wealthy and the financially sophisticated taxpayers from those who were less wealthy or financially sophisticated.[2] They found that wealthier taxpayers exhibit significantly lower long-run responses to changes in capital gains tax rate than other taxpayers—suggesting closer adherence to capital gains tax avoidance strategies that emphasize arbitrage based on tax rate differentials. The responsiveness of the financially sophisticated taxpayers exhibited a similar pattern.

Auten and Joulfaian (2001) conducted the first empirical study that explicitly considered the effects of the estate tax on the decision to realize gains. They employed a dataset that matches a sample of federal estate tax returns for 1982 decedents with their 1980 and 1981 federal income tax returns. Their dataset straddles the Economic Recovery Tax Act of 1981, which reduced tax rates on both capital gains and estates.

[1] For complete review of the literature on capital gains taxation, see Zodrow (1993) and Gravelle (2010).
[2] Auerbach and Siegel identified the financially sophisticated taxpayers as those who reported the sale of at least one option, commodity, or futures contract, or who engaged in a short-sale transaction at any time during the panel period.

Using the standard model that corrected for the endogeneity of both capital gains tax rates and estate tax rates, they found that the estate tax has a significant unlocking effect on realizations of capital gains with an implied elasticity of 0.36.[3] Their result is robust to a number of specifications. The estate taxes have the largest effects on realizations for individuals between 75 and 84 years old, with no effect for those over 85 years old or under 50 years old.

One of the critical features of Auten and Joulfaian's study was that the sample was restricted to taxpayers who were within one or two years of their death. As a result of this restriction, the mean age in their sample is approximately 75 years old. It is possible that the sample included many people—who, because of their age or their state of health, were aware that they might be approaching the end of their life and adjusted their estate planning accordingly.[4]

Estate tax planning—in particular, portfolio adjustment and realizations of capital gains—may be taken well before taxpayers enter the final years of their lives. This hypothesis is supported by several studies, which find that young taxpayers take into account their expected estate tax liabilities when deciding whether to transfer gifts to relatives and charities during their lifetime.

For example, Bernheim et al. (2004) used the Survey of Consumer Finances from 1989 to 2001 to investigate the effects of estate and gift taxation on the timing of private transfers. They restricted the sample to households whose heads were between the ages of 50 and 79, resulting in a sample with an average age of 61—significantly younger than that in the sample used by Auten and Joulfaian. Bernheim et al. examined the impact of TRA97, which increased the unified lifetime exemption of estate and gift taxes from $600,000 to $1 million. Despite the unified lifetime exemption, it was generally more advantageous under pre-TRA97 law for taxpayers to give to heirs during their lifetimes

[3] Auten and Joulfaian also estimated a generalized Tobit model and found that the estimated coefficient on the estate tax rate from the level equation is statistically significant and thus consistent with their standard Tobit result.

[4] Of course, not everyone in the sample would have reason to believe that death was imminent. For example, about 20 percent of the sample were individuals who were under the age 65. It is possible that younger members of the sample—particularly if they believed that they were healthy—did not expect death to be imminent and thus did not engage in estate tax planning. The tax return data, however, do not contain information on health status or cause of death.

than to bequest those amounts at death—in part because of the exemption from taxation of annual gifts of up to $10,000 for each recipient and the exclusion of those gifts from the unified lifetime exemption. Increasing the lifetime exemption eliminated exposure to estate taxation for some households and thus lowered the tax disadvantage of bequests compared with gifts from those households. If the price effect (resulting from a reduction in the effective marginal gift and estate tax rate) is sufficiently strong, this will lower those households' incentives to make inter vivos transfers (that is, gifts made during the giver's lifetime).[5] Bernheim et al. found that TRA97 significantly lowered the likelihood of inter vivos transfers for households whose exposure to estate taxation was reduced the most relative to the households whose exposure was unaffected. Their findings therefore suggest that the timing of transfers is responsive to applicable estate and gift tax rates.

A second study of the effects of the estate tax included younger households. Greene and McClelland (2001) examined the effects of the estate tax on charitable contributions using the 1992 wave of the Health and Retirement Study survey. Using only observations from the primary respondents, their sample's average age is about 56. They calculated the expected value of an individual's estate and the applicable estate tax rate under several scenarios of asset growth. They found that the estate tax has a significant impact on charitable contributions, with the elasticity ranging from 0.30 to 0.69. Given the big difference in the estate tax rates between those who were not subject to the estate tax and those who were, they suggest that this elasticity estimate may be interpreted as the elasticity for being subject to the estate tax rather than the elasticity for marginal changes in the estate tax rate.

3. Background on Relevant Estate Tax and Capital Gains Tax Law

This study identifies the effects of estate taxation through the changes in the estate tax exemption level introduced by the Taxpayer Relief Act of 1997. The federal estate tax is levied on the net value of assets transferred to individuals, other than the surviving spouse, upon a person's death. Under the law prior to TRA97, the unified credit shielded

[5] However, if the wealth effect (resulting from an increase in after-tax wealth) dominates, and gift-giving is a normal good, the incentive for making inter vivos transfers will increase.

from taxation any combination of a decedent's taxable estate and a decedent's lifetime taxable gifts up to $600,000 from tax.[6] The graduated estate tax rate schedule ranged from 37 to 55 percent. In addition, there was a 5 percent surtax levied on taxable estates from $10 million to $21.04 million. Its purpose was to reclaim the benefit of the graduated tax rates below 55 percent.

TRA97 reduced the estate tax in a series of steps. It raised the unified credit for the first time since 1981. As a result of the scheduled gradual increase in the credit, the effective exemption level would have increased from $625,000 in 1998 to $1 million in 2006. TRA97 also slightly modified the surtax provision so that the 5 percent surtax was levied on taxable estates from $10 million to $17.184 million.

Although the focus of this study is the effect of the 1997 tax law, the study period includes years following the enactment of the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA). Beginning in 2002, EGTRRA phased out the estate tax gradually, repealing it entirely for 2010 decedents. The gradual increase in the unified credit resulted in the effective exemption level rising from $1 million in 2002 to $3.5 million in 2009.[7] In a series of steps, EGTRRA also lowered top marginal tax rates from 55 percent to 45 percent by 2007. The 5 percent surtax was also repealed starting from 2002. The provisions of EGTRRA are scheduled to sunset at the end of 2010. In 2011, the estate tax will revert to what it would have been under TRA97. Table 1 summarizes top marginal estate tax rates and estate tax exemption levels from 1989.

[6] A fixed credit, known as the unified credit, effectively exempts a certain portion of each estate from tax. The effective exemption also serves as the tax-filing threshold. An estate tax return must be filed if the gross value of the estate exceeds the exemption for the year of death. In order to determine the value of the taxable estate, deductions for the gross estate are allowed for spousal bequests, charitable bequests, debts and mortgages owed, funeral expenses and costs of administering the estate.

[7] The exemption for cumulative lifetime gifts, however, remained capped separately at $1 million. The gift tax also remains in place in 2010 while the estate tax is repealed.

Table 1: Top Marginal Estate Tax Rates and Estate Tax Exemption Amounts from 1989

Year of Death	Top Marginal Tax Rate (%)		Estate Tax Exemption	
1989 - 1997	55		$600,000	
	TRA97	**EGTRRA**	**TRA97**	**EGTRRA**
1998	55	n/a	$625,000	n/a
1999	55	n/a	$650,000	n/a
2000	55	n/a	$675,000	n/a
2001	55	n/a	$675,000	n/a
2002	55	50	$700,000	$1 million
2003	55	49	$700,000	$1 million
2004	55	48	$850,000	$1.5 million
2005	55	47	$950,000	$1.5 million
2006	55	46	$1 million	$2 million
2007	55	45	$1 million	$2 million
2008	55	45	$1 million	$2 million
2009	55	45	$1 million	$3.5 million
2010	55	Repealed	$1 million	Repealed
2011 onward	55	n/a	$1 million	n/a

As noted earlier, many studies have found that the treatment of capital gains in the individual income tax system affects decisions to realize capital gains. The marginal tax rate on capital gains depends both on the taxpayer's income tax bracket and on the amount of time the investment is held before being sold. Short-term capital gains, which are gains on assets held for one year or less before being sold, are generally taxed at the taxpayer's ordinary income tax rate. Long-term capital gains, which are gains on assets held for more than one year, are generally taxed at preferential rates.

From 1988 through 1990, capital gains were taxed at the same rate as ordinary income. Consequently, marginal tax rates applicable to capital gains income ranged from 15 percent to 28 percent. An additional surtax of 5 percent (intended to recapture the benefits from the lower 15 percent tax rate) applied to all income, including capital gains, over a certain income range. From 1991 through the first four months of 1997, the long-term capital gains tax rate was capped at 28 percent.[8]

Starting in May 1997, TRA97 lowered the long-term capital gains tax rates to 10 and 20 percent. From 2001 through the first four months of 2003, the long-term capital gains tax rate for low-income individuals dropped to 8 percent for gains on assets held

[8] Slightly higher rates could apply over certain income ranges because of the phase-out of itemized deductions and personal exemptions.

five years or more (as provided under TRA97). Beginning in May 2003, the capital gains tax rates were temporarily reduced. For high-income individuals, the rate was lowered to 15 percent for 2003 through 2008. For low-income individuals, the rates were lowered to 5 percent for 2003 through 2007 and to 0 percent in 2008. These provisions were later extended for two years (2009 and 2010). Table 2 summarizes capital gains tax rates facing SCF households during the time span of this study.

Table 2: Marginal Capital Gains Tax Rates Schedule for SCF Households in This Study

Marginal Income Tax Rates	Marginal Long-Term Capital Gains Tax Rate
Households from SCF 1989: Tax Law 1988	
15%	15%
28%	28%
33% (includes 5% surtax)	33% (includes 5% surtax)
Households from SCF 1992: Tax Law 1991	
15%	15%
28% and 31%	28%
Households from SCF 1995: Tax Law 1994	
15%	15%
28%, 31%, 36% and 39.6%	28%
Households from SCF 1998: Tax Law 1997	
15%	10%
28%, 31%, 36% and 39.6%	20%
Households from SCF 2001: Tax Law 2000	
15%	10%
28%, 31%, 36% and 39.6%	20%
Households from SCF 2004 and SCF 2007: Tax Law 2003 and 2006	
10% and 15%	5%
25%, 28%, 33% and 35%	15%

Note: Short-term capital gains are taxed at the same rate as ordinary income.

4. Model and Estimation

A household can choose to realize capital gains for a number of different reasons. Both the capital gains tax and the estate tax affect the costs and benefits of those realization decisions.

For example, a household may sell its assets in order to finance its consumption. If the household is subject to the capital gains tax at rate *t*, selling assets allows it to

consume only (1-*t*) of each dollar of gains realized in addition to the original value of the assets, after adjusting for factors such as depreciation (the "basis"). A rise in the capital gains tax rate increases the cost of realizing gains. This creates an incentive for households to hold their assets longer, locking in capital gains realizations.

Alternatively, a household may choose to bequeath its assets. Should the household decide to save its assets for bequests, the bequest recipient would receive (1-*e*) of the market value of the assets—ignoring discounting—where *e* is the estate tax rate. In contrast to the capital gains tax, a rise in the estate tax rate lowers the costs of realizing capital gains, increasing the likelihood that the household will sell the asset to pay for current consumption.

Another perspective on the capital gains and estate taxes is that they are transaction costs incurred when the household adjusts its portfolio. Ignoring the estate tax, this transaction cost is equal to tG, where G is the amount of capital gains. An increase in the capital gains tax causes transaction costs to rise, reducing the probability that the household will sell its assets. With the estate tax, the true transaction cost is $(1-e)tG$. A rise in the estate tax effectively lowers those transactions costs—increasing the likelihood that the household will realize its capital gains.

For households whose head expects to live for a number of years, calculating the ultimate estate tax liability is complicated, because it depends on the head's lifespan, growth path of assets, and estate tax law at the time of death. As discussed in the next section, my sample consists of households whose head's life expectancy spanned a number of years. Therefore, instead of calculating the expected marginal estate tax rate, I follow the approach of Bernheim et al. (2004) of identifying the effects of estate taxation through the changes in the estate tax exemption level introduced by TRA97.[9] This change systematically alters the expectation across groups of households in a way that can be identified by households' anticipated estate values.[10]

[9] Auten and Joulfain (2001) used the marginal estate tax rate but their analysis is based on a sample of taxpayers who were within one or two years of death.

[10] As illustrated in the next section, the head of almost every household chosen in this analysis had a life expectancy that extends beyond the phased-in periods of the estate tax law provisions. It is therefore reasonable to assume that the expectation concerning estate tax of the households surveyed after 1997 are governed by the TRA97.

Expectations concerning the estate tax are unaffected for households anticipating their bequests to be smaller than $600,000 (the pre-TRA97 exemption amount). Holding other factors constant, the change in estate tax law should not affect their decisions to realize capital gains. These households constitute Group 1 in this study.

Households anticipating their bequests to be between $600,000 and $1 million (the new exemption amount after the enactment of TRA97) face a significant reduction in their effective estate tax rate. The resulting price effect increases the incentive to hold assets with accrued gains until death. The reduction in effective estate tax rate also results in a wealth effect whose direction depends on how taxpayers perceive bequests to heirs. Taxpayers may view their own consumption as fulfilling basic needs and perceive savings for a bequest to heirs as a luxury good. If this is the case, the positive wealth effect should result in more savings for bequests, thus reinforcing the price effect. Certain taxpayers, on the other hand, may have a target level of bequests that they wish to leave to their heirs. With the reduction in effective estate tax rate, they can reduce their saving (realize higher gains for consumption) and still leave the same after-tax bequest as before. The finding by Auten and Joulfaian (2001)–that increases in estate tax rates unlock realizations—supports the view that either the price effect dominates the wealth effect or that the two effects move in the same direction. I therefore expect that Group 2 households with wealth between $600,000 and $1 million will realize fewer gains after 1997.

A third group includes those whose anticipated estates exceed $1 million—an amount that is greater than the exemption level both before and after TRA97. These households did not experience any change in their marginal estate tax rate but instead experienced a slight positive wealth effect due to the higher credit introduced by TRA97.[11] As discussed above, the direction of the change in the capital gains realization decision attributable to the wealth effect is ambiguous. Given the ambiguous direction of the wealth effect and the relatively small impact of the 1997 legislation on estates with

[11] There is, however, a group of very wealthy households that experienced a slight reduction in their marginal estate tax rates after 1997. These were households that anticipated their estates to be between $17.184 million and $21.04 million. These households were no longer subject to the 5 percent surtax after 1997.

assets in excess of $1 million, I do not expect households in Group 3 to significantly change their realization behavior after 1997.

The regression analysis includes several dummy variables and interaction terms to account for these effects. First, dummy variables (*Group2* and *Group3*) control for time-invariant differences across groups. Second, a dummy variable signifies that data comes from a survey year after the enactment of TRA97 (*PostTRA97*), thus controlling for variation before and after TRA97. The regression framework also includes interaction terms between group dummies and the dummy for years after TRA97 (*Group2*Post TRA97* and *Group 3*PostTRA97*). These interaction terms constitute a focus point of this analysis. They capture changes in behavior of Group 2 and of Group 3 relative to Group 1 using surveys taken before 1997 as a baseline. If the realization decision of Group 2 is responsive to estate taxation as expected, the coefficient on the Group 2 interaction term should be negative and statistically significant. However, because of the ambiguous prediction of the wealth effect, I would not necessarily expect to see a significant change in the behavior of Group 3 relative to Group 1.

The estimating equations can be written as:

$$\begin{aligned} I^* = {} & \alpha_1 \tau + \alpha_2 (Group2 * PostTRA97) \\ & + \alpha_3 (Group3 * PostTRA97) + X\alpha_4 + u_1 \end{aligned} \qquad (1)$$

and

$$\ln(Y) = \begin{cases} \beta_1 \tau + \beta_2 (Group2 * PostTRA97) \\ \quad + \beta_3 (Group3 * PostTRA97) + X\beta_4 + u_2 & \text{if } I^* > 0, \\ 0 \qquad \text{otherwise} \end{cases} \qquad (2)$$

where I^* is a latent indicator of the decision to realize capital gains, Y is the amount of capital gains realized, τ is the marginal capital gains tax rate, *Group2* and *Group3* are group dummy variables, *PostTRA97* is a dummy variable for surveys taken after the enactment of TRA97, and X is a vector of other control variables. The regression framework allows for the possibility that the effects of these explanatory variables are different for the extensive margin of whether to realize capital gains and the intensive margin of how to choose the amount of gains realized. This semi-log functional form suggests that the elasticity of capital gains realizations with respect to the marginal tax rate is an approximately linear function.

Given the progressivity of the individual income tax schedule, it is very likely that the capital gains tax rate variable is affected by the amounts of realized capital gains. The realization of capital gains increases the taxpayer's taxable income and possibly pushes the taxpayer into a higher tax bracket. This endogeneity makes it necessary to find instruments that are highly correlated with the tax rates but are uncorrelated with the amount of realized gains. Consequently, I use the "first-dollar" marginal tax rate as an instrument for the endogenous marginal tax rate. This strategy assumes that all components of the tax base other than the amount of realized gains are exogenous. The marginal tax rate is then computed with the assumption that the taxpayer does not have any realized gains. It is also possible that the capital gains realization decision is related to charitable contributions. Consequently, in the computation of the tax instrumental variable, I set charitable contribution equal to the sample mean ratio of charity contributions to non-gain income. However, with only two capital gains tax rates during the study period (three for 1988), the endogeneity issue is much less important than for years prior to the Tax Reform Act of 1986.

Auten and Joulfaian (2001) found that the estate tax rate is simultaneously determined with realized gains. Selling assets with accrued gains reduces a taxpayer's net worth by the amount of capital gains tax paid and could therefore affect a person's estate tax rate. For most taxpayers in my sample, however, the decline in wealth from realizing gains is small compared to the uncertainty about the length of their lifespans and the ultimate value of their estates and should have little effect, if any, on the group classification.[12]

Burman and Randolph (1994) emphasized the importance of correcting for sample selection. It is possible that those who realize capital gains are not randomly selected from the population. In such case, ignoring sample selection will lead to inconsistent estimates.

This study uses the generalized Tobit estimation model developed by Lee et al. (1980). It consists of four steps. First, I regress the capital gains marginal tax rate (τ) on its instrument and other regressors to obtain fitted values of τ. Next, I estimate a criterion

[12] Adding back estimated capital gains tax and charitable contributions (net of savings from the income tax deduction) to the wealth measure used in classifying households has little effect on the result.

function on the full sample using Probit maximum likelihood, with the fitted values of τ substituting for the actual values. Third, the fitted value of τ is reestimated for the subsample of those realizing gains. The regression includes the estimate of the inverse Mills ratio from the second step as a regressor to control for possible sample selection. In the final step, the level equation is estimated by using ordinary least squares on the subsample of households that had already realized capital gains. The regressors include the fitted values from the preceding step and the estimate of the inverse Mills ratio. The standard errors are estimated using bootstrap methods because the precise asymptotic variance of this estimator is unknown.

5. Data and Construction of Variables

The data used in this study come from the Federal Reserve Board's Survey of Consumer Finances. The SCF is widely regarded as the best available source on asset holdings and wealth accumulation for a nationally representative sample. It is drawn from an area probability sample of the U.S. population and a sample of high-income tax returns derived from an Internal Revenue Service dataset. One of the most valuable aspects of the SCF is the oversampling of high-income households. Oversampling high-income households helps equalize the probability of each dollar of wealth in the economy appearing in the sample.[13] That is critical for this analysis of the effects of estate tax, because the distribution of wealth is highly concentrated.

Each SCF survey year is a random, stratified cross-section of U.S. households.[14] Interviews were conducted during the second half of the survey year. Assets include those held by all members of the household and are valuated using market values at the time of the interview. Demographic characteristics are also reported as of the time of the

[13] For more discussion of SCF sample and weight design, see Kennickell (1998) and Kennickell and Woodburn (1999).

[14] The SCF's unit of analysis is the primary economic unit (PEU). It consists of an economically dominant single individual or couple and all other household members who are financially interdependent with that individual or couple. The SCF creator gave an example of a household consisting of a married couple who own their home, a minor child, a dependent adult child, and a financially independent parent of one of the members of the couple. In such case, the PEU would be the couple and the two children. In most cases, the PEU and the household are identical. In a PEU headed by a couple, the head of the household is assumed to be the male in a mixed-sex couple or the older individual in a same-sex couple.

interview. However, the tax information, such as taxable income and capital gains income, corresponds to the previous calendar year.

In order to protect respondents' privacy, the SCF has a complex sampling scheme. For each survey year, the Federal Reserve Board makes available a file of 999 replicate weights and multiplicity factors for each weight so that users can approximate variation in the data using a bootstrap technique. A multiple imputation procedure is also used to yield five implicates for each respondent.[15]

The SCF has several advantages over tax return data, although it lacks information on some of the wealthiest people in the United States.[16] It allows examination of the effects of estate taxes for a larger number of years before death. This could be crucial if one believes that estate tax planning starts before the last few years of life. It also contains more extensive household demographic information.

In classifying the households into three groups as discussed in the previous section, I assume that a household expects to pay the estate tax if its anticipated estate exceeds the relevant unified exemption level. Almost every household head from the survey years after 1997 (2001, 2004, and 2007) had a life expectancy that extends beyond 2010. Therefore, it is reasonable to assume that the expectations concerning the estate tax schedule of the households surveyed after 1997 are governed by TRA97 rather than the changes resulting from EGTRRA.[17]

Consequently, Group 1 consists of households that anticipated their estates to be below $600,000 ($1.2 million if married), Group 2 includes households that anticipated their estates to between $600,000 and $1 million (between $1.2 million and $2 million if married) and Group 3 contains households that anticipated their estates to be above $1

[15] The program for correcting standard errors given the SCF's imputation scheme is adapted from the original Stata code written by Karen Pence with the Board of Governors of the Federal Reserve System. Parameter estimates are corrected by averaging the estimates obtained by analyzing each of the five implicates separately. Corrected standard errors are given by taking the square root of the sum of 1.2 times the imputation variance and the sampling variance. The imputation variance is the variance of the five-implicate schemes. The sampling variance is estimated using the bootstrap technique with the provided 999 replicate weights and multiplicity factors.

[16] Some assets are likely to be held disproportionately by a few relatively wealthy families. The SCF uses a dual-frame sample design to provide a representation of families overall. However, by design, the SCF excludes families who are on the *Forbes Magazine* list of the 400 wealthiest people in the United States and whose privacy might be difficult to protect if they were included in the SCF.

[17] This assumption is relaxed in the sensitivity analysis.

million (or $2 million if married). The thresholds are twice as large for married couples because the analysis takes into account the unlimited spousal bequest deduction.[18]

In the basic specification, I assume that the households' anticipated estate values equal their current net worth with an adjustment in the valuation of life insurance. For each household, the cash value of life insurance is replaced by its face value. As noted by Bernheim et al. (2004), transitions between categories should be relatively uncommon, because wealth tends to change rather slowly with age and the classification brackets are reasonably wide. This approach, however, may understate values of estates held by young families and may overstate values of estates of older families. To address this concern, in the sensitivity analysis section, I reestimate the model using an alternative way of predicting final estate values.

The dependent variable is the household's realized capital gains, which are the net capital gains from mutual funds or from the sale of stocks, bonds, or real estate. The SCF, however, does not distinguish between short- and long-term capital gains. Consequently, I assume that all net capital gains are long-term. This assumption is not central to the analysis, because about 90 percent of capital gains are long-term for all years in the analysis period.[19] The capital gains tax rates are calculated using the tax calculator (TAXSIM) provided by the National Bureau of Economic Research's microsimulation model. From the SCF, I construct a file of households' income and deduction variables and pass that file to TAXSIM to compute statutory federal marginal tax rates.[20] The SCF contains information relevant to computing the household's tax liability, including taxable income, capital gains realization, and marital status. TAXSIM computes marginal capital gains tax rate by adding a small finite difference to realized gains (in order to avoid encountering a discontinuity in the tax function) and calculates the effective marginal tax rate over this increment. Because of data limitations as well as the focus on the estate tax, the study does not differentiate between permanent and transitory responses to changes in the capital gains tax.

[18] The results do not change substantially if the estate tax exemption amount is allowed to double for widowed households as well as married households.
[19] See the IRS Statistics of Income Individual Report Table 1.4.
[20] TAXSIM assigns head of household status to respondents who have a qualified dependent. For husbands and wives, it also tries both joint and separate filing and selects the option that results in lower tax liabilities. If separate filing is chosen, non-wage income and deductions are divided equally.

A household's decision to realize capital gains also reflects its position in the life cycle and other factors. The control variables thus include demographic characteristics of the household head, such as age, education attainment, retirement status, marital status, number of children, health status, and race.[21] I also include a dummy variable for the household's past receipt of an inheritance.

In addition, I include the logarithm form of wealth. Because the measure of wealth in the SCF is for the year after the year of the capital gains decision, estimated capital gains tax and charitable contributions (net of the value of the income tax deduction) are added back in order to reflect the household's wealth prior to the effects of capital gains realizations and charitable giving decisions. The use of logarithm form helps eliminate skewing of the wealth distribution.[22] The proportion of equity in wealth is included in order to take into account the transaction cost of portfolio adjustment. It could also proxy for household's risk attitude. Shares of retirement assets—personally established IRAs and employment-based 401(k) accounts—and personal residences in wealth are also included in the model. Finally, I include the Standard & Poor's inflation-adjusted 500 index variable for each survey year to control for time-series variation in asset values.

This empirical analysis examines the relationship between estate taxation and the decision to realize capital gains. In particular, the focus is on the extent to which households changed their decisions to realize capital gains after the estate tax change in 1997. Consequently, I restrict the sample to households with wealth (adjusted for the valuation of life insurance) greater than $200,000 (in 2004 dollars) in order to make households more comparable across groups.[23] In addition, the sample is restricted to households whose heads are between 50 and 80 years old. Households with heads who are younger than 50 are less likely to engage in any estate tax planning; those with heads older than 80 are more likely to die during the phased-in periods of the estate tax law

[21] The survey question about race was asked only of the interview respondent. This person could be the head or his/her spouse. The dummy variable for health status equals 1 if either the household head or his/her spouse (or both) had poor health. All other demographic variables reflect characteristics of the household head.

[22] Because capital gains on personal residences are rarely subject to tax, one of the sensitivity tests removes personal residences from the wealth variable; this has little effect on the results.

[23] Bernheim et al. (2004) use similar restrictions. They restrict their sample to households with children and net worth over $300,000 (in 2001 dollars). Heads of household must be between 50 and 80 years old.

provisions (from 1998 to 2006 for TRA97 and from 2002 to 2009 for EGTRRA).[24] I also restrict the sample to households with at least one child, because the bequest motive is likely to be strongest in the case of parents.[25] These restrictions are relaxed in the sensitivity analysis.

Finally, I pool households from the SCF for the following years: 1989, 1992, 1995, 2001, 2004, and 2007. This time period is particularly useful for the identification of the estate tax response, because the years straddle TRA97. Households from the survey taken in 1998 are excluded because TRA97 was enacted in August 1997. Recall that the capital gains realization information in the SCF corresponds to the tax year before the interview; hence, the 1998 SCF contains information on capital gains realizations in 1997. This complicates the interpretation of the responses of the households in the 1998 SCF. Under these restriction assumptions, the sample includes 7,542 households (with 2,638 households realized gains).[26] I relax those restrictions in the sensitivity analyses.

Table 3 presents descriptive statistics of the variables used in the study. The fourth and fifth columns of the table present information for the restricted sample used in the base estimation. The second and third columns present information for the full sample (including 1998 SCF), which is used in one of the robustness tests. The SCF oversamples wealthy households; as a consequence, the means from the unweighted sample are substantially different from the means from the weighted sample. I use the unweighted sample in my regression analysis.[27]

In the unweighted sample used for the base estimation, approximately half of the households have projected estates in excess of the TRA97 exemption level (Group 3), and ten percent have projected estates valued between $600,000 and $1 million (Group 2). Slightly over 80 percent of all households in the primary sample are married couples. The average age of the household head is around 62 years old. More than half of all households are headed by a college graduate. The average value of net capital gains is

[24] Auten and Joulfaian (2001) find that estate taxes primarily affect the behavior of individuals of ages 50 through 84, with the effects peaking in ages 75 through 84.
[25] See Hurd (1990).
[26] I also drop 15 observations because their capital gains income is greater than their net worth.
[27] See Dumouchel and Duncan (1983), Deaton (1997) and Winship and Radbill (1994) for discussions of issues related to using sample weights in regression analysis.

$231,825, while the average value of wealth excluding personal residences is around $18 million (all dollar amounts are in 2004 dollars). About 80 percent of all households expect to leave a sizable bequest to their heirs.

Table 3: Descriptive Statistics of Variables Used in the Model

	All Households (Including 1998 SCF)		Households with at Least One Child, at Least $200,000 of Wealth, and Head of Household Between 50 and 80 Years Old	
	Weighted Mean/Fraction	Unweighted Mean/Fraction	Weighted Mean/Fraction	Unweighted Mean/Fraction
Capital gains realizations	$3,240	$96,705	$10,906	$231,825
Marginal capital gains tax rate	0.133	0.155	0.158	0.187
Fraction of Group 1	0.912	0.696	0.758	0.396
Fraction of Group 2	0.043	0.059	0.111	0.098
Fraction of Group 3	0.045	0.245	0.131	0.507
Fraction of SCF 1989	0.126	0.108	0.130	0.120
Fraction of SCF 1992	0.131	0.134	0.132	0.144
Fraction of SCF 1995	0.137	0.148	0.134	0.167
Fraction of SCF 1998	0.142	0.148	0.000	0.000
Fraction of SCF 2001	0.147	0.153	0.179	0.173
Fraction of SCF 2004	0.156	0.156	0.203	0.195
Fraction of SCF 2007	0.161	0.153	0.221	0.201
Retired	0.243	0.207	0.369	0.268
Married	0.537	0.624	0.756	0.827
Widowed	0.105	0.079	0.109	0.071
White	0.768	0.816	0.888	0.920
Age	49.059	50.620	62.196	61.963
Poor health	0.079	0.062	0.067	0.043
Previously inherited	0.212	0.257	0.351	0.382
Number of children	2.289	0.849	3.051	3.088
Less than high school	0.179	0.133	0.106	0.064
High school degree	0.299	0.241	0.261	0.169
Some college	0.229	0.200	0.214	0.162
Bachelor's degree	0.171	0.217	0.206	0.272
More than bachelor's degree	0.121	0.208	0.213	0.334
Expects to leave sizable estate	0.524	0.629	0.633	0.785
Equity/wealth	0.105	0.133	0.164	0.184
Retirement assets/wealth	0.119	0.110	0.172	0.123
Housing assets/wealth	0.975	0.701	0.575	0.339
Wealth (in thousands)	$378	$7,423	$1,148	$17,913
Wealth with adjustment on life insurance (in thousands)	$513	$8,030	$1,346	$19,140

Notes: All dollar amounts are in 2004 dollars.

6. Results

I first test for the strength of the instrument used in the model, because a weak instrument would produce a biased estimator. I follow the testing procedure proposed by Stock and Yogo (2003). It is based on the concern that weak instruments lead to size distortion of Wald tests on the parameters in finite samples. Table 4 shows selected results from the first-stage regression of the level equation (step 3 in the generalized Tobit procedure outlined at the end of Section 4). The coefficient on the instrument is positive and is statistically significant. The F-statistic for the exclusion restriction is 260.11. Because the critical value for a 5 percent Wald test and a desired maximal distortion size of 10 percent is 16.38, I reject the null hypothesis that the instrument is weak.

Table 4: First-Stage Regression Results of the Level Equation
Dependent Variable: Actual Marginal Capital Gains Tax Rate

Variable	Coefficient	Standard Error	p-value
Instrument	0.546	0.034	0.000
Number of Households	2,638		
Adjusted R-squared	0.78		
F-statistic for instrument	260.11		

Notes: The sample is restricted to households that realize capital gains, have adjusted wealth above $200,000 (in 2004 dollars), and have at least one child, and whose heads are between 50 and 80 years old. Estimates and bootstrapped standard errors are corrected for multiple imputations. Data are unweighted. All other exogenous regressors are included as control variables but are not reported.

Table 5 presents estimates of a generalized Tobit model describing taxpayers' decisions to realize capital gains. It consists of a criterion function reflecting the decision at the extensive margin and a level equation reflecting the decision at the intensive margin.

Table 5: Generalized Tobit Results
Dependent Variable: ln(Capital Gains Realized)

Variable	Level Equation			Criterion Function		
	Coefficient	Standard Error	p-value	Marginal Effects	Standard Error	p-value
Marginal Capital Gains Tax Rate (instrumented)	-0.036	0.012	0.003	-0.001	0.001	0.476
Group 2	0.792	0.286	0.006	0.093	0.035	0.009
Group 3	0.660	0.316	0.037	0.093	0.021	0.000
Post TRA97	-2.096	0.589	0.000	-0.233	0.038	0.000
Group 2 * Post TRA97	-0.568	0.271	0.036	-0.011	0.043	0.792
Group 3 * Post TRA97	0.253	0.198	0.201	-0.007	0.023	0.772
S&P 500 Index	0.160	0.051	0.002	0.021	0.004	0.000
Retired	0.522	0.138	0.000	0.043	0.014	0.001
Married	-0.254	0.132	0.054	-0.003	0.017	0.844
Widowed	-0.532	0.214	0.013	0.014	0.025	0.588
White	0.870	0.267	0.001	0.079	0.020	0.000
Age	-0.181	0.069	0.008	-0.003	0.010	0.793
Age squared	0.149	0.054	0.005	0.004	0.008	0.605
Poor health	-0.156	0.261	0.551	-0.030	0.025	0.230
Previously inherited	0.286	0.133	0.031	0.048	0.012	0.000
Number of children	-0.040	0.029	0.172	-0.007	0.004	0.039
High school degree	0.238	0.321	0.459	0.031	0.030	0.298
Some college	0.554	0.337	0.100	0.060	0.029	0.037
Bachelor's degree	1.072	0.407	0.008	0.115	0.030	0.000
More than bachelor's degree	1.261	0.421	0.003	0.128	0.028	0.000
ln (Equity/Wealth)	0.103	0.032	0.001	0.014	0.001	0.000
ln (Retirement Accts/Wealth)	0.006	0.007	0.411	0.002	0.001	0.003
ln (Housing/Wealth)	0.006	0.013	0.636	0.001	0.002	0.445
ln (Wealth)	1.406	0.151	0.000	0.077	0.005	0.000
Inverse Mills Ratio	3.680	1.111	0.001			
Constant	-11.004	4.596	0.017			
Number of households	7,542 (2,638 uncensored)					
Capital gains tax elasticity	-0.763; S.E. = 0.592					

Notes: The sample is restricted to households that have adjusted wealth above $200,000 (in 2004 dollars), and have at least one child, and whose heads are between 50 and 80 years old. Estimates and bootstrapped standard errors are corrected for multiple imputations. Data are unweighted.

The interaction terms between the dummy variables for the three groups and the years after the enactment of TRA97 are the main focus points of the analysis. They capture the extent of the changes in the behavior of Group 2 and Group 3 relative to Group 1 using the years before the enactment of TRA97 as a baseline.

The coefficient for the interaction term between Group 2 and Post TRA97 (*Group2*PostTRA97*) is negative and statistically significant at the 0.05 level in the level equation (intensive margin). It implies that, relative to Group 1, households in Group 2 realize significantly smaller amounts of gains after TRA97. This interaction coefficient in the criterion function is also negative but is less precisely estimated. The coefficient for the interaction term between Group 3 and Post TRA97 (*Group3*PostTRA97*) is statistically insignificant in both the criterion function and the level equation. The Wald test strongly rejects the hypothesis that the difference between Group 2 and Group 3 is zero after TRA97 in the level equation (p-value = 0.0003). It does not reject that hypothesis in the criterion function. These findings are consistent with Auten and Joulfaian (2001), who found that the estate tax rate had significant effects on realizations in the level equation of their generalized Tobit specification. In addition, the interaction coefficients for Group 2 and Group 3 suggest that the observed changes in the amount of capital gains realized were non-monotonic in wealth. It is thus difficult to find another obvious explanation for this pattern other than the impact of TRA97.

This study thus provides evidence to support the hypothesis that the increase in the estate tax exemption level in 1997 significantly increases the incentive to continue to hold assets with accrued gains among the households in Group 2. Although the sign and the statistical significance of the Group 2 interaction term in the level equation are as predicted, the fact that the coefficient of this interaction term is statistically insignificant (although still negative) in the criterion equation is less easily explained. One possible explanation is that households with some capital gains income were likely to have larger and more diversified portfolios. This implies greater flexibility when adjusting their portfolio. In addition, they were also likely to be more aware of changes in estate tax law and their implications.[28] Variables such as education, share of equity, and net worth are included to pick up these effects (their coefficients are highly significant), but may not capture the full effect of factors such as portfolio flexibility or financial literacy.

[28] Financial literacy and consciousness about capital gains tax avoidance techniques may be reflected by education level. In one of the sensitivity tests, I group households by education level and find that the coefficient for the interaction dummy between college education and post-TRA97 in the criterion function is more precisely estimated.

The coefficient for the marginal tax rate on capital gains is negative and statistically significant at the 0.01 level in the level equation. It is negative but less precisely estimated in the criterion function. The negative sign is expected because a higher tax rate implies a higher cost of realizing capital gains. The effect of the capital gains tax rate on both the realization probability and the level of gains can be summarized by the elasticity of capital gains with respect to the tax rate. Following Burman and Randolph (1994), this elasticity (ε) is computed as

$$\varepsilon_i = \tau_i[\beta_1 + \alpha_1\lambda(h_i + \sigma)],$$

where τ is the capital gains marginal tax rate for household *i*, β_1 and α_1 are coefficients of the capital gains marginal tax rate in the level equation and criterion function, respectively; λ is the inverse Mills ratio function evaluated at the expected value of the criterion function (h_i); and σ is the covariance between the error terms in the criterion function and the level equation (estimated by the coefficient on the inverse Mills ratio).[29] The estimated elasticity is -0.76, which implies that a one-percent reduction in the long-run capital gains tax rate would increase expected realized net long term gains by 0.76 percent. This elasticity is consistent with the estimate of capital gains tax elasticity at -0.89 reported in Auten and Joulfaian (2001). It is important to note that this elasticity is likely to capture both permanent and transitory tax effects because of data limitations.

The statistical significance of the inverse Mills ratio indicates that the error terms of the criterion function and the level equation are correlated. This suggests that the sample selection must be accounted for in order to avoid bias and inconsistent estimates.

The other coefficients are generally consistent with an individual's motives at different points in his or her life cycle. Capital gains realizations are positively and significantly related to wealth. The share of stocks in the portfolio also has a positive and significant effect on a household's decision to realize capital gains. This result possibly reflects the fact that the sale of stocks is associated with lower transaction costs than for other assets such as real estate and business property. The share of wealth in retirement accounts is positive and statistically significant in the criterion function but not in the level equation, but the share of wealth in housing does not have a significant effect on

[29] Because the elasticity varies across households, I report the sample mean elasticity.

gains realization. The inflation-adjusted S&P 500 index—included in order to control for time-series variation in asset values—has significant effects in both equations. Controlling for all other factors, households are less likely to realize capital gains and they also realize smaller gains on average after TRA97. The likelihood and the amount of realizations for both Group 2 and Group 3 are significantly higher than for Group 1 on average.

Controlling for age, households with retired heads realize larger gains than other households, on average. Using education to proxy for permanent income, the result shows that households with higher education are more likely to realize capital gains and that they also realize larger amount of gains than average. Households headed by married couples or widowers realize smaller gains relative to households headed by unmarried individuals or couples.

Sensitivity Analysis

I explore the sensitivity of the study's results to a number of alternative assumptions and specifications. Table 6 reports coefficients for the key interaction terms. Complete results are provided in Appendix A.

Table 6: Sensitivity Analyses
Dependent Variable: ln(Capital Gains Realized)

Variable	Level Equation			Criterion Function		
	Coefficient	Standard Error	p-value	Marginal Effects	Standard Error	p-value
Panel A: Subsample of households that expect to leave a sizable bequest						
Group 2 * Post TRA97	-0.622	0.320	0.052	-0.014	0.057	0.799
Group 3 * Post TRA97	0.272	0.245	0.267	-0.003	0.028	0.904
Panel B: Expanding the threshold that separates Group 2 and Group 3						
Group 2 * Post TRA97	-0.453	0.229	0.048	-0.013	0.028	0.641
Group 3 * Post TRA97	0.334	0.204	0.103	-0.005	0.023	0.829
Panel C: Removing personal residence from the wealth variable						
Group 2 * Post TRA97	-0.601	0.268	0.025	-0.012	0.043	0.779
Group 3 * Post TRA97	0.255	0.199	0.200	-0.008	0.023	0.733
Panel D: Removing all sample restrictions						
Group 2 * Post TRA97	-0.412	0.216	0.056	-0.017	0.014	0.218
Group 3 * Post TRA97	-0.021	0.166	0.898	-0.027	0.007	0.000
Panel E: Classifying households by education attainment						
College and Above * Post TRA97	-0.295	0.184	0.108	-0.045	0.024	0.054
Panel F: Classifying households by imputed values of wealth						
Group 2 * Post TRA97	-0.468	0.247	0.059	-0.024	0.042	0.568
Group 3 * Post TRA97	0.322	0.203	0.113	0.000	0.024	0.996

Notes: Estimates and bootstrapped standard errors are corrected for multiple imputations. Data are unweighted.

6.1 Subsample of Households That Expect to Leave a Sizable Bequest

The responsiveness to the change in estate tax legislation may be stronger among households that expect to leave a bequest to heirs. One SCF question asks whether the respondent (or his or her partner) expects to leave a sizable estate to others and the answer choices are “yes,” “possibly.” or “no.” In this sensitivity test, I further restrict the sample from those used in the basic specification to those who answer “yes” or “possibly” to this question. This lowers the number of households to 5,926 (2,639 uncensored). Panel A of Table 6 reports estimated coefficients for the key interaction terms.

The result is consistent with the main finding. Coefficients for the key interaction terms follow the same pattern as those in Table 5. Wald tests reject the hypothesis that the difference between Group 2 and Group 3 interaction terms is zero in the level question but not in the criterion function (p-values = 0.0007 and 0.8436, respectively).

The coefficient for the Group 2 interaction term is slightly larger than that in the base specification. This finding suggests that those with bequest motives are likely to have stronger responses to estate taxation.

6.2 Expanding the Threshold that Separates Group 2 and Group 3

It is possible that households engage in estate tax minimization strategies, such as giving annual tax-exempt gift to heirs and setting up trusts that shelter part of their wealth from the estate tax. Consequently, households with current wealth slightly above $1 million (or $2 million for married households) may expect to face the same reduction in estate tax as the households in the original Group 2 classification. In addition, the uncertainty regarding the fate of the estate tax after 2010 may have complicated the formation of taxpayers' expectations. It is possible that some estate tax practitioners anticipated future increases in the estate tax exemption level and advised their clients to plan accordingly.[30]

In the second sensitivity test, I modify Group 2 by increasing the threshold that separates Group 2 and Group 3 by $500,000 ($1 million if married). That is, Group 2 consists of households with an adjusted value of wealth between $600,000 and $1.5 million (between $1.2 million and $3 million if married) and Group 3 is modified to include households with an adjusted value of wealth above $1.5 million (or $3 million if married). As a result, Group 2 and Group 3 account for about 17 percent and 44 of the sample, respectively. The estimation results are summarized in Panel B of Table 6.

The results are generally consistent with the main finding. In the level equation, the coefficient for the Group 2 interaction term is negative and statistically significant, and that for Group 3 is positive and somewhat significant. This may be indicative of Group 3 households that have a target level of bequests. The Wald test again rejects the null hypothesis of no difference between these two coefficients (p-value = 0.0001). In the criterion function, the coefficients for both interaction terms are negative and not statistically significant. The Wald test fails to reject the hypothesis that these two coefficients are not different from each other (p-value = 0.8436).

[30] Kiplinger (2005) suggested that the Congress would modify the estate tax after 2010 by keeping a large estate tax exemption rather than repealing it outright or returning it to the level prescribed by TRA97.

6.3 Removing Personal Residence from the Wealth Variable

A third concern involves the treatment of personal residence, because capital gains on personal residences are rarely subject to tax. As a sensitivity test, I replace the wealth variable with total assets, excluding personal residence. However, because of data limitations, the dependent variable still includes gains from real estate. The estimation results are summarized in Panel C of Table 6.

The results follow the pattern shown in Table 5. In the level equation, the interaction coefficient for Group 2 is negative and statistically significant, but that for Group 3 is not precisely estimated. The Wald test rejects the hypothesis of no difference between Group 2 and Group 3 interaction coefficients (p-value is 0.0003). Both interaction coefficients are statistically insignificant in the criterion function.

6.4 Removing Sample Restrictions Related to Wealth, Age, and Presence of Children

The sample used in the base estimation excludes young households that may be less likely to engage in estate tax planning and low-wealth households that are less comparable to Group 2 and Group 3 households. Panel D of Table 5 removes these sample restrictions related to wealth, age, and the presence of children. This increases the number of households to 22,836 (4,447 uncensored).

The results are reasonably consistent with the main finding. In the level equation, the coefficient for the Group 2 interaction term is negative and statistically significant while that for Group 3 is not statistically significant. The Wald test rejects the null hypothesis of no difference between these two coefficients (p-value = 0.0284). Coefficients in the criterion function differ somewhat from the pattern shown in Table 5. The coefficient for the Group 2 interaction term is negative and statistically insignificant, and that for Group 3 is negative and statistically significant. However, the hypothesis that there is no difference between these two coefficients is not rejected (p-value = 0.4760).

6.5 Classifying Households by Education Attainment

Panel E of Table 6 classifies households based on the attainment of advanced education (college and above) rather than using current values of their net worth.

Households with higher education are likely to save more and consequently likely to benefit from the increased estate tax exemption amount under TRA97. This method is less refined than the method adopted for the base estimation. Less than half of households in Group 1 (38 percent) have household heads with advanced education. For households in Group 2 and Group 3, 68 percent and 78 percent, respectively, have a head with advanced education. Also, in contrast to the current-wealth method, this method does not allow identification of the three distinct household groups. However, this could be an important sensitivity test to respond to concerns that estate taxation may influence the classification variable (current value of net worth). Classifying households by their educational attainment could help address this issue, because education is likely exogenous with respect to the estate tax.

Although it is reasonable to assume that those with higher education are more likely to benefit from the 1997 estate tax change, the difference in the reduction in the effective estate tax rates between these two groups is not as large as the difference between the groups classified by wealth. Consequently, I expect to observe smaller relative changes under this classification method. The coefficient for the interaction between advanced education and Post TRA97 (*College and Above*PostTRA97*) is negative and somewhat significant in the level equation. As expected, the interaction coefficient is smaller (in absolute term) than that in the base specification. Moreover, it is negative and statistically significant in the criterion function.

6.6 Classifying Households by Imputed Values of Wealth

Panel F of Table 6 follows the approach taken by Bernheim et al. (2004), using estimated age-wealth profiles and the 1998 life expectancy tables published by the Centers for Disease Control and Prevention (CDC), to predict the ultimate value of estates for each household. First, I place each household into wealth quintiles based on the real value of their net worth. Next, I estimate quantile regressions (at the 10^{th}, 30^{th}, 50^{th}, 70^{th}, and 90^{th} percentiles) of current wealth on a number of control factors including age, income, and demographic information.[31] The coefficients on the age variables from those quantile regressions and the estimate of the date at which death will occur (derived

[31] Complete quantile regression results are included in Appendix B.

from the life expectancy tables) are then used to predict each household's net worth at death. Approximately 93 percent of observations used in the base specification are classified in the same groups under the current wealth and the imputed wealth methods.

The results follow the pattern shown in Table 5. In the level equation, the coefficient for the interaction term for Group 2 is negative and statistically significant while that for Group 3 is positive and not statistically significant. The Wald test rejects the hypothesis of no difference between these two coefficients (p-value = 0.002). In the criterion function, the coefficients on the interaction terms for Group 2 and Group 3 are both statistically insignificant. The Wald test does not reject the hypothesis of no difference between these two coefficients (p-value = 0.5032).

7. Conclusion

The empirical results presented in this study support the hypothesis that the presence of estate taxation helps unlock capital gains realizations. In particular, after the enactment of TRA97, households that experienced the largest decline in their marginal estate tax rate realized significantly smaller gains relative to households that were unaffected. The results also suggest that estate taxation may enter the realization decision at the intensive margin rather than at the extensive margin. That is, the capital gains lock-in effect that resulted from TRA97 is likely confined to households that already had capital gains income; it does not appear to induce responses from more households. This is possibly because households with some capital gains income have larger, more diversified portfolios and access to better tax advice. The results are reasonably robust to a variety of alternative specifications.

The lock-in effect of capital gains taxation has been extensively investigated, but the unlocking effect of estate taxation is an empirical question that has not been fully explored. This is the second study that provides empirical evidence on the effect of the estate tax on capital gains realization. It contributes to the literature by using the SCF data, which contain more households with younger heads than those found in the tax return data used by Auten and Joulfaian (2001). Focusing on young households could be crucial because it is likely that estate tax planning—in particular portfolio adjustment and

realizations of capital gains—is taken well before household heads near the end of their lives. Rather than calculating expected marginal tax rate, the empirical strategy employed in this study exploits the changes in estate tax exemption level introduced by TRA97 and involves comparing changes in capital gains realization of households that experienced the decline in their marginal estate tax rates to those that were unaffected.

Using a younger sample of households allows the examination of the effects of estate tax for a longer span of time before death, and thus improves the estimation of the responsiveness of capital gains realizations to changes in the estate tax law. However, other measurement problems persist. In particular, the variable measuring the expected value of a household's estate is likely to be mismeasured. Compared with the very old, young households are subject to higher uncertainties regarding the ultimate sizes of their bequests. This data limitation poses a caveat for this study and suggests an avenue for future research.

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APPENDIX A

Complete Results of Sensitivity Analyses

Table A1: Subsample of Households that Expect to Leave a Sizable Bequest
Dependent Variable: ln(Capital Gains Realized)

Variable	Level Equation			Criterion Function		
	Coefficient	Standard Error	p-value	Marginal Effects	Standard Error	p-value
Marginal Capital Gains Tax Rate (instrumented)	-0.040	0.015	0.007	-0.001	0.001	0.522
Group 2	0.833	0.309	0.007	0.101	0.042	0.016
Group 3	0.711	0.328	0.030	0.095	0.024	0.000
Post TRA97	-2.352	0.633	0.000	-0.238	0.046	0.000
Group 2 * Post TRA97	-0.622	0.320	0.052	-0.014	0.057	0.799
Group 3 * Post TRA97	0.272	0.245	0.267	-0.003	0.028	0.904
S&P 500 Index	0.175	0.051	0.001	0.021	0.004	0.000
Retired	0.657	0.157	0.000	0.052	0.016	0.001
Married	-0.187	0.132	0.157	-0.004	0.020	0.826
Widowed	-0.489	0.218	0.025	0.011	0.030	0.725
White	1.091	0.298	0.000	0.090	0.025	0.000
Age	-0.217	0.074	0.003	-0.010	0.013	0.442
Age squared	0.179	0.059	0.002	0.010	0.010	0.320
Poor health	-0.195	0.261	0.456	-0.022	0.032	0.493
Previously inherited	0.294	0.123	0.017	0.043	0.014	0.003
Number of children	-0.038	0.030	0.199	-0.007	0.004	0.097
High school degree	0.233	0.327	0.477	0.012	0.037	0.739
Some college	0.720	0.372	0.053	0.068	0.035	0.050
Bachelor's degree	1.168	0.416	0.005	0.111	0.036	0.002
More than bachelor's degree	1.406	0.443	0.001	0.130	0.034	0.000
ln (Equity/Wealth)	0.134	0.037	0.000	0.016	0.001	0.000
ln (Retirement Accts/Wealth)	0.007	0.008	0.332	0.002	0.001	0.007
ln (Housing/Wealth)	0.017	0.014	0.232	0.002	0.002	0.363
ln (Wealth)	1.469	0.153	0.000	0.077	0.006	0.000
Inverse Mills Ratio	4.430	1.225	0.000			
Constant	-11.775	4.344	0.007			
Number of households	5926 (2639 uncensored)					

Notes: The sample is restricted to households that have adjusted wealth above $200,000 (in 2004 dollars), and have at least one child, and whose heads are between 50 and 80 years old. Estimates and bootstrapped standard errors are corrected for multiple imputations. Data are unweighted.

Table A2: Expanding the Threshold that Separates Group 2 and Group 3

Dependent Variable: ln(Capital Gains Realized)

Variable	Level Equation			Criterion Function		
	Coefficient	Standard Error	p-value	Marginal Effects	Standard Error	p-value
Marginal Capital Gains Tax Rate (instrumented)	-0.036	0.012	0.003	-0.001	0.001	0.477
Group 2	0.833	0.283	0.003	0.097	0.024	0.000
Group 3	0.856	0.307	0.005	0.086	0.026	0.001
Post TRA97	-2.210	0.567	0.000	-0.233	0.038	0.000
Group 2 * Post TRA97	-0.453	0.229	0.048	-0.013	0.028	0.641
Group 3 * Post TRA97	0.334	0.204	0.103	-0.005	0.023	0.829
S&P 500 Index	0.168	0.049	0.001	0.021	0.004	0.000
Retired	0.546	0.132	0.000	0.043	0.014	0.002
Married	-0.232	0.135	0.087	-0.004	0.018	0.824
Widowed	-0.527	0.217	0.015	0.014	0.025	0.579
White	0.909	0.255	0.000	0.079	0.020	0.000
Age	-0.188	0.069	0.006	-0.003	0.010	0.795
Age squared	0.156	0.053	0.004	0.004	0.008	0.607
Poor health	-0.171	0.253	0.500	-0.030	0.025	0.231
Previously inherited	0.312	0.129	0.016	0.048	0.012	0.000
Number of children	-0.045	0.028	0.112	-0.007	0.004	0.039
High school degree	0.269	0.317	0.395	0.031	0.030	0.304
Some college	0.595	0.329	0.071	0.060	0.029	0.038
Bachelor's degree	1.132	0.393	0.004	0.115	0.030	0.000
More than bachelor's degree	1.329	0.406	0.001	0.128	0.028	0.000
ln (Equity/Wealth)	0.110	0.030	0.000	0.014	0.001	0.000
ln (Retirement Accts/Wealth)	0.006	0.007	0.368	0.002	0.001	0.003
ln (Housing/Wealth)	0.006	0.013	0.615	0.001	0.002	0.451
ln (Wealth)	1.395	0.146	0.000	0.078	0.006	0.000
Inverse Mills Ratio	3.932	1.044	0.000			
Constant	-11.140	4.436	0.012			
Number of households	7542 (2638 uncensored)					

Notes: The sample is restricted to households that have adjusted wealth above $200,000 (in 2004 dollars), and have at least one child, and whose heads are between 50 and 80 years old. Estimates and bootstrapped standard errors are corrected for multiple imputations. Data are unweighted.

Table A3: Removing Personal Residence from the Wealth Variable

Dependent Variable: ln(Capital Gains Realized)

Variable	Level Equation			Criterion Function		
	Coefficient	Standard Error	p-value	Marginal Effects	Standard Error	p-value
Marginal Capital Gains Tax Rate (instrumented)	-0.046	0.012	0.000	-0.001	0.001	0.335
Group 2	0.972	0.283	0.001	0.088	0.036	0.014
Group 3	0.906	0.314	0.004	0.092	0.021	0.000
Post TRA97	-2.610	0.566	0.000	-0.228	0.038	0.000
Group 2 * Post TRA97	-0.601	0.268	0.025	-0.012	0.043	0.779
Group 3 * Post TRA97	0.255	0.199	0.200	-0.008	0.023	0.733
S&P 500 Index	0.200	0.048	0.000	0.020	0.004	0.000
Retired	0.647	0.144	0.000	0.045	0.014	0.001
Married	-0.290	0.135	0.032	-0.005	0.017	0.754
Widowed	-0.489	0.215	0.023	0.015	0.025	0.543
White	1.081	0.271	0.000	0.079	0.020	0.000
Age	-0.155	0.069	0.026	-0.002	0.010	0.871
Age squared	0.135	0.054	0.013	0.003	0.008	0.668
Poor health	-0.146	0.268	0.587	-0.026	0.025	0.310
Previously inherited	0.349	0.118	0.003	0.046	0.012	0.000
Number of children	-0.060	0.030	0.045	-0.008	0.004	0.034
High school degree	0.293	0.331	0.376	0.029	0.030	0.338
Some college	0.673	0.348	0.053	0.057	0.029	0.048
Bachelor's degree	1.340	0.428	0.002	0.114	0.030	0.000
More than bachelor's degree	1.560	0.445	0.000	0.127	0.028	0.000
ln (Equity/Wealth)	0.129	0.031	0.000	0.013	0.001	0.000
ln (Retirement Accts/Wealth)	0.005	0.007	0.485	0.002	0.001	0.011
ln (Housing/Wealth)	0.038	0.014	0.008	0.003	0.002	0.058
ln (Wealth)	1.443	0.145	0.000	0.070	0.005	0.000
Inverse Mills Ratio	4.812	1.116	0.000			
Constant	-13.701	4.554	0.003			
Number of households	7542 (2638 uncensored)					

Notes: The sample is restricted to households that have adjusted wealth above $200,000 (in 2004 dollars), and have at least one child, and whose heads are between 50 and 80 years old. Estimates and bootstrapped standard errors are corrected for multiple imputations. Data are unweighted.

Table A4: Removing Restrictions on Net Worth, Age, and Presence of Children

Dependent Variable: ln(Capital Gains Realized)

Variable	Level Equation			Criterion Function		
	Coefficient	Standard Error	p-value	Marginal Effects	Standard Error	p-value
Marginal Capital Gains Tax Rate (instrumented)	-0.005	0.008	0.525	0.000	0.000	0.413
Group 2	0.628	0.222	0.005	0.046	0.016	0.004
Group 3	0.672	0.217	0.002	0.056	0.009	0.000
Post TRA97	-1.310	0.266	0.000	-0.073	0.012	0.000
Group 2 * Post TRA97	-0.412	0.216	0.056	-0.017	0.014	0.218
Group 3 * Post TRA97	-0.021	0.166	0.898	-0.027	0.007	0.000
S&P 500 Index	0.129	0.027	0.000	0.008	0.001	0.000
Retired	0.645	0.114	0.000	0.028	0.006	0.000
Married	-0.228	0.083	0.006	-0.001	0.005	0.775
Widowed	-0.397	0.139	0.004	0.002	0.008	0.814
White	0.598	0.158	0.000	0.027	0.005	0.000
Age	-0.044	0.015	0.003	-0.002	0.001	0.046
Age squared	0.036	0.013	0.006	0.002	0.001	0.023
Poor health	-0.118	0.182	0.516	-0.011	0.009	0.240
Previously inherited	0.377	0.086	0.000	0.027	0.004	0.000
Number of children	-0.073	0.024	0.003	-0.006	0.001	0.000
High school degree	0.101	0.213	0.634	0.010	0.008	0.215
Some college	0.658	0.237	0.005	0.036	0.010	0.000
Bachelor's degree	1.147	0.291	0.000	0.066	0.009	0.000
More than bachelor's degree	1.380	0.305	0.000	0.077	0.011	0.000
ln (Equity/Wealth)	0.121	0.022	0.000	0.008	0.000	0.000
ln (Retirement Accts/Wealth)	-0.001	0.004	0.886	0.000	0.000	0.112
ln (Housing/Wealth)	-0.022	0.006	0.000	-0.001	0.000	0.129
ln (Wealth)	1.493	0.108	0.000	0.040	0.002	0.000
Inverse Mills Ratio	4.270	0.681	0.000			
Constant	-17.550	2.610	0.000			
Number of households	22836 (4487 uncensored)					

Notes: Estimates and bootstrapped standard errors are corrected for multiple imputations. Data are unweighted.

Table A5: Classifying Households by Educational Attainment

Dependent Variable: ln(Capital Gains Realized)

Variable	Level Equation			Criterion Function		
	Coefficient	Standard Error	p-value	Marginal Effects	Standard Error	p-value
Marginal Capital Gains Tax	-0.028	0.011	0.014	0.000	0.001	0.844
Post TRA97	-0.937	0.428	0.028	-0.194	0.039	0.000
College and Above * Post TRA97	-0.295	0.184	0.108	-0.045	0.024	0.054
S&P500 Index	0.094	0.041	0.022	0.020	0.004	0.000
Retired	0.396	0.128	0.002	0.041	0.014	0.003
Married	-0.271	0.136	0.047	-0.013	0.018	0.476
Widowed	-0.526	0.212	0.013	0.017	0.025	0.500
White	0.607	0.251	0.016	0.079	0.020	0.000
Age	-0.183	0.069	0.008	-0.004	0.010	0.731
Age squared	0.144	0.054	0.008	0.005	0.008	0.559
Poor Health	-0.096	0.262	0.713	-0.033	0.025	0.175
Previously Inherited	0.168	0.118	0.156	0.050	0.012	0.000
Number of children	-0.021	0.028	0.454	-0.008	0.004	0.027
High school degree	0.100	0.328	0.760	0.025	0.030	0.410
Some college	0.328	0.343	0.338	0.056	0.029	0.050
Bachelor's degree and above	0.969	0.456	0.033	0.141	0.028	0.000
ln (Equity/Wealth)	0.061	0.030	0.040	0.014	0.001	0.000
ln (Retirement Accts/Wealth)	0.001	0.007	0.916	0.002	0.001	0.001
ln (Housing/Wealth)	0.003	0.013	0.818	0.001	0.002	0.441
ln (Wealth)	1.286	0.171	0.000	0.093	0.003	0.000
Inverse Mills Ratio	2.170	1.000	0.030			
Constant	-6.621	4.569	0.147			
Number of households	7542 (2638 uncensored)					

Notes: The sample is restricted to households that have adjusted wealth above $200,000 (in 2004 dollars), and have at least one child, and whose heads are between 50 and 80 years old. Estimates and bootstrapped standard errors are corrected for multiple imputations. Data are unweighted.

Table A6: Classifying Households by Imputed Wealth

Dependent Variable: ln(Capital Gains Realized)

Variable	Level Equation			Criterion Function		
	Coefficient	Standard Error	p-value	Marginal Effects	Standard Error	p-value
Marginal Capital Gains Tax Rate (instrumented)	-0.035	0.012	0.003	-0.001	0.001	0.466
Group 2	0.850	0.321	0.008	0.111	0.032	0.001
Group 3	0.655	0.325	0.044	0.099	0.020	0.000
Post TRA97	-2.143	0.615	0.000	-0.236	0.040	0.000
Group 2 * Post TRA97	-0.468	0.247	0.059	-0.024	0.042	0.568
Group 3 * Post TRA97	0.322	0.203	0.113	0.000	0.024	0.996
S&P 500 Index	0.159	0.050	0.002	0.021	0.004	0.000
Retired	0.511	0.138	0.000	0.042	0.014	0.002
Married	-0.247	0.131	0.058	-0.002	0.017	0.912
Widowed	-0.511	0.215	0.017	0.015	0.025	0.545
White	0.868	0.272	0.001	0.080	0.020	0.000
Age	-0.188	0.068	0.006	-0.004	0.010	0.717
Age squared	0.154	0.053	0.004	0.005	0.008	0.538
Poor health	-0.148	0.263	0.573	-0.030	0.025	0.228
Previously inherited	0.282	0.128	0.028	0.047	0.012	0.000
Number of children	-0.039	0.029	0.178	-0.007	0.004	0.036
High school degree	0.225	0.323	0.486	0.031	0.030	0.295
Some college	0.544	0.338	0.108	0.060	0.029	0.036
Bachelor's degree	1.062	0.408	0.009	0.115	0.029	0.000
More than bachelor's degree	1.247	0.419	0.003	0.127	0.028	0.000
ln (Equity/Wealth)	0.103	0.033	0.002	0.014	0.001	0.000
ln (Retirement Accts/Wealth)	0.005	0.007	0.460	0.002	0.001	0.004
ln (Housing/Wealth)	0.005	0.013	0.695	0.001	0.002	0.487
ln (Wealth)	1.407	0.148	0.000	0.075	0.005	0.000
Inverse Mills Ratio	3.682	1.130	0.001			
Constant	-10.827	4.560	0.018			
Number of households	7542 (2638 uncensored)					

Notes: The sample is restricted to households that have adjusted wealth above $200,000 (in 2004 dollars), and have at least one child, and whose heads are between 50 and 80 years old. Estimates and bootstrapped standard errors are corrected for multiple imputations. Data are unweighted.

APPENDIX B:
Quantile Regression Results for Estate Imputation Used in Panel F of Table 6

Table B1: Quantile Regression Results
Dependent Variable: ln(Net Worth)

	Coefficients				
	10th Percentile	**30th Percentile**	**50th Percentile**	**70th Percentile**	**90th Percentile**
SCF Year = 1992	-0.176	-0.135	-0.141	-0.141	-0.159
SCF Year = 1995	-0.303	-0.193	-0.182	-0.182	-0.214
SCF Year = 1998	-0.322	-0.226	-0.204	-0.204	-0.171
SCF Year = 2001	-0.296	-0.177	-0.106	-0.106	-0.145
SCF Year = 2004	-0.201	-0.078	-0.050	-0.050	0.024
SCF Year = 2007	-0.244	-0.049	0.055	0.055	0.086
Age	0.061	0.068	0.065	0.065	0.048
Age (squared)	-0.035	-0.040	-0.037	-0.037	-0.026
High school degree	0.047	0.078	0.062	0.062	-0.025
Some college	0.104	0.122	0.121	0.121	0.034
College	0.100	0.173	0.166	0.166	0.057
More than college	0.096	0.152	0.124	0.124	0.109
Previously Inherited	0.124	0.144	0.177	0.177	0.185
ln (Income)	0.688	-0.024	-0.562	-0.562	-1.522
ln (Income) squared	-0.015	0.019	0.046	0.046	0.090
ln (Equity)	0.200	-0.083	-0.286	-0.286	-0.326
ln (Equity) squared	0.017	0.024	0.028	0.028	0.028
Retired	0.246	0.260	0.222	0.222	0.249
White	0.197	0.149	0.033	0.033	-0.007
Business owner	0.381	0.476	0.679	0.679	0.890
Poor health	-0.143	-0.095	-0.138	-0.138	-0.075
Married	0.365	0.240	0.111	0.111	0.051
Widow	0.272	0.286	0.202	0.202	0.151
Female	-0.022	-0.095	-0.087	-0.087	-0.094
Have 1 child	0.028	0.026	0.009	0.009	-0.001
Have 2 children	0.060	0.073	0.063	0.063	0.026
Have 3 children	0.054	0.073	0.137	0.137	0.112
Have 4 children	0.182	0.085	0.082	0.082	0.106
Have 5 or more children	-0.175	-0.076	-0.122	-0.122	0.037
Born during 1900 to 1909	-0.251	0.227	-1.647	-1.647	-1.646
Born during 1910 to 1919	-0.212	0.454	-1.508	-1.508	-1.346
Born during 1920 to 1929	-0.066	0.470	-1.375	-1.375	-1.298
Born during 1930 to 1939	-0.069	0.449	-1.431	-1.431	-1.337
Born during 1940 to 1949	-0.005	0.480	-1.408	-1.408	-1.298
Born during 1950 to 1959	0.020	0.533	-1.378	-1.378	-1.341
Constant	-0.894	4.755	11.908	11.908	18.562
Number of households	16,236				