Taxation and Households' Financial Decisions: Evidence from the Bush Tax Acts

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Abstract

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This dissertation provides insights into the impact of differential taxation of financial assets on household portfolio decisions. To address endogeneity of household marginal tax rates, it exploits the structural tax rate changes created by the Bush-era tax acts in 2001 and 2003. In the first chapter, *Taxation and Household Asset Location and Allocation: Evidence from the Bush Tax Acts*, examines the effects of different tax treatments across different financial assets on household asset location and allocation decisions in taxable and tax-deferred accounts. The empirical results, based on the Survey of Consumer Finances data, indicate that households with greater tax rate differentials between interest and capital gains hold significantly lower shares of bonds in taxable accounts and greater shares of bonds in tax-deferred accounts by "risk-preserving" portfolio changes. These households also hold significantly more shares of stocks in their taxable portfolio. The second chapter, *Dividend Taxation and Households' Dividend Portfolio Decisions: Evidence from the 2003 Bush Tax Act*, examines how the different tax treatments across different types of financial income affect households' portfolio decisions. The empirical results, based on the Public Use Tax File, suggest that households in the upper tax bracket hold significantly greater shares of qualified dividends in their dividend income, whereas the preferential tax treatment and 60-day holding period required of qualified dividends significantly hamper households' capital gains realization in the short run. However, the

significant effect of the preferential tax treatment of long-term capital gains over dividends on households' income composition disappears after the 2003 tax act. The third chapter, *Effects of Uncertain Tax Rates on Households' Financial Decisions: Evidence from the Bush Tax Acts*, investigates how tax rate uncertainty affects households' demand for dividend yields. During 2008−2010, persistent political debates and the late enactment of the tax cut extension creates great uncertainty for high-income households regarding their future tax rates. Empirical results indicate that high-income households significantly lower their dividend yields during the period of uncertainty because they face the potential of increased tax disadvantages for dividends relative to capital gains.

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DEDICATION

To my parents and my wife

Chapter 1 − Taxation and Household Asset Location and Allocation: Evidence from the Bush Tax Acts

1.1 Introduction

As the number of tax-deferred savings accounts has grown, households also have come to face the need to deliberate about which savings account to use for financial asset holdings and how much to invest in each asset.[1] Incomes obtained from financial assets in tax-deferred accounts incur no tax liabilities until withdrawal; financial incomes in taxable accounts are taxed every year. Therefore, after-tax returns vary depending on where households maintain their financial assets, that is, on their asset location decisions. This study empirically investigates whether different tax treatments across different financial assets affect households' asset location decisions in taxable and tax-deferred accounts, and, if so, how households respond.

Regarding the asset location and allocation problem, Shoven (1999) outlined joint portfolio decisions, with the suggestion that holding heavily taxed bonds in tax-deferred accounts and less heavily taxed stocks in taxable accounts could minimize the tax burdens generated from the income of each asset. Thus, households should not hold highly taxed assets in taxable accounts if the desired holdings of those highly taxed assets do not exceed the capacity of tax-deferred accounts. This strict pecking order of asset holdings relies on the tax arbitrage argument, as proposed by Black (1980) and Tepper (1981) and followed by Auerbach and King (1983): If households have room to replace low-taxed assets in tax-deferred accounts with high-taxed assets held elsewhere, they make tax arbitrage profits by relocating the assets. The highest taxed asset should be always located in tax-preferred accounts before any lower taxed assets can be

[1] For example, tax-deferred assets in IRAs, self-employed plans, and employer-based defined contribution plans such as 401(k) and 403(b) amounted to almost $8.5 trillion in 2007. Also, 58.7 million households held positive amounts of financial assets in both taxable and tax-deferred accounts and decided where to locate their assets.

replaced there. Portfolio allocations thus are "tax efficient" when it is not possible to replace low-taxed assets in tax-deferred accounts with high-taxed assets held elsewhere.

Several studies provide empirical evidence about households' actual asset location decisions that indicates they deviate from the suggestion of tax arbitrage arguments in practice. Bodie and Crane (1997) find that many investors maintain significant amounts of money in both taxable and tax-deferred accounts and that a large portion of them do not take advantage of the potential tax arbitrage benefits of optimal asset locations. Other studies (Barber and Odean, 2004; Bergstresser and Poterba, 2004; Poterba and Samwick, 1997, 2003) indicate that portfolio choices by U.S. households substantially deviate from tax-efficient asset locations; they keep both stocks and bonds in each account type and often maintain higher shares of stocks in their tax-deferred accounts. This discrepancy is referred to as the "asset location puzzle."

To resolve it, Amromin (2003) considers a model that includes uninsurable labor market risk and institutional rules regarding penalties on early withdrawal from tax-deferred accounts. He shows that holding taxable bonds in taxable accounts can be optimal for households with labor income shocks that thus need liquidity. Related studies (Dammon, Spatt and Zhang, 2004; Zhou, 2009) consider limitations on the set of investment options available to households, or the credit constraints of borrowing and short selling. In such settings, tax is only one of the factors that affects households' asset location decisions. Models with labor income risk or accessibility restrictions improve on the uniformly tax-efficient corner solutions of the model. That is, considerations of an early withdrawal penalty, transaction costs, or liquidity constraints in the model make it optimal for some households to hold high-taxed but riskless assets (bonds) in taxable accounts.

Although many past studies investigate which determinants affect household asset location

decisions and how, a substantial gap remains between the theoretical model and the empirical findings. The preceding empirical studies performed extensive Monte Carlo simulations and calibrations to gain an idea of how each possible factor affects households' asset location decisions, or else undertook cross-tabulations to describe the patterns of households' asset locations in recent years. No extant literature offers any empirical analysis of households' asset location decisions in a natural experimental framework, relying on the tax arbitrage model.

This study offers the first direct investigation of how the differential taxation of financial assets affects households' asset location in taxable and tax-deferred accounts with a tax arbitrage model. Using the 1998 and 2007 Surveys of Consumer Finances (SCF) data, I explore households' asset location patterns and relate these patterns to household characteristics, especially household marginal tax rates on interest and capital gains. To address the endogenous tax rates, I exploit the exogenous changes in tax rates created by the Bush tax acts in 2001 and 2003; they dramatically reduced the tax rates on interest, dividends, and long-term capital gains. The Tobit estimates suggest that households with greater tax rate differentials between interest income and capital gains (i.e., greater tax disadvantage of bonds relative to stocks) hold significantly higher shares of bonds in tax-deferred accounts and lower shares of bonds in taxable accounts. These empirical findings are consistent with the prediction of the tax arbitrage model, in support of the idea of households' tax-motivated asset allocation decisions. According to the after-tax capital asset pricing model (CAPM), households that face high tax rate differentials between bonds and stocks maintain portfolios tilted toward lightly taxed assets (stocks) and away from more heavily taxed assets (bonds) in their taxable accounts.

In addition, using Tobit estimates, it is possible to assess the impact of the Bush tax acts on households' asset location in taxable and tax-deferred accounts. The reduced tax rates for capital

gains were greater than the reduction for interest, so bonds have become more tax-disadvantaged relative to stocks after the 2001 and 2003 tax acts. This feature induces households to shift their heavily taxed bonds from taxable to tax-deferred accounts as a tax shelter. I quantify the magnitude of these asset location changes resulting from tax rate changes due to the tax acts.

From a theoretical perspective, I construct and use a new tax measure—tax rate differentials between interest income (bonds) and capital gains (stocks)—relying on the tax-arbitrage model, according to which investors move taxable bonds from taxable accounts to tax-deferred accounts to make tax-arbitrage profits, which increase as the tax rate differentials between bonds and stocks increase. Prior studies of the tax effects on households' asset location have used marginal tax rates on ordinary income, which cannot precisely measure the tax effects on households' asset location decisions, because they ignore different tax treatments across different financial assets. In contrast, the proposed new measure reflects the different tax treatments between bonds and stocks, which is critical to estimate the precise tax effects on households' asset locations in taxable and tax-deferred accounts. The new measure also can capture the effects of different tax treatments on households' asset allocation by reflecting the tax disadvantages of bonds over stocks.

The rest of the first chapter is organized as follows. In Section 1.2, I explain the tax arbitrage that derives from a change in asset location and derive the optimal asset location in taxable and tax-deferred accounts. There is a strong preference for holding taxable bonds in tax-deferred accounts and stocks in taxable accounts. Section 1.3 summarizes the major changes in tax rates made by the Bush tax acts. Section 1.4 describes the SCF data and explains the TAXSIM program that calculates the marginal tax rates from the survey data. In Section 1.5, I outline the empirical model for analyzing how different tax treatments among different financial assets

affect households' asset location in taxable and tax-deferred accounts. Section 1.6 contains the empirical findings about the effects of tax rate differentials on households' asset location decisions. A brief conclusion appears last.

1.2 Tax-Arbitrage from Asset Location

In this section, I use the tax arbitrage argument to derive the optimal location of asset holdings, in line with studies by Shoven and Sialm (2004) and Dammon, Spatt, and Zhang (2004). The tax arbitrage approach considers a *risk-preserving* change in the asset location to determine whether the after-tax returns on an investor's portfolio can be improved. The investor's main objective is to maximize the expected utility of after-tax wealth by holding assets in the right location.

1.2.1 No Borrowing or Short-Sale Constraints

The optimal asset allocation moves all tax-deferred wealth to the asset with the highest pre-tax yield. Investors then adjust the asset holdings in their taxable accounts, by borrowing or selling short if necessary, to achieve their optimal overall risk exposure. To derive this result, assume that investors must realize all capital gains each year and have unrestricted borrowing and short-sale opportunities in taxable accounts.[2]

Let the tax rates on ordinary income (dividends and interest) be τ_b, the tax rates on capital gains be τ_{cg}, the random pre-tax capital gain return on asset *i* be $\tilde{g}_i$, and the constant pre-tax yield on asset *i* be d_i. The yield is defined as the fraction of total asset value distributed as either dividends or interest. The random pre-tax return on asset *i* then can be expressed as $\tilde{r}_i = d_i + \tilde{g}_i$. For risky stocks (asset *s*), the random pre-tax return is $\tilde{r}_s = d_s + \tilde{g}_s$. For example, assume a stock that an investor purchases is priced at \$10 and the investor is paid \$4 as dividends. Then suppose

[2] The main result still holds when investors realize part of their capital gains. With an assumption of partial capital gains realization, the only difference in the analysis would be to replace the statutory tax rates on capital gains with the effective tax rates.

that the stock price increases to \$12 in the next period. The dividend yield (d_s) on the stock is 0.4 $\left(\frac{\$4}{\$10}\right)$, and the pre-tax capital gain return ($\tilde{g}_s$) is 0.2 $\left(\frac{\$12-\$10}{\$10}\right)$. Thus, the pre-tax return ($\tilde{r}_s$) on the stock is 0.6 $\left(\frac{\$12+\$4-\$10}{\$10}\right)$, which is the same as the return derived from $d_s + \tilde{g}_s$ $(= 0.4 + 0.2)$. Taxable bonds (asset *b*) are assumed to have no random capital gains ($\tilde{g}_b = 0$) and distribute only interest ($d_b = r$). Thus, the pre-tax return on taxable bonds is $\tilde{r}_b = r$, which is non-random (i.e., riskless).

Consider another investor with positive holdings of both riskless taxable bonds and risky stocks in taxable and tax-deferred accounts. The investor implements a risk-preserving portfolio change, such that a shift of one after-tax dollar from risky stocks to the riskless taxable bonds in the tax-deferred account is offset by a shift of x_s dollars from the riskless taxable bonds to risky stocks in the taxable account. This change in the location of the asset holdings leads to the following change in the investor's total wealth in the next period:

$$\begin{aligned}\Delta\tilde{w} &= \tilde{w}^{TDA}(marginal\ wealth\ change\ in\ Tax-Deferred\ Account)\\ &\quad +\tilde{w}^{TA}(marginal\ wealth\ change\ in\ Taxable\ Account)\\ &= [\mathrm{r} - (d_s + \tilde{g}_s)] + x_s\left[\{d_s(1-\tau_b) + \tilde{g}_s(1-\tau_{cg})\} - r(1-\tau_b)\right]. \qquad (1.1)\end{aligned}$$

If $x_s = \frac{1}{1-\tau_{cg}}$,[3] it is easy to show that for all possible values of random capital gains ($\tilde{g}_s$), the change in the investor's total wealth in the next period is given by

$$\Delta\tilde{w} = \frac{(r-d_s)(\tau_b-\tau_{cg})}{1-\tau_{cg}} = x_s(r-d_s)(\tau_b-\tau_{cg}). \qquad (1.2)$$

Because $\Delta\tilde{w}$ is independent of the random pre-tax capital gains ($\tilde{g}_s$), it represents a risk-free after-tax payoff that can be generated by simply shifting the location of the asset holdings. If $\Delta\tilde{w}$

[3] This asset location change decreases financial risk by $\tilde{g}_s$ in tax-deferred accounts and increases it by $x_s[\tilde{g}_s(1-\tau_{cg})]$ in taxable accounts. Thus, the investor can preserve its risk exposure by setting $x_s = \frac{1}{1-\tau_{cg}}$.

is positive (i.e., the investor's total wealth increases after the change in asset location), the investor is strictly better off holding taxable bonds in the tax-deferred account and stocks in the taxable account.[4] If $\Delta\widetilde{w}$ is negative, the investor is strictly worse off moving taxable bonds into the tax-deferred account.

The sign of $\Delta\widetilde{w}$ depends on the sign of $(r - d_s)(\tau_b - \tau_{cg})$, because the amount of risk-adjusted money (x_s) is strictly positive. Thus, the investor prefers to allocate all tax-deferred wealth to the asset with the highest yield and holds all other assets in the taxable account, as long as $\tau_b > \tau_{cg}$.[5] After allocating the entire tax-deferred wealth to the asset with the highest yield, the investor adjusts the asset holdings with the targeted risk exposure in the taxable account by borrowing or selling short.[6]

The changes in the tax rates instituted by the Bush-era tax acts caused dividends and capital gains income to be taxed at the same rate, whereas interest income was taxed at the higher rate (i.e., $\tau_b > \tau_d = \tau_{cg}$). Then, Equation (1.2) becomes $\frac{r(\tau_b - \tau_{cg})}{1-\tau_{cg}}$, and the sign only depends on $\tau_b - \tau_{cg}$, which is positive in the U.S. tax system. In this case, it is optimal for the investor to hold taxable bonds in the tax-deferred account, regardless of the dividend yield on stocks. In summary, the investor must place the heaviest taxed asset (taxable bonds) in the tax-deferred account before any lower taxed assets are replaced there. This asset location policy provides the investor with the highest level of tax efficiency while maintaining the desired risk exposure of the overall portfolio. The tax arbitrage profit from the change in the asset location ($\Delta\widetilde{w}$) increases

[4] Because wealth in the tax-deferred account might be more valuable than wealth in the taxable account, there is no guarantee that the change in the expected utility of total wealth has the same sign as the change in the final wealth ($\Delta\widetilde{w}$) if the taxable and tax-deferred account are affected differently. Appendix A contains a proof that shows that the change in the expected utility has the same sign as the change in total wealth.

[5] Under U.S. federal tax laws, tax rates on bonds are greater than tax rates on capital gains.

[6] The SCF data do not contain information about a coupon rate of each bond and a dividend yield on each stock that households hold in their portfolio. Thus, I conventionally assume that the asset with the highest yield is the taxable bond, because the historical data from 1998 to 2007 show that the pre-tax interest rate for T-bills is around 4.85%, higher than the S&P 500 dividend yield on average (1.55%).

monotonically with the tax rate differential between interest income and capital gains ($\tau_b - \tau_{cg}$).

1.2.2 Borrowing Constraints and Liquidity Needs

With unrestricted borrowing and short-sale constraints, the investor optimally holds only assets with the heaviest taxed asset (taxable bonds) in the tax-deferred account and mixed assets in the taxable account with the desired risk exposure by borrowing or selling short. If the investor has restrictions on borrowing and short selling, the investor holds the heaviest taxed asset in the tax-deferred account until he or she reaches borrowing or short-sale constraints in the taxable account. Then, the investor begins to allocate the remaining tax-deferred wealth to the next heaviest taxed asset, until the restrictions again bind. The investor keeps allocating to successively lower taxed assets in the tax-deferred account until he or she completely allocates his or her tax-deferred wealth. Thus, under the borrowing and short-sale restrictions, an investor may hold a mix of taxable bonds and stocks in the tax-deferred account.

Although the optimal asset location policy maximizes the tax efficiency of the portfolio, it also increases the portion of risky assets in the taxable account. An investor with relatively little taxable wealth or facing labor income shocks may wish to control taxable wealth to guarantee a minimum level of consumption. In this case, the investor has a reason to hold more heavily taxed but riskless bonds in the taxable account. Thus, liquidity needs can affect households' optimal asset location (i.e., tax-efficient corner solutions are not optimal with liquidity considerations).

For example, consider an investor who holds a mix of taxable bonds and stocks in the tax-deferred account and stocks in the taxable account. As long as taxable bonds have higher tax rates than stocks, this asset location is tax efficient without the liquidity consideration. Consider the risk-preserving change in the location of asset holdings. The investor shifts one after-tax dollar from taxable bonds to stocks in the tax-deferred account and $x_b \left(= \frac{1}{1-\tau_{cg}}\right)$ dollars from

stocks to taxable bonds in the taxable account. Although this asset shift is tax inefficient, it reduces the share of risky assets in the taxable account and potentially increases the funds to finance unexpected liquidity shocks. Thus, the investor is less likely to withdraw money from the tax-deferred account by paying the penalty. The marginal increment in the taxable wealth due to the shift from stocks to taxable bonds is

$$\widetilde{\Delta w}^{TA} = x_b\left[r(1-\tau_b) - \left\{d_s(1-\tau_b) + \tilde{g}_s\left(1-\tau_{cg}\right)\right\}\right] \equiv \tilde{G}^{TA}. \quad (1.3)$$

The marginal change in the tax-deferred wealth from shifting taxable bonds to stocks is

$$\Delta\widetilde{w}^{TDA} = \left[\frac{1-\tau_b}{1-\tau_b-f}\right]\widetilde{\Delta w}^{TA}\tilde{S} - [r-(d_s+\tilde{g}_s)] = \left[\frac{1-\tau_b}{1-\tau_b-f}\right]\tilde{G}^{TA}\tilde{S} - \tilde{G}^{TDA}, \quad (1.4)$$

where *f* is the penalty per dollar withdrawn from the tax-deferred account, $\tilde{G}^{TDA} \equiv [r-(d_s+\tilde{g}_s)]$, and $\tilde{S}$ is the indicator for an income shock. The indicator $\tilde{S}$ is equal to 1 if the investor cannot deal with the income shock using only his or her taxable wealth, and 0 otherwise. The incremental wealth in the tax-deferred account decomposes into two parts. The first term in Equation (1.4) indicates the marginal change in the tax-deferred wealth from being withdrawn to finance a shortfall in the taxable account when the investor has a large income shock. The second term in Equation (1.4) is the marginal change in the tax-deferred wealth from the differential pre-tax returns on taxable bonds and stocks.

Because the investor wants to maximize the expected utility of after-tax wealth, it is necessary to check the change in expected utility that arises from such as shift in asset location (which thereby changes the after-tax wealth). The change in expected utility by holding a mix of taxable bonds and stocks in the taxable account is

$$\Delta \mathrm{E}\left[\widetilde{U}\right] = \mathrm{E}\left[\widetilde{U}'\Delta\widetilde{W}^{TA}\right] + \lambda E\left[\widetilde{U}'\Delta\widetilde{W}^{TDA}\right]$$

$$= \mathrm{E}\left[\widetilde{U}'\tilde{G}^{TA}\right] + \left[\frac{\lambda(1-\tau_b)}{1-\tau_b-f}\right] E\left[\widetilde{U}'\left(\tilde{G}^{TA}\tilde{S}\right)\right] - \mathrm{E}\left[\widetilde{U}'\tilde{G}^{TDA}\right]$$

$$= \mathrm{E}\left[\widetilde{U}'\tilde{G}^{TA}\right] + \left[\frac{\lambda(1-\tau_b)}{1-\tau_b-f}\right] E\left[\widetilde{U}'\left(\tilde{G}^{TA}\tilde{S}\right)\right], \quad (1.5)$$

where λ is the shadow price of taxable wealth per dollar of tax-deferred wealth, and $\mathrm{E}\left[\widetilde{U}'\tilde{G}^{TDA}\right] = 0$, by the assumption that the investor is indifferent between taxable bonds and stocks at the margin in the tax-deferred account. Because $\tilde{G}^{TDA} - \tilde{G}^{TA}$ is equal to $x_b\left[(r - d_s)(\tau_b - \tau_{cg})\right]$, it is the positive, risk-free, after-tax payoff, as denoted by *P*. This reasoning implies

$$\mathrm{E}\left[\widetilde{U}'\tilde{G}^{TA}\right] = \mathrm{E}\left[\widetilde{U}'(\tilde{G}^{TDA} - P)\right] = -P\mathrm{E}\left[\widetilde{U}'\right]. \quad (1.6)$$

Substituting into Equation (1.5) yields

$$\Delta \mathrm{E}\left[\widetilde{U}\right] = -P\mathrm{E}\left[\widetilde{U}'\right] + \left[\frac{\lambda(1-\tau_b)}{1-\tau_b-f}\right] E\left[\widetilde{U}'\left(\tilde{G}^{TA}\tilde{S}\right)\right] = \left[\left(\frac{\lambda(1-\tau_b)}{1-\tau_b-f}\right)\bar{E}\left[\tilde{G}^{TA}\tilde{S}\right] - P\right] E[\widetilde{U}'], \quad (1.7)$$

where $\bar{E}$ is the expectation operator under a risk-neutral measure. The value of $\Delta \mathrm{E}\left[\widetilde{U}\right]$ is positive when $\bar{\mathrm{E}}\left[\tilde{G}^{TA}\tilde{S}\right] > P\left[\frac{(1-\tau_b-f)}{\lambda(1-\tau_b)}\right]$. A notable element of Equation (1.7) is that investors who have enough taxable wealth to deal with the income shock without drawing the fund from the tax-deferred account ($\tilde{S} = 0$ with certainty) or who are certain to have big income shocks that require them to access the tax-deferred account ($\tilde{S} = 1$ with certainty) are strictly worse off (i.e., $\Delta \mathrm{E}\left[\widetilde{U}\right] < 0$) when they hold taxable bonds in the taxable account to meet their liquidity needs.

The preceding analysis suggests that liquidity needs can influence the asset location decision. However, it is not likely to be a major concern for most investors, who generally have some non-financial income and ability to borrow to smooth their consumption levels. On the whole,

liquidity needs alone likely cannot generate significant demand for taxable bonds in the taxable account. Thus, this study focuses on the tax effects on households' asset location decisions by controlling for borrowing constraints and liquidity considerations. The tax arbitrage profits from the change in asset locations increase (i.e., opportunity costs of having stocks in the tax-deferred account increase) as the tax rate differentials ($\tau_b - \tau_{cg}$) increase. Therefore, I expect that the investor with the greater tax rate differential (i.e., stronger incentive to shelter taxable bonds into the tax-deferred account) will hold a higher share of bonds in the tax-deferred account, whereas there will be a lower share of bonds in the taxable account due to the risk-preserving portfolio changes. According to the after-tax CAPM, the investor with the greater tax rate differential prefers to hold the low-taxed asset in the taxable account and thus should hold a higher share of stocks in the taxable accounts. The study hypotheses are as follows:

H_1: A household with a greater tax rate differential between bonds and stocks holds a higher share of bonds in tax-deferred accounts.

H_2: A household with a greater tax rate differential between bonds and stocks holds a lower share of bonds in taxable accounts.

H_3: A household with a greater tax rate differential between bonds and stocks holds a higher share of stocks in taxable accounts.

1.3 The Bush Tax Acts

Two major federal tax laws were passed during the presidency of George W. Bush: the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA) and the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA). Prior to the passage of EGTRRA, the federal income tax rate structure consisted of five tax brackets, ranging from 15% to 39.6%. Then EGTRRA introduced a new 10% tax bracket and reduced individual income tax rates by

1%. Next, JGTRRA continued this precedent by accelerating tax rate reductions on dividends and capital gains. Table 1.1 summarizes the changes in the statutory tax rates on ordinary income, dividends, and long-term capital gains due to ETRRA and JGTRRA.

As Table 1.1 reveals, the JGTRRA legislation contained several key provisions. First, it reduced most marginal tax rates on ordinary income above 15% by 2% and reduced the top marginal tax rate by 3.6%. These tax rate reductions had already been included in EGTRRA but were scheduled to go into effect gradually, with a 1% rate reduction in 2004 and the remainder in 2006. Under JGTRRA, the scheduled reductions all occurred in 2003. Second, the marginal tax rates on long-term capital gains were reduced from 20% to 15% at the top income bracket and from 10% to 5% (and then to 0% in 2008) for the bottom income bracket. Third, dividends were taxed differently, depending on their category. Qualified dividends were paid by U.S. corporations or qualified foreign corporations and required investors to hold the stocks for more than 60 days. If the dividends were qualified, they were taxed at the long-term capital gain tax rates rather than at ordinary income tax rates. Thus, the marginal tax rates on qualified dividends dropped dramatically, from 35% to 15% at the top income bracket and from 10% to 5% at the bottom bracket, after JGTRRA. In contrast, ordinary dividends continued to be taxed at the level of ordinary income tax rates.

As a result of these changes in the statutory tax rates on ordinary income, capital gains, and dividends, the differentials in the tax rates between interest income and capital gains increased. That is, the tax disadvantages of bonds relative to stocks were bigger after JGTRRA. Figure 1.1 shows the change in tax rate differentials between interest and capital gains over the different income tax brackets. Because EGTRRA and JGTRRA provide exogenous variation in tax rates, I can use these structural changes to address the endogeneity problem of the marginal tax rates in

Section 1.5.

1.4 Data Description and Summary Statistics

The Survey of Consumer Finances (SCF) is a triennial data collection conducted by the Federal Reserve Board. The SCFs contain repeated, cross-sectional data and provide complete and disaggregate information on the portfolios held by a large sample of U.S. households. The asset holdings across all financial intermediaries in the data make it possible to study the overall structure of the household portfolio, rather than just the structure of the components held at a single financial institution. The data also contain information about households' demographic characteristics, attitudes toward investment risk and financial decisions, and financial credit. The SCF data reflect an area-based probability sample of the U.S. population and households drawn from an Internal Revenue Service file of high-income returns. They oversample high-income households to identify the households' asset location behavior, in that financial asset holdings are strongly concentrated at the top of the income distribution. Sampling weights also are included in the SCF, so the estimates are weighted to represent the U.S. household population.[7]

The 1998 and 2007 SCF data appear in the empirical analysis; this data sample contains only households that hold assets in both tax-deferred and taxable accounts, considering the focus in this study on how different tax treatments among different financial assets affect a household's asset location in taxable and tax-deferred accounts. The sample also excludes households with negative tax rates on ordinary income and capital gains.[8] The number of observations in the data set is five times the actual number of respondents, because a multiple imputation technique replaces any missing values. These multiple imputations improve the precision of the point

[7] One disadvantage of the SCF data is that the household's state of residence is not included. Thus, it is not possible to calculate the households' state income tax rates, which also could help identify the effect of marginal tax rates on households' asset location decision in taxable and the tax-deferred accounts.

[8] Households that receive the earned income tax credits (EITC) and realize net capital losses have negative tax rates on ordinary income and on capital gains, respectively.

estimates by increasing the sample size. However, many statistical package programs treat each of the five replicates as independent observations, which inflates the statistical significance of the results. I correct all summary statistics, estimates, and standard errors for the multiple imputations.[9] Table 1.2 presents the summary statistics of households' tax rates, financial incomes, and demographic characteristics.

1.4.1 Estimating the Marginal Tax Rates for SCF Households

The SCF data include detailed information on households' tax filing, adjusted gross income, and deductions but not the household's tax rates, for confidentiality reasons. To determine marginal tax rates, I used the TAXSIM web program at the National Bureau of Economic Research (NBER), which computes federal marginal tax rates on ordinary incomes and capital gains using relevant information provided by the SCF data.[10]

Next, using the statutory tax rates on capital gains from TAXSIM, I constructed the effective tax rates on capital gains. Poterba (1999) argues that the relevant capital gains tax rates may not be the statutory rates but rather the effective tax rates reflecting the deferral of capital gains realization. Because taxes are levied on realized capital gains, not accrued ones, investors can avoid capital gains taxes by deferring their capital gains realization. Unrealized capital gains also qualify for a "stepped-up" basis when investors defer their capital gains realization until death.[11] The deferral of capital gains tax and the "stepped-up" basis make the effective tax rates on long-term capital gains lower than the statutory tax rates. Previous studies (e.g., Ivković, Poterba and Weisbenner, 2005; King, 1984) that use effective tax rates on capital gains suggest that statutory

[9] The SCF codebook provides the programming codes to correct for the inflated statistical significance from the multiple imputations. See Kennickell (1988) for detailed explanations of the imputation procedure in the SCF.
[10] The NBER's FORTRAN program, TAXSIM calculates tax liabilities and marginal tax rates under U.S. federal and state income tax laws from individual data. It is available at http://www.nber.org/~taxsim/. To convert the public SCF data into the variables required for TAXSIM, I used programming codes provided at the NBER website (http://www.nber.org/~taxsim/to-taxsim/scf/). Further procedures are explained in Appendix B.
[11] Bailey (1969) estimates that this provision reduced the effective tax burden on capital gains by about 50%.

tax rates on capital gains should be halved by the tax-deferral provision and then halved again by the "stepped up" basis provision. Thus, 25% of the statutory tax rates are used as the effective tax rates on the capital gains in the estimation.[12]

To perform the analyses of households' asset location decisions, I construct a new tax measure, defined as the difference between the tax rates on interest and the effective tax rates on capital gains. Because tax arbitrage profits from changing the asset location rely on the tax rate differentials between interest income and capital gains, as discussed in Section 1.2, this new measure precisely captures the effects of the different tax treatments between bonds and stocks on households' asset location in taxable and tax-deferred accounts. The new tax measure also reflects the tax disadvantages of taxable bonds over stocks. The tax rate differentials thus can measure the effect of the different tax treatments between the different financial assets on households' asset allocation decisions. As the tax rate differential between interest and capital gains increases, so does the tax disadvantage of taxable bonds over stocks. This increase in tax rate differentials causes households to move their bonds from taxable to tax-deferred accounts.

1.4.2 Defining Financial Asset Categories

Financial assets are classified into six categories, on the basis of their tax treatments: bonds held in tax-deferred accounts, stocks held in tax-deferred accounts, taxable bonds, taxable stocks, tax-exempt bonds such as municipal bonds, and interest-bearing accounts. For most types of tax-deferred accounts, the SCF data ask respondents whether the account is invested all in stocks, all in interest-earning assets/bonds, split (and what percentage is in stocks), in real estate, in insurance, or other. This information serves to construct the asset composition of tax-deferred accounts. I describe these asset categories and their different tax treatments in more detail next.

[12] Using the 25% of statutory tax rates for effective capital gains tax rates is a long-established convention in prior literature. The main empirical results still hold when the statutory tax rates on capital gains are used in the estimation. The estimates using the statutory tax rates are presented in Section 1.6.3.

1.4.2.1 Assets Held in Tax-Deferred Accounts

This category includes all assets held in individual retirement accounts (IRAs), Keogh plans for the self-employed, and defined contribution plans, including 401(k) plans and employee stock ownership plans (ESOPs). Stocks held in tax-deferred accounts include the total value of stocks held directly or in mutual funds. Bonds in tax-deferred accounts include all of the interest-earning assets and bonds, as well as assets not specifically coded as equity.[13] Interest income and capital gains within tax-deferred accounts incur no tax liabilities until withdrawal. This deferral allows households to accumulate their retirement wealth at pre-tax rates of return.

1.4.2.2 Taxable Bonds

This category includes federal government bonds, corporate bonds, certificates of deposit, and foreign bonds outside tax-deferred accounts, whether held directly or through mutual funds. Interest income within taxable accounts is taxed each year at the household's ordinary income tax rate.

1.4.2.3 Taxable Stocks

This category includes all holdings of stocks outside tax-deferred accounts, whether directly held or in mutual funds, including brokerage accounts, investment clubs, and shares in a household's current employed company. Dividend income outside tax-deferred accounts is taxed each year at the household's ordinary income tax rate. Long-term realized capital gains are taxed at the household's capital gains tax rate. Short-term capital gains are taxed as ordinary income upon realization. The tax treatment of mutual fund dividends and realized capital gains is very similar to that of directly held stocks.[14]

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[13] Hardly any TDA assets are held in real estate, insurance, or other.

[14] The tax treatment of mutual funds is slightly heavier than that of directly held stocks because mutual funds generate short-term and long-term capital gains even if investors do not sell the stocks.

1.4.2.4 Tax-Exempt Bonds

This category includes savings bonds and tax-exempt bonds, such as state and municipal bonds outside tax-deferred accounts. Although interest income from these assets is not taxed, coupon rates are lower relative to taxable bonds. Thus, holders of tax-exempt bonds pay implicit taxes, and this effective tax burden on tax-exempt bonds is the yield spread between comparable taxable bonds and tax-exempt bonds. Considering this aspect, the savings bonds, state bonds, and municipal bonds are classified as tax-exempt bonds.

1.4.2.5 Interest Bearing Accounts

This category includes checking accounts, saving accounts, and money market accounts that are not tax-exempt. Income within these accounts is taxed at the household's ordinary income tax rate. The main purpose of having these accounts is for short-term financial transaction and liquidity reasons, not for getting favorable tax treatment.[15]

1.4.3 Summary Information on Asset Holdings

Table 1.3 reveals the ownership of each asset category in the SCF data sample. First, there were substantial changes in the ownership of tax-deferred assets between 1998 and 2007. The ownership of bonds in tax-deferred accounts rose by 5%, whereas the probability of holding stocks in them fell by 4% between 1998 and 2007. Second, the probability of holding taxable bonds dropped by 6% during 1998−2007. In contrast, ownership of taxable stocks increased by 3%. Third, ownership of tax-exempt bonds, such as municipal and savings bonds, fell by 2%.

Table 1.4 presents more detailed information on households' financial asset holdings in both taxable and tax-deferred accounts. The share of bonds held in tax-deferred accounts was 20.96% in 1998 and increased to 23.93% in 2007. As this pattern reflects, the asset allocation in tax-deferred accounts shifted toward bonds and away from stocks, resulting from the Bush tax acts,

[15] Because this category is not of interest for this study, it is excluded from the estimation.

which increased the tax disadvantages of bonds during 2001−2003. Thus, the share of bonds held outside tax-deferred accounts fell from 16.76% to 13.88%, whereas the share of stocks held in taxable accounts rose from 29.23% to 31.35%. Table 1.4 also shows the percentage of households that held positive amounts of financial assets in taxable or tax-deferred accounts. The percentage of households that held bonds or stocks in tax-deferred accounts rose from 50.77% to 56.86%, and the percentage of households with bonds, stocks, or tax-exempt bonds outside tax-deferred accounts also increased from 51.83% to 54.81%.

1.5 Econometric Framework

To estimate how the different tax treatments among different financial assets affected households' asset location in taxable and tax-deferred accounts, I used the Tobit model for asset shares in the taxable and tax-deferred accounts as a function of households' marginal tax rate differentials. I also controlled for households' demographic characteristics and financial risk tolerance, as discussed next. The share of each financial asset category located in an account *a* for household *i* from the survey sample *t* is denoted $S_{a,i,t}$. The latent variable denoted by $S^*_{a,i,t}$ indicates the share of the asset that would be notionally allocated to the account. For example, for households without bonds in the tax-deferred account, the shares of bonds in the tax-deferred accounts would be censored at 0; they would be censored at 1 if households invested all their tax-deferred wealth in bonds. The resulting censored regression model, or Tobit model, is given by

$$\begin{cases} S^*_{a,i,t} = \beta_1 \tau_{i,t} + X'_{i,t}\beta_2 + \beta_3 I(Year = 2007) + \varepsilon_{i,t} \\ \\ S_{a,i,t} = \begin{cases} 0 & if\ S^*_{a,i,t} < 0 \\ S^*_{a,i,t} & if\ 0 \le S^*_{a,i,t} \le 1 \\ 1 & if\ S^*_{a,i,t} > 1 \end{cases} \end{cases}, \tag{1.8}$$

where $S^*_{a,i,t}$ is the latent share of the asset; $S_{a,i,t}$ is the observed share of the asset in the account *a*,

whether in taxable or tax-deferred accounts; $\tau_{i,t}$ is the effective marginal tax rate differential between interest and capital gains; $X_{i,t}^{'}$ is a vector of households' characteristics; and $I(Year = 2007)$ is a dummy for the 2007 SCF sample. The vector $X_{i,t}^{'}$ includes the age, age dummy, education, sex, marital status, risk tolerance, household size, net worth, and other income of the head of the household.[16]

The parameter of interest is β_1, or the tax effects on asset locations in taxable and tax-deferred accounts. According to the prediction of the asset location model, households with greater tax rate differentials between interest income and capital gains would hold a higher share of bonds in the tax-deferred accounts. The coefficient for the tax rate differential (β_1) should be positive (negative) for the share of bonds in the tax-deferred (taxable) accounts.

The econometrics problem for the estimation is that the households' tax rates are endogenous. The main regressor $\tau_{i,t}$ is endogenous to the asset holdings in the account because households can affect their tax liabilities and thus their marginal tax rates through portfolio choices. Previous studies of taxes and portfolio choices deal with this problem by introducing a new proxy for the marginal tax rates that investors face. Feldstein et al. (1980) constructed an algorithm, called the "first dollar" approach, that avoids the potential endogeneity of the marginal tax rates, especially with regard to the relationship between tax rates and households' portfolio choices.

However, to address the endogeneity problem of the tax rates, this study instead exploited the structural tax rate changes by the Bush tax acts, because the relevant information to implement the first dollar method is only available in 1998 SCF data and because tax rates instrumented by this method may still suffer endogeneity problems when households affect marginal tax rates

[16] There is no restriction on accessing the tax-deferred accounts if the person's age is older than 59½ years. Thus, the age dummy is equal to 1 if the investor's age is older than 59½ years and 0 otherwise. As listed in the SCF data, the head of the household is a single individual; in a couple, it is the man in a mixed-sex couple or the older member of a same-sex couple.

through their labor supply. Because education is correlated with permanent income and thus marginal tax rates, I used a dummy for educational attainment as an instrumental variable (Eissa, 1996; Kawano, 2010; Moffitt and Wilhelm, 1998).[17] Yet, the dummy for educational attainment is uncorrelated with tax arbitrage asset location behavior, because households are unable to adjust their education level in response to the Bush tax acts within a short period of time. The dummy for the educational attainment is equal to 1 if the household head has a college degree or higher and 0 otherwise. Finally, an interaction term features the dummy for educational attainment and the year dummy for the 2007 SCF data. The estimated model is as follows:

$$S^*_{a,i,t} = \beta_1 \tau_{i,t} + X^{'}_{i,t}\beta_2 + \beta_3 I(Year = 2007) + \varepsilon_{i,t}$$

$$\tau_{i,t} = \gamma_0 + \gamma_1 I(EDU \geq colloge) + \gamma_2 I(EDU \geq college) \times I(Year = 2007)$$

$$+\gamma_3 I(Year = 2007) + X^{'}_{i,t}\gamma_4 + \eta_{i,t}, \qquad (1.9)$$

where $I(EDU \geq college)$ is the indicator for a college degree or above, and the other notations are as described in Equation (1.8). The interaction term between the education dummy and the year dummy, $I(EDU \geq college) \times I(Year = 2007)$, supports a distinction of the households into high- and low-treatment groups, according to the magnitudes of the tax rate changes by the Bush tax reforms, which vary across households' income distributions. The non-tax factors also can affect households' asset holdings; they are in the vector $X'_{i,t}$ and controlled in the estimation. The estimates of the first stage regression are presented in Table 1.5. The coefficient for the interaction term between the education dummy and the year dummy is negative because the increase in tax rate differential between interest and capital gains was smaller for households in

[17] Moffitt and Wilhelm (1998) show that a variable that categorizes the group on the basis of their different tax treatments can be a valid instrumental variable for the tax rate changes.

the upper tax bracket.[18]

In addition to the Tobit model, I run a two-tiered model to distinguish the tax effects on households' asset ownership decisions (i.e., extensive margins) from the effects on the share decisions of each asset categories (i.e., intensive margins). The Tobit estimates do not distinguish these two margins, because the Tobit model assumes that the parameters governing the asset ownership decisions are the same as the ones governing the allocation of financial assets. Because the two-tiered model relaxes this assumption, it separates the tax effects on the asset location at the intensive margins from those at the extensive margins.

In the first tier, I run a probit model, which captures the tax effect on households' asset ownership decisions:

$$P^*_{a,i,t} = \delta_1 \tau_{i,t} + X'_{i,t}\delta_2 + \delta_3 I(Year = 2007) + \nu_{i,t} \,, \tag{1.10}$$

where $P^*_{a,i,t}$ is the indicator for the positive amount of the financial asset in the account *a*, taxable or tax-deferred accounts. If a household holds a positive amount of the asset in the account, the dependent variable is equal to 1, and it is 0 otherwise. Thus, the probit model is:

$$\begin{aligned} P_{a,i,t} &= 1 \text{ if } S^*_{a,i,t} > 0 \\ &= 0 \text{ if } S^*_{a,i,t} = 0 \,. \end{aligned} \tag{1.11}$$

In the second tier, I run a log-linear regression conditional on positive holdings of the asset in the account, which captures the tax effects on the asset location at the intensive margins:

$$\log\left(S^*_{a,i,t} \,\middle|\, P_{a,i,t} = 1\right) = \theta_1 \tau_{i,t} + X'_{i,t}\theta_2 + \theta_3 I(Year = 2007) + \xi_{i,t} \,. \tag{1.12}$$

In the two-tiered model, the endogenity problem of the tax rates can be addressed by implementing the same instrumental variables used in the Tobit regression.

[18] The Conditional Likelihood Ratio (CLR) confidence interval derived from the weak instrument test is smaller than the Wald confidence interval. This test result suggests that the instruments are strong enough to ensure consistent estimates.

1.6 Empirical Findings

1.6.1 Households' Asset Location in Taxable And Tax-Deferred Accounts: Tobit Estimates

Table 1.6 presents the Tobit estimates of the tax effects on households' asset locations in taxable and tax-deferred accounts. Columns (1) and (2) show the estimates for the shares of bonds in the taxable and tax-deferred accounts without using instrumental variables. Because tax rate differentials are endogenous, these estimates are not consistent.[19] The rest of the columns in Table 1.6 present the coefficients and standard errors for the asset shares in the taxable and tax-deferred accounts, with the endogeneity of tax rate differentials addressed by the instrumental variable method. The coefficient for the tax rate differentials is positive and statistically significant ($\beta_1 = 0.058, p < 0.05$) for the share of bonds in the tax-deferred accounts in Column (3). The estimate shows that households with greater tax rate differentials between interest income and capital gains (i.e., the greater tax disadvantage of bonds relative to stocks) hold significantly higher shares of bonds in the tax-deferred accounts to exploit the preferential tax treatments of these tax-deferred accounts. Column (5) shows that the coefficient for the tax rate differentials is negative and statistically significant ($\beta_1 = -0.062, p < 0.05$) for the share of bond in the taxable accounts. That is, households with greater tax disadvantages of bonds relative to stocks hold significantly lower shares of bonds in taxable accounts because they move their heavily taxed bonds into tax-deferred accounts and need to preserve their targeted financial risk exposure in their overall portfolio. This result is consistent with the prediction of the tax arbitrage model.

The empirical results in Table 1.6 also support the idea of households' tax-motivated *asset allocation*. According to after-tax CAPM (e.g., Auerbach and King, 1983; Litzenberger and

[19] I run the Hausman test for the model specification and find that $\chi^2(9) = 19.69$ and prob > $\chi^2 = .019$. Because it rejects the null hypothesis (H_0: the ordinary least square estimator is consistent), the estimates using instrumental variables are consistent.

Ramaswamy, 1979, 1980; Long, 1977), investors who face high tax rates should hold low-taxed assets, and those with low tax rates should hold more heavily taxed assets in the market equilibrium. Column (6) shows that the coefficient for the tax rate differentials is positive ($\beta_1 = 0.041, p < 0.10$) for the share of taxable stocks. That is, households with greater tax rate differentials between bonds and stocks tend to hold more stocks in their taxable accounts, because stocks are less heavily taxed assets to them. These results are consistent with previous work (e.g., Kawano, 2011; Poterba and Samwick, 2003) and provide empirical evidence of household allocation behavior in response to different tax provisions on different financial assets.

The remaining rows in Table 1.6 report the coefficients for households' demographic characteristics. The coefficient for age is positive and statistically significant for the share of bonds in both tax-deferred and taxable accounts; it is negative for the share of stocks in both accounts. These results offer some evidence of a link between age and asset allocation, consistent with the life-cycle model. Age-specific patterns of total asset holdings show that younger households tend to hold more risky assets (stocks) in their portfolio. Younger households have relatively less income over their lifetimes and are credit constrained; holding stocks with high rates of return helps compensate for their low income.[20] The coefficient for the size of households is positive for the share of bonds in both tax-deferred and taxable accounts, such that when households have more members, they have greater needs for liquidity that cause them to hold more bonds in their portfolios. Finally, the coefficient for marital status suggests that married heads of households are more likely to hold bonds in tax-deferred accounts and hold significantly more stocks in taxable accounts.

Because the choice of portfolio shares is based on a model that results in corner solutions, the marginal effects of tax rate differentials on the observed choice of portfolio shares are of interest,

[20] Poterba and Samwick (1997) analyze the age profiles of asset holdings and portfolio allocations in detail.

rather than the latent choice of portfolio shares. Table 1.7 presents the Tobit estimates of the marginal effects on the observed portfolio shares. Compared with the estimates of the marginal effects on the latent portfolio shares in Table 1.6, the signs and statistical significance of the marginal tax effects on the observed portfolio shares in Table 1.7 stay the same and differ only in the magnitude of the coefficients.

In addition to the Tobit estimates for each financial asset, I consider the possibility that households' asset location in taxable and tax-deferred accounts may correlate through the presence of unobservable factors. Consideration of this unobserved correlation may improve the Tobit estimates. For this analysis, a multivariate Tobit model with a correlated error structure was difficult to estimate while considering the correlation across four equations because of the unstable regions of the parameter space. Thus, a set of bivariate Tobit estimates for each possible pair of asset categories likely has information about the cross-correlation of asset categories.[21] Table 1.8 shows the correlation matrix of the residuals from the bivariate probits and bivariate Tobit values. The cross-correlation for holding bonds in the taxable and the tax-deferred accounts in Panel (a) is negative, which means households that hold bonds in either account are less likely to hold bonds in the other type of account.

With this correlation matrix, it is possible to estimate the bivariate Tobit model; those estimates are in Table 1.9. The t-statistics for the tax rate differentials are not improved by considering the correlations of unobservable factors of asset holdings in the estimation, because their correlations are not strong enough to improve the standard errors. The decrease in t-value for the tax rate differentials is significant in Column (3) because the correlation of the unobservable characteristics of holding tax-deferred bonds and tax-exempt bonds is weak.

[21] The programming codes for the bivariate Tobit model are available at http://ideas.repec.org/c/boc/bocode/s456864.html.

I assess the impacts of the Bush tax acts on households' asset location and allocation in taxable and tax-deferred accounts. The predicted changes in households' portfolio shares in response to the Bush tax acts, calculated using the Tobit estimates ($\hat{\beta}_1$and $\hat{\beta}_3$) in Table 1.6, can be computed as a percentage of the 1998 baseline:

$$\widehat{\Delta S}_{b,j} = \frac{\hat{\beta}_{1,j}(\tau_{b,2007}-\tau_{b,1998})+\hat{\beta}_{3,j}}{\sum_b S_{i,j}/n_b}, \tag{1.13}$$

where $\widehat{\Delta S}_{b,j}$ represents the predicted change in asset *j*'s share in households' income tax bracket b, and n_b is the number of households in that tax bracket. Table 1.10 provides the net predicted changes as a percentage of the average shares in 1998 for households in that tax bracket. I focus on the predictions for tax-deferred bonds, tax-deferred stocks, taxable bonds, and taxable stocks, because the tax effects are statistically significant for these asset classes, and risk-preserving portfolio changes are involved for these assets. Households in the 39.6% tax bracket should increase their shares of tax-deferred bonds by more than 25% due to the increase in tax-disadvantage of bonds relative to stocks after the Bush tax acts. Thus, households should reduce their portfolio shares of taxable bonds by the risk-preserving portfolio changes. These percentage changes should be considered cautiously though, because very large percentage changes arise from relatively small values in the denominator.

1.6.2 Households' Asset Location in Taxable And Tax-Deferred Accounts: Two-Tiered Estimates

The estimation of the two-tiered model aims to separate the tax effects on the asset holdings at extensive margins (asset ownership decisions) from those at intensive margins (asset share decisions, conditional on positive asset holdings). Table 1.11 presents the probit coefficients and standard errors for the shares of financial assets in the taxable and the tax-deferred accounts (i.e., parameters governing the asset ownership decision in the first part). The coefficient for the tax

rate differentials is significantly positive ($\delta_1 = 0.186, p < 0.05$) for the share of tax-deferred bonds and significantly negative ($\delta_1 = -0.240, p < 0.05$) for the share of taxable bonds. These empirical results suggest that households switch their asset holdings from bonds to stocks in taxable accounts and from stocks to bonds in tax-deferred accounts as the tax disadvantage of bonds relative to stocks increases.

In the second part, to measure the tax effects on the change in asset holdings at the intensive margins, I estimated a log-linear model, conditional on positive asset holdings. Table 1.12 shows the coefficients and standard errors for the shares of each asset category in the taxable and tax-deferred accounts. The coefficient for the tax rate differentials is significantly positive ($\theta_1 = 0.110, p < 0.05$) for the logarithm of the share of tax-deferred bonds in Column (1) and significantly negative ($\theta_1 = -0.273, p < 0.01$) for the logarithm of the share of taxable bonds in Column (3). Conditional on positive holdings of bonds in taxable and tax-deferred accounts, households with greater tax rate differentials tend to hold a greater share of bonds in the tax-deferred, which accounts for the lower share of bonds in the taxable accounts to take advantage of favorable tax treatments of the tax-deferred accounts. Table 1.12 also presents the effects of income and demographic characteristics on the asset holdings at the intensive margins. Older households are more likely to hold riskless bonds in the taxable accounts and less likely to hold them in the tax-deferred accounts. More educated households are associated with higher shares of bonds in the tax-deferred accounts and lower shares of bonds in the taxable accounts.

1.6.3 Robustness Check

To investigate the tax effects on households' asset location in taxable and tax-deferred accounts, the main analysis used effective tax rate differentials. However, because 25% of the statutory tax rates on capital gains are used as the effective tax rates on capital gains, the Tobit

estimates might be sensitive to the choice of tax rate measure. As a robustness check, I replaced the effective tax rate differentials with the statutory tax rate differentials,[22] then estimated the Tobit model again. The first five columns in Table 1.13 present the estimates for the share of asset holdings in the taxable and tax-deferred accounts, which show that the qualitative results in the main analyses remain unchanged. That is, the estimates using the statutory tax rates supported the idea of households' tax-motivated asset location and allocation in taxable and tax-deferred accounts.

In addition, by relaxing the Tobit assumptions of normality and homoscedasticity,[23] I also implement semiparametric estimators (Powell, 1984, 1986): (1) censored least absolute deviations (CLAD) estimator which is robust to heteroskedasticity and asymptotic normality, and (2) symmetrically censored least squares (SCLS) estimator based on weaker assumption of symmetric distribution. The estimates from these two approaches are consistent with the Tobit estimates, and the coefficient differences are smaller than 0.01.

To conclude this analysis, I aimed to explain the deviation of the actual asset location from the optimal tax-minimizing asset portfolio. To explore which types of households make tax-efficient asset location, I estimated a regression model that could explain the difference between the share of bonds in taxable accounts and the share of bonds in tax-deferred accounts. This new specification with the same explanatory variables used in the main analyses is given by

$$Difference_{i,t} = \alpha_1 \tau_{i,t} + X_{i,t}^{'} \alpha_2 + \alpha_3 I(Year = 2007) + \zeta_{i,t} \,, \tag{1.14}$$

where $Difference_{i,t} \equiv Share\ of\ Bonds_{TA,i,t} - Share\ of\ bonds_{TDA,i,t}$. The theory of the tax-

[22] The endogeneity problem of the tax rates is again addressed by the same instrumental variable method used in the main estimation.

[23] For testing normality, I regress a vector of ones on likelihood scores and generalized residuals raised to a power of 1 to 4, and run the same regression model including interaction terms of second moment of score and relevant variables for test of homoscedasticity. The tests show that the validity of Tobit assumptions is violated for some asset classes. For more detailed process of the tests, see Chapter 16 of Cameron and Trivedi (2010).

efficient asset location in Section 1.2 predicts that $Difference$ should not be positive. As Bergstressor and Poterba (2004) point out, this dependent variable has shortcomings for the estimation. The dependent variable, $Difference$, may vary widely even across tax-efficient households when they differ in their desired portfolio shares for bonds and stocks, and when they are constrained to hold different asset shares in taxable and tax-deferred accounts. For example, such tax-efficient households might have $Difference$s of -1, which would reflect that holding only stocks in the taxable accounts and only bonds in the tax-deferred accounts, or of zero, which would imply holding only bonds in taxable and tax-deferred accounts. The last column in Table 1.13 reports the estimates, which suggests a negative, statistically insignificant relationship between the household tax rate differentials and the tax-efficient asset location.

1.7 Conclusions

This study investigates how different tax treatments across different financial assets affect households' asset location decisions in taxable and tax-deferred accounts. Unlike past studies, I construct a new tax measure based on tax rate differentials between interest income and capital gains. This new measure has advantages: It precisely captures households' asset location decisions by relying on the tax-arbitrage model, and it captures their allocation decisions reflecting the tax disadvantages of bonds relative to stocks. Finally, this study addresses the endogeneity problem of the tax rates by exploiting the structural tax rate changes by the Bush tax reforms, instead of implementing the "first-dollar" method. The tax-arbitrage model predicts that households with greater tax rate differentials between interest income and capital gains hold higher shares of bonds in tax-deferred accounts and lower shares of bonds in taxable accounts, in line with a risk-preserving portfolio change. The empirical results show that households with greater tax disadvantages due to bonds relative to stock (i.e., greater tax rate differentials

between interest income and capital gains) hold significantly higher shares of bonds in tax-deferred accounts and lower shares of bonds in taxable accounts, which is consistent with the prediction of the asset location model. Also, the empirical findings support the idea of the households' tax-motivated asset allocation. Because bonds (stocks) are more (less) heavily taxed assets for households with greater tax rate differentials, they hold significantly lower (higher) shares of bonds (stocks) in their taxable accounts.

In addition to the Tobit estimates, I estimate a two-tiered model to separate the tax effects on households' asset location at the extensive margins from the effects at the intensive margins. The estimates in the two-tiered model suggest that households' portfolio decisions in response to differential taxation on financial assets are consistent with the prediction of the asset location model, both at the extensive margins and at the intensive margins. Conditional on positive holdings of bonds in taxable and tax-deferred accounts, households with greater tax rate differentials have higher shares of stocks and lower shares of bonds in taxable accounts.

Taxation and households' asset location and allocation decisions already attract attention, in both applied tax policy debates and public finance. More than 60 million U.S. households hold positive amounts of both taxable and tax-deferred assets, and they must decide where to place their assets. This issue appears likely to become more important as the "baby boom" generation ages; their first priority is often asset accumulation for their retirement savings. The effects of taxation on households' asset location decisions are therefore likely to be a topic of growing interest and importance. When policymakers enact a new tax policy, the empirical findings in this study can help them predict how much and in which ways households will change their asset location and allocation in response to the new tax rates. Finally, this study does not elucidate the role of non-financial assets such as housing, nor does it not estimate a structural model of

household asset location behavior. Further work should explore household asset location decisions based on the structural modeling and evaluate any welfare changes due to an introduction of a new tax policy.

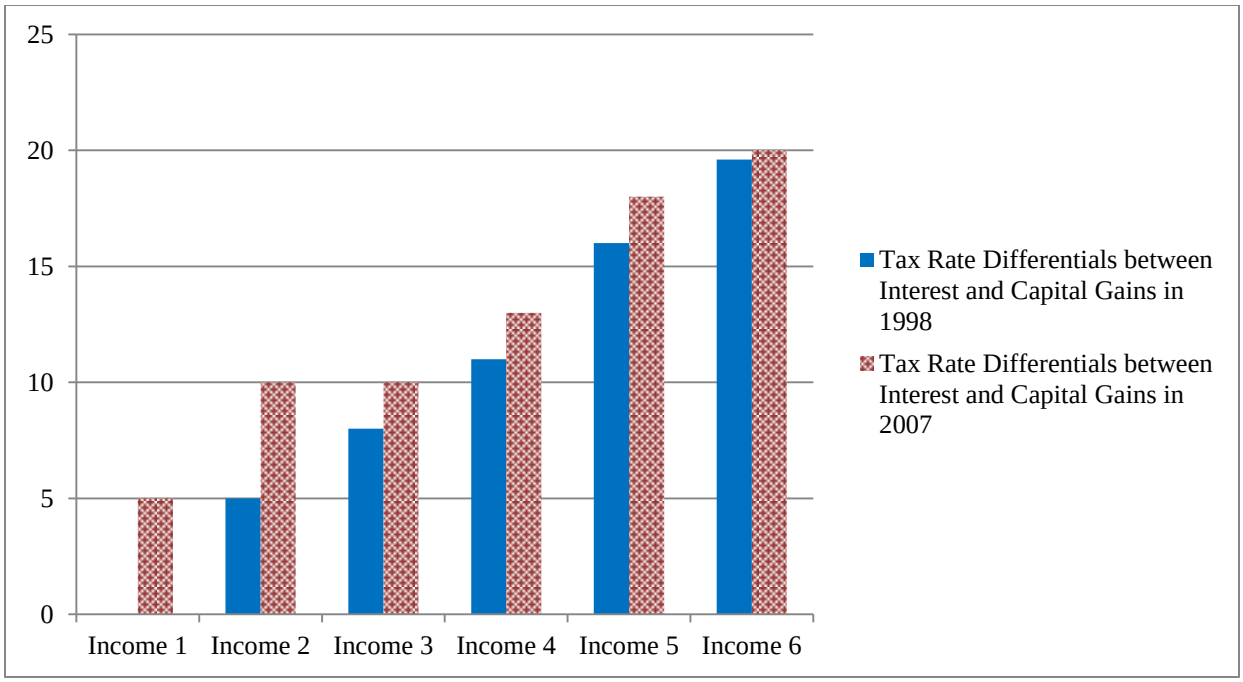

Figure 1.1 Distribution of Tax Rate Differentials between Interest and Capital Gains

Table 1.1 Changes in Tax Rates (%) by the Bush Tax Acts

Before EGTRRA (2000)		After EGTRRA / Before JGTRRA (2002)		After JGTRRA (2003)	
Ordinary Income / Interest / Dividends	*Long-Term Capital Gains*	*Ordinary Income / Interest / Dividends*	*Long-Term Capital Gains*	*Ordinary Income / Interest / Ordinary Dividends*	*Qualified Dividends / Long-Term Capital Gains*
		10	10	10	5
15	10	15	10	15	5
28	20	27	20	25	15
31	20	30	20	28	15
36	20	35	20	33	15
39.6	20	38.6	20	35	15

Source: Tax statistics at the Internal Revenue Service (IRS).

Table 1.2 Summary Statistics: 1998 and 2007 SCF Data

	1998 SCF			2007 SCF		
	Mean	Min	Max	Mean	Min	Max
Tax rate differentials (%)	7.37	0	19.6	10.10	0	20
Amount of money in taxable accounts (thousands of 2007 dollars)	121.79	0.01	334,000	170.06	0.01	345,000
Amount of money in tax-deferred accounts (thousands of 2007 dollars)	99.28	0.03	37,800	159.25	0.01	54,400
Income (millions of 2007 dollars)	0.10	0	128	0.14	0	117
Net worth (millions of 2007 dollars)	0.56	-19.1	652	0.95	-0.25	922
Mortgage (millions of 2007 dollars)	0.07	0	7.0	0.1	0	19.9
Head age (years)	46.03	19	95	48.63	21	95
Education (years)	14.14	1	17	14.46	1	17
Household size (#)	2.76	1	11	2.66	1	13
Financial risk averseness (1–4)	2.77	1	4	2.84	1	4
Number of observations (N)		2,193			2,337	

Source: Author's calculations, Survey of Consumer Finances. All averages are weighted by SCF sampling weights and are corrected for multiple imputations.

Table 1.3 Probability of Asset Ownership: 1998 and 2007

	1998	2007
Financial Assets Held in Tax-Deferred Accounts		
Tax-deferred bonds	40.91	46.24
Tax-deferred stocks	54.35	50.10
Financial Assets Held in Taxable Accounts		
Taxable bonds	35.86	29.14
Taxable stocks	39.36	42.17
Tax-exempt bonds	12.19	10.22
Interest-bearing accounts	93.77	94.74

Source: Author's tabulations from the Surveys of Consumer Finances. Households are weighted by SCF sampling weights in each year. and all averages are corrected for multiple imputations. Each asset category is described in the text.

Table 1.4 Asset Allocation in Taxable and Tax-Deferred Accounts: 1998 and 2007

	1998	2007
Financial Assets Held in Tax-Deferred Accounts (TDA)		
Bond as percentage of TDA financial assets	20.96	23.93
Stock as percentage of TDA financial assets	27.39	25.36
Percentage of households with bonds or stock in TDA	50.77	56.86
Financial Assets Held in Taxable Accounts (TA)		
Bond as percentage of TA financial assets	16.76	13.88
Stock as percentage of TA financial assets	29.23	31.35
Tax-exempt bonds as percentage of TA financial assets	5.66	5.48
Percentage of households with any financial assets in TA	51.83	54.81

Source: Author's tabulations from the Surveys of Consumer Finances. Households are weighted by SCF sampling weights in each year, and all averages are corrected for multiple imputations. Each asset category is described in the text.

Table 1.5 Estimates of the First Stage Regression

	Dependent Variable: Tax rate differential between interest and capital gains
$I(EDU \geq College)$	0.6130*** (0.1972)
$I(EDU \geq College) * I(Year = 2007)$	-0.0663** (0.0332)
$I(Year = 2007)$	-1.2531*** (0.1469)
Constant	8.8078*** (0.6057)
Observations	4525
R-squared	0.71
F-statistics	371.46

Notes: Effective tax rates on capital gains are used to construct the tax rate differentials between bonds and stocks. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. Standard errors are in parentheses. Estimates are weighted by the SCF sampling weights and corrected for multiple imputations. All the other control variables are included in the estimation but not reported.

Table 1.6 Financial Asset Shares in Taxable and Tax-Deferred Accounts: Tobit

	Shares of bonds in TDA	Shares of bonds in TA	Shares of bonds in TDA	Shares of stocks in TDA	Shares of bonds in TA	Shares of stocks in TA	Shares of tax-exempt bonds in TA
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Tax rate differentials	0.0076***	-0.0045***	0.0581**	-0.0510**	-0.0618**	0.0407*	-0.0201
	(0.0011)	(0.0012)	(0.0252)	(0.0236)	(0.0314)	(0.0227)	(0.0270)
Year dummy	-0.0303**	-0.0137	0.1147**	-0.1564***	-0.1466*	0.0589	-0.0545
	(0.0137)	(0.0161)	(0.0570)	(0.0562)	(0.0764)	(0.0558)	(0.0642)
Risk averseness	0.0667***	0.0580***	0.1461***	-0.0624**	-0.0138	0.0079	0.0152
	(0.0090)	(0.0117)	(0.0324)	(0.0300)	(0.0407)	(0.0290)	(0.0347)
Net worth	-0.0226***	0.0016	-0.0352***	-0.0035	0.0101*	0.0008	0.0065
	(0.0054)	(0.0021)	(0.0072)	(0.0051)	(0.0052)	(0.0037)	(0.0048)
Income	-0.0221	-0.0011	-0.0983*	-0.0545	0.0634	-0.0491	0.0606*
	(0.0441)	(0.0190)	(0.0551)	(0.0539)	(0.0388)	(0.0314)	(0.0351)
Stock turnover ratio	-0.0027**	-0.0005	-0.0055***	0.0021**	0.0020	-0.0008*	0.0002
	(0.0013)	(0.0033)	(0.0017)	(0.0011)	(0.0036)	(0.0004)	(0.0018)
Mortgage	-0.0956	-0.0375	-1.3695***	0.7427*	0.9078	-0.4781	0.3330
	(0.2089)	(0.2511)	(0.4759)	(0.4303)	(0.6010)	(0.4192)	(0.4775)
Age	-0.0021***	-0.0021**	0.0136***	-0.0036	0.0081**	-0.0052	0.0042
	(0.0008)	(0.0010)	(0.0045)	(0.0042)	(0.0037)	(0.0040)	(0.0048)
Age > 59 ½ dummy	-0.0407*	0.0518**	0.0757	-0.1218***	-0.0510	0.1090**	0.0334
	(0.0226)	(0.0257)	(0.0487)	(0.0471)	(0.0590)	(0.0440)	(0.0532)
Sex	0.0155	0.0211	0.1548***	-0.0579	-0.1007	0.1090**	-0.0732
	(0.0252)	(0.0294)	(0.0586)	(0.0579)	(0.0722)	(0.0540)	(0.0635)
Marital status	0.0047	0.0041	0.0119**	-0.0087	-0.0023	0.0128**	0.0032
	(0.0049)	(0.0067)	(0.0059)	(0.0057)	(0.0074)	(0.0055)	(0.0069)
Education	-0.0242***	-0.0168***	-0.1004***	0.0405	0.0513	-0.0475*	0.0298
	(0.0033)	(0.0047)	(0.0294)	(0.0278)	(0.0377)	(0.0273)	(0.0324)
HH size	0.0013	0.0113	0.0234**	0.0141	0.0326**	-0.0111	-0.0061
	(0.0058)	(0.0080)	(0.0114)	(0.0106)	(0.0151)	(0.0105)	(0.0124)
Constant	0.8534***	0.4400***	0.6448***	1.1671***	0.5945***	0.2300**	-0.0909
	(0.0729)	(0.1019)	(0.1103)	(0.1073)	(0.1330)	(0.1022)	(0.1191)
Use instrumental variables?	No	No	Yes	Yes	Yes	Yes	Yes

Notes: Effective tax rates on capital gains are used to construct the tax rate differentials between bonds and stocks. Net worth, income, and mortgage are adjusted to 10 millions of 2007 dollars. The univariate Tobit estimates are presented. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. Standard errors are in parentheses. Estimates are weighted by the SCF sampling weights and corrected for multiple imputations.

Table 1.7 Marginal Effects of Tax Rates on Portfolio Shares: Tobit

	Shares of bonds in TDA	Shares of stocks in TA	Shares of bonds in TDA	Shares of stocks in TA	Shares of tax-exempt bonds in TA
	(1)	(2)	(3)	(4)	(5)
Estimate of Marginal Effects					
	0.0416**	-0.0407**	-0.0419**	0.0365*	-0.0115
	(0.0200)	(0.0183)	(0.0213)	(0.0211)	(0.0151)

Notes: The table presents the marginal effect of a unit increase in the tax rate differential on the observed portfolio shares. This marginal effect is calculated as $\Phi(\frac{X\beta}{\sigma})\beta_i$. Effective tax rates on capital gains are used to construct the tax rate differentials between bonds and stocks. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. Estimates are weighted by the SCF sampling weights and corrected for multiple imputations. All the other control variables are included in the estimation but not reported.

Table 1.8 Estimated Correlation Matrix

	Taxable bonds	Taxable stocks	Tax-exempt bonds
Panel (a): Probit			
Tax-deferred bonds	-0.17	0.19	-0.10
Tax-deferred stocks	0.15	-0.22	0.14
Panel(b): Tobit			
Tax-deferred bonds	-0.25	0.21	-0.13
Tax-deferred stocks	0.18	-0.26	0.11

Source: Author's calculations from the Surveys of Consumer Finances. Estimates are weighted by the SCF sampling weights and corrected for multiple imputations.

Table 1.9 Financial Asset Shares in Taxable and Tax-Deferred Accounts: Bivariate Tobit

	Shares of bonds in TDA (1)	Shares of bonds in TDA (2)	Shares of bonds in TDA (3)
Tax rate differentials	0.0624**	0.0525**	0.0612*
	(0.0313)	(0.0261)	(0.0324)
Year dummy	0.0194	0.0005	0.1048
	(0.0971)	(0.0621)	(0.0769)
Risk averseness	0.0469	0.0254	0.1055**
	(0.0530)	(0.0335)	(0.0416)
Net worth	-0.0182**	-0.0086*	-0.0396***
	(0.0077)	(0.0045)	(0.0067)
Income	-0.2911***	-0.2744***	-0.0621
	(0.0764)	(0.0710)	(0.0432)
Stock turnover ratio	-0.0022	-0.0015	-0.0036
	(0.0031)	(0.0026)	(0.0033)
Mortgage	-0.2993	-0.1346	-1.1450*
	(0.8136)	(0.4913)	(0.6420)
Age	-0.0023	-0.0027	-0.0123**
	(0.0072)	(0.0045)	(0.0057)
Age > 59 ½ dummy	0.0067	-0.0004	0.0725
	(0.0771)	(0.0489)	(0.0625)
Sex	0.0440	-0.0116	0.1262
	(0.0911)	(0.0628)	(0.0789)
Marital status	-0.0085	-0.0026	0.0085
	(0.0086)	(0.0061)	(0.0081)
Education	-0.0221	-0.0145	-0.0902**
	(0.0472)	(0.0310)	(0.0389)
HH size	-0.0001	-0.0032	-0.0107
	(0.0163)	(0.0116)	(0.0147)
Constant	0.4151**	0.5668***	0.5992***
	(0.1636)	(0.1203)	(0.1466)
Correlation of asset holdings	With bonds in TA	With stocks in TA	With tax-exempt bonds in TA

Notes: Effective tax rates on capital gains are used to construct the tax rate differentials between bonds and stocks. Net worth, income, and mortgage are adjusted to 10 millions of 2007 dollars. The bivariate Tobit estimates consider the correlation of unobservable factors of asset holdings. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. Standard errors are in parentheses. Estimates are weighted by the SCF sampling weights and corrected for multiple imputations.

Table 1.10 Effects of the Bush Tax Acts on Households' Portfolio Shares

	Predicted Change in Portfolio Shares (1998 baseline)		
	Tax Brackets in 1998		
	31%	36%	39.6%
Tax-deferred bonds	32.96	32.61	25.73
Tax-deferred stocks	-25.40	-24.89	-28.30
Taxable bonds	-114.61	-97.07	-292.64
Taxable stocks	7.47	8.10	9.17
Tax-exempt bonds	-33.64	-35.84	-17.15

Notes: The predicted changes as a percentage of the 1998 baseline are computed as $\widehat{\Delta S}_{b,j} = \frac{\widehat{\beta}_{1,j}(\tau_{b,2007} - \tau_{b,1998}) + \widehat{\beta}_{3,j}}{\sum_b S_{i,j}/n_b}$, where $\widehat{\Delta S}_{b,j}$ represents the predicted change in asset *j*'s share in households' income tax bracket *b*, and n_b is the number of households in that tax bracket. Each asset category is described in the text.

Table 1.11 Financial Asset Shares in Taxable and Tax-Deferred Accounts: Two-Tiered Model (Probit)

	First Part: Probit Regression				
	Share of bonds in TDA (1)	Share of stocks in TDA (2)	Share of bonds in TA (3)	Share of stocks in TA (4)	Share of tax-exempt bonds in TA (5)
Tax rate differentials	0.1855**	-0.1609**	-0.2402**	0.1312*	-0.1872
	(0.0929)	(0.0797)	(0.1218)	(0.0709)	(0.1547)
Year dummy	0.3554*	-0.5393***	-0.5973*	0.0969	-0.4192
	(0.2091)	(0.1878)	(0.3152)	(0.2670)	(0.3611)
Risk averseness	0.4585***	-0.2163**	-0.0747	0.0271	-0.1305
	(0.1209)	(0.1012)	(0.1709)	(0.1378)	(0.1936)
Net worth	-0.1176***	-0.0064	0.0429**	0.0027	0.0399
	(0.0352)	(0.0184)	(0.0213)	(0.0197)	(0.0254)
Income	-0.2632*	-0.0613	0.2442	-0.1463	0.3626**
	(0.1534)	(0.1792)	(0.1669)	(0.1721)	(0.1845)
Stock turnover ratio	-1.0179	2.6383***	0.0151	1.8151	-0.0183
	(0.8062)	(0.9339)	(0.0123)	(2.8015)	(0.0343)
Mortgage	-5.2219***	2.4707	3.6543	-1.4960	0.9066
	(1.9016)	(1.5063)	(2.6402)	(2.0518)	(2.9410)
Age	-0.0432***	0.0125	0.0296	-0.0125	0.0398
	(0.0165)	(0.0145)	(0.0234)	(0.0187)	(0.0275)
Age > 59 ½ dummy	0.1932	-0.3798**	-0.1716	0.3296	-0.2144
	(0.1849)	(0.1671)	(0.2609)	(0.2090)	(0.3055)
Sex	0.4336*	-0.2456	-0.3769	0.1730	-0.4467
	(0.2250)	(0.1908)	(0.3158)	(0.2612)	(0.3701)
Marital status	0.0356	-0.0291	-0.0182	0.0648**	-0.0213
	(0.0217)	(0.0199)	(0.0335)	(0.0260)	(0.0445)
Education	-0.3368***	0.1306	0.2036	-0.1448	0.2254
	(0.1102)	(0.0949)	(0.1559)	(0.1291)	(0.1868)
HH size	-0.0741*	0.0433	0.1103*	-0.0223	0.0449
	(0.0430)	(0.0364)	(0.0598)	(0.0507)	(0.0676)
Constant	1.3196***	2.4027***	1.4143**	-0.2283	-1.1163
	(0.4424)	(0.3708)	(0.6057)	(0.4948)	(0.6596)

Notes: Effective tax rates on capital gains help construct the tax rate differentials between bonds and stocks. Net worth, income, and mortgage are adjusted to 10 millions of 2007 dollars. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. Standard errors are in parentheses. Estimates are weighted by the SCF sampling weights and corrected for multiple imputations. Estimates from the probit model are average marginal effects.

Table 1.12 Financial Asset Shares in Taxable and Tax-Deferred Accounts: Two-Tiered Model (Log-Linear)

	Second-Part: Log-Linear Regression				
	Log (share of bonds in TDA) (1)	Log (share of stocks in TDA) (2)	Log (share of bonds in TA) (3)	Log (share of stocks in TA) (4)	Log (share of tax-exempt bonds in TA) (5)
Tax rate differentials	0.1097**	-0.0959**	-0.2728***	0.1051*	-0.0838
	(0.0557)	(0.0487)	(0.1015)	(0.0627)	(0.1115)
Year dummy	0.2487	-0.2507*	-0.6821***	0.1599	-0.1909
	(0.1514)	(0.1300)	(0.2401)	(0.1537)	(0.2610)
Risk averseness	0.2928***	-0.1496**	-0.1984	0.0459	0.0039
	(0.0822)	(0.0687)	(0.1310)	(0.0822)	(0.1498)
Net worth	-0.0735***	-0.0023	0.0470***	0.0007	0.0199
	(0.0226)	(0.0105)	(0.0167)	(0.0097)	(0.0174)
Income	-0.0763	-0.0270	0.3351**	-0.1285	0.2548*
	(0.1139)	(0.1169)	(0.1333)	(0.0877)	(0.1349)
Stock turnover ratio	-0.0213***	0.0005**	0.0249***	-0.0018**	0.0022
	(0.0032)	(0.0003)	(0.0058)	(0.0009)	(0.0053)
Mortgage	-3.2091**	1.3303	4.4227**	-1.4008	1.2690
	(1.4134)	(1.0047)	(2.2080)	(1.1227)	(1.9603)
Age	-0.0245**	0.0094	0.0395**	-0.0114	0.0172
	(0.0115)	(0.0098)	(0.0181)	(0.0110)	(0.0198)
Age > 59 ½ dummy	0.0595	-0.3089***	-0.2863	0.2279*	-0.0285
	(0.1291)	(0.1056)	(0.2023)	(0.1220)	(0.2220)
Sex	0.3337**	-0.1760	-0.6328***	0.3068**	-0.2633
	(0.1625)	(0.1262)	(0.2358)	(0.1498)	(0.2544)
Marital status	0.0134	-0.0264**	-0.0119	0.0346**	0.0011
	(0.0152)	(0.0130)	(0.0269)	(0.0145)	(0.0289)
Education	-0.1942**	0.0914	0.2620**	-0.1223	0.0880
	(0.0762)	(0.0627)	(0.1200)	(0.0756)	(0.1342)
HH size	-0.0419	0.0348	0.1106**	-0.0226	0.0177
	(0.0301)	(0.0248)	(0.0478)	(0.0289)	(0.0500)
Constant	-0.8468***	0.0910	0.0209	-1.6550***	-1.9018***
	(0.3215)	(0.2393)	(0.4786)	(0.2748)	(0.4654)

Notes: Effective tax rates on capital gains are used to construct the tax rate differentials between bonds and stocks. Net worth, income, and mortgage are adjusted to 10 millions of 2007 dollars. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. Standard errors are in parentheses. Estimates are weighted by the SCF sampling weights and corrected for multiple imputations.

Table 1.13 Financial Asset Shares in Taxable and Tax-Deferred Accounts and Tax-Efficiency

	Share of bonds in TDA (1)	Share of stocks in TDA (2)	Share of bonds in TA (3)	Share of stocks in TA (4)	Share of tax-exempt bonds in TA (5)	Difference in share of bonds (6)
Tax rate differentials	0.0678***	-0.0281**	-0.0579**	0.0428*	-0.0178	-0.0067
	(0.0219)	(0.0142)	(0.0263)	(0.0222)	(0.0167)	(0.0228)
Year dummy	0.1133***	-0.0006	-0.0662**	0.0636**	-0.0217	-0.0920*
	(0.0331)	(0.0285)	(0.0332)	(0.0291)	(0.0242)	(0.0539)
Risk averseness	0.1184***	-0.0196	0.0048	-0.0343**	0.0122	-0.0400
	(0.0176)	(0.0161)	(0.0214)	(0.0174)	(0.0136)	(0.0296)
Net worth	-0.0188***	-0.0024	0.0094**	0.0059*	0.0049	0.0022
	(0.0038)	(0.0032)	(0.0042)	(0.0033)	(0.0030)	(0.0038)
Income	-0.0835***	-0.0135	0.0612**	-0.0199	0.0512**	0.0181
	(0.0319)	(0.0267)	(0.0312)	(0.0306)	(0.0240)	(0.0280)
Stock turnover ratio	-0.0051***	0.0016**	0.0028	-0.0022*	-0.0002	0.0027**
	(0.0011)	(0.0008)	(0.0022)	(0.0012)	(0.0012)	(0.0012)
Mortgage	-1.3089***	0.2069	0.6349	0.0817	0.1841	0.1896
	(0.3173)	(0.2880)	(0.3883)	(0.3195)	(0.2230)	(0.4130)
Age	-0.0104	-0.0019	0.0037	0.0011	0.0024	0.0019
	(0.0023)	(0.0023)	(0.0029)	(0.0024)	(0.0018)	(0.0041)
Age > 59 ½ dummy	0.0634*	-0.0590*	-0.0238	0.0545	0.0140	-0.0317
	(0.0336)	(0.0334)	(0.0390)	(0.0348)	(0.0268)	(0.0475)
Sex	0.1471***	0.0013	-0.0802	0.0363	-0.0521	0.0150
	(0.0437)	(0.0425)	(0.0493)	(0.0454)	(0.0327)	(0.0513)
Marital status	0.0163***	-0.0068	-0.0040	0.0115**	0.0001	-0.0111**
	(0.0059)	(0.0058)	(0.0065)	(0.0058)	(0.0049)	(0.0056)
Education	0.0764***	0.0009	-0.0227	-0.0076	0.0141	0.0259
	(0.0148)	(0.0144)	(0.0187)	(0.0159)	(0.0120)	(0.0273)
HH size	-0.0093	-0.0016	0.0137*	0.0052	-0.0043	-0.0007
	(0.0058)	(0.0056)	(0.0075)	(0.0061)	(0.0046)	(0.0101)
Constant	0.8711***	0.9523***	0.3609***	0.3334***	0.0108	-0.5383***
	(0.0679)	(0.0696)	(0.0963)	(0.0765)	(0.0603)	(0.1017)

Notes: Statutory tax rates on capital gains are used to construct the tax rate differentials between bonds and stocks. Net worth, income and mortgage are adjusted to 10 millions of 2007 dollars. The difference between the share of bonds in taxable accounts and the share in tax-deferred accounts is the dependent variable in last column. The univariate Tobit estimates are presented. Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels. Standard errors are in parentheses. Estimates are weighted by the SCF sampling weights and corrected for multiple imputations.

Chapter 2 − Dividend Taxation and Households' Dividend Portfolio Decisions: Evidence from the 2003 Bush Tax Act

2.1 Introduction

Under the U.S. federal tax rules, dividends have historically been taxed at a higher rate than capital gains. In 2003, however, the Jobs and Growth Tax Relief Reconciliation Act (JGTRRA) dramatically altered the dividend tax regime facing U.S. investors. Specifically, the tax rates on qualified dividends are reduced sharply to the level of the tax rates on long-term capital gains of up to 15% while ordinary dividends are still taxed at the level of ordinary income tax rates.[24] Previous research extensively focuses on how tax rates on dividends affect dividend yields on stocks. Yet, extant literature provides very limited evidence on the effects of the preferential tax treatment of qualified dividends on a household's financial decision. Therefore, this chapter focuses on its favorable tax treatment of qualified dividends relative to ordinary dividends, and investigates the impacts of the different tax treatment between the two types of dividends on households' dividend portfolio choices.

There have been many empirical studies of how dividend taxation affects dividend yields on stocks. For example, a seminal paper by Miller and Modigliani (1961) proposes that capital market imperfections such as taxes and transaction costs might cause the formation of a *dividend clientele*. When dividends are more heavily taxed than capital gains, high-taxed investors prefer to hold stocks that generate their returns in the form of capital gains rather than dividends. Consequently, investors in the upper tax bracket gravitate to low-dividend yield stocks and low-taxed investors hold high-dividend yield stocks in the equilibrium.

After Miller and Modigliani (1961) suggested how an asset clientele can emerge in the equity

[24] A detailed explanation about the different tax treatment between ordinary dividends and qualified dividends is in Appendix D.

market, many empirical studies have tested the dividend clientele hypothesis. (Blume, Crockett and Friend, 1974; Chaplinsky and Seyhun, 1990; Kawano, 2010; Lewellen, Stanley, Lease and Schlarbaum, 1978; Miller and Scholes, 1978; Pettit, 1977; Scholz, 1992). The empirical evidence of the clientele effects is mixed, and some of these studies find that the dividend clientele exists in the equity market; stock dividend yields significantly decline as the investors' marginal tax rates increase. The latest work by Kawano (2010) investigates the effect of JGTRRA on the dividend clientele using the Survey of Consumer Finances (SCF) data. She reaffirms the evidence for the dividend clientele and estimates the impact of JGTRRA on the dividend yield by simulation. However, the paper does not elucidate the different tax treatments across the different types of dividends provided by JGTRRA.

In this study, I explore three aspects of households' tax-motivated financial decisions that have not been examined by prior research. First, I investigate how the different tax treatment between qualified dividends and ordinary dividends in JGTRRA affects households' dividend portfolios. To perform this analysis, the Public Use Tax File data are used because they include specific information regarding the dividend income types. If the different tax treatment matters to households' dividend portfolio decisions, the share of qualified dividends in the dividend income will be different across the households that face different tax rates. I find that the households with greater tax advantages from qualified dividends significantly reduce the ordinary dividends in their dividend portfolio.

Second, I investigate whether households' financial decisions are affected by the different tax treatment between dividends and long-term capital gains before and after JGTRRA. Tax rates on long-term capital gains have been lower than the rates on dividends, and this tax treatment of long-term capital gains has shown greater preference for the households in the upper tax bracket.

This tax feature would cause the ratio of dividends relative to long-term capital gains to decline as the households' marginal tax rates increase. My empirical results suggest that the households with a greater differential in tax rates between their dividends and long-term capital gains (i.e., the greater preferential tax treatment of their long-term capital gains) have a significantly lower ratio of dividends relative to long-term capital gains before JGTRRA.

In contrast, this aspect of the households' tax-motivated financial decision disappears after JGTRRA. This disappearance results from the short holding period requirement for qualified dividends. After JGTRRA, households can apply the low tax rates for the long-term capital gains to their dividend income by holding stocks just over 60 days. This 60-day holding period requirement for qualified dividends is shorter than the requirement for long-term capital gains, which is over one year. Thus, households substitute qualified dividend income for long-term capital gains after JGTRRA. Since the preferential tax treatment and the holding period requirement of qualified dividends can also affect household stock trading within a short term, I additionally investigate the effect of the preferential tax treatment of qualified dividends on the households' short-term capital gains realization. The empirical results suggest that the households with a greater amount of qualified (ordinary) dividends have significantly lower (higher) short-term capital gains. Since households with a greater amount of qualified dividends are more concerned about tax-disadvantage of short-term capital gains relative to qualified dividends and are restricted to trading their stocks within a short-term due to the 60-day holding period requirement, they realize lower short-term capital gains. In contrast, households with a lot of ordinary dividends taxed at 35% are willing to realize short-term capital gains, also taxed at 35%. Also, they are not restricted to trading stocks within a short-term because there is no minimum holding period requirement for ordinary dividends. Thus, the households with a greater

amount of ordinary dividends realize higher short-term capital gains.

In sum, all of these empirical findings suggest that the different tax treatments between different financial income sources interactively affect households' financial decisions and that households rationally respond to these tax provisions in a way that reduces their tax burden. The preferential tax treatment of qualified dividend affects not only households' dividend portfolio decisions but also their short-term and long-term capital gains realizations. These empirical findings suggest that policymakers should consider the effects of different taxation rates on different financial income sources simultaneously before implementing a new tax policy.

This study contributes to the literature in several ways. First, to the best of my knowledge, this is the first study to elucidate the effects of the different tax treatments between qualified dividends and ordinary dividends on households' financial decisions. Because the qualified dividends and the ordinary dividends only differ in their tax treatment, the estimates that account for the preferential tax treatment of qualified dividends precisely evaluate the tax effects on the households' demand for dividends.

Second, I construct a new measure, the share of qualified dividends in the dividend income, to estimate the tax effect on the households' asset demand. This new measure has an advantage in that it precisely captures the households' tax-motivated financial decisions in response to tax rate changes. The share of qualified dividends is only affected by households' dividend demand in active response to the new tax rules of JGTRRA. Earlier studies of firm responses to JGTRRA (Blouin et al., 2011; Chetty and Saez, 2005) documented that JGTRRA caused firms to increase their dividend payments significantly. Because the increase in overall supply of dividends by firms does not inform how these dividends were distributed across households, we need to consider differences in household dividend portfolios. Different shares of qualified dividends

across households reflect households' active response to their tax circumstances for dividends. The dividend yields used in past studies, however, are affected by firms' dividend payments as well as by households' demand for dividends, thus it is hard to distinguish whether the change in the dividend yield arises from households' active response to their tax treatments or from their passive response (i.e., from the increase in firms' dividend payments).

Lastly, this study introduces the novel finding that the households' dividend portfolios significantly affect their short-term capital gains realization. While past studies focus on how the capital gains tax affects households' capital gains realization, this study investigates how the holding period requirement for qualified dividends affects households' asset sales in the short term. After the passage of JGTRRA, households' main interest in reducing tax liabilities has shifted from exploiting the preferential tax treatment of long-term capital gains to exploiting the preferential tax treatment of qualified dividends with the 60-day holding period. Hence, the empirical findings show that the households with greater amounts of qualified dividends realize significantly lower short-term capital gains.

The rest of the chapter is divided into seven sections. Section 2.2 explains the dividend clientele and the capital asset pricing model. Section 2.3 summarizes the new tax provisions provided by JGTRRA and how these tax rules affect households' portfolio decisions. Section 2.4 describes the Public Use Tax File data, explains the procedure for calculating marginal tax rates, and summarizes the descriptive statistics of the data sample. Section 2.5 explains the empirical methods for analyzing the effect of dividend taxation on the households' investment decisions. Section 2.6 presents the empirical findings on the shares of qualified dividends and the dividends relative to capital gains that households choose to minimize their tax burden. A brief conclusion is contained in the last section.

2.2 Taxation and Portfolio Structure

To investigate the effect of taxation on an investor's portfolio choice, I adopt Miller's (1977) clientele model. Miller (1977) suggests an equilibrium model for a firm's capital structure between debt and equity in the presence of taxes. When investors face different tax rates on different types of assets, investor clienteles emerge depending on their tax rates; that is, the optimal holdings of debt and equity would be different across investors. Because Miller assumes that both debt and equity are riskless, the investors' choice of which assets to hold only depends on the after-tax returns rather than the financial risk. Moreover, he assumes that the equity returns are untaxed but that interest income is taxed for all investors and the tax rates (τ_b) on the interest income are different across investors. The asset demand functions of equity (S^D) and debt (B^D) for an investor with net worth W can be expressed as

$$\begin{aligned} &S^D = W, \quad B^D = 0 \quad if\ (1-\tau_b)r_b < r_s \\ &S^D = 0, \quad B^D = W \quad if\ \ (1-\tau_b)r_b > r_s \end{aligned}, \tag{2.1}$$

where r_b and r_s are the pre-tax returns on debt and equity, respectively. This simple model predicts that investors will hold a completely specialized portfolio. Figure 2.1 depicts the market equilibrium. In the equilibrium, the high-taxed investors would invest their wealth in equity and the low-taxed investors would hold bonds. That is, investors hold the assets that are less heavily taxed for them. If this idea is generalized to multiple equities with varying dividend yields, the clientele equilibrium emerges where "high dividend paying stocks will be preferred by tax exempt institutions and low income investors; those stocks yielding more of their return in the form of capital gains will gravitate to the taxpayers in the upper brackets" (Miller 1977).

I now apply Miller's model to the analysis of the dividend clientele provided by the 2003 tax act. I assume that there are only two different types of stocks available in the market: one that pays qualified dividends and the other that pays ordinary dividends. Both stocks generate their

returns in the form of dividends (d) or capital gains (g). Suppose that both stocks have the same capital gains tax rates (τ_{cg}), and that they only differ in the tax treatment of the dividend income and in the dividend yield. The tax rates on the qualified dividends are denoted by τ_Q, which are assumed to be less than the ordinary dividend tax rates, τ_O.[25] Suppose that these two dividend tax rates increase with the investors' ordinary taxable income, and that the tax rates on the ordinary dividends increase at a greater rate than the rates on the qualified dividends as the investors' income increases. The after-tax return on the stock paying qualified dividends is $r_Q = (1-\tau_Q)d_Q + (1-\tau_{cg})g_Q$, and the after-tax return on the stock paying ordinary dividends is $r_O = (1-\tau_O)d_O + (1-\tau_{cg})g_O$. Figure 2.2 illustrates the market equilibrium. The dividend clientele emerges in the equilibrium in which the stocks paying qualified dividends would be preferred by the investors in the upper income tax bracket. As a result, the low income investors would gravitate toward the stocks paying ordinary dividends.

Although the Miller (1977) model provides useful insight into how asset clienteles emerge under different tax rates across investors, it has some limitations. Because the model assumes that all assets are risk free, it does not account for how the investors choose their portfolio of risky assets on the basis of their tax treatment and the risk characteristics of the assets.[26] Analyses of asset demands in the framework of taxes and financial risk have been performed by Auerbach and King (1983), Litzenberger and Ramaswamy (1979,1980), and Long (1977). They developed the after-tax Capital Asset Pricing Model (CAPM) in their studies.

To derive the formal relationship between tax rates and the optimal dividend portfolio, this

[25] Under the U.S. tax rules, the qualified dividends are less heavily taxed than the ordinary dividends. In addition, the differentials in tax rates between ordinary dividends and qualified dividends are greater for investors' in the upper income tax bracket.

[26] Assets are risk free in the sense that the two different types of stocks have the same level of financial risk and a bond is not available in the market.

study follows the after-tax CAPM. Let W_1 denote an investor's investable wealth in the initial period. For simplicity, I assume that there are only two types of stocks, one paying qualified dividends and the other paying ordinary dividends.[27] Suppose that the risky asset *i* is taxed at a rate of τ_i, that the pre-tax return on the risky asset *i* is r_i, that the variance of the risky asset *i* is σ_i^2, and that the expected pre-tax return on risky equity *i* is μ_i, where *i = Qualified (Q), Ordinary (O)*. Let I_i denote the amount of investment in risky asset *i*. Suppose that the pre-tax return on a risk-free bond is r_b, that this asset pays all of its returns in the form of interest, and that the tax rate on interest income is τ_b.

In the CAPM framework, the investor's utility function can be expressed in terms of the mean and the variance of the final wealth, $U(W, \sigma_W^2)$ and the function is assumed to have the properties of $U_W > 0$ and $U_{\sigma_w^2} < 0$. Investors want to maximize their expected utility by choosing the optimal holdings of risky asset *i*. The objective function of the investor can be written as,

$$\max_{\{I_i\}} E\left[U\left((W_1 - \sum_i I_i)\cdot(1-\tau_b)r_b + \sum_i I_i \cdot (1-\tau_i)r_i,\ \sum_i \sum_j I_i I_j \cdot (1-\tau_i)(1-\tau_j)\cdot\sigma_{ij}\right)\right] \quad \text{s.t. } W_1 - \sum_i I_i \geq 0. \tag{2.2}$$

The first order condition for the optimal holdings of risky asset *i* is

$$[I_i]:\ U_W \cdot [-(1-\tau_b)r_b + (1-\tau_i)r_i] + 2\cdot U_{\sigma^2}\cdot(1-\tau_i)I_i \cdot \sum_j \left(1-\tau_j\right)\cdot I_j \cdot \sigma_{ij} = 0. \tag{2.3}$$

Then, the optimal holdings of the risky asset *i* result in

$$I_i^* = \frac{U_W \cdot \sigma_{-i}^2}{2(-U_{\sigma^2})\cdot(1-\tau_i)\cdot[\sigma_Q^2 + \sigma_O^2 + (\sigma_{Q,O})^2]} \cdot \left[\frac{(1-\tau_b)r_b - (1-\tau_i)\mu_i}{1-\tau_i} - \frac{[(1-\tau_b)r_b - (1-\tau_{-i})\mu_{-i}]\sigma_{Q,O}}{(1-\tau_{-i})\sigma_{-i}^2}\right]. \tag{2.4}$$

The share of the optimal holdings of stocks paying qualified dividends and ordinary dividends, $\frac{I_Q^*}{I_Q^* + I_O^*}$, increases as the differential in the tax rates between the ordinary dividends and the

[27] It is straightforward to generalize to the case of *N* different stocks. Poterba (2002) explains the general case of *N* different stocks in detail.

qualified dividends increases.[28]

The above analysis provides a key insight regarding how the different taxation on the two types of dividends affects the households' dividend portfolios. Because the share of qualified dividends increases as the tax rate differential increases, I expect that households in the upper tax bracket would hold greater shares of qualified dividends relative to ordinary dividends.

H_1: A household with a greater tax rate differential between ordinary and qualified dividends holds a higher share of qualified dividends relative to ordinary dividends.

2.3 The Jobs and Growth Tax Relief Reconciliation Act of 2003

Two major federal tax laws were passed during the presidency of George W. Bush: (1) the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA) and (2) the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA). Prior to the passage of EGTRRA, the structure of the federal income tax rates consisted of five tax brackets ranging from 15% to 39.6%. EGTRRA introduced a new 10% tax bracket and generally reduced the individual income tax rates by 0.5%. Then, JGTRRA continued on the precedent established by EGTRRA by accelerating tax rate reductions on dividends and capital gains. Table 2.1 summarizes the changes in the statutory tax rates on ordinary income, dividends, and long-term capital gains by JGTRRA.

According to Table 2.1, the legislation of JGTRRA has several key provisions. First, it reduced most marginal tax rates on ordinary income above 15% by 2% and reduced the top marginal tax rate by 3.6%. These tax rate reductions had already been included in EGTRRA but had been scheduled to go into effect gradually, with a 1% rate reduction in 2004 and the remainder in 2006. Under JGTRRA, these scheduled reductions all occurred in 2003. Second,

[28] The partial derivative of the share of qualified dividends with respect to the tax rate differentials is positive, i.e., $\frac{\partial\,(Qualified\ Dividend\ Share)}{\partial(\tau_O-\tau_Q)} > 0$.

the marginal tax rates on long-term capital gains were reduced from 20% to 15% at the top income bracket and from 10% to 5% (and to 0% from 2008) at the bottom income bracket. Third, dividends are taxed differently depending on their category. Dividends become qualified if they are paid by U.S. corporations or qualified foreign corporations and if investors hold stocks for more than 60 days. If dividends are qualified, they are taxed at the same level of tax rates as long-term capital gains rather than at the ordinary income tax rates. Thus, the marginal tax rates on qualified dividends dropped dramatically from 35% to 15% at the top income bracket and from 10% to 5% at the bottom bracket after JGTRRA. In contrast, ordinary dividends are still taxed at the level of ordinary income tax rates. This tax provision makes the stocks that pay qualified dividends more attractive to investors, all other things being equal.

As a result of the changes in the statutory tax rates on ordinary income, capital gains, and dividends, the tax rate differentials between ordinary dividends and capital gains have increased. That is, the tax disadvantages of ordinary dividends relative to capital gains have increased after JGTRRA. In addition, JGTRRA creates a tax advantage for qualified dividends relative to ordinary dividends. These structural changes in the tax rates by JGTRRA are exploited to identify households' tax-motivated financial decisions in the empirical analyses.

2.4 Data Description and Summary Statistics

The Internal Revenue Service Public Use Tax File data include detailed information from U.S. federal individual income tax returns taken from the Statistics of Income (SOI) sample records. The data are a series of cross-sectional data that have been produced every year since 1960. The data consist of random stratified samples of Form 1040, Form 1040A, and Form 1040EZ for U.S. residents with an oversampling of high income households. To protect the identity of individuals, the data exclude certain records with extreme values and a multivariate

blurring technique is applied to the high income returns with non-zero values. Sampling weights are also included in the data and so the estimates are weighted to represent the U.S. household population. Each observation in the data contains line-by-line totals for Form 1040 along with the relevant items from Schedule A, Schedule B, Schedule D, and Schedule E. In particular, specific information about a household's dividend income and capital gains are included in Schedule B and Schedule D, respectively, which allows an examination of the structure of dividend portfolios across households. Because the amount of qualified dividends and ordinary dividends that households receive has been reported since 2003, the Tax File data from 2003 to 2006 are used to analyze how the different tax treatments between qualified dividends and ordinary dividends affect a household's dividend portfolio. In addition, I use the data from 1999 to 2002 to analyze how the different tax treatments between dividends and long-term capital gains affect a household's dividend income relative to long-term capital gains before the 2003 tax act.

Because the data do not provide the households' marginal tax rates for confidentiality reasons, the TAXSIM web program at the National Bureau of Economic Research is used to calculate the households' marginal tax rates. The TAXSIM program computes the federal marginal tax rates on dividend income and capital gains using the relevant information provided by the Public Use Tax File data.[29] Because some of the calculated marginal tax rates are out of statutory tax rates under U.S. federal tax rules and extremely large, I exclude those observations from the sample. Several cut-off levels are tested in the sensitivity analysis to verify that the main estimates are robust to the different cut-off level.

Table 2.2 presents the summary statistics for tax rates, financial income and demographic

[29] TAXSIM is the NBER's FORTRAN program that calculates tax liabilities and marginal tax rates under the U.S. federal and state income tax laws from individual data. TAXSIM is available at http://www.nber.org/~taxsim/. Procedures of getting the marginal tax rates are explained in Appendix C.

characteristics in the data for the period before and after the 2003 tax act. All averages are weighted by the Public Use Tax File sampling weights, and all of the dollar values for financial income are adjusted to 2006 dollars. On average, households hold about 60% of their total taxable dividends in the form of qualified dividends. The average amount of qualified dividends is 770 dollars, which is greater than the amount of ordinary dividends, 320 dollars. The total amount of dividend income rises from 1,020 dollars to 1,090 dollars because the tax disadvantage of dividends decreases after the 2003 tax act. The tax rate differentials between ordinary income and long-term capital gains range from −2.65% to 35% during the 2003−2006 sample period. Since some of the observations in the bottom tax bracket have zero tax rates on ordinary income but positive tax rates on long-term capital gains, they have negative tax rate differentials between ordinary income and long-term capital gains. These differentials rise from 7.63% to 10.24% on average after the 2003 tax act. It is noteworthy that the average amount of short-term capital gains increases from −430 dollars to 88 dollars after the 2003 tax act. This increase occurs because households can apply the lower tax rates to their qualified dividends, and the tax-disadvantage of dividends relative to capital gains decreases after the 2003 tax act. Households change their stocks 2.5 times per year on average before 2003 and they increase their stock trading after 2003, which results in the increase in short-term capital gains realization.[30] I discuss the effect of the preferential tax treatment of qualified dividends on short-term capital gains in detail in section 2.6.3.

2.5 Empirical Framework

To investigate how the different tax treatments between ordinary dividends and qualified dividends affect the households' dividend portfolios, I estimate the Tobit model for the share of

[30] The Survey of Consumer Finance (SCF) data show that turnover ratios of households' stock holdings increase after the Bush tax acts. Households change their stock holdings 2.3, 2.8, 3.5 and 7.8 times per year on average in 1998, 2001, 2004, and 2007, respectively.

qualified dividends as a function of the households' marginal tax rate differentials between ordinary dividends and qualified dividends. Moreover, I control for demographic characteristics and financial wealth, which are discussed below. The dependent variable, the share of qualified dividends, is defined as the ratio of qualified dividends to the sum of ordinary dividends and qualified dividends, $S = \frac{Qualified\ Dividends}{Qualified\ Dividends + Ordinary\ Dividends}$. The share of qualified dividends in the dividend income would vary across households that are facing different tax rate differentials. Compared with the dividend yield used in past studies, this new measure is more robust because it is not affected by changes in the firms' dividend payments.[31] The share of qualified dividends is only affected by households' dividend demand in active response to the new tax rules of JGTRRA. Earlier studies of firm responses to JGTRRA (Blouin et al., 2011; Chetty and Saez, 2005) documented that JGTRRA caused firms to increase their dividend payments significantly. Because the increase in overall supply of dividends by firms does not inform how these dividends were distributed across households, we need to consider differences in household dividend portfolios. Different shares of qualified dividends across households reflect households' active response to their tax circumstances for dividends. The dividend yields used in past studies, however, are affected by firms' dividend payments as well as by households' demand for dividends, thus it is hard to distinguish whether the change in the dividend yield arises from households' active response to their tax treatments or from their passive response (i.e., from the increase in firms' dividend payments).

The share of qualified dividends in the dividend income for household *i* from the survey year *t* is denoted by $S_{QD,i,t}$. The latent variable denoted by $S^*_{QD,i,t}$ indicates the proportion of dividend

[31] The dividend yields are affected by the firms' dividend policy. Blouin et al. (2011) and Chetty and Saez (2005) find that firms significantly increased their dividend payments after the 2003 tax act. Thus, the change in dividend yields arises from the change in the firms' dividend policy as well as from the change in the households' demand for dividends.

income that would be notionally treated as qualified dividends. A household that does not hold qualified dividends in its dividend income is censored at zero, and it is at one if the household invests its entire wealth in stocks paying qualified dividends. This investment pattern suggests a censored regression model and the Tobit model is given by:

$$\begin{cases} S^*_{QD,i,t} = \beta_1 \tau_{i,t} + X'_{i,t}\beta_2 + I(Year)'\beta_3 + \varepsilon_{i,t} \\ \\ S_{QD,i,t} = \begin{cases} 0 & if \quad S^*_{QD,i,t} < 0 \\ S^*_{QD,i,t} & if \quad 0 \le S^*_{QD,i,t} \le 1 \\ 1 & if \quad S^*_{QD,i,t} > 1 \end{cases} \end{cases}, \tag{2.5}$$

where $\tau_{i,t}$ is the marginal tax rate differential between ordinary dividends and qualified dividends, $X'_{i,t}$ is a vector of the households' characteristics and financial wealth, $I(Year)$ is a vector of the year dummies for the 2004, 2005, and 2006 data samples. The vector $X'_{i,t}$ includes the age dummy, marital status, household size, wealth, adjusted gross income, and taxable interest income.[32] The parameter of interest is β_1, which measures the tax effects on the households' dividend portfolios. Because the households with greater tax rate differentials between their ordinary dividends and their qualified dividends would hold a higher share of qualified dividends in their dividend income, β_1 is expected to be positive.

The econometrics problem for the estimation is that the households' tax rates are endogenous. The main regressor, $\tau_{i,t}$, is endogenous to the composition of dividend investment because the households can affect their tax liabilities, and thus their marginal tax rates, through their dividend portfolio choices. Previous studies of taxation and portfolio choices address this endogeneity problem by introducing a new proxy for the marginal tax rates that investors face. Feldstein et al. (1980) first proposed an algorithm, the "first dollar" approach. This approach avoids the potential endogeneity of the marginal tax rates, in particular the relationship between tax rates

[32] The age dummy is equal to one if a tax filer's age is over 65 and zero otherwise.

and the households' portfolio choices. A measure of the marginal tax burden by the "first dollar" method is calculated by artificially setting the investment income from interest, dividends, and capital gains to zero. The tax rates from this base level of income are independent of the actual dividend investment decisions but highly correlated with the actual marginal tax rates.[33]

In addition to the tax-motivated financial decisions that are related to the different tax treatments between ordinary dividends and qualified dividends, I also consider the possibility that households try to reduce their tax burdens by understanding the tax disadvantages of dividends relative to long-term capital gains. According to the U.S. tax rules, the tax rates on dividends have been greater than the rates on long-term capital gains.[34] Moreover, the tax rate differentials between dividends and long-term capital gains increase as the households' income increases (i.e., the greater the households' taxable income, the greater the tax disadvantage of dividends relative to long-term capital gains).

To investigate the households' tax reduction efforts in regard to the preferential tax treatment of long-term capital gains, I construct a new dependent variable, the ratio of dividends to long-term capital gains or losses (*DR*). The estimated model is given by:

$$DR_{i,t} = \delta_1 \tau_{i,t} + X'_{i,t}\delta_2 + I(Year)'\delta_3 + \eta_{i,t}\ , \tag{2.6}$$

where $DR_{i,t} = \frac{Dividends_{i,t}}{Dividends_{i,t} + Long\ term\ Capital\ Gains\ or\ Losses_{i,t}}$, $\tau_{i,t}$ is the marginal tax rate differential between dividends and long-term capital gains, $X'_{i,t}$ is a vector of the households' characteristics and financial wealth as described in Equation (2.5), and $I(Year)$ is a vector of the year dummies for the 2004, 2005, and 2006 samples.[35] Again, the tax rates obtained by the "first

[33] The result for the weak instrumental variable test shows that the tax rates by the "first dollar" method are strong for instrumenting the endogenous tax rates.
[34] This holds true for ordinary dividends after the 2003 tax act.
[35] The 1999, 2000, 2001, and 2002 datasets are used for the analysis of the pre-2003 tax act period. In this case, I create year dummies for the 2000, 2001, and 2002 data samples.

dollar" method are used to address the endogenous tax rates.

2.6 Empirical Findings

2.6.1 Tax-Motivated Financial Decisions under the Different Tax Treatments between Ordinary Dividends and Qualified Dividends

Table 2.3 presents the empirical results of the tax effects on the households' dividend portfolios. Column (1) shows the Tobit estimates without addressing the endogeneity problem of the tax rates. The coefficient for the tax rate differentials is positive and statistically nonsignificant. However, the estimates are not consistent because the Hausman test for the model specification rejects the null hypothesis at a 1% significance level. Hence, the Tobit estimates using the instrumental variable, the tax rates calculated by the "first dollar" method, are consistent for true parameters, and they are presented in Columns (2) and (3). The coefficient for the tax rate differentials between ordinary dividends and qualified dividends is positive and statistically positive at the 1% level ($\hat{\beta}_1$= 0.011, p<0.01) in Column (2). This result suggests that the different tax treatments between ordinary dividends and qualified dividends do affect the households' dividend portfolio decisions. The estimate shows that a 1% increase in the tax disadvantage of ordinary dividends relative to qualified dividends causes households to increase the share of qualified dividends in their taxable dividends by 1.1%, to reduce the tax burdens. Since the choice of dividend shares is based on a model that results in corner solutions, marginal effects of tax rate differentials on the observed choice of dividend shares are of interest. Column (3) presents the marginal effects of the observed shares of qualified dividends.

The remaining rows in Table 2.3 show the coefficients for the demographic characteristics and financial wealth variables. There is a significant negative income effect on the dividend portfolio decision. The year dummies are positive and statistically significant, which implies that

households changed their dividend portfolio over time after JGTRRA was enacted.[36] Households could be restricted to changing their portfolio all at once after the passage of JGTRRA because of the existence of transaction costs. The coefficient for age over 65 years is negative and statistically significant, which is some evidence for a link between age and portfolio decisions that is consistent with the life-cycle model.[37] For elderly investors with a relatively short life expectancy, the "stepped-up" basis causes a pronounced "lock-in" effect for the capital gains, which hampers any portfolio change accompanying the capital gains realization.[38]

2.6.2 Tax-Motivated Financial Decisions under the Different Tax Treatments between Dividend Income and Long-Term Capital Gains

I now explore how the tax rate differentials between dividends and long-term capital gains affect a household's financial income. Because households have a tax disadvantage for dividends compared with long-term capital gains (i.e., the marginal tax rates on dividends are greater than the rates on long-term capital gains), they prefer long-term capital gains to dividends. I expect that the households would reduce the proportion of dividends relative to their long-term capital gains as the tax rate differentials between dividends and long-term capital gains increase.

H_2: A household with a greater tax rate differential between dividends and long-term capital gains holds a lower ratio of dividends relative to their long-term capital gains.

Table 2.4 shows the estimates of the tax effects on households' financial income before and after the 2003 tax act. The Public Use Tax File data from 1999 to 2002 are used for the estimation during the pre-tax act period, and the estimates are presented in Column (1). The

[36] The parameter estimates using repeated cross-sectional data can be interpreted in the context of a panel data structure. (Heckman and Robb 1985)

[37] Because the Public Use Tax File data do not contain enough information on demographics, age information is limited. The data only include information as to whether a tax filer is over 65 years old.

[38] The "stepped-up" basis is one of the U.S. capital gains tax provisions, which effectively eliminates the tax liability on capital gains that accrued during a decedent's lifetime. An heir would inherit the decedent's appreciated asset with a new, "stepped up" basis equal to the asset's value at the time of the decedent's death. Poterba and Samwick (1997) analyze the age profiles of asset holdings and allocation in detail.

coefficient for the tax rate differentials is negative and statistically significant ($\hat{\delta}_1 = -0.014$, $p<0.05$). Households that are more tax disadvantaged regarding dividends have a significantly lower ratio of dividends relative to long-term capital gains to reduce their tax burdens. This result implies that the different tax treatment between dividends and long-term capital gains significantly affect households' financial decisions in such a way that their tax burdens are reduced. These empirical results are consistent with the results in a study by Chaplinsky and Seyhun (1990).

Next, I perform the exact same analysis using the data from 2003 to 2006 to investigate whether households continue to exert these tax reduction efforts after the 2003 tax act. Because there are two types of dividend income after the 2003 tax act, two different measures of the dividend ratio are proposed. The first dividend ratio uses the total dividend income and can be expressed as $DR_1 = \frac{Dividends}{Dividends + Long\ term\ capital\ gains\ (or\ losses)}$, which is the same as the ratio used in the previous analysis using the pre-2003 tax act data. The other measure excludes the qualified dividends and only includes the ordinary dividends. The measure can be expressed as $DR_2 = \frac{Ordinary\ Dividends}{Ordinary\ Dividends + Long\ term\ capital\ gains\ (or\ losses)}$. The second column in Table 2.4 presents the estimates that use the first dividend ratio, DR_1. Column (2) shows the positive coefficient for the tax rate differential, which suggests that households with a greater tax disadvantage from dividends relative to long-term capital gains hold, counterintuitively, a higher ratio of dividends to long-term capital gains.

This interesting result may be driven by the inclusion of qualified dividends that do not have any tax disadvantages as compared with long-term capital gains. When the preferential tax treatment of qualified dividends is taken into account, the effective total tax burden of dividend income becomes much smaller. To check this possibility, I use the other dividend ratio, DR_2,

which excludes the qualified dividends. The estimates are presented in Column (3) in Table 2.4. The coefficient for the tax rate differentials is negative but statistically nonsignificant. This result suggests that the significant effect of the different tax treatment between dividends and long-term capital gains on households' tax reduction efforts disappears after the 2003 tax act.

2.6.3 Are Households Tax-Savvy?

The empirical findings in the previous sections, 2.6.1 and 2.6.2, imply that households' main concerns about reducing their tax burden has shifted from one trade-off to another: from the trade-off between dividends and long-term capital gains to the trade-off between ordinary dividends and qualified dividends after the 2003 tax act. Households recognize that they can reduce the tax rates on dividends to the level of the tax rates on long-term capital gains by holding stocks for just over 60 days, instead of holding appreciated stocks for over one year to obtain the preferential tax treatment for their capital gains.[39] If households utilize this tax feature, the short-term capital gains would be affected by the households' dividend portfolios. Since the qualified dividends are taxed at lower rates compared to the short-term capital gains, households would be less willing to substitute qualified dividends for short-term capital gains. However, they would be willing to substitute ordinary dividends for short-term capital gains because their tax treatments are same. I expect that households with greater amounts of qualified (ordinary) dividends in their total dividend incomes would realize less (more) frequently their short-term capital gains.

H_3: A household with a greater amount of qualified (ordinary) dividends in their total dividend income realizes higher (lower) short-term capital gains.

Because the literature that studies taxation and capital gains realization is not well developed,

[39] According to the U.S. tax rules, investors must hold stocks for over 60 days to receive the preferential tax treatment for qualified dividends. For the capital gains, investors must hold appreciated stocks for over one year to apply the lower tax rates.

all of the previous studies (Auerbach and Siegel, 2000; Auten and Clotfelter, 1982; Burman and Randolph, 1994; Feldstein et al., 1980; Poterba and Weisbenner, 2001) estimate a reduced-form relationship between the capital gains and the factors that affect the households' capital gains realization. Following the previous studies, I model the relationship between capital gains and tax rates, dividend portfolios, and other factors that could affect the households' capital gains realization. Two measures of capital gains realization are used in the estimations: (1) the short-term capital gains and losses and (2) the logarithm of net short-term capital gains. The estimated equation with the first measure is as follows:

$$STCG_{i,t} = \theta_1 Div_{i,t} + \theta_2 \tau_{i,t} + X'_{i,t}\theta_3 + I(Year)'\theta_4 + \xi_{i,t} \,, \tag{2.7}$$

where $STCG_{i,t}$ denotes the short-term capital gains or losses, $Div_{i,t}$ is the amount of dividend incomes, $\tau_{i,t}$ is the marginal tax rates on short-term capital gains, $X'_{i,t}$ includes a vector of demographic characteristics, financial wealth, and $I(Year)$ is a vector of year dummies for the 2004, 2005, and 2006 data samples.[40]

Table 2.5 shows the estimates of the dividend portfolio's effect on the short-term capital gains realization. I include the amount of qualified dividends, the amount of ordinary dividends, or both in Column (1), (2), and (3), respectively. The amount of qualified (ordinary) dividends itself has a negative (positive) correlation with the short-term capital gains realization, respectively, which implies that households with greater amount of qualified (ordinary) dividends have significantly lower (higher) amount of short-term capital gains realization. That is, households with a lot of ordinary dividends taxed at 35% are willing to realize short-term capital gains, also taxed at 35%. In addition, they are not restricted to trading stocks within a short-term because there is no minimum holding period requirement for ordinary dividends. In

[40] Tax rates calculated by the first-dollar method are used to address endogenous tax rates on short-term capital gains.

contrast, households with a greater amount of qualified dividends realize lower short-term capital gains because they are more concerned about tax-disadvantage of short-term capital gains relative to qualified dividends, and are restricted to trading their stocks within a short-term due to the 60-day holding period requirement.

To have more ideas of the dividend portfolio effects on households' short-term capital gains realization, I also estimate the model with a different specification. Instead of the amount of qualified dividends or ordinary dividends, I include the share of qualified dividends. Column (4) presents a negative coefficient for the share of qualified dividends, which suggests that the households with the greater share of qualified dividends in their total dividend income are less likely to realize the capital gains within a year.

In addition to the estimates with the linear form, I estimate Equation (2.7) with a different dependent variable, the log of net short-term capital gains. The primary results still hold except the specification with the share of qualified dividends. The estimates of the model with the share of qualified dividends are presented in Column (5), and the coefficient for the share of qualified dividends is positive but nonsignificant. The opposite sign suggests that the nonsignificant coefficients for the share of qualified dividends should be considered cautiously.

Table 2.5 also shows the coefficient for the tax rates on short-term capital gains. The first-dollar method described in Section 2.5 is used to address the endogeneity of the tax rates. The coefficients for the tax rates in all of the specifications are negative and statistically significant, which implies that high tax rates on capital gains significantly reduce households' capital gains realization. Because this study primarily examines how a household's dividend portfolio affects its asset sales within the short term, it does not focus on the tax elasticity and the debate regarding separating permanent from transitory tax effects that has been discussed in other

studies.[41]

2.6.4 Robustness Check

In the primary analyses, observations out of the statutory tax rate schedules are excluded from the sample because they have unrealistic tax rates under the U.S. tax rules. Thus, I further examine the sensitivity of the analyses using different cut-off levels to ensure that the primary estimates are robust to the cut-off level. Equation (2.5) is estimated with the 1%, 2%, and 5% cut-off levels. Table 2.6 presents these additional estimation results. Since some of the tax rates are extremely large, the coefficients for the tax rate differentials are very small. Although the coefficients are small and vary by the different cut-off levels, the qualitative estimation results still hold.

2.6.5 Specification Test for the Tobit Model

The Tobit specification assumes that the tax effect on the ownership of qualified dividends (i.e., the extensive margins) is the same as the effect on the shares of qualified dividends, which is conditional on the positive holdings of qualified dividends (i.e., the intensive margins). To test this restriction, I first estimate a probit model, which is given by:

$$P^*_{QD,i,t} = \gamma_1 \tau_{i,t} + X'_{i,t}\gamma_2 + I(Year)'\gamma_3 + \zeta_{i,t}\ , \tag{2.8}$$

where $P^*_{QD,i,t}$ is the latent variable of the ownership of qualified dividends and all of the explanatory variables are the same as stated in the Tobit model, Equation (2.5). An indicator variable denoted by $P_{QD,i,t}$ is equal to one if the households hold a positive amount of qualified dividends and zero otherwise. After running the probit regression, I then compare the coefficient for the tax rate differential (γ_1) from the probit model to the ratio of $\frac{\beta_1}{\sigma}$ from Equation (2.5), the

[41] Auten and Clotfelter (1982) and Burman and Randolph (1994) deliberate these issues thoroughly by examining a panel data set for taxpayers.

Tobit model. As Greene (2008, p.776) points out, the probit estimate should be consistent for $\frac{\beta_1}{\sigma}$. The coefficient for the tax rate differentials of the probit model is 0.011 in Table 2.7. Because the coefficient from the Tobit model is 0.011 and σ is 0.767 in Table 2.3, the standardized Tobit estimate is 0.015 (= 0.011/0.767), which is not statistically different from the probit estimate, 0.014. Thus, this test verifies that the restriction of the Tobit specification is valid.

2.7 Conclusion

This study first elucidates the effects of the different tax treatments between ordinary dividends and qualified dividends in JGTRRA on households' financial decisions. The empirical results suggest that the preferential tax treatment of qualified dividends has a significant influence on the composition of households' dividend portfolios. Households with a greater differential in tax rates between ordinary dividends and qualified dividends (i.e., the greater tax disadvantage of ordinary dividends) receive a higher share of qualified dividends in their dividend. This empirical result is consistent with a number of past studies that examine the dividend clientele hypothesis, which suggests that households hold assets that are less heavily taxed for them.

In addition, I find that the ratio of dividends received relative to long-term capital gains declines as the household tax rate rises before JGTRRA. However, the effect of this different tax treatment between dividends and long-term capital gains on households' financial decisions disappears after JGTRRA. These results are driven by the short holding period requirement for the qualified dividends. Households do not have to hold stocks for over one year to receive the preferential tax treatment for their capital gains. Instead, after JGTRRA, they can apply the low tax rates for the long-term capital gains to their dividends by just holding stocks for over 60 days. The empirical results show that households with a greater amount of qualified dividends realize

significantly lower short-term capital gains.

In sum, these empirical findings clearly show that taxes do matter for households' financial decisions and that households rationally respond to the new tax rules of JGTRRA to reduce their tax burdens. As we see in the empirical results, wealthy people respond more to the new tax rules and enjoy more benefits from the Bush tax cuts. However, this study does not evaluate how JGTRRA affects wealth redistribution in U.S. society as a general equilibrium framework, because of the data limitations. Lastly, this study provides policymakers and corporate financial managers with a clear understanding of the change in households' asset demands in response to changes in the tax rates. They can apply these empirical results to implement new tax policies or dividend payment policies.

One possible direction for future research is to analyze the stock price adjustment patterns after JGTRRA, depending on the type of dividends. Following the work by Elton and Gruber (1970), much of the finance literature has investigated the price adjustments on an ex-dividend date to find evidence of dividend preferences. It is worth studying whether the price adjustment patterns are different between the stocks paying ordinary dividends and the stocks paying qualified dividends. The taxation and households' dividend portfolio decisions that I consider here are just one part of the taxation and financial decisions that households cope with. Thus, future research should analyze stock trading patterns, dynamic clientele effects, and stock holding periods before and after JGTRRA using tax return panel data or data from major U.S. brokerage firms.

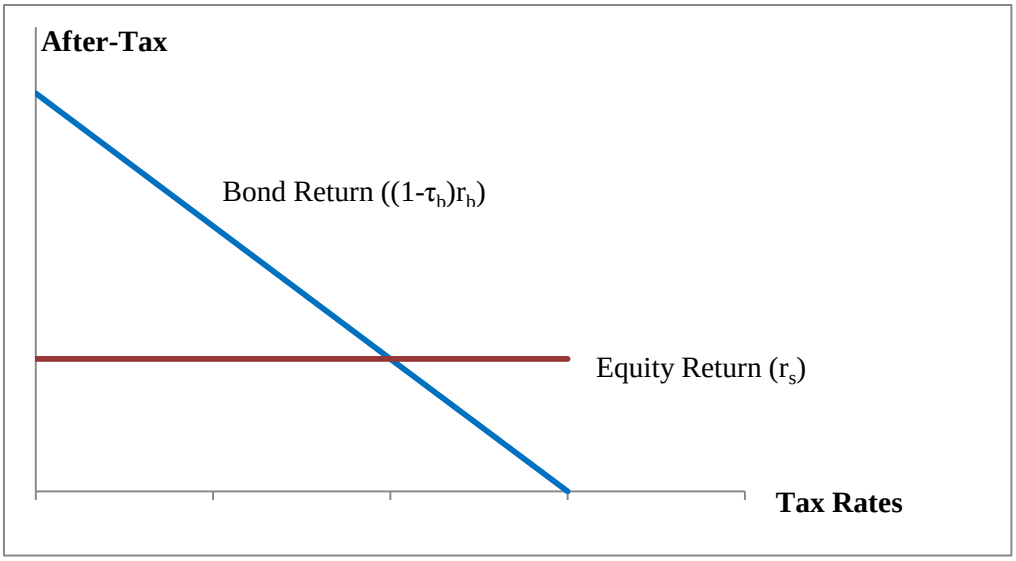

Figure 2.1 Equilibrium in the Miller Model

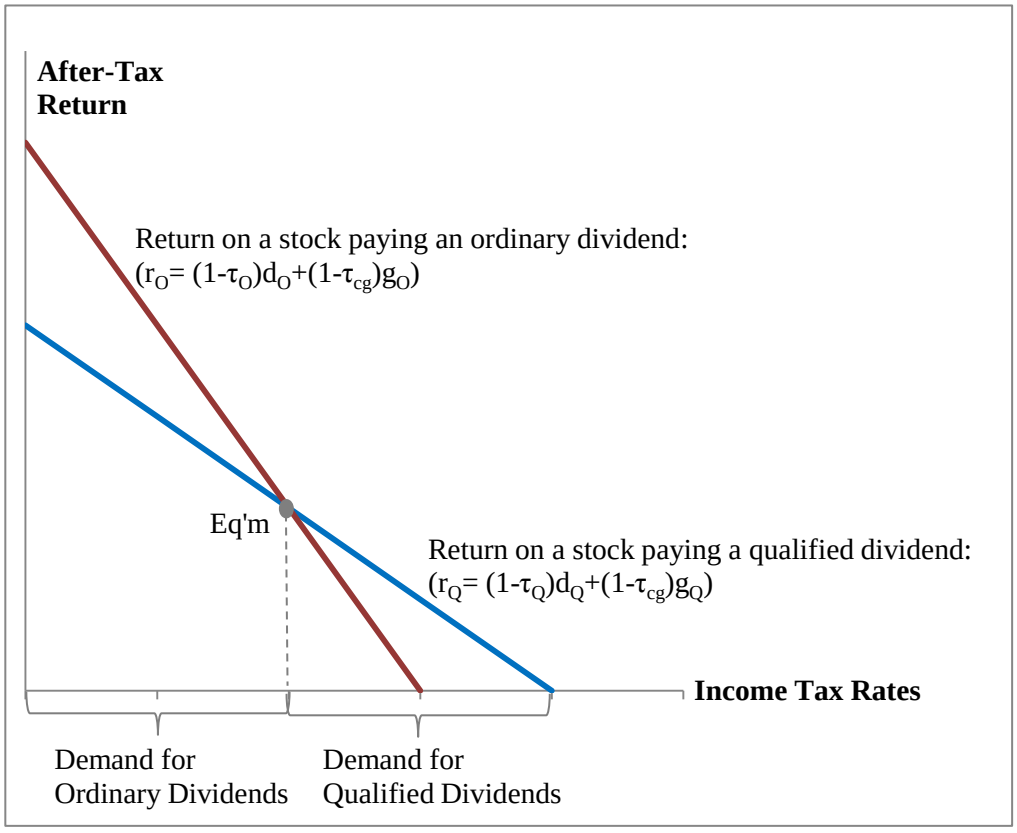

Figure 2.2 Equilibrium in the Clientele Model

Table 2.1 Changes in Tax Rates (%) by the 2003 Tax Act

Before the 2003 Tax Act		After the 2003 Tax Act	
Ordinary Income / Dividend Income	*Long-term Capital Gains*	*Ordinary Income / Ordinary Dividend*	*Qualified Dividend / Long-term Capital Gains*
10	10	10	5
15	10	15	5
27	20	25	15
30	20	28	15
35	20	33	15
38.6	20	35	15

Source: Tax statistics at the Internal Revenue Service (IRS).

Table 2.2 Summary Statistics: Public Use Tax File Data (1999−2006)

	Pre-2003 Tax Act (1999−2002)			Post-2003 Tax Act (2003−2006)		
Variables	Mean	Min	Max	Mean	Min	Max
Share of qualified dividends	-	-	-	0.60	0	1
Tax rates (ordinary income)	20.10	0	39.6	16.39	0	35
Tax rates (long-term capital gains)	12.48	0	20	6.15	0	15
Tax rate differentials (%)	7.63	-10	39.6	10.24	-2.65	35
Total dividends (thousands of 2006 dollars)	1.02	0	80,700	1.09	0	158,000
Qualified dividends (thousands of 2006 dollars)	-	-	-	0.77	0	151,000
Ordinary dividends (thousands of 2006 dollars)	-	-	-	0.32	0	57,500
Short-term capital gains (thousands of 2006 dollars)	-0.43	-217,000	217,000	0.088	-99,100	205,000
Long-term capital gains (thousands of 2006 dollars)	2.91	-398,000	431,000	3.51	-123,000	299,000
Adjusted gross income (thousands of 2006 dollars)	67.73	-260,000	212,000	62.51	-132,000	461,000
Interest income (thousands of 2006 dollars)	1.74	0	74,800	1.16	0	82,600
Number of dependents	0.64	0	11	0.67	0	11
Households' proportion over age 65	0.07	0	1	0.07	0	1

Notes: The Public Use Tax File from 1999 to 2006 and the author's calculation. All averages are weighted by the Public Use Tax File sampling weights. The amount of qualified dividends and ordinary dividends are not available before 2003 because they have only been classified and reported since 2003.

Table 2.3 Effects of the Tax Rates on Dividend Portfolio Share (2003−2006)

	Share of Qualified Dividends		
	Tobit	IV Tobit	IV Tobit (marginal effects)
	(1)	(2)	(3)
Tax rate differentials	0.001	0.011***	0.005***
	(0.001)	(0.001)	(0.001)
Adjusted gross income	-0.141**	-1.228***	-0.582***
(100 million dollars)	(0.070)	(0.141)	(0.067)
Interest income	-1.949***	-0.248	-0.118
(100 million dollars)	(0.514)	(0.580)	(0.275)
Marital status	0.007	0.004	0.002
	(0.011)	(0.011)	(0.005)
Number of dependents	0.010	0.006	0.003
	(0.007)	(0.007)	(0.004)
Age dummy (over 65)	-0.082***	-0.059***	-0.028***
	(0.020)	(0.020)	(0.010)
Year dummy_2004	0.105***	0.147***	0.069***
	(0.027)	(0.026)	(0.012)
Year dummy_2005	0.127***	0.170***	0.080***
	(0.027)	(0.026)	(0.012)
Year dummy_2006	0.085***	0.130***	0.061***
	(0.027)	(0.025)	(0.012)
Constant	0.566***	0.426***	-
	(0.036)	(0.034)	

Notes: The dependent variable is the share of qualified dividends. The tax rates by the "first dollar" method are instrumented for the endogenous tax rates. Column (3) presents the average marginal effect of the observed share of qualified dividends. This marginal effect is calculated as $\Phi(\frac{X\beta}{\sigma})\beta_i$. Adjusted gross income and interest income are adjusted to 100 millions of 2006 dollars. All the estimates are weighted by the Public Use Tax File sampling weights. *, **, and *** represent 10%, 5%, and 1% significance levels. Standard errors are in parentheses.

Table 2.4 Effects of the Tax Rates on Dividends Relative to Capital Gains

	Pre 2003 Act (1999–2002)	Post 2003 Act (2003–2006)	
	DIV/(DIV+LTCG) (1)	DIV/(DIV+LTCG) (2)	ORD DIV/ (ORD DIV+LTCG) (3)
Tax rate differentials	-0.014**	0.019	-0.010
	(0.007)	(0.012)	(0.025)
Adjusted gross income	-1.016	-2.940***	-1.632*
(100 million dollars)	(1.109)	(0.942)	(0.974)
Interest income	-3.739	-13.119	6.844
(100 million dollars)	(4.490)	(9.878)	(9.870)
Marital status	0.029	-0.046	-0.226
	(0.026)	(0.039)	(0.243)
Number of dependents	-0.017	-0.027	0.042
	(0.022)	(0.044)	(0.044)
Age dummy (over 65)	-0.143	0.139***	-0.027
	(0.117)	(0.046)	(0.101)
Year dummy_2001	0.019	-	-
	(0.024)		
Year dummy_2002	-0.107	-	-
	(0.070)		
Year dummy_2003	-0.124*	-	-
	(0.066)		
Year dummy_2004	-	0.821*	1.179
		(0.465)	(1.116)
Year dummy_2005	-	0.754	1.080
		(0.473)	(1.129)
Year dummy_2006	-	0.786	1.161
		(0.478)	(1.128)
Constant	0.745***	-0.294	-0.117
	(0.062)	(0.439)	(0.990)

Notes: The dependent variable for the first two columns is the ratio of dividends relative to long-term capital gains and for the last column is the ratio of ordinary dividends relative to long-term capital gains. Adjusted gross income and interest income are adjusted to 100 millions of 2006 dollars. All the estimates are weighted by the Public Use Tax File sampling weights. *, **, and *** represent 10%, 5%, and 1% significance levels. Standard errors in parentheses are robust to heteroskedasticity.

Table 2.5 Effects of the Dividend Portfolio on Short-Term Capital Gains (2003−2006)

	Short-Term Capital Gains (STCG) or Losses				Log (Net STCG)
	(1)	(2)	(3)	(4)	(5)
Qualified dividends	-21.289** (8.662)	-	-24.842*** (9.088)	-	-
Ordinary dividends	-	233.067* (137.513)	238.357* (138.217)	-	-
Share of qualified dividends	-	-	-	-0.070 (0.104)	0.004 (0.107)
Marginal tax rates	-0.147*** (0.026)	-0.131*** (0.025)	-0.136*** (0.025)	-0.316*** (0.055)	-0.009** (0.003)
Adjusted gross income (100 million dollars)	1746.801*** (420.084)	1496.709*** (404.507)	1592.412*** (417.902)	1723.786*** (420.151)	15.638*** (1.572)
Interest income (100 million dollars)	18268.487*** (4716.261)	15425.133*** (3642.649)	15600.130*** (3659.253)	18064.891*** (4791.247)	51.468*** (13.408)
Marital status	0.003 (0.010)	0.007 (0.010)	0.007 (0.010)	-0.249*** (0.083)	0.169** (0.066)
Number of dependents	-0.019 (0.038)	0.009 (0.039)	-0.002 (0.040)	0.205* (0.107)	0.109** (0.045)
Age dummy (over 65)	-0.559*** (0.077)	-0.522*** (0.063)	-0.533*** (0.065)	-0.795*** (0.121)	-0.691*** (0.118)
Year dummy_2004	1.260*** (0.167)	1.255*** (0.159)	1.260*** (0.160)	2.707*** (0.388)	-0.527*** (0.124)
Year dummy_2005	1.230*** (0.155)	1.222*** (0.148)	1.225*** (0.149)	2.554*** (0.346)	-0.523*** (0.124)
Year dummy_2006	1.116*** (0.140)	1.105*** (0.134)	1.107*** (0.134)	2.203*** (0.300)	-0.768*** (0.122)
Constant	-0.098 (0.089)	-0.274** (0.137)	-0.240* (0.133)	0.703* (0.384)	6.408*** (0.160)

Notes: The dependent variable for the first four columns is the short-term capital gains or losses in thousands of dollars and for the last column is the logarithm of the net short-term capital gains. Standard errors in parentheses are robust to heteroskedasticity. Adjusted gross income and interest income are adjusted to 100 millions of 2006 dollars. All the estimates are weighted by the Public Use Tax File sampling weights. *, **, and *** represent 10%, 5%, and 1% significance levels.

Table 2.6 Sensitivity Check of Different Cut-off Levels for Tax Rate Distribution

	Tax Rate Differentials (%)		
	Tobit estimates	Standard errors	p-value
1% cut-off level [-34%, 3.03e+07%]	6.87e-09***	1.18e-09	0.000
2% cut-off level [-15%, 1.21e+07%]	7.40e-08***	5.18e-09	0.000
5% cut-off level [-10%, 35%]	0.261***	0.018	0.000

Notes: The dependent variable is the share of qualified dividends and Equation (2.5) is estimated by varying the different cut-off levels for the tax rates. All of the other control variables are included in the estimation but not reported. All the estimates are weighted by the Public Use Tax File sampling weights. *, **, and *** represent 10%, 5%, and 1% significance levels. All of the other estimates are available upon request.

Table 2.7 Probit Estimates of the Tax Effects on Dividend Portfolio Share (2003−2006)

	Probability (Qualified Dividend>0)	
	Probit estimate	Marginal effect
	(1)	(2)
Tax rate differentials	0.014***	0.006***
	(0.0006)	(0.0002)

Notes: The dependent variable is an indicator of holding qualified dividends and Equation (2.8) is estimated. All of the other control variables are included in the estimation but not reported. *, **, and *** represent 10%, 5%, and 1% significance levels. Standard errors are in parentheses. All of the other estimates are available upon request.

Chapter 3 − Effects of Uncertain Tax Rates on Households' Financial Decisions: Evidence from the Bush Tax Acts

3.1 Introduction

A notable characteristic of the Economic Growth and Tax Relief Reconciliation Act of 2001 was that its tax provisions were designed to sunset. That is, the tax rate reductions on ordinary income, dividends, and long-term capital gains were slated to expire on January 1, 2011, unless further legislation were enacted to extend the provisions or make the change permanent. The political debate about whether to extend the Bush-era tax cuts to high-income households raged during 2008−2010. The seemingly endless argument and then the very late enactment of the extension caused many high-income households to experience heightened exposure to uncertainty regarding the tax rates for their financial assets in the future. This exposure was particularly substantial, though most households face some tax uncertainty due to frequent, seemingly random changes to tax rates or tax bases (Dickson, 2000). Yet most research into taxation and household financial decisions assumes that households know their future tax rates with certainty when they make investment decisions. By relaxing the assumption of tax certainty, this study instead aims to investigate how tax rate uncertainty affects households' financial decisions, especially with regard to their earned dividend yields on stocks.

During 2008−2010, households making more than $200,000 ($250,000 for couples) experienced greater tax rate uncertainty than normal, but households making less than that amount did not.[42] Congressional representatives from Democratic and Republican parties mutually consented to tax cut extensions for low- and middle-income households as early as 2008. However, the parties could not reach agreement about the extension for high-income

[42] For simplicity, the threshold is referred to as $200,000 in the remainder of this chapter.

households.[43] The political debates lasted for more than two years, creating a very long lag between any proposals and their enactment; the ultimate enactment of the extension at the last minute instead made the lag between enactment and implementation very short.[44] Accordingly, high-income households lacked reliable foresight about the tax rates for their future financial decisions and portfolio adjustments. Thus, high-income household financial decisions during 2008−2010 inevitably were affected by uncertain future tax rates.[45]

In turn, it is possible to divide households into two groups: (1) those that make more than $200,000 and thus had greater tax uncertainty during 2008−2010 and (2) those that make less than $200,000 and experienced the same degree of tax uncertainty.[46] For simplicity, households in the second group (i.e., the control) are designated as having no tax uncertainty compared with households in the first group (i.e., treatment group). These latter households in the treatment group may pay higher tax rates on their financial income in 2011−2012, or they may maintain their same tax rates. Depending on the final enactment of the act, the after-tax returns on the households' portfolio would be different. If the tax cuts were not extended to high-income households, the tax disadvantages of dividends relative to capital gains would revert and increase. Also, increases in tax disadvantages for dividends would be greater for higher income households in the treatment group.

Using the 2007 and 2009 Survey of Consumer Finances data, I investigate whether uncertain future tax rates affect household financial decisions in the treatment group. The dividend clientele model predicts that households in the treatment group should lower their dividend

[43] President Barack Obama promised to sunset the Bush-era tax cuts for high-income households during the 2008 presidential election campaign, and he kept insisting on it after the inauguration. In contrast, the Republican Party proposed that the extension should include high-income households for the 2011 and 2012 tax years.
[44] The final enactment of the extension, including high-income households, went into effect on December 17, 2010. Just two weeks later, the new tax policy was implemented.
[45] High-income households whose investment time horizon is very short, such as within one year, or long, such as more than five years, may not be affected by the tax rate uncertainty during this period.
[46] This study mainly focuses on the uncertainty surrounding tax rates, not tax bases.

yields on stocks during 2008−2010. The Difference-in-Difference estimates in the Tobit model suggest that households in the treatment group significantly lowered their dividend yields over the sample period, compared with households in the control group. As a robustness check, I also estimated Tobit models with different specifications. First, dividing the control group into several subgroups reveals whether the different groups exhibit the same time trends of dividend yield changes. Second, using Survey of Consumer Finances data from 1998 to 2007, I investigate whether there is a significant decrease in dividend yields by high-income households before 2008. Third, I divide the treatment group into several subgroups on the basis of the magnitudes of their tax uncertainty and investigate whether households within the treatment group respond differently. The estimates suggest that the treatment effect arises only during 2007−2009, not in previous years, and is greater for households with greater tax rate uncertainty in the treatment group. In summary, these empirical findings indicate that a significant difference in dividend yield changes between the treatment and the control group results from the level of uncertainty they experience about future tax rates.

With this approach, this study contributes to extant literature in several ways. First, it incorporates tax rate uncertainty into household financial decisions, especially those pertaining to dividend yields on stocks; empirically investigates whether households respond to tax rate uncertainty; and, if they do, how they respond. A few previous studies in tax uncertainty literature (Alm, 1988; Basu and Ghosh, 2001; Mirrlees, 1990; Skinner, 1988; Watson, 1992) theoretically predict how uncertain tax rates or tax bases should affect household labor supply and saving decisions. Empirical contributions (Gomes et al., 2007; Hassett and Metcalf, 1999) also have performed simulations of the effects of tax uncertainty on firms' investment decisions or households' work decisions. Some finance research also tests whether uncertain tax policies

affect firms' long-term investment decisions. However, unlike extant literature, this study empirically examines how uncertain tax rates affect household financial decisions in a natural experimental framework.

Second, the empirical findings precisely reflect the effects of tax uncertainty on household financial decisions (i.e., demand for dividend yields). In most cases though, tax codes can be known in advance, due to time lags between the proposal, enactment, and implementation of tax reforms. The early enactment of tax codes before their implementation grants households some foresight about future tax rates for their investment decisions. If an early enactment of the tax cut extension took place during 2008−2010, the results would have shown households' adaptive financial decisions with a perfect foresight and could not have captured the effects of tax rate uncertainty on households' financial decisions. However, the long-dragging political debate resulted in the late enactment, just two weeks before the implementation. Thus, households making more than $200,000 during 2008−2010 could not gain perfect foresight and had to make investment decisions with uncertainty. In this context, this study shows precisely how tax rate uncertainty (i.e., potential increases in tax rates on dividends relative to capital gains) affects households' financial decisions. The Tobit estimates indicate that these uncertain, high-income households during 2008−2010 significantly lowered their dividend yields compared with households without such uncertainty. Data limitations prevent an assessment of the dynamics of financial decisions though, such as whether tax rate uncertainty causes households to postpone investment decisions until the future tax rates have been determined.

Third, this study uses the Difference-in-Difference technique to identify which households are affected by tax rate uncertainty and how much they are exposed to it. Past literature (Auten and Clotfelter, 1982; Bakija and Heim, 2011; Burman and Randolph, 1994; Hrung, 2007) instead

has used panel data, taking the previous year's tax rates over the sample period as a proxy for future tax rates.[47] Although this method reveals patterns of households' tax rates over time and suggests whether households will have higher future tax rates, the proxy is realized ex post and observed through data, which is inevitably affected (i.e., biased downward) by households' tax reduction efforts in the previous year. Difference-in-Difference estimators are free of this downward bias.

Fourth, the empirical findings show policy makers how to enact new tax codes most effectively. Households that were uncertain about their future tax rates changed their dividend yields on stocks in advance, before the government enacted the new tax codes for 2011 and 2012. Although the potential increase in tax disadvantages caused them to reduce their dividend yields during 2008−2010, tax rates on dividends and long-term capital gains ex post remained the same after 2010. Households that changed their stocks with lower dividend yields did not take on more tax burdens after 2010, because tax rates on long-term capital gains were the same as (lower than) tax rates on qualified dividends (ordinary dividends).[48] However, the dragged out political debate incurred social costs, because some households that shifted to low dividend-paying stocks in response to their tax uncertainty might not have planned to make the change during 2008−2010. The unnecessary portfolio adjustment due to tax uncertainty created transaction costs, which led to decrease social welfare. Instead, policy makers should ensure a short lag between the proposal and enactment of a new tax policy, to minimize the welfare costs due to unnecessary portfolio changes.

[47] To be precise, the difference between tax rates on the pertinent year and the average tax rates over the sample period is used as the proxy for the future tax rates. Households with negative differences in tax rates are designated as those with higher future tax rates.

[48] Because stocks generate their returns in the form of dividends or capital gains, stocks with low dividend yield generate their returns mostly in the form of capital gains. Households can avoid paying capital gains taxes by not realizing them, because taxes are levied on realized capital gains, not accrued ones.

In Section 3.2, I summarize the tax provisions associated with the Bush-era tax acts and the main political debates raised by Democratic and Republican parties during 2008−2010. Section 3.3 explains the dividend clientele and the capital asset pricing model, as well as the model predictions for uncertain tax effects on households' dividend portfolio decisions. Section 3.4 details the Survey of Consumer Finances data, explains the procedure for calculating marginal tax rates, and summarizes the descriptive statistics of the data sample. The empirical methods for analyzing the effects of uncertain tax rates on households' demand for dividend yields appear in Section 3.5, followed by the empirical findings regarding the significant change in dividend yields by households in the treatment group in Section 3.6. The last section offers a brief conclusion.

3.2 The Bush Tax Acts and Political Debates: 2008−2010

Two major federal tax laws were passed during the presidency of George W. Bush: the Economic Growth and Tax Relief Reconciliation Act of 2001 (EGTRRA) and the Jobs and Growth Tax Relief Reconciliation Act of 2003 (JGTRRA). Prior to the passage of EGTRRA, the federal income tax rate structure consisted of five tax brackets, ranging from 15% to 39.6%. Then EGTRRA introduced a new 10% tax bracket and reduced individual income tax rates by 1%. Next, JGTRRA continued this precedent by accelerating tax rate reductions on dividends and capital gains. Table 3.1 summarizes the changes in the statutory tax rates on ordinary income, dividends, and long-term capital gains due to ETRRA and JGTRRA.

As Table 3.1 reveals, the JGTRRA legislation contained several key provisions. First, it reduced most marginal tax rates on ordinary income above 15% by 2% and reduced the top marginal tax rate by 3.6%. These tax rate reductions had already been included in EGTRRA but were scheduled to go into effect gradually, with a 1% rate reduction in 2004 and the remainder in

2006. Under JGTRRA, the scheduled reductions all occurred in 2003. Second, the marginal tax rates on long-term capital gains were reduced from 20% to 15% at the top income bracket and from 10% to 5% (and then to 0% in 2008) for the bottom income bracket. Third, dividends were taxed differently, depending on their category. Qualified dividends were paid by U.S. corporations or qualified foreign corporations and required investors to hold the stocks for more than 60 days. If the dividends were qualified, they were taxed at the long-term capital gain tax rates rather than at ordinary income tax rates. Thus, the marginal tax rates on qualified dividends dropped dramatically, from 35% to 15% at the top income bracket and from 10% to 5% at the bottom bracket, after JGTRRA. In contrast, ordinary dividends continued to be taxed at the level of ordinary income tax rates. This tax provision made qualified dividend-paying stocks more attractive to investors, all else being equal.

As a result of these changes in the statutory tax rates on ordinary income, capital gains, and dividends, the differentials in the tax rates between dividends and capital gains decreased. That is, the tax disadvantages of dividends relative to capital gains were smaller after JGTRRA. In addition, JGTRRA created a tax advantage for qualified dividends relative to ordinary dividends. However, these tax provisions were designed to *sunset*, such that EGTRRA would expire on January 1, 2011, unless further legislation were enacted to make its extension or changes permanent. If the provisions were to revert to the levels before EGTRRA, the tax disadvantages of dividends, relative to capital gains, would revert and thus increase, while the preferential tax treatment for qualified dividends would lapse.

Whether the Bush-era tax cuts would be extended or expire was a central political discussion during 2008−2010. During the 2008 U.S. presidential election, the Democratic Party nominee Barack Obama proposed extending the tax cuts for low- and middle-income families while

letting taxes go back up for individuals earning over $200,000 or couples earning over $250,000. In contrast, the Republican Party nominee John McCain called for further tax cuts to all families. After Obama was inaugurated as president on January 20, 2009, his administration had trouble reaching an agreement to extend the cuts for high-income households with leaders of the Republican Party. These years thus were filled with speculation and debates about whether the Bush tax cuts should be extended; only on December 6, 2010, did President Obama reach an agreement with the Republican Party, with a compromise tax package that provided a temporary, two-year extension of the Bush tax cuts for high-income households too. The Tax Relief, Unemployment Insurance Reauthorization, and Job Creation Act of 2010 was passed by the U.S. Congress on December 16, 2010, and signed into law by the President on December 17, 2010, two weeks before it was implemented.

As a result of the drawn out political debates and late enactment of the extension, households making more than $200,000 during 2008−2010 faced substantial uncertainty about the future tax rates applied to their income. In contrast, these political debates did not affect households making less than $200,000, so they had little tax rate uncertainty during 2008−2010. This tax uncertainty distinction reveals two household groups: (1) the treatment group of households that make more than $200,000 and face uncertain future tax rates and (2) the control group of households that make less than $200,000 and have no tax uncertainty.

Depending on the final enactment, the treatment group might have had higher tax rates or the same tax rates, which would determine their after-tax returns on their financial portfolios. If the Bush tax cuts were not extended to high-income households, tax rates on dividends and long-term capital gains would increase, and the preferential tax treatment of qualified dividends would lapse, leading to greater tax disadvantages associated with dividends relative to capital gains.

Figure 3.1 depicts the possible tax rate changes; notable is that the increases in tax disadvantages for dividends would be greatest for households in the upper-most tax bracket in the treatment group.

In summary, to identify which households are affected by uncertain future tax rates for their investment decisions, this study exploits the political debate about whether to include high-income households in the extension, as well as the late enactment of the new tax policy. During 2008−2010, the long political debates lengthened the lag between proposal and enactment but reduced the gap between enactment and implementation, which prevented high-income households from gaining foresight into future tax rates. High-income households thus made financial decisions with great uncertainty surrounding future tax rates; households making less than $200,000 did not.

3.3 Uncertain Tax Policy and Households' Portfolio Decisions

The dividend clientele model can derive the effect of uncertain tax rates on an investor's dividend yields. With this approach, I extend Miller's (1977) clientele model, which suggests that different tax rates across different investors lead to the formation of *dividend clienteles* in the stock market who exhibit a tax-based preference for stocks with different dividend yields. A clientele equilibrium emerges when "high dividend paying stocks will be preferred by tax exempt institutions and low income investors; those stocks yielding more of their return in the form of capital gains will gravitate to the taxpayers in the upper brackets" (Miller 1977, p.30).

Although Miller's (1977) model provides useful insights into how asset clienteles emerge with different tax rates across investors, it also has some limitations. Because the model assumes that all assets are risk free, it does not account for how investors choose their portfolio of risky assets, on the basis of their tax treatment and the risk characteristics of the assets. Analyses of

asset demands in frameworks involving taxes and financial risk appear in work by Auerbach (1983), Auerbach and King (1983), Brennan (1970), and Litzenberger and Ramaswamy (1979, 1980), which have led to the after-tax capital asset pricing model (CAPM).

Therefore, to derive the formal relationship between differential taxation of dividends and capital gains and the optimal dividend portfolio yields, I combine Long's (1977) model of optimal dividend portfolio yields with the after-tax CAPM. Long (1977) characterizes investors' efficient portfolio choices in terms of the mean and variance of their portfolios' after-tax returns, then characterizes differences in mean-variance efficient portfolios for investors in different tax brackets. Let the tax rates on dividends and capital gains be τ_D and τ_{CG}, respectively. The mean of portfolio returns is characterized by linear isoquants of the after-tax expected return with a slope $\frac{1-\tau_{CG}}{\tau_D-\tau_{CG}}$; their variance can be described by concentric ellipse isoquants of after-tax variance centered around the minimum variance portfolio. The construction of the locus of efficient portfolios involves taking the tangency points of after-tax expected return and variance isoquants. Then, the relationship between dividend yields and efficient portfolios is given by

$$\delta_p^i = \alpha_0^i \tilde{\rho}_p^i + \alpha_1^i \,, \tag{3.1}$$

where δ_p^i is the dividend yield for investor *i*'s portfolio *p*, $\tilde{\rho}_p^i$ is the expected after-tax return on investor *i*'s portfolio *p*, α_0^i and α_1^i are constant parameter values that are functions of investors' tax rates on dividends and capital gains. The parameter α_0 can be expressed as $-k\left(\frac{\tau_D-\tau_{CG}}{1-\tau_{CG}}\right)$, which is inversely related to the slope of after-tax return isoquant $\left(\frac{1-\tau_{CG}}{\tau_D-\tau_{CG}}\right)$.[49] Thus the dividend portfolio yield decreases as the differential in tax rates between dividends and capital gains increases. That is, the investor finds a new, after-tax efficient portfolio that offers lower dividend

[49] Here, *k* is an arbitrary constant.

yields and thus avoids the tax disadvantages of dividends relative to capital gains. This portfolio change increases the after-tax return in new tax systems, but it also increases the financial risk of the portfolio. Thus, it does not result in an obvious gain in after-tax efficiency.

To measure the gain in after-tax efficiency, the combination of Long's (1977) model with the after-tax CAPM can help establish the market equilibrium. According to the after-tax CAPM, the after-tax return on a stock portfolio as a function of the systematic risk (i.e., beta parameter), and the dividend yield is given by

$$\tilde{\rho}_p = \gamma_0 + \gamma_1 \beta_p + \gamma_2 \delta_p \, . \tag{3.2}$$

This equation implies that a stock portfolio with a higher dividend yield (δ_p) must have a higher after-tax return ($\tilde{\rho}_p$) to compensate for the high tax burden on dividends. Substituting (3.2) into investor *i*'s demand equation reveals the relationship between the dividend yield for investor *i*'s portfolio and the beta, which can be represented as

$$\delta_p^i = \frac{\alpha_0^i \gamma_0 + \alpha_1^i + \alpha_0^i \gamma_1 \beta_p}{1 - \alpha_0^i \gamma_{2,}} \, , \tag{3.3}$$

where δ_p^i is the dividend yield for investor *i*'s portfolio *p*, β_p is the systematic financial risk, and α_0^i is a constant parameter value that is a function of the investor's tax rates on dividends and capital gains, $-k\left(\frac{\tau_D - \tau_{CG}}{1 - \tau_{CG}}\right)$. Equation (3.3) implies that a dividend yield with the compensated return relates negatively to the differentials in tax rates between dividends and capital gains for a given level of risk.

This analysis provides a key insight into how different taxation rates between dividends and capital gains affect the investors' dividend yields. As the tax rate differential between dividends and capital gains increases (i.e., the tax disadvantage of dividends relative to capital gains increases), the investor seeks a stock portfolio with lower dividend yields. Because the tax rate

differentials between dividends and capital gains might increase for households making more than $200,000 after 2010, these households have incentives to decrease their dividend yields on stocks during 2008−2010.

H: A household who makes more than $200,000 during 2008-2010 reduces its dividend yields on stocks relative to a household who does not.

3.4 Data Description and Summary Statistics

The Survey of Consumer Finances (SCF) is a triennial survey conducted by the Federal Reserve Board (FRB). Thus the SCFs contain repeated, cross-sectional data and provide complete, disaggregated information about the portfolios held by a large sample of U.S. households. In 2009, FRB implemented a follow-up survey of households who had participated in the 2007 SCF. The combined 2007 and 2009 panel SCF data provide households' asset holdings across all financial intermediaries and also contain information about households' demographic characteristics, attitudes towards risk, financial decisions, and credit. Thus it is possible to track the same households over the sample period and examine changes in their dividend yields over time. The SCF data reflect an area-probability sample of the U.S. population and a sample of households drawn from an Internal Revenue Service file of high-income returns. They oversample high-income households, which is critical to identify demand for dividend yields on stocks, because stock holdings are strongly concentrated at the top of the income distribution. Sampling weights are also included in SCF, so the estimates are weighted to represent the U.S. household population.

Table 3.2 shows the summary statistics of households' financial portfolio and demographic characteristics in the 2007 and 2009 panel data sample. The number of observations in the data set is five times the actual number of respondents, because a multiple imputation technique

replaces any missing values. However, many statistical package programs treat each of the five replicates as independent observations, which inflates the statistical significance of results. I correct all summary statistics, estimates, and standard errors for the multiple imputations.[50]

3.4.1 Estimating the Marginal Tax Rates for SCF Households

The SCF data include detailed information on households' tax filing, adjusted gross income, and deductions but not the household's tax rates, for confidentiality reasons. To determine marginal tax rates, I used the TAXSIM web program at the National Bureau of Economic Research (NBER), which computes federal marginal tax rates on ordinary incomes and capital gains using relevant information provided by the SCF data.[51] If any calculated marginal tax rates failed to match statutory tax rates under U.S. federal rules, I excluded those observations.[52]

Next, using the tax rates on dividends and capital gains calculated from TAXSIM, I constructed a new tax measure, defined as the difference in tax rates between dividends and capital gains, to capture the tax disadvantages of dividends over capital gains. As the tax rate differential between dividends and capital gains increases, the tax disadvantage of dividends versus capital gains increases. As Section 3.3 detailed, a household's demand for dividend yield thus should decrease as the tax rate differential between dividends and capital gains increases.

3.4.2 Defining Dividend Yields

The main dependent variable, the dividend yield, is the ratio of a household's dividend income to the value of taxable stock holdings. Dividend income is the annual amount of income

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[50] The SCF codebook provides programming codes to correct for inflated statistical significance due to multiple imputations. Kennickell (1988) explains the imputation procedure in detail.

[51] TAXSIM is the NBER's FORTRAN program for calculating tax liabilities and marginal tax rates according to U.S. federal and state income tax laws from individual data. It is available at http://www.nber.org/~taxsim/. To convert the public SCF data into the variables required for TAXSIM, I used programming codes provided on the NBER website (http://www.nber.org/~taxsim/to-taxsim/scf/). The procedures to obtain the marginal tax rates and assumptions about income and tax filing in the codes are explained in Appendix B.

[52] The original panel SCF data contain 3,857 households, and the sample for the analyses includes 3,272 households.

received from stocks in taxable accounts, as reported on IRS 1040 forms.[53] Taxable stock holdings are the sum of the full market dollar value of stocks held directly or through mutual funds and half the market value of combination mutual funds. Stocks held in tax-deferred accounts such as 401(k)s, IRAs, or other retirement accounts are excluded from the total value of stock holdings, because financial incomes incur no tax liability within these accounts, and the preferential tax treatment for dividends does not apply to stocks in these accounts.

3.4.3 Summary Statistics on Dividend Yields

As Table 3.2 shows, dividend yields rise overall: The average dividend yields were 0.041 in 2007 and 0.056 in 2009. The changes in dividend yields by different income groups during 2007−2009, presented in Table 3.3, show a substantial decrease for households in the top two tax brackets between 2007 and 2009. For example, the unconditional average of dividend yields for households in the top tax bracket fell by 0.059, possibly because of the potential for increased tax disadvantage (note that I investigate what made these households lower their dividend yields over 2007−2009 in more detail in Section 3.5). In contrast, dividend yields rose for low- and middle-income households, except those in the 15% tax bracket. Households in 10% and 15% brackets experienced decreased tax rates on long-term capital gains, from 5% to 0%, in 2008, which gave them an incentive to switch to stocks with lower dividend yields, likely resulting in the decrease in the unconditional average of dividend yields.

3.5 Econometric Framework

To test empirically whether uncertainty about future tax rates affects households' dividend yield decisions, I estimate a Tobit model for the dividend yields as a function of households' marginal tax rate differentials, demographic characteristics, and financial risk tolerance. The

[53] The amount of dividend income received in the previous year is reported on lines 9a and 9b of the 1040 form.

dependent variable, the dividend yield, is the ratio of a household's dividend income to the value of taxable stock holdings, as described in Section 3.4.2, $\frac{Dividends}{Total\ value\ of\ taxable\ stocks}$. The dividend yield for a household *i* from survey sample *t* is denoted by $DY_{i,t}$, and the latent variable is $DY_{i,t}^{*}$. If households do not hold dividend-paying stocks, their dividend yields are censored at 0, suggesting a censored regression model. The Tobit model is given by

$$DY_{i,t}^{*} = \beta_1 \tau_{i,t} + \beta_2 I(Year = 2009) + \beta_3 I(Income > \$200{,}000) + \beta_4 I(Year = 2009) \cdot I(Income > \$200{,}000) + X_{i,t}' \beta_5 + \varepsilon_{i,t}$$

$$DY_{i,t} = \max(0, DY_{i,t}^{*}), \tag{3.4}$$

where $DY_{i,t}^{*}$ is the latent demand for the dividend yield, $DY_{i,t}$ is the observed demand, $\tau_{i,t}$ is the marginal tax rate differential between ordinary dividends and long-term capital gains, $I(Year = 2009)$ is a time dummy for the 2009 survey year, $I(Income > \$200{,}000)$ is a dummy for households that make more than $200,000, and $X_{i,t}'$ is a vector of households' characteristics (age, age dummy, education, sex, marital status, risk tolerance, household size, net worth, and other income of the head of the household).[54]

The main parameter of interest is β_4, which captures the treatment effects. Because households making more than $200,000 face uncertainty in their future tax rates, they should lower their dividend yields during 2008−2010,[55] so β_4 should be negative for households in the treatment group. The main assumption of the Difference-in-Difference estimator is that the time trends in dividend yields between treatment and control group are the same, so I also check whether the main estimates are driven by different time trends between the two groups.

[54] The head of the household is a single individual; in a couple, it is the man in a mixed-sex couple or the older member of a same-sex couple, as listed in the SCF data.

[55] High-income households whose investment time horizon is very short or very long may not be affected by tax rate uncertainty during this period. However, the SCF data do not reveal respondents' ex ante investment time horizons, so I cannot separate very short- or very long-term traders from the sample.

The econometrics problem for the estimation is that the households' tax rates are endogenous. The main regressor, $\tau_{i,t}$, is endogenous to the dividend yield because households can affect their tax liabilities, and thus their marginal tax rates, through their dividend yields on stocks. Previous studies of dividends and taxation address this endogeneity problem by introducing a new proxy for the marginal tax rates. Feldstein et al. (1980) first proposed an algorithm, the "first dollar" approach, that avoids potential endogeneity in the marginal tax rates, such as the relationship between tax rates and the households' portfolio choices. The measure of the marginal tax burden by the first dollar method artificially sets the investment income from interest, dividends, and capital gains to 0. The tax rate from this base level of income is independent of the actual dividend investment decision but highly correlated with the actual marginal tax rate.[56]

In addition, estimates for the Tobit model with fixed effects in the panel setting are not consistent because of the incidental parameters problem (Cameron and Trivedi, 2005). Honoré (1992) suggests the consistent estimator for the Tobit model with fixed effects in the two-period panel, but his method does not work with SCF data.[57] Bertrand et al. (2004) find that Difference-in-Difference estimates that ignore the serial correlation of outcomes may understate the estimated treatment effects. To address these econometrics problems, I use panel-robust standard errors, which indicate both individual heteroskedasticity and serial correlation.

3.6 Empirical Findings

3.6.1 Effects of Tax Uncertainty on Dividend Yields

Table 3.4 contains the empirical results of the uncertain tax effects on households' dividend yields. The Difference-in-Difference estimates in the first column reveal that the coefficient for

[56] The result for the weak instrumental variable test shows that the tax rates by the first dollar method are strong for instrumenting the endogenous tax rates. I ran the Hausman test for the model specification; it showed that the estimates using instrumental variables were consistent.

[57] Honoré (1992) provides STATA codes for the Tobit model with fixed effects in two-period panel, but they do not work in SCF due to the multiple imputation of the SCF data.

the interaction term of the treatment group dummy and the year dummy is negative and statistically significant ($\beta_4 = -0.519$, $p < 0.05$). That is, households that made more than \$200,000 and confronted the possibility of an increase in the tax disadvantage of their dividends in the near future lowered their dividend yields by 0.52 during 2007−2009, compared with households that did not.

Because the significant treatment effect may be caused by the different time trends between the treatment and the control group, I checked whether the different income groups revealed different time trends for their dividend yields. To perform this analysis, I divided the control group into several subgroups, created dummies for each subgroup, and interacted them with the year dummy. The empirical model including these additional interaction terms is given by

$$\begin{aligned} DY_{i,t}^{*} = {} & \beta_1 \tau_{i,t} + \beta_2 I(Year = 2009) + \beta_3 I(Income > \$200{,}000) + \\ & \beta_4 I(Year = 2009) \cdot I(Income > \$200{,}000) + \\ & I(Year = 2009) \cdot I'(Subgroups)\beta_5 + X_{i,t}'\beta_6 + \varepsilon_{i,t} \\ DY_{i,t} = {} & \max(0, DY_{i,t}^{*}) , \end{aligned} \tag{3.5}$$

where $I'(Subgroups)$ is a vector of dummies for income-based subgroups and the other notations are as described in (3.4). Again, the tax rates calculated by the first dollar method served as instruments for endogenous tax rates.

Using (3.5), I investigated whether the treatment effects emerged from any groups other than the treatment group. If the treatment effect were observed in any sub-control groups (i.e., a vector of β_5 is statistically significant), the main estimate (β_4) may be driven by the different time trends between the treatment and the control group, such that it could not precisely reflect the treatment effect of tax uncertainty on households' dividend yields. Further evidence in Table 3.4 shows that none of the coefficients for the interaction terms of the sub-control group

dummies and the year dummy were statistically significant; only β_4 was significantly negative. Thus the treatment effect existed only in the treatment group, and the estimates were robust to the various numbers of subgroups.

Finally, to verify that the treatment effects resulted from the uncertainty of future tax rates, I regressed the same model using SCF data from 1998 to 2007. Since all households noticed the scheduled tax rate changes by the Bush tax acts in advance, households making more than $200,000 did not have greater tax rate uncertainty compared to other households during 1998−2007. The results in Table 3.5 suggest that the treatment effect only existed during 2007−2009 (i.e., β_4 was not statistically significant at times other than 2007−2009).

3.6.2 Robustness Check

To intensify the main argument (i.e., that the decrease in dividend yields for households in the treatment group resulted from the uncertain future tax rates), I exploited the different magnitudes of tax uncertainty among households in the treatment group. According to Figure 3.1, households in the top tax bracket should suffer from a greater increase in the tax disadvantages of dividends (i.e., 19.6%) compared with households in the next tax bracket (i.e., 16%) if the Bush tax cuts were to expire. Some households in the treatment group had 15% differentials in the tax rates between their dividends and capital gains, because they had only dividend incomes and no realized capital gains. These households would have 24.6% or 21% increases in the tax disadvantages of their dividends relative to capital gains if the tax cuts expired.[58] Using the different levels of tax uncertainty among households within the treatment group, I divided the treatment group into four subgroups. A household with a greater tax uncertainty (i.e., bigger variance in the tax rate change) should exhibit a greater decrease in dividend yields during

[58] If the Bush tax cuts expired, these households would have 39.6% or 36% tax rate differentials between dividends and capital gains. Thus, the increases in tax disadvantages of their dividends over capital gains would be 24.6% or 21%.

2007−2009. To perform this analysis, I included the interaction terms of the three sub-treatment group dummies and the year dummy, and I regressed the Tobit model again, which can be represented as[59]

$$DY_{i,t}^{*} = \beta_1 \tau_{i,t} + \beta_2 I(Year = 2009) + \beta_3 I(Income > \$200{,}000) + \beta_4 I(Year = 2009) \cdot I(Income > \$200{,}000) + X_{i,t}' \beta_5 + \beta_6 I(\hat{\tau} = 19.6\%) \cdot I(Income > \$200{,}000) + \beta_7 I(\hat{\tau} = 21.0\%) \cdot I(Income > \$200{,}000) + \beta_8 I(\hat{\tau} = 24.6\%) \cdot I(Income > \$200{,}000) + \varepsilon_{i,t}$$

$$DY_{i,t} = \max(0, DY_{i,t}^{*}), \tag{3.6}$$

where $I(\hat{\tau} = 19.6\%)$ is the indicator of households facing the a possibility of an increase in tax rate differentials between dividends and long-term capital gains by 19.6%. The other indicators for tax uncertainty were similar, and the rest of the variables were as described for (3.4). The tax rates calculated by the first dollar method served to instrument the endogenous tax rates.

The Tobit estimates in Table 3.6 reveal that the interaction terms of the tax uncertainty dummy and the year dummy are negative and statistically significant (β_6= −0.052, $p < 0.05$; β_7= −0.108, $p < 0.01$; β_8= −0.140, $p < 0.05$). That is, households in the treatment group lower their dividend yields more as they confront greater tax rate uncertainty. The significantly negative coefficient (β_1= −0.024, $p < 0.01$) for the tax rate differentials between dividends and capital gains supported the dividend clientele hypothesis. That is, high-taxed households gravitate to low-dividend yield stocks; low-taxed households hold high-dividend yield stocks in equilibrium.

[59] Households with a 16% potential increase in tax rates within the treatment group served as the base group.

3.6.3 Why Do Households Take Actions in Advance, Before the Government Enacts a New Tax Policy?

When facing uncertain future tax rates, households have two alternatives: They can postpone financial decisions until the future tax rates are determined, or they can take the uncertain future tax rates into account. Data limitations prevented me from investigating whether households postponed their financial decisions until the government enacted the new tax policy. However, the empirical findings in the previous sections imply that uncertain households made their financial decisions during 2007−2009, before the government announced the tax policy for 2011 and 2012.

The reason for this choice might involve stock price effects. Shackelford (2000) and Lang and Shackelford (2000) find that stock prices moved inversely with dividend yields in response to a reduction in the capital gains tax rate in May 1997. Stock prices react to changes in the capital gains tax policy, as well as to information about tax legislation. If households postpone their financial decisions until the government announced a new tax policy, they might have been forced to sell their stocks with high-dividend yields at low prices and buy low dividend-paying stocks at high prices, to avoid paying high taxes on dividends. Thus, they had an incentive to adjust their portfolio in advance, before the enactment of the tax-cut extension.

3.7 Conclusion

This chapter elucidates the effects of uncertain future tax rates on household dividend yields. To identify which households are exposed to uncertain future tax rates for their investment decisions, I exploited the political situation in which Congressional members debated whether to extend Bush-era tax cuts to high-income households, then ultimately did so at nearly the last minute. With this unique natural experiment, I found that households that made more than

$200,000, and thus faced uncertainty about their future tax rates, significantly lowered their dividend yields during 2008−2009 compared with households that faced no such uncertainty. Because these high-income households worried that they would be forced to sell low and buy high if the extension did not pass, they reduced their dividend yields in advance, before the government enacted the new tax policy for the extension.

Uncertain taxation and household dividend portfolio decisions here are just parts of the uncertain tax policy and financial decisions that households must address. I could not investigate whether uncertain future tax policies caused households to postpone making their financial decisions or how tax rate uncertainty affected stock prices across different dividend yields, due to data limitations. Further research should analyze the patterns of stock prices across different dividend yields and the dynamic effects on household financial decisions during periods involving uncertain future tax rates, perhaps by using data from major U.S. brokerage firms.

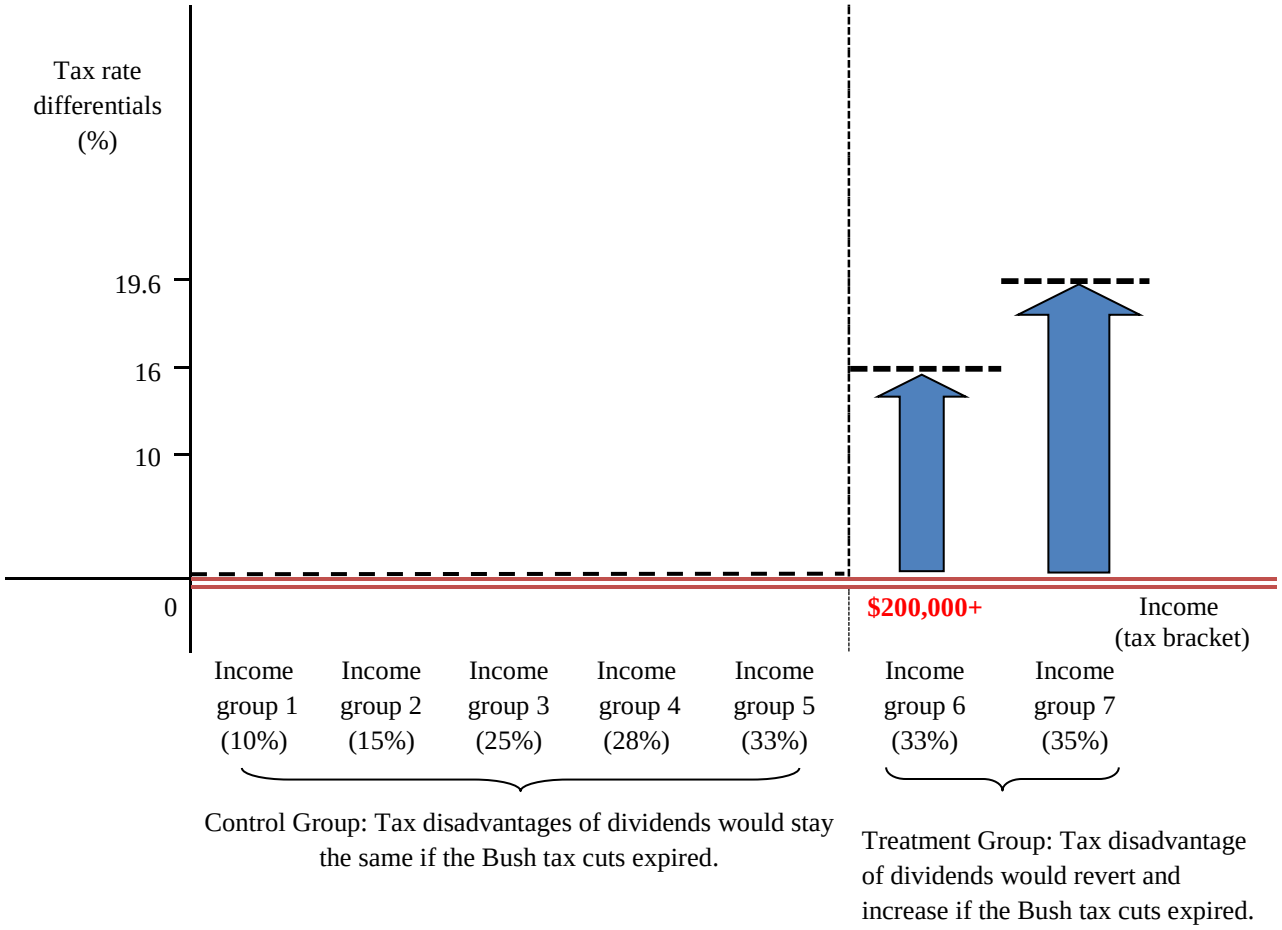

Figure 3.1 Change in Tax Rates by the Expiration of the Bush Tax Cuts

Table 3.1 Changes in Tax Rates (%) by the Bush Tax Acts

Before EGTRRA (2000)		After EGTRRA / Before JGTRRA (2002)		After JGTRRA (2003)	
Ordinary Income / Interest / Dividends	*Long-term Capital Gains*	*Ordinary Income / Interest / Dividends*	*Long-term Capital Gains*	*Ordinary Income / Interest / Ordinary Dividends*	*Qualified Dividends / Long-term Capital Gains*
		10	10	10	5 (0)
15	10	15	10	15	5 (0)
28	20	27	20	25	15
31	20	30	20	28	15
36	20	35	20	33	15
39.6	20	38.6	20	35	15

Source: Tax statistics at the Internal Revenue Service (IRS). After 2008, the tax rates on long-term capital gains were reduced from 5% to 0% for households in the two bottom-tax brackets.

Table 3.2 Summary Statistics in the 2007 and 2009 Panel SCF

	2007			2009		
Variable	Mean	Min	Max	Mean	Min	Max
Dividend yield	0.041	0	39.78	0.056	0	56.64
Tax rate differentials (%)	8.66	0	35	11.30	0	35
Income (millions in 2009 dollars)	0.087	0	188	0.078	0	77.3
Net worth (millions in 2009 dollars)	0.055	-5.63	1,450	0.043	-1.72	952
Financial assets (millions in 2009 dollars)	0.065	-4.13	1,450	0.053	-0.06	954
Diversification (# of stocks)	1.07	0	150	0.99	0	150
Head age (years)	49.76	19	95	51.33	21	95
Education (years)	13.38	0	17	13.41	0	17
Household size (#)	2.47	1	12	2.41	1	11
Averseness toward financial risk (1~4)	3.16	1	4	3.28	1	4

Source: These calculations were derived from the Survey of Consumer Finances. All averages are weighted by SCF sampling weights and corrected for multiple imputations.

Table 3.3 Dividend Yields across Different Groups in 2007 and 2009 SCF

	$\text{Dividend Yield} = \frac{\text{Dividend Income}}{\text{Total Value of Taxable Stocks}}$		Difference in Dividend Yield
	2007	2009	
Households in the 10% tax bracket	0.006	0.067	0.061
Households in the 15% tax bracket	0.055	0.025	-0.030
Households in the 25% tax bracket	0.025	0.092	0.067
Households in the 28% tax bracket	0.024	0.075	0.051
Households in the 33% tax bracket	0.042	0.030	-0.012
Households in the 35% tax bracket	0.105	0.046	-0.059

Source: These calculations were derived from the Survey of Consumer Finances. All averages are weighted by SCF sampling weights and corrected for multiple imputations.

Table 3.4 Effects of Uncertain Tax Rates on Household Dividend Yields: 2007−2009 SCF

	Dependent Variable: Dividend Yield $= \frac{\text{Dividend Income}}{\text{Total Value of Taxable Stocks}}$		
I(Year = 2009) × I(Income > $200,000)	-0.5190**	-0.6791**	-0.6784**
	(0.2257)	(0.3460)	(0.3450)
I(Year = 2009) × I(Control group1)		-0.0334	-0.3891
		(0.4182)	(0.4326)
I(Year = 2009) × I(Control group2)		-0.4747	-0.5437
		(0.4027)	(0.4252)
I(Year = 2009) × I(Control group3)			-0.4016
			(0.4219)
I(Year = 2009) × I(Control group4)			0.6788
			(0.7375)
I(Year = 2009)	0.4356*	0.5976	0.5887
	(0.2622)	(0.4449)	(0.4430)
I(Income > $200,000)	0.5083*	0.5306*	0.5642*
	(0.2855)	(0.3125)	(0.3147)
I(Control group 1)		0.1631	0.0548
		(0.2132)	(0.2044)
I(Control group 2)		-0.0130	-0.1086
		(0.1640)	(0.1979)
I(Control group 3)			0.1195
			(0.2324)
I(Control group 4)			0.1236
			(0.2993)
Number of control groups	1	3	5

Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.
Notes: Estimates are weighted by the SCF sampling weights and corrected for multiple imputations. All the other control variables are included in the estimation but not reported. These estimates are available on request. Standard errors in parentheses are panel-robust.

Table 3.5 Measuring Treatment Effects over Time: 1998 to 2009 SCF

	Dependent Variable: Dividend Yield $= \frac{\text{Dividend Income}}{\text{Total Value of Taxable Stocks}}$			
	1998 & 2001	2001 & 2004	2004 & 2007	2007 & 2009
I(Year = post) × I(Income > $200,000)	0.0335 (0.1093)	0.0436 (0.0789)	0.0054 (0.0167)	-0.6784** (0.3450)
I(Year = post) × I(Control group 1)	0.1210 (0.1131)	0.0193 (0.0514)	0.0076 (0.0214)	-0.3891 (0.4326)
I(Year = post) × I(Control group 2)	0.0268 (0.0840)	-0.0052 (0.0480)	-0.0146 (0.0203)	-0.5437 (0.4252)
I(Year = post) × I(Control group 3)	0.0837 (0.0799)	-0.0199 (0.0475)	0.0049 (0.0208)	-0.4016 (0.4219)
I(Year = post) × I(Control group 4)	0.0422 (0.0842)	-0.0074 (0.0397)	0.0038 (0.0366)	0.6788 (0.7375)

Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.
Notes: I(Year = post) represents the indicator for the post year data sample. All the other control variables are included in the estimation but not reported. These estimates are available on request. Estimates are weighted by the SCF sampling weights and corrected for multiple imputations. Standard errors are in parentheses.

Table 3.6 Effects of Uncertain Tax Rates on Household Dividend Yields: 2007−2009 SCF

	Dependent Variable: Dividend Yield $= \frac{\text{Dividend Income}}{\text{Total Value of Taxable Stocks}}$
I(Year = 2009) × I($\hat{\tau}$ = 19.6%)	-0.0517**
	(0.0260)
I(Year = 2009) × I($\hat{\tau}$ = 21.0%)	-0.1083***
	(0.0413)
I(Year = 2009) × I($\hat{\tau}$ = 24.6%)	-0.1402**
	(0.0664)
Tax rate differentials	-0.0238***
	(0.0025)
I(Year = 2009) × I(Income > $200,000)	-0.4656*
	(0.2445)

Asterisks denote significance at the 1% (***), 5% (**), and 10% (*) levels.
Notes: Estimates are weighted by the SCF sampling weights and corrected for multiple imputations. All the other control variables are included in the estimation but not reported. These estimates are available on request. The standard errors in parentheses are panel-robust.

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Appendix A. Verification of the Change in Expected Utility

This proof builds upon the model used in Dammon, Spatt, and Zhang (2004). To verify that the change in expected utility has the same sign as $\Delta\widetilde{w}$, let *U* denote the household's utility function and U' denote the marginal utility function. Then, the change in expected utility is

$$\Delta \mathrm{E}[U] = \mathrm{E}[U'\widetilde{w}^{TA}] + \lambda E[U'\widetilde{w}^{TDA}] \quad \text{(A1)}$$

where $\lambda > 1$ is the shadow price of taxable wealth per dollar of tax-deferred wealth. Since we assume that the investor has unrestricted borrowing and short-sale opportunities in taxable accounts, there must be indifference between bonds and stocks at the margin. Thus, the first-order optimality conditions must satisfy $\mathrm{E}[U'(\Delta\widetilde{w}^{TA})] = 0$. Using $\widetilde{w}^{TDA} = \Delta\widetilde{w} - \widetilde{w}^{TA}$, the change in expected utility becomes $\Delta \mathrm{E}[U] = \lambda \Delta\widetilde{w} \mathrm{E}[U']$, which clearly shows that $\Delta \mathrm{E}[U]$ has the same sign as $\Delta\widetilde{w}$.

Appendix B. Calculation of Marginal Tax Rates from the SCF Data

Since the SCF data do not have information of households' marginal tax rates, the TAXSIM program is used to calculate federal and state income tax liabilities from survey data at the NBER website. To create TAXSIM variables from the public SCF data, I use program code provided by Kevin Moore at the NBER. It assumes that all married or cohabiting couples file a joint tax return because it is hard to disentangle each member's income, deductions and other information of the tax returns from the SCF data. The percentage of married or cohabiting couples who filed tax returns separately was 3.51% in 1998 and 3.62% in 2007 and thus the issue with this assumption is relatively small. Total standard deductions and total itemized deductions for mortgage interest, investment interest expense, and charitable contributions are also considered. Investment expenses only consist of interest paid on the loans for investments.

To get the marginal tax rates on capital gains, the information of annual income from net capital gains or losses from mutual funds, the sale of stocks, bonds, or real estate are used from the SCF data. However, the SCF data do not have specific information whether the capital gains are short-term or long-term. In order to divide capital gains and losses up into long-term and short-term portions, the following procedure is done. Using the aggregate data on long-term and short-term capital gains/losses from the IRS SOI Individual report (table 1.4), the share of capital gains/losses that are long and short-term is determined for three broad adjusted gross income (AGI) classes, less than 50K, 50K to 100K, and more than 100K. The shares from this computation are then applied to the data (by AGI class). Johnson and Moore (2008) focus on income data derived from two sources, SCF and SOI, and they find that estimates of total income for each AGI group and tax year examines from these sources are very close.

Appendix C. Calculation of Marginal Tax Rates from the Public Tax File Data

Because the Public Use Tax File data do not contain information on households' marginal tax rates, I use the TAXSIM program to calculate federal and state income tax liabilities and tax rates. TAXSIM is available at the NBER website (http://www.nber.org/~taxsim/).[60] I use a program code provided by Daniel Feenberg and Jean Roth to obtain the marginal tax rates from the Public Use Tax File (available at http://www.nber.org/stata/taxpuf9.ado).

While studies that use other survey data make strong assumptions such as joint tax filings to calculate households' marginal tax rates, I do not need to make these assumptions because the Public Use Tax File data have very detailed information on households' tax returns such as tax filing status, adjusted gross income (AGI) and other taxable income.

[60] Feeberg and Coutt (1993) briefly explain what the TAXSIM model is and how it works.

Appendix D. Ordinary Dividends and Qualified Dividends

The Internal Revenue Service provides detailed stipulation regarding ordinary dividends and qualified dividends. Ordinary dividends are the most common type of distribution from a corporation or a mutual fund. They are paid out of earnings and profits, which are ordinary income to investors. Investors can assume that any dividend they receive on common or preferred stock is an ordinary dividend unless the paying corporation or mutual fund tells them otherwise. Dividends paid by a tax-exempt organization, farmer's cooperative, or a corporation on employer securities held on the date of record by an Employee Stock Ownership Plan (ESOP) are ordinary dividends. These dividends are subject to the same ordinary income tax rates.

To receive preferential tax treatments for dividend income, investors must satisfy several requirements. First, the dividends must have been paid by a U.S. corporation or a qualified foreign corporation. A qualified corporation is a foreign corporation that satisfies any of the following conditions: 1) the corporation is incorporated in a U.S. possession, 2) the stock is readily tradable on an established securities market in the U.S. such as the New York Stock Exchange (NYSE) or the National Association of Securities Dealers Automated Quotations (NASDAQ), and 3) the corporation is eligible for the benefits of a comprehensive income tax treaty with the United States.

Second, investors must meet the holding-period requirement. They must have held the stock for over 60 days during the 121 day period that begins 60 days before the ex-dividend date. The ex-dividend date is the first date following the declaration of a dividend on which the buyer of a stock is not entitled to receive the next dividend payment. When counting the number of days that investors held the stock, the day that they disposed of the stock is included but not the day that they acquired it. When the investors meet these criteria, the dividends are considered to be

qualified dividends and these are taxed at the same 0% or 15% maximum tax rate that applies to long-term capital gains. For example, qualified dividends are subject to the 15% rate if the regular tax rate that would apply is 25% or higher.

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