TAXES AND PORTFOLIO CHOICE

by

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to my parents

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CHAPTER I

Introduction

This dissertation consists of three distinct essays which are closely related. In each chapter, I examine an aspect of the effect of taxes on household portfolio choices. Under the US tax system, an investment can deliver different after-tax returns to different investors. This feature of the tax structure figures importantly in the individual asset choice. I use variation in the tax structure resulting from the Economic Growth and Tax Reconciliation Act of 2001 (the 2001 tax act) and the Jobs and Growth Tax Relief Reconciliation Act of 2003 (the 2003 tax act) to estimate the relationship between taxes and portfolio structures.

In the first essay, I test the dividend clientele hypothesis (DCH) by examining the impact of the 2003 tax act on household portfolio dividend yields. The DCH predicts that the 2003 tax act, which reduced the tax-disadvantage of dividends differentially across the income distribution, would cause high income households to shift their portfolios towards dividend paying stocks more than lower income households. Using the 2001 and 2004 Surveys of Consumer Finances (SCF), I examine how changes to tax rates affect changes in household portfolio dividend yields. I find that the 2003 tax act caused portfolio shifts that are statistically and economically significant. Using the 2007 SCF, I find that the reduced variation in dividend tax

rates across households caused portfolio dividend yields to become similar across households within three years of the tax act.

In the second essay, I estimate the joint impact of the 2001 tax act and the 2003 tax act on household allocation of wealth across different types of financial assets. Together, the tax acts reduced the tax rates on directly held equities relative to taxable bonds and decreased the tax incentives to shelter assets in tax-deferred accounts. Using the 1998, 2001, 2004 and 2007 Surveys of Consumer Finances, I estimate the effect of taxes on the types of assets a household chooses to hold and the share of assets allocated across six asset classes: directly held equities, taxable bonds, nontaxable bonds, equities in retirement accounts, bonds in retirement accounts and other interest-bearing assets. I find that, as expected, the tax acts caused large shifts in the portfolio share allocated to directly held equities. In addition, changes to retirement account holdings are consistent with households using tax-deferred accounts to shelter their more heavily taxed assets.

In the final essay, I consider whether the responses of financial portfolios to tax policy changes depend on financial sophistication. First, I construct novel measures of financial sophistication using information about the sources of advice sought when making investment and borrowing decisions. Then, I test whether portfolio adjustments in response to tax policy changes are the same for households with different levels of financial sophistication. Examining changes in portfolio dividend yields in response to the 2003 tax act, I find little evidence that portfolio responses for financially sophisticated households differed from those that are not financially sophisticated.

CHAPTER II

The dividend clientele hypothesis: Evidence from the 2003 Tax Act

2.1 Introduction

Because dividends and capital gains generally face different tax rates and these rates vary across individuals, an equity security provides different after-tax returns for individuals facing different tax rates. Miller and Modigliani (1961) hypothesize that such heterogeneity leads to what they termed a "dividend clientele effect": investors naturally sort into equity holding classes based on their dividend payout ratios. According to the dividend clientele hypothesis, firms with high (low) dividend-payout ratios attract investors with low (high) marginal tax rates. In the aggregate, an individual's portfolio dividend yield, i.e., the ratio of dividend income to the value of equity holdings, should decrease with income.

This paper examines the dividend clientele hypothesis by analyzing the response of household equity portfolios to the Jobs and Growth Tax Relief Reconciliation Act of 2003 (henceforth referred to as the 2003 tax act). There are two major components of the 2003 tax act. First, capital gains tax rates were reduced. Second, dividend income was now taxed at the same rates as capital gains, rather than ordinary income. Together, these changes greatly reduced the tax disadvantage of dividend income and, importantly, did so by a relatively larger amount for high-income individuals. By

providing exogenous variation in marginal tax rates, the 2003 tax act provides an opportunity to examine the dividend clientele hypothesis in a natural experiment framework.

This paper has two goals. The first is to test whether the relationship between tax rates and household portfolio choices is consistent with the dividend clientele hypothesis. There are previous empirical studies that examine dividend clientele effects. This study contributes to this existing literature both in terms of the quality of data used and empirical methodology employed to provide a more compelling estimate of the causal impact of taxes on household portfolio dividend yields. I use data from the Federal Reserve Board's 2001, 2004 and 2007 Surveys of Consumer Finances (SCF), a triennial survey that contains detailed information on household wealth. Importantly, the SCF data allow accurate marginal tax rate calculations and a rich description of portfolio structures, the combination of which is not common to other data sources. In addition, the timing of the 2003 tax act clearly separates tax regimes across the SCF samples. I exploit the resulting exogenous variation in tax rates to identify tax effects rather than relying on variation in a single cross-section. This paper is the first to test for dividend clienteles among the class of individual investors using a natural experiment.

The second goal is to quantify the clientele-related economic impact of the 2003 tax act. Because the supply of dividends also changed, this paper is related to earlier studies of firm responses to the 2003 tax act that document the increase in dividend payments (Chetty and Saez (2005) and Brown, Liang and Weisbenner (2004)). Note, though, that the overall supply of dividends increased does not inform how these dividends were distributed across households. This question can only be answered by directly considering changes to household portfolios, as is done here.

The paper addresses two econometric issues. First, the dependent variable, a household's portfolio dividend yield, has a mass point at zero. Second, the main regressor of interest, tax rates, is endogenous to investor choices. To account for these issues, I estimate a Tobit-type model with instrumental variables techniques. The natural experiment framework provides an instrumental variable that is preferable to those used in previous research designs. Specifically, the different intensities of tax treatment that households face provides the basis for separating households into low- and high-treatment groups used to identify the effects of taxes.

I find strong evidence for the dividend clientele hypothesis. I estimate that the relationship between the tax disadvantage of dividend income and household portfolio dividend yields is negative and statistically significant. This suggests both that taxes cause a high degree of investor sorting and that households quickly responded to the tax changes caused by the 2003 tax act. In particular, affluent households shifted their portfolios, either actively or passively, to high dividend yielding stocks in response to the 2003 tax act. I also find that in the longer term, portfolio dividend yields became quite similar across households. This finding is expected because the distributions of effective dividend and capital gains tax rates were compressed. The differences between the short-term and longer-term responses are interesting and informative regarding the heterogeneity in portfolio adjustments and the importance of adjustment costs.

To assess the economic impact of the 2003 tax act, I use the parameter estimates to simulate the change in portfolio dividend yields caused by the 2003 tax act. I find that households in the top tax bracket more than doubled their portfolio dividend yields (a 115% increase). These top tax bracket households increased their yields by 1.1 percentage points more than those households in the next tax bracket and by

2.6 percentage points more than those two tax brackets below, reflecting the relative intensity of the tax treatment. In addition, the 2003 tax act caused a 0.94 percentage point differential response in portfolio dividend yields across treatment groups, defined by educational attainment measures. Given that average portfolio yields in the 2001 SCF were 2.05%, this represents a large and economically significant response.

I run a battery of specification tests to verify that the estimated response to the 2003 tax act is not explained by other factors. I determine that the estimates are robust to different treatment group definitions, to different outlier cut-offs, and to alternative methods of handling imputed values. I find that the main conclusions are unchanged when relaxing the assumptions of the Tobit model. I check that other determinants of household preferences for dividends, such as expectations over the future performance of the economy, did not change differentially across treatment groups over the two periods considered.

Understanding the relationship between taxes and investor decisions is important for several reasons. First, such information is useful to corporate financial managers who may consider the tax characteristics of their investors to determine optimal financial policies. Second, because equity holdings and dividend receipts have historically been concentrated in the upper tail of the income distribution, the impact of changing tax rates on household equity portfolios has important implications for the redistributive properties of the tax system. Indeed, one argument for taxing dividend income at higher rates than capital gains has been that it aids the progressivity of the tax schedule. Lastly, the magnitude of household behavioral responses to changes in the tax structure inform estimates of the efficiency losses of taxation (Galper, Lucke and Toder 1988). For example, the relationship between taxes and portfolio choice is central to tax reform discussions because switching to a comprehensive income tax

or a consumption tax would eliminate the differential tax treatment of assets. Because reorganizing investment strategies can be costly, understanding shifts caused by changing tax rates is important to such debates.

The remainder of the paper is organized as follows. Section 2.2 reviews theoretical models of dividend clientele formation. Section 2.3 summarizes the main components of the 2003 tax act, and Section 2.4 provides a brief description of the data. Section 2.5 explains the estimation strategy and presents the empirical results. The previous empirical literature on the existence of dividend clientele is reviewed in section 2.6. Section 2.7 provides a description of the sensitivity analysis for the baseline results, while section 2.8 concludes. Appendix A contains detailed information about the marginal tax rate calculation procedure, Appendix B provides a brief overview of a related line of research regarding dividend clienteles, and Appendix C provides detailed descriptions of the sensitivity checks for the main analysis.

2.2 Overview of clientele theory

The Modigliani-Miller theorem establishes that in perfect capital markets (i.e., without taxes, transaction or bankruptcy costs, or asymmetric information) a firm's dividend policy does not affect its value (Modigliani and Miller 1958). In this setting, investors can replicate any stream of dividend payments through the purchase and sale of appropriate equities. Thus, investors view dividend polices as irrelevant and will not pay a premium for any particular policy. However, when investors face different dividend and capital gains tax rates, they have different after-tax valuations for the same asset. Miller and Modigliani hypothesize that such differences lead to the formation of what they termed "dividend clienteles," in which investors have tax-based preferences over equities that differ only in their dividend policies (Miller

and Modigliani 1961).

To gain intuition for the mechanism through which investor clienteles emerge, I apply Miller's (1977) simple clientele model to the case of dividend policies. For simplicity, assume that there are two available stocks: one that does not pay dividends and one that does. Both stocks are assumed to be riskless and there is no available debt security. Also assume that the tax rate on capital gains (τ_{cg}) is zero, while the tax rate on dividend income (τ_{div}) increases with income. The market equilibrium of this model is depicted in Figure 2.1.

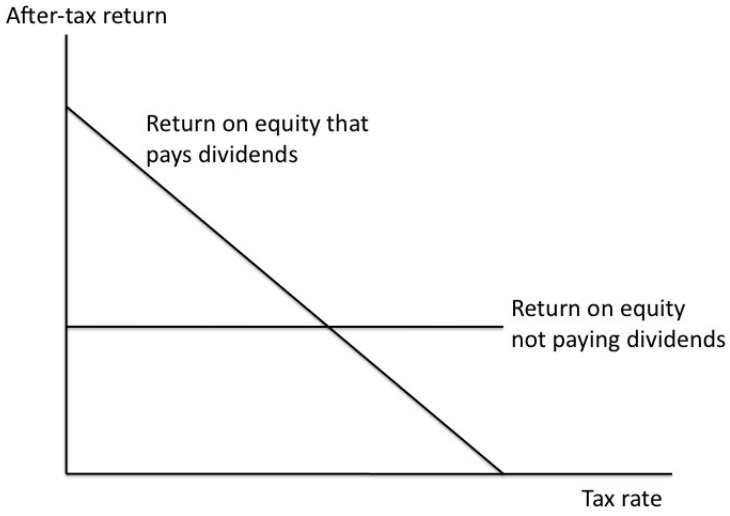

Figure 2.1: Equilibrium in the Miller model

This simple model predicts completely specialized portfolios. For a given set of pre-tax returns on the dividend-paying stock (r_{div}) and the non-dividend paying stock (r_{nodiv}), the asset demand functions for the dividend stock (D_{div}) and for the non-dividend paying stock (D_{nodiv}) for an investor with wealth level W are given by:

$$D_{div} = W, D_{nodiv} = 0 \text{ if } (1 - \tau_{div})r_{div} < r_{nodiv} \tag{2.1}$$

$$D_{div} = 0, D_{nodiv} = W \text{ if } (1 - \tau_{div})r_{div} > r_{nodiv} \tag{2.2}$$

Generalizing to the case of multiple equities with varying dividend yields, "high dividend paying stocks will be preferred by tax exempt organizations[1] 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 tax brackets" (Miller 1977).[2] This model also shows how clienteles can shift in response to changes in the tax rate structure. The tax rate that defines the cusp for household portfolio specialization in the simple model changes with the progressivity of the tax system. It is important to note that Miller's (1977) model concerns the equity market equilibrium and not an individual firm's choice over its payout policy. The model does not predict which firms pay dividends; indeed, from the perspective of any one firm, each clientele is as good as the next. That is, firms do not choose their dividend policy to attract a particular group of investors.

Miller's equilibrium provides intuition for how asset holding clienteles may emerge when investors face differences in tax rates. Yet the model is incomplete because it assumes all assets are riskless. When forming its equity portfolio, a household considers not only the impact of taxes on expected returns but also the riskiness of these holdings. To formally derive the relationship between tax rates and optimal dividend portfolio yields, I combine a model of optimal portfolio dividend yields, which defines the set of after-tax efficient portfolios for an investor with particular tax rates and risk preferences, with the after-tax capital asset pricing model, which provides the equity market equilibrium conditions.

Characterizing an investor's portfolio maximization problem in terms of the mean and variance of portfolios, isoquants of after-tax returns are linear with slope $\frac{1-\tau_{cg}}{\tau_{div}-\tau_{cg}}$

[1] There are additional non-tax reasons that tax-exempt institutional investors may form their own clientele. Because institutions are more likely to engage in "due diligence" and equilibrium prices make dividend-paying stocks more attractive to institutional investors, firms may use dividends to signal quality (Allen, Bernardo and Welch 2000).

[2] Where foreign investors align in the market for equities will depend on the tax treatment of his income derived from US equities in the US and in their country.

and isoquants of portfolio variance are concentric ellipses in the expected return-dividend yield plane centered around the minimum-variance portfolio (Long 1977).[3] The locus of after-tax efficient portfolios are tangency points of these isoquants and are described by the following relationship between dividend yield and after-tax efficient portfolios:

$$\delta_p^i = b_0^i + b_1^i \bar{r}_p^i \tag{2.3}$$

where δ_p is the dividend yield of investor i's portfolio and $\bar{r}_p^i$ is investor i's expected return from portfolio p. The parameters b_0 and b_1 are individual-specific constants that are a function of the dividend and capital gains tax rates. The coefficient b_1 is inversely related to the tax rate variable, $\frac{\tau_{div}-\tau_{cg}}{1-\tau_{cg}}$, so the dividend yield of an after-tax efficient portfolio decreases with higher levels of expected returns. When the tax rate on dividends relative to capital gains taxes increases, b_1 rises. Thus for a given level of expected returns, portfolio dividend yields increase as their relative tax disadvantage falls. The household cannot do this without changing the level of portfolio risk, so Long's (1977) model does not give an unambiguous prediction about portfolio choices in response to a tax change.

To obtain such a market equilibrium condition, I combine Long's (1977) model of portfolio choice with the after-tax capital asset pricing model (Brennan (1970), Litzenberger and Ramaswamy (1979), Litzenberger and Ramaswamy (1980), Auerbach (1983), Auerbach and King (1983)), where the expected pre-tax return of stock j ($\bar{r}_j$) is a function of its pre-tax beta coefficient (β_j) and pre-tax dividend yield (δ_j):

$$\bar{r}_j = \gamma_0 + \gamma_1 \beta_j + \gamma_2 \delta_j \tag{2.4}$$

That is, given two equities with the same risk exposure, the stock with a higher dividend yield must have a higher expected return to compensate for the tax burden

[3] Proof of this is provided in Appendix A of Long (1977).

associated with the dividend.

Substituting this condition into the investor demand equation yields the following relationship between pre-tax portfolio dividend yields and beta:

$$\delta_p^i = \frac{b_0^i + b_1^i \gamma_0 + b_1^i \gamma_1 \beta_p}{1 - b_1^i \gamma_2} \tag{2.5}$$

This equation implies a linear relationship between efficient portfolio dividend yields and portfolio risk, with the nature of this relationship (i.e., the slope and intercept of this line in dividend-risk space) determined by the relative dividend and capital gains tax rates. For a given level of risk, the compensation required for a higher dividend yield is positively related to the differential in tax rates on dividends and capital gains.[4]

2.3 Jobs and Growth Tax Relief Reconciliation Act of 2003

The Jobs and Growth Tax Relief Reconciliation Act of 2003 contained two major components relevant to this study. The first is reductions in long-term capital gains tax rates. The top capital gains marginal tax rate fell from 20% to 15%, while the 10% rate for lower-income individuals fell to 5% (and to zero percent in 2008). The second is that qualified dividends were now taxed at the same statutory rate as capital gains, rather than at the ordinary income marginal tax rate.[5] As a result, the top marginal tax rate for dividends fell from 35% to 15%, and from 10% to 5% for lower income individuals.[6] This change was applied to dividends from directly held equities and those passed through by a mutual fund or other regulated investment company, partnership, REIT, or common trust fund.

[4] Without taxes, the "two-fund theorem" states that all investors hold some combination of riskless bonds and the market portfolio, where the proportion in each is determined by risk preference.

[5] Dividends from most foreign corporations, credit unions and banks were excluded from "qualified" dividend income. Non-qualified dividends remained taxed as part of ordinary income.

[6] Taxpayers on the Alternative Minimum Tax schedule also benefited from the reduction by facing a reduction from the 28% flat rate to 15%.

Changes to statutory tax rates on capital gains and dividend income are depicted in Figure 2.2. Prior to the 2003 tax act, high-income individuals had a strong tax incentive to receive equity returns in the form of capital gains rather than dividends. Thus, portfolio dividend yields for high-income households are predicted to be lower than those for low-income households. The 2003 tax act completely closed the gap between dividend and capital gains tax rates, making dividend income more attractive for all households. That the change in the tax treatment was dramatic at high levels of income is also clear in Figure 2.2. Thus, portfolio dividend yields for higher-income households are predicted to grow by relatively more than those for lower-income households, *ceteris paribus*. It is this differentially dramatic decrease in the tax treatment of dividend income that is used to identify the effect of dividend and capital gains tax rates on household equity portfolio choices.

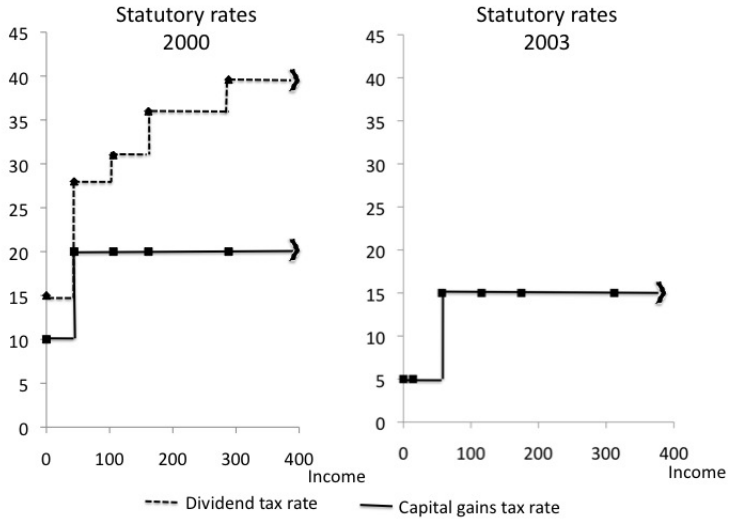

Figure 2.2: Statutory tax rates: Married couples filing jointly

2.4 Survey of Consumer Finances

In the main analysis, I use data from the 2001 and 2004 Surveys of Consumer Finances (SCF), a triennial survey conducted by the Federal Reserve Board of Governors that provides repeated cross-sectional data on wealth in the United States.[7] In analyzing the longer term household response to the 2003 tax act, I also use 2007 SCF data. The SCF contains detailed household-level information on assets and liabilities, which makes it one of the best data sources for studying household portfolios. The data additionally contain rich information on demographic characteristics and attitudes towards risk and credit.

The SCF includes 4,442 households in the 2001 sample, 4,519 in the 2004 sample and 4,418 in the 2007 sample. The sampling methodology of the SCF has two parts to improve coverage of U.S. households. One sample frame is from an area probability weighted sample derived from the Census Bureau's national sampling frame. The second frame is derived from the IRS Statistics of Income Individual Taxpayer File and is used to oversample high-income households. The oversampling of these households is important for identifying clientele effects since financial asset holdings are concentrated at the top end of the income distribution. Indeed, according to the 2001 SCF, 60.6% of families in the top 10th percentile of the income distribution held stocks, while only 3.5% of families in the bottom 20th percentile held stocks. In 2004, the percentages are 55.0% and 5.1%, respectively (Bucks, Kennickell and Moore 2006). Sampling weights are provided so estimates can be weighted to represent the U.S. household population in each year. The weighted sample represents 106.5, 112.1 and 116.1 million households in the 2001, 2004 and 2007 samples, respec-

[7] Panel data would allow me to observe household-specific changes in portfolios in response to the tax reform. While the SCF contains a panel component for the 1983 - 1989 waves, it does not for the period considered. That the SCF is repeated cross-sectional data rather than panel data does not change the interpretation of the parameter estimates (Heckman and Robb 1985).

tively. All summary statistics and regressions presented in this paper are weighted using the sampling weights. Missing values are replaced using a multiple imputation technique. These multiple imputations improve the efficiency of the point estimates by increasing the sample size, but as with any imputed values, require that the missing observations be conditionally random. All summary statistics, regressions and their standard errors are corrected for multiple imputations.[8]

The dependent variable is a household's portfolio dividend yield, defined as the ratio of the dollar value of dividend income to the dollar value of taxable equity. This measure represents a household's weighted-average dividend yield on its taxable equity. Dividend income is the dollar amount of ordinary dividend income received from stocks in taxable accounts in the previous calendar year.[9] Taxable equity is the sum of stocks held directly, stocks held through mutual funds, and stocks held in trusts, annuities, or other managed investment accounts. Equity held in mutual funds is the sum of the full value of stock mutual funds and half the value of combination mutual funds. The full value of other managed assets is included if it is mostly invested in stock, half the value if it is split between stocks and bonds, or stocks and money market accounts, and a third of the value if it is split between stocks, bonds, and money market accounts. The dollar value of equity is the market value at the time of interview, conducted in the second half of the survey year.[10] Stocks held in 401Ks, IRAs or other qualifying retirement accounts, as well as dividend income received from such securities, are not included in this measure. This exclusion is

[8]See Kennickell (1998) for an overview of the multiple imputation methodology. The SCF codebooks describe methods to correct for multiple imputations to account for observations not being independent across imputations.

[9]This value should correspond to item 9 on IRS form 1040 in 2000 and item 9a on IRS form 1040 in 2003/2006, and reported on a 1099-DIV.

[10]The 2001 SCF was conducted between May and December 2001, while the 2004 SCF was conducted between June 2004 and February 2005. The difference in timing may bias the yield measure if the equity holdings at the time of the survey are not representative of the equity holdings from which the dividend income was drawn. Unfortunately, there is no information in the survey that informs on the direction of this bias. Small denominator values may create outliers, so sensitivity checks to the influence of outliers are provided in the analysis.

important because the tax rate reductions for dividends do not apply to equities in tax-deferred accounts. However, I am unable to identify if 2004 dividend yields contain stocks shifted between taxable and tax-deferred accounts. All components are adjusted to 2004 dollars.

To compute marginal tax rates on dividends and capital gains, I construct household adjusted gross income and deductions information from variables provided in the SCF. Then, I pass a flat file of these variables through the National Bureau of Economic Research's TAXSIM web program to compute statutory federal marginal tax rates.[11] The *effective* tax rate on long-term capital gains is lower than the statutory rate because taxes on capital gains are deferred until they are realized and because capital gains that are accrued until death qualify for a "basis step-up," which excuses the tax liability on such gains. I compute effective long term capital gains tax rates following (King and Fullerton 1984), who argue that the statutory tax rate on capital gains should be halved to account for the option value of tax-deferral, and halved again to account for the step-up basis at death and the selected realization of losses.[12]

Figure 2.3 is a plot of the average effective dividend and capital gains tax rate by income percentile computed from the two samples. This figure shows that the treatment effect is larger for high income households than for lower income households. Because the dividend clientele hypothesis regards the relative tax treatment of dividend income and capital gains, I use the difference in effective dividend and

[11] Stata programs that convert SCF data into variables required for TAXSIM are available at the NBER website. A detailed description of the implicit assumptions about income and family structure in this procedure is included in Appendix A. The TAXSIM programs are found at `http://www.nber.org/~taxsim/to-taxsim/`. See Feenberg and Coutts (1993) for a description. State tax rates are a potentially useful source of tax rate variation. However, to maintain anonymity, state identifiers are omitted from the public SCF datasets so this information cannot be used.

[12] Ivkovic, Poterba and Weisbenner (2005) use individual stock holding data to estimate the effective capital gains tax rates for various stock holding patterns, prospective appreciation rates, and whether stocks were held in taxable or non-taxable accounts. Various assumptions provide a wide range of simulated effective tax rates. They do not have demographic information that might predict effective tax rates, so I use the long-established convention of using 25% of the statutory rate to measure the effective capital gains rate.

capital gains marginal tax rates as the main regressor of interest.[13] The gap between the two lines represents the absolute tax disadvantage of dividends.

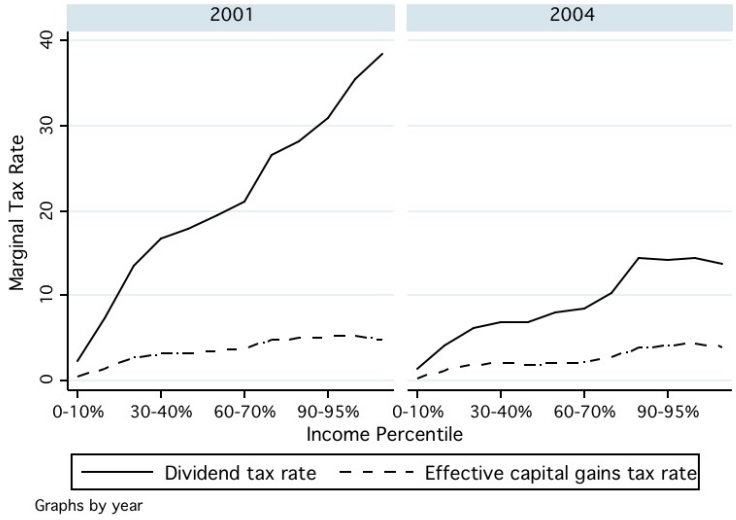

Figure 2.3: Empirical tax rate distribution

The validity of using estimates from the SCF surveys to infer the effect of the 2003 tax act depends in part on the timing of the tax changes and the surveys. Auerbach and Hassett (2007) document the key events leading to the 2003 tax act. Reductions in dividend tax rates were not seriously discussed prior to December 2002, suggesting that there was no anticipation of such a tax change before that time.[14] Notably, capital income tax rate cuts were not part of the 2000 Bush campaign platform. Since dividend income reported in the 2001 SCF sample are derived from equity holdings in 2000, these data are not impacted by the 2003 tax act. By the beginning of 2003, however, households and corporations knew that there was a significant probability that dividends would face a lower tax rate and that when a

[13]This is the numerator of the tax rate variable described in equation 2.3. I use this measure because it nicely captures the relative tax disadvantage of dividends. This is the same tax variable used in Scholz (1992).

[14]The first notable mention of the reductions in the press occurred on December 25, 2002, when the Wall Street Journal reported that the Bush administration planned to reduce dividend tax rates by 50 percent. On January 6, 2003, the Wall Street Journal announced the Bush administration's plans to eliminate dividend taxes. Reductions to capital gains and dividend tax rates were officially proposed on January 7, 2003 by the Bush administration. The Conference Committee version of the 2003 tax act passed the House and Senate on May 23, 2003, and was signed into law on June 20, 2003.

tax act was passed, the tax cuts would be applied retroactively to the beginning of 2003. The 2004 SCF contains information on dividend receipts from 2003, which are clearly impacted by the 2003 tax act. When the 2003 tax act was first passed, the reduced tax rates were set to expire in 2008. However, the Tax Increase Prevention and Reconciliation Act of 2005 extended the reduced tax rates on dividends and capital gains through 2010.

A number of demographic characteristics are used to control for non-tax factors in the regression analysis that may influence household choices over portfolio dividend yields. Age categories, an indicator variable for being retired, and educational attainment categories are constructed to correspond to the head of household. Net worth categories and household size are computed for the household unit. Responses to a question about the "amount of financial risk that you or your (spouse/partner) [are] willing to take when you save money or make decisions" are used to construct proxies for risk preference. The risk-aversion indicator variable is set to one if respondents answered that they were "not willing to take financial risks," and zero otherwise. The "'moderate risk", "high risk" and "very high risk" indicator variables equal one if the respondent answered that they were willing to "take average financial risks expecting to earn average returns", "take above average financial risks expecting to earn above average returns", and "take substantial financial risks expecting to earn substantial returns" respectively, and zero otherwise. Summary statistics of these variables are presented in Table 2.1.

SCF data are self-reported, so measurement error may be of concern, particularly for sensitive data items such as components of wealth. Measurement error may arise when individuals have to sum up values over several financial accounts or because people are unwilling to accurately report such items. As an overall check

Table 2.1: Summary statistics of demographic and socioeconomic variables

Variable	2001	2004	2007
Share of SCF Sample			
Income (thousands)			
0-15	0.14	0.14	0.13
15-25	0.11	0.12	0.13
25-50	0.27	0.26	0.27
50-75	0.16	0.18	0.17
75-100	0.12	0.10	0.11
100-250	0.15	0.17	0.16
250+	0.03	0.03	0.04
Net worth (thousands)			
0-50	0.38	0.38	0.36
50-100	0.12	0.11	0.10
100-250	0.19	0.18	0.19
250-1000	0.23	0.23	0.25
1000+	0.09	0.09	0.09
Demographic characteristics			
No degree	0.09	0.09	0.09
High school degree	0.31	0.30	0.32
Some college but no college degree	0.18	0.18	0.18
College degree	0.34	0.37	0.35
Not willing to take financial risks	0.40	0.42	0.42
Female	0.27	0.28	0.28
Married	0.60	0.58	0.59
Household size	2.41	2.39	2.42
Retired	0.19	0.19	0.19
Average Age	48.97	49.56	50.01
Number of households (millions)	106.5	112.1	116.1
Number of observations	4519	4442	4418

Observations are weighted by their sampling weights. Financial data are in 2004 dollars. Demographic characteristics refer to the head of household. Statistics are corrected for multiple imputations.

of the dividends data, I compare dividend income reported in the SCF with that reported on tax returns provided by the IRS Statistics of Income (SOI) Tax Statistics publications. Unweighted, the dividend income reported in the SCF account for approximately 1% of dividend income reported on tax returns. In the SOI data, 26.3% and 23.3% of tax filers report that they received dividend income in 2000 and 2003, respectively. Of the SCF households, only 16.8% and 15.5% report positive dividend income in the 2001 and 2004 surveys, respectively. This difference could reflect that some households with relatively little dividend income do not remember such income or think it is not important enough to report. In the SOI, individuals report $142 and $111 billion in dividend income in 2000 and 2003, respectively, whereas the SCF accounts for $108 and $107 billion in the 2001 and 2004 surveys, respectively. In the aggregate, the SOI and SCF data provide information that is fairly consistent, though substantial measurement error at the individual level may remain.[15] In the remaining analysis, I implicitly assume that measurement error is time invariant conditional on treatment group, which allows the main estimates to remain consistent.

Before turning to the empirical models, I report on some patterns in dividend yields in the data. Interestingly, many equity-holding households report that they receive zero income from dividends. In fact, 55.7% and 57.4% of equity-holding households are computed to have a zero dividend yield in 2001 and 2004, respectively.[16] Thus, when considering portfolio dividend yields, there will be a mass point at zero. The proportion of equities held and dividends received by income percentiles is presented in Table 2.2. The percentage of dividends received by households in the

[15] Antoniewicz (1996) compares the SCF with the Federal Reserve's Flow of Funds (FOF) data, which are based off reports by financial institutions, and finds that the two are fairly consistent after adjusting for differences in variable definitions.

[16] Information on publicly traded stocks from CRSP reveals that between 75% to 80% of publicly traded stocks do not pay dividends.

top 5% increased substantially between the 2001 and 2004 surveys while the percentage of equities remained roughly the same. This provides evidence that denominator effects are not driving the regression results to follow. Regardless, dividend clientele effects are about the ratio of dividend income to equity holdings, so predictions about dividend clienteles remain the same even if equity valuations changed. Table 2.2 also presents information about the percentage of income that was received from dividends from the SCF samples. This provides casual evidence that the highest income households increased their dividend income by relatively more than lower-income households.

Table 2.2: Dividend receipts and equity holdings by income

Income	Percentage of total dividends			Percentage of total equity			Dividends as a percent of income		
Percentile	2001	2004	2007	2001	2004	2007	2001	2004	2007
0-10	1.21	0.98	0.84	0.80	0.97	1.49	1.42	0.90	0.47
10-20	0.57	0.35	0.60	0.60	0.41	0.64	0.43	0.28	0.54
20-30	1.57	1.20	1.19	0.90	1.01	1.04	0.74	0.46	0.63
30-40	2.30	0.88	0.93	2.28	1.84	2.70	0.70	0.28	0.30
40-50	3.31	1.15	1.87	1.85	2.23	1.45	0.97	0.28	0.60
50-60	5.18	3.30	1.29	3.48	3.93	1.80	1.13	0.70	0.31
60-70	6.13	4.93	4.58	5.82	5.98	4.30	0.96	0.73	0.94
70-80	4.33	4.23	6.34	6.34	5.99	7.57	0.53	0.50	0.92
80-90	10.54	6.45	8.60	9.86	7.96	7.12	1.04	0.59	0.91
90-95	13.39	7.36	5.44	10.89	8.61	6.89	1.88	0.88	0.84
95-99	23.59	26.64	24.92	28.58	24.69	25.14	2.09	2.15	2.14
99-100	27.88	42.53	43.39	28.59	36.39	39.86	2.03	3.32	3.08

Source: Author's calculations using SCF data. Observations are weighted by their SCF sampling weights. Statistics are corrected for multiple imputations.

2.5 Econometric methodology and results

To examine the existence of tax-based dividend clienteles, I consider the relationship between household portfolio dividend yields and tax rates. Because I am interested in the mix of equities that households choose to hold, rather than the choice of whether to hold equities, I focus on equity-holding households in the main

analysis. Additionally, I exclude 7 observations with dividend yields of over 1000%.[17] I use several other cut-off values in the sensitivity analysis to ensure that the main estimates are robust to this choice. Since many equity-holding households do not receive dividend income, there is a mass point in the dependent variable at zero. I treat these observations with dividend yields equal to zero as households for whom no dividend income is preferred to receiving some. This suggests a censored regression model (Type II Tobit) that Wooldridge (2002) calls the "corner solution model" because there is a mass point that results from household optimization.

The estimating equation for the treatment effects model of the effect of taxes on portfolio dividend yields that incorporates the Tobit framework is given by:

$$\begin{aligned} Y_{it}^{*} &= X_{it}\beta + \alpha\tau_t(x_{it}) + \varepsilon_{it} \\ Y_{it} &= \max\{0, X_{it}\beta + \alpha\tau_t(x_{it}) + \varepsilon_{it}\} \end{aligned} \tag{2.6}$$

where Y^* is the latent (uncensored) dividend yield, Y is the observed (censored) dividend yield, i corresponds to the household and t denotes the time period. The vector X contains factors other than taxes that may affect household choices over dividend yields. The continuous treatment variable is $\tau_t(x_{it})$, the difference in dividend and capital gains marginal tax rates. It is a function of various household characteristics, such as income, marital status, and family structure. The vector x contains a subset of X. Note that the tax function is indexed only by t because all households face the same tax schedule at a given point in time. That is, two households with the same values of x_{it} face the same tax rates.

The parameter of interest is a function of α, the effect of the tax treatment on portfolio dividend yields. Specifically, because this is a corner solution model the

[17] These large outliers likely arise because some households who received dividend income in the year prior to the survey liquidated their equity holdings by the time of the survey. When excluding households with yields over 1000%, the maximum dividend yield is 650%.

marginal effect of interest is that on the observed dividend yield. In principle, α could be identified from a single cross-section of data because it enters the equation linearly and the tax schedule is nonlinear (Scholz 1992). Such identification is weak, however, and thus undesirable in practice. Because all households face the same tax system at a given point in time, two households with the same level of income will face different tax rates only through differences in other characteristics. When variations in economic situations, such as income levels and family structure, are the driving source of variation in marginal tax rates that a household faces, it is difficult to disentangle income effects (and other factors that are correlated with income) from pure tax effects in a single cross-section. Identification of the tax effect is achieved only through the nonlinearities in the tax schedule, which is typically weak in practice. For example, if income impacts dividend yields nonlinearly but we only include the level of income in the regression, then the nonlinearity in the tax schedule used to identify the tax effect is partly due to the nonlinearity of the income effect, and so would confound income effects and tax effects.

Instead, the 2003 tax act provides exogenous variation in tax rates that can be used to identify α. Because the SCF is a repeated cross-section rather than a panel, we cannot follow the same individuals over time. Assuming that the two cross-sections are independent, which likely holds given the sampling design of the survey, we can pool the data across the periods and estimate α:

$$\begin{aligned} Y_{i,s}^* &= \alpha[\tau_{2003}(x_{i,2004}) - \tau_{2000}(x_{i,2001})]\mathbb{I}(SCF = 2004) + \alpha\tau_{2000}(x_{i,2001}) \\ &\quad + \eta\mathbb{I}(SCF = 2004) + X_{i,s}\beta + \varepsilon_{i,s} \\ Y_{i,s} &= \max\{0, Y_{i,s}^*\}, \quad s \in (2001, 2004) \end{aligned} \tag{2.7}$$

where $\mathbb{I}(SCF = 2004)$ is an indicator variable that equals one if the observation

is from the 2004 SCF and zero if the observation is from the 2001 SCF. Note that the year subscripts for the tax function, τ, and its inputs, x, differ by one year to reflect that the survey data contains income information for the previous calendar year. Conditional on the observed variables, α is identified from people with the same vector of X characteristics facing two different sets of tax rates because of the 2003 tax act.

The post-treatment indicator variable, $\mathbb{I}(SCF = 2004)$, controls for the average difference in portfolio dividend yields across SCF samples. This is important because there is a well-documented increase in the supply of dividends following the 2003 tax act (Chetty and Saez (2005) and Brown et al. (2004)). Perhaps most notably, Microsoft initiated a dividend payment for the first time immediately following the 2003 tax act. Such changes in dividend policies affect market prices, so dividend yields are expected to change between the two samples. That firms altered dividend policies and market prices changed in response does not affect the interpretation of the tax effect. This is because the dividend clientele hypothesis regards differences in portfolio dividend yields across investors. It does not matter if the response to the 2003 tax act comes through changes in the numerator or denominator of the dividend yield measure since either reflects the types of equities that a household chooses to hold.

Because households can affect their tax rates through their portfolio dividend yield choices, the actual difference in marginal tax rates on dividends and capital gains is endogenous. To solve this endogeneity problem, I use instrumental variable techniques to consistently estimate α. Moffitt and Wilhelm (2000) show that when a tax reform changes tax rates by different intensities across groups, a valid grouping variable for a difference-in-differences analysis can instrument for the change in tax

rates. The 2003 tax act provides both a natural experiment and a grouping variable. Educational attainment is correlated with permanent income, and thus marginal tax rates (Eissa (1996b), Blundell, Duncan and Meghir (1998), and Moffitt and Wilhelm (2000)).[18] Because it is unlikely that households manipulated their choice of education in response to the 2003 tax act, particularly in such a short time frame, educational attainment is uncorrelated with transitory income and with behavioral responses to the tax change. I use an indicator for whether the household head has a college degree as the difference-in-differences grouping variable.[19] Thus, one of the key identifying assumptions is that non-tax factors that influence dividend yield choices did not change differentially by treatment group across the 2003 tax act.

The estimated model is Amemiya's generalized least squares estimator for a limited dependent variable with endogenous regressors (Amemiya (1978), Amemiya (1979)), described by the following system:

$$\begin{aligned} Y^*_{i,s} &= \alpha[\tau_{2003}(x_{i,2004}) - \tau_{2000}(x_{i,2001})]\mathbb{I}(SCF = 2004) + \alpha\tau_{2000}(x_{i,2001}) \\ &\quad + \eta\mathbb{I}(SCF = 2004) + X_{i,s}\beta + \varepsilon_{i,s} \\ Y_{i,s} &= \max\{0, Y^*_{i,s}\}, \quad s \in (2001, 2004) \\ \tau_s(x_{i,s}) &= \gamma_0 + \gamma_1\{college * \mathbb{I}(SCF = 2004)\}_{i,s} + \gamma_2\mathbb{I}(SCF = 2004)_{i,s} + X_{i,s}\xi + u_{i,s} \end{aligned} \tag{2.8}$$

where *college* is an indicator variable that equals one if the head-of-household has at least a college degree, and zero otherwise. The interaction term $college * \mathbb{I}(SCF = 2004)$ instruments for receiving the high tax treatment of the 2003 tax act. Note that

[18] For an example of how difference-in-differences has been used to examine the impact of a tax policy, see Eissa (1996a) and Heckman's (1996) response to Eissa (1996a).

[19] If this endogeneity is ignored, the estimated tax effect will be biased upwards (towards zero) because households may reduce their dividend income to reduce their tax liability. Indeed, when I use actual marginal tax rates in the main regressions, the estimated tax effect is closer to zero (and sometimes even positive), though no longer statistically significant.

college is included in the vector X and proxies for the average difference in financial sophistication across treatment groups. The model is estimated by maximum likelihood where the estimating equation is equation 5.6 in Newey (1987).

The variables included in X are used to control for other non-tax factors that may affect household portfolio dividend yields. This is important because the composition of households in each group may differ over time. Including these characteristics also improves the efficiency of treatment effect estimates by reducing the residual variance of the regression. First, life-cycle models predict that older individuals and those with a greater need for a steady income flow will prefer steady dividend payments to finance consumption (Shefrin and Thaler 1988). To account for such preferences, I include age categories, an indicator variable for whether the household head is retired, and household size (level and square).[20] Transaction costs associated with liquidating stock to realize capital gains may cause individuals to prefer the consistency of dividend payments (Leape 1987). Because the importance of transaction costs is likely a function of the size of such costs relative to overall wealth, I include net worth groups in the estimation. In addition, information costs associated with acquiring an asset may be important for portfolio choices. Educational attainment measures are used to proxy for the importance of information costs and financial sophistication. Lastly, risk-averse households may prefer to receive payments in the relatively consistent form of dividends, rather than be subject to price fluctuations in capital markets. Risk preference proxies derived from self-reports of the household's willingness to participate in financial markets are used.

[20]Shefrin and Statman (1984) argue that some investors maintain separate "mental accounts" for dividend income and capital gains because of self-control problems or regret aversion. This effect cannot be identified in SCF data. Theories of why firms pay dividends may also be informative. If dividends alleviate agency problems between firms and investors (Jensen and Meckling 1976) or signal the future profitability of a firm (Bhattacharya (1979) and Bernheim (1991)), investors with high marginal tax rates may prefer high dividend-yield securities despite their tax disadvantage.

Figure 2.4 presents average portfolio dividend yields by education group and year, weighted by both SCF sampling weights and the value of equity holdings. Weighting by equity valuations dampens the influence of outliers caused by small equity holdings. This figure provides suggestive evidence for the dividend clientele hypothesis. In the 2001 sample, when dividends are very tax disadvantaged for high income individuals, the no college group has a higher dividend yield than the college-educated group. This is consistent with the sorting predicted by the dividend clientele hypothesis. The 2003 tax act reduced the relative tax disadvantage of dividends for all individuals, but especially for high-income households. In the 2004 data, the dividend yield pattern is reversed so that college-educated households increased their dividend yields by more than households without a college degree. In the aggregate, the group average yields are supportive of the dividend clientele hypothesis.

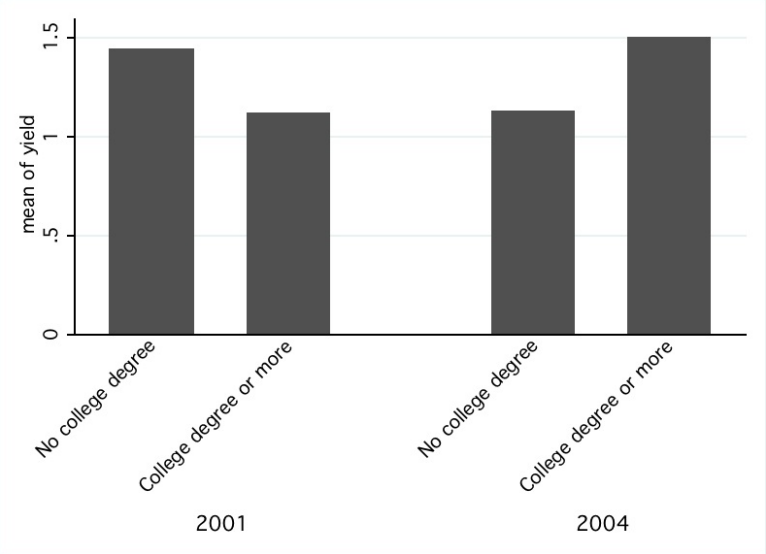

Figure 2.4: Portfolio dividend yields by educational attainment, 2001 and 2004

As a basic check of the validity of using educational attainment measures as a grouping variable, Table 2.3 provides summary statistics for households by education class and year. The difference in tax treatment intensities is preserved by the

grouping variable, suggesting that the instrument is relevant for the endogenous tax rate variable. Table 2.3 also provides the p-value for a test that a characteristic evolves differentially across groups. This is the p-value on β_2 in the following difference-in-differences regression:

$$characteristic_{i,t} = \beta_0 + \beta_1 college_{i,t} + \beta_2 college * \mathbb{I}(SCF = 2004)_{i,t} + u_{it} \qquad (2.9)$$

Importantly, these characteristics are not changing differentially across groups in the two samples. The statistically different change in tax rates does not appear to be due to differential changes in income. Additionally, the proportion of households in each group is stable, so considering the sample of equity-holding households in each education class also appears to be appropriate.

Table 2.3: Characteristics of equity-holders, medians by education group

	No college degree		College degree		p-value on
	2001	2004	2001	2004	diff-in-diff
Tax differential	15.8	7.1	22.3	10.0	0.00
Income (thousands, median)	58.9	60.0	103.4	104.3	0.34
Percent with dividend income	34.9	32.3	51.2	49.4	0.85
Not willing to take financial risk	20.1	22.9	8.1	8.6	0.49
Percent married	68.0	63.8	75.3	72.3	0.83
Percent retired	25.3	28.7	16.0	16.9	0.57
Age	51.4	54.6	49.8	51.0	0.23
Household size	2.3	2.3	2.6	2.5	0.47
Number of observations	608	533	1387	1429	

Each observations is weighted by its SCF sampling weight. Statistics are corrected for multiple imputations. Demographic characteristics correspond to the head of household. The p-value for test for differences in income corresponds to a test of differences in mean income.

Because this analysis focuses on equity-holding households, the assumption that the composition of groups is stable across periods may be violated. Indeed, several studies find that taxes influence stock ownership probabilities (Poterba and Samwick (2002), King and Leape (1998)). To test whether the 2003 tax act altered the population of equity-holders, I estimate a difference-in-differences probit for the probability of holding equities. Table 2.4 presents results from this estimation. The parameters

of interest, the coefficients for $college * y04$ and $y04$, are not statistically significant and I fail to reject the null hypothesis that equity-holding households did not change across the two periods. Thus, changes in dividend yields across treatment groups are not likely to be due to the 2003 tax act causing new households to enter equity markets.

Table 2.4: Probit model for holding equities

Dependent variable: whether the household has equities			
Variable	Estimated Marginal Effect	Std. Error	p-value
College * y04	-0.01	0.02	0.58
College	0.11	0.02	0.00
SCF = 2004	-0.01	0.01	0.41
Retired	0.04	0.02	0.05
Married	0.05	0.02	0.00
Household size	-0.06	0.02	0.00
Household size (squared)	0.01	0.00	0.00
Net worth 50,000-100,000	0.10	0.02	0.00
Net worth 100,000-250,000	0.17	0.01	0.00
Net worth 250,000-1,000,000	0.31	0.01	0.00
Net worth >1,000,000	0.56	0.02	0.00
Not willing to take financial risk	-0.22	0.01	0.00

Presented estimates are average marginal effects. Standard errors are heteroskedasticity robust. Observations are weighted by their SCF sampling weights. Estimates are corrected for multiple imputations. Age categories are included but estimates are not reported. None are statistically significant. The full table of results is available upon request.

The validity of a difference-in-differences approach relies on the assumption that the growth rate of the dependent variable would be equal across groups in the absence of treatment. Otherwise, the estimated treatment effect may partly reflect other differences across groups. Figure 2.5 presents household portfolio dividend yields by education groups from the 1992, 1995, 1998 and 2001 SCF samples. The trends in dividend yields look quite similar between the two groups.[21] To test this more formally, I run a regression of portfolio dividend yields on a linear trend, a dummy variable for whether or not the head of household has a college degree, and the

[21] The decreasing trend in dividend yields is consistent with the well-documented reduction in firm dividend payments in favor of share repurchases as a means of distributing profits to their shareholders.

interaction of the college indicator variable and the linear trend:

$$yield = \beta_0 + \beta_1 trend + \beta_2 college + \beta_3 college * trend + \varepsilon. \tag{2.10}$$

A test for the difference in slope coefficients for the two groups over time is equivalent to a test that the coefficient on the interaction term (β_3) is zero. In this regression, the p-value for the test that β_3 is zero is 0.98 and I fail to reject the null.[22]

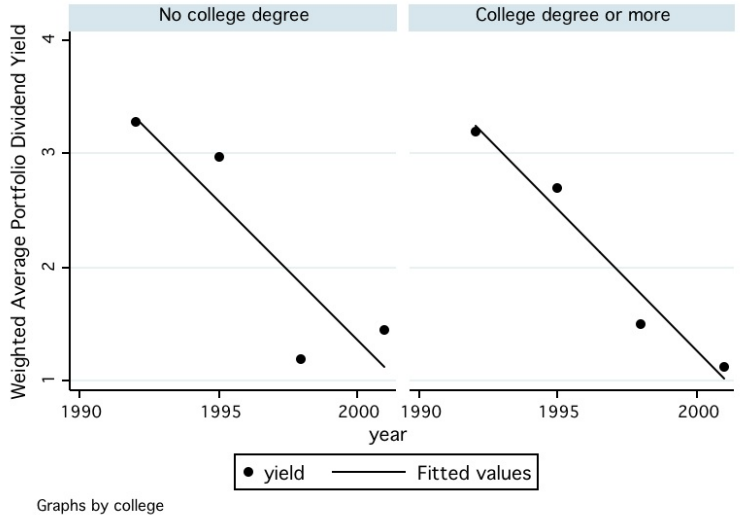

Figure 2.5: Trends in portfolio dividend yields by educational attainment group

While nonlinear instrumental variables models are not literally estimated in two stages, I run what would be the first stage regression in the linear case to ascertain the instruments' strength. Table 2.5 shows select results from this estimation. Because of the different intensities of the 2003 tax changes, we should expect that college-educated households experienced a larger decrease in the tax differential than those without a college education. Indeed, the parameter estimate on the treatment effects variable is negative and statistically significant. The F-statistic for the exclusion restriction is 28.45. Because the critical value of a 5% Wald test is 16.38,[23] the

[22] When allowing for a quadratic trend differences in trends across the two groups remains statistically insignificant. The p-values on the linear and quadratic trend-interaction terms are 0.35 and 0.34, respectively.

[23] See Stock and Yogo (2002) for critical values for a test of weak instruments.

hypothesis that the high treatment indicator is a weak instrument is rejected. To test that using the instrumental variables techniques is necessary, I perform the test of exogeneity for the Tobit model proposed by Smith and Blundell (1986).[24] The null hypothesis that all the regressors are exogenous is rejected at the 5% level.

Table 2.5: "First-stage" regression results

Dependent variable: Dividend and capital gains tax rate differential

Variables	Est. Coeff.	Std. Error	p-value
College * 2004	-3.55	0.68	0.00
2004 SCF dummy	-8.58	0.55	0.00
College	4.14	0.65	0.00
Constant	12.30	1.14	0.00
Observations		3965	
R-squared		0.48	
F-statistic for instrument		28.45	
F-statistic for model		154.84	

All observations are weighted by their SCF sampling weight. Standard errors are heteroskedasticity-robust and are corrected for multiple imputations. Other controls are included in the regressions but not reported: age and net worth categories, household size (level and square), indicator variables for head being retired/married, and risk preference proxies.

Table 2.6 presents the average marginal effect of the covariates on observed dividend yields derived from the instrumental variables Tobit regression results.[25] According to the dividend clientele hypothesis, as dividends become more tax-disadvantaged relative to capital gains (i.e., the dividend and capital gains tax rates differential, τ, becomes larger), households choose to hold equities with lower dividend yields. Indeed, the coefficient on the dividend and capital gains tax rate differential is negative and statistically significant at the 5% level.[26] To interpret the year effect, its magnitude must be calibrated against the average effect of the change in tax rates,

[24] This test expresses the suspected endogenous regressors as a linear projection of the instruments, and the residuals from that regression are added to the original model. If the model is correctly specified and the regressors are exogenous, the residuals from the first-stage should have no explanatory power in the second-stage regression.

[25] This is the appropriate marginal effect from the Tobit model because an observed zero dividend yield is the result of a choice rather than censoring. This marginal effect is computed as $\Phi(\frac{X\beta}{\sigma})\beta_j$. See Cameron and Trivedi (2006) pp. 541-542 for a derivation.

[26] Excluding the net worth categories, the parameter estimate on the tax rate differential effect is -0.33 (std. error = 0.16). Two survey questions ask how intensely households search for the best terms when making savings and investment decisions. When including proxy variables for "shopping intensity" constructed from these questions, the parameter estimate on the tax rate differential is roughly the same at -0.30 (std. error = 0.14) and the shopping variables are not significantly different from zero.

3.87. This is because one of the macroeconomic factors that changed between the two samples is the tax schedule. Thus, the average change to *observed* portfolio dividend yields across the two samples is very close to zero at -0.18 percentage points. To gauge the magnitude of this effect, note that the dividend yield on the S&P 500 index increased from 1.23% to 1.61% between 2000 and 2003.

Table 2.6: Instrumental variable Tobit results

Dependent variable: Portfolio dividend yield
Instrumental variable: $College * y04$ (High treatment indicator)

Variable	Estimated Marginal Effect Effect	Std. Error	p-value
Tax differential	-0.31	0.14	0.03
Age 25-35	3.94	1.81	0.03
Age 35-45	4.51	2.2	0.04
Age 45-55	5.42	2.69	0.04
Age 55-65	5.15	2.5	0.04
Over 65	4.92	2.29	0.03
Retired	-0.79	0.92	0.39
College	1.87	0.88	0.03
Net worth 50,000-100,000	-0.35	1.32	0.79
Net worth 100,000-250,000	0.05	1.23	0.97
Net worth 250,000-1,000,000	2.58	1.4	0.07
Net worth >1,000,000	5.06	2.18	0.02
Not willing to take financial risk	-1.79	1.12	0.11
Willing to take average financial risk	-0.34	0.6	0.57
Willing to take high financial risk	0.05	0.64	0.94
SCF = 2004	-4.05	1.74	0.02
Constant	-3.07	1.54	0.05
Number of observations		3956	
Number of uncensored observations		2379	

Marginal effects are effects on observed dividend yields. Standard errors are computed using the Delta Method and are heteroskedasticity-robust. Observations are weighted by their SCF sampling weights. Estimates are corrected for multiple imputations. Included in the regressions but not reported are an indicator for the household head being married and household size (level and square). None are statistically significant at the 5% level.

That the effect of taxes on portfolio dividend yields is statistically significant does not inform upon the economic importance of the dividend clientele effect. To interpret the economic significance of the coefficient on the tax rate differential, first consider the impact of the 2003 tax act on dividend yields of portfolios of households at different tax brackets, summarized in Table 2.7. A household in the highest tax bracket would have faced a decrease in the tax rate differential from 34.6 percentage

points to 11.25 percentage points, leading portfolio dividend yields to increase by 7.24 (=[11.25-34.6]*-0.31) percentage points. On average, macroeconomic factors are estimated to decrease yields by 4.05 percentage points (the estimate of η) for all households between 2001 and 2004. Thus, the predicted change in observed portfolio dividend yields for households in the highest tax bracket is a 3.19 percentage point increase. Relative to an average portfolio yield for households in the top bracket in 2001 of 2.7 percentage points, this is a 115% increase in dividend yields. This constitutes a large and economically substantive response. Similar calculations are done for households in the next two tax brackets, which shows that the tax effect is large and varies substantially with the intensity of the tax treatment.[27]

Table 2.7: Effect of the 2003 tax act for select tax brackets

	Highest Bracket 39.6%	Next Bracket 36 %	Two below 31%
Tax rate differential, 2003	11.25	11.25	11.25
Tax rate differential, 2000	34.60	31.00	26.00
Change in tax rate differential	-23.35	-19.75	-14.75
Predicted change in yields $(\tau_{2003} - \tau_{2000}) * \hat{\beta}_{\tau} + \hat{\beta}_{y04}$	3.1	2.1	0.5
Average yield in 2001 sample	2.7	6.5	2.4
Percent change	115	32	21

Author's calculations based on the regression results in Table 2.6 and SCF data.

The previous exercise provides estimates of the impact of the 2003 tax act at particular points in the tax schedule. However, the realized economic impact of the 2003 tax act is better understood as the average portfolio response weighted by the proportion of households at various points of the income distribution.To obtain this estimate, I take households from the 2001 SCF sample and use TAXSIM to compute the tax rates that they would have faced under the 2003 tax rules. This change between a household's actual tax rates in 2000 and its simulated tax rates for 2003

[27]The parameter estimates are interpreted as the effect of small changes in tax rates. With large changes to tax rates, these simulated responses are only approximations and unmodeled nonlinearities in the response function could make this estimate inaccurate. However, given the nature of the data, this is still the best way to understand the magnitude of the tax effect.

is exogenous to household decisions in response to the 2003 tax act. I use these simulated tax rate changes and the estimated effect of the dividend and capital gains tax rate differential on portfolio dividend yields to compute the household-specific predicted change in dividend yields caused by the 2003 tax act.

Based on these simulations, college-educated households increased their portfolio dividend yields by 4.26 percentage points with an average yield in 2001 of 1.22% (standard deviation of 2.5%), whereas non-college educated households increased their portfolio dividend yields by 3.32 percentage points with an average yield of 2.23% in 2001 (standard deviation of 8.53%).[28] Thus, the treatment effect of the 2003 tax act is a 0.94 percentage point differential response in portfolio dividend yields between educational attainment groups. This estimated effect of the 2003 tax act is both economically significant and of plausible magnitude. Figure 2.6 depicts the actual portfolio dividend yields in 2001 and 2004, along with the predicted dividend yields in 2004 based on these simulations. As before, the predicted dividend yields are the predicted yields scaled by the year fixed effect. The predicted yields broadly match the patterns that are observed in 2004.

The estimated tax effect is a general equilibrium response that captures both changes to investor demands and changes to the supply of dividends. Because the SCF data is a repeated cross-section and does not contain information on the stocks in a household's portfolio, active portfolio rebalancing (i.e., the sale and purchase of stocks) and passive rebalancing (i.e., the equities a household held before the tax act changed payout policies) are empirically indistinguishable. While the mechanism through which portfolio adjustments occur is interesting, it does not affect the

[28] This calculation is $\frac{1}{N}\sum_{i=1}^{N}(\hat{\tau}_i^{2003} - \tau_i^{2000})\hat{\beta}_\tau$, where $\hat{\tau}_i^{2003}$ is the tax rate differential that household i would have faced under the 2003 tax rules, τ_i^{2000} is the tax rate differential for household i in 2000, and $\hat{\beta}_\tau$ is the estimated marginal effect of the tax rate differential on portfolio dividend yields. This is computed for all equity-holding households in the 2001 SCF.

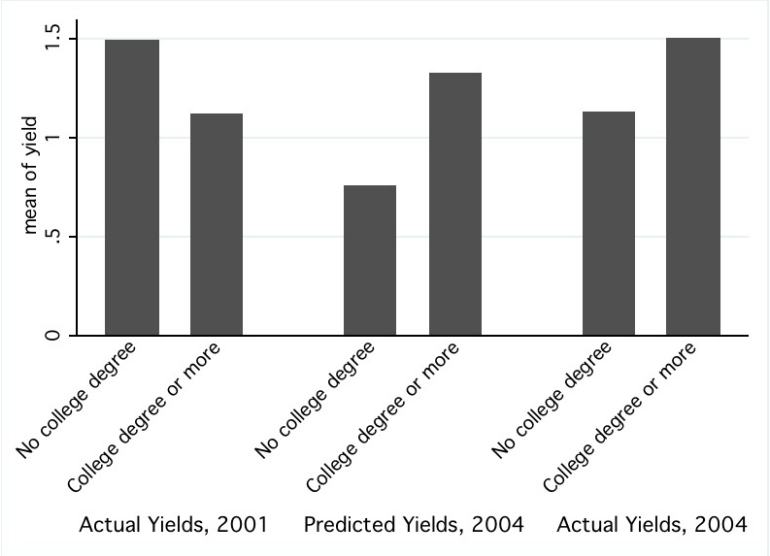

Figure 2.6: Comparing simulated change in portfolio dividend yields with actual yields

interpretation of the tax effect. If portfolio adjustments are costless, households instantaneously adjust their portfolios in response to changes to firm dividend payout policies. In this case, household portfolios in the 2004 SCF reflect optimal portfolios after the 2003 tax act. At the other extreme with infinite adjustment costs, changes to household portfolio yields only reflect changes to firm policies. In this case, the estimated tax effect implies that households sorted according to the dividend clientele hypothesis prior to the tax act and firm responses were targeted at investors who would benefit the most.[29]

The nature of portfolio adjustments likely falls between these two extremes. Indeed, there is evidence for both active and passive portfolio adjustments. Lightner, Morrow, Ricketts and Riley (2008) find that abnormal returns following key events leading to the passage of the 2003 tax act are positively related to an equity's dividend yield. They interpret this result as evidence of active portfolio shifting. In

[29]See Hamada and Scholes (1985) for a discussion of how the tax characteristics of a firm's investors may influence the firm's optimal payout policy. However, the Brav, Graham, Harvey and Michaely (2005) survey of financial executives indicates that managers consider the tax preferences of their investors to be of secondary importance, at best, when making decisions over payout policies.

addition, several investment companies began offering "high dividend yield" mutual funds in 2003, which indicates that there was an ability to increase portfolio dividend yields even through the selection of mutual funds. Chetty and Saez (2005) find that dividend initiations and increases following the 2003 tax act occurred among those firms whose equities were largely held by taxable investors, suggesting that firms were influenced by institutional investor preferences. Thus, the change in household portfolios in response to the 2003 tax act likely contains both active and passive portfolio adjustments.

With transaction costs, lags in portfolio adjustments may bias the longer term treatment effect in either direction. The direction of the bias depends on how the household would adjust their portfolios barring transaction constraints, i.e., towards stocks with higher or lower dividend yields. In addition, there may be differences in adjustment periods across households that are important for understanding the effect of the 2003 tax act. If high-income households adjust their portfolios faster than lower income households, then the estimated treatment effect parameter overstates the long term relative responsiveness of affluent households to taxes. This may happen if high-income households respond faster because they face stronger financial incentive to adjust their portfolios. These households may also be more aware of tax code changes and their implications for optimal portfolio choices.[30] However, these parameter estimates are unbiased estimates of the average treatment effect by the time of data collection.[31]

Aside from tax effects, other parameter estimates are interesting to note. Life-cycle models of clientele formation are supported by the data. The age coefficients

[30]Kezdi and Willis (2003) argue that a lack of financial literacy may cause households to choose suboptimal portfolios. Financial literacy may affect other aspects of portfolio choice, such as adjusting to changes in tax policy.

[31]Date of interview information could be leveraged to examine if portfolio adjustments were lagged and to test whether those with a college degree responded more quickly than those who did not. The date of interview is not contained in the public version of the Survey of Consumer Finances, however.

are all positive and statistically significant, and importantly are increasing in age. This is consistent with the hypothesis that older individuals prefer a steady stream of payments to finance their consumption. The estimated age effect could in part reflect a cohort effect. For example, those born before 1939 (i.e., those who are 65 years or older at the time of the 2004 survey) may prefer steadier flows of income from dividends because of experiences during the Depression.

High educational attainment and high net worth have a positive and significant effect on dividend yields. This relationship is consistent with signaling models in which firms pay dividends to attract more sophisticated investors. To the extent that education and investment sophistication are correlated, these results are consistent with empirical evidence that unsophisticated investors trade too frequently. Risk measures do not statistically significantly influence portfolio dividend yields. Risk preferences might matter more for a household's allocation of wealth between debt and equity, rather than the types of equity that it chooses to hold. Also, self-reported measures of risk preferences may not accurately reflect cross-sectional differences across households.

Because older households may be more financially sophisticated due to prolonged experience with financial markets, older college-educated households may respond more quickly to tax policy changes than others. To account for this possibility, I run the same instrumental variables Tobit specification including interaction terms between the age categories and retired indicator variable with the treatment group indicator. In this specification, parameter estimates on the interaction terms are not statistically significantly different from zero and the estimated tax rate differential effect remains roughly the same. The effects of these controls on portfolio dividend yields do not appear to change over the two periods considered.

In addition, optimism over the future state of the economy has been shown to influence portfolio choices, particularly the decision of whether to hold stocks (Kezdi and Willis 2003). If investors believe that dividends signal safety, then optimistic households may choose lower dividend yields, *ceteris paribus*. Responses to the question, "Over the next five years, do you expect the U.S. economy as a whole to perform better, worse, or about the same as it has over the past five years?" are used to construct indicator variables for households who believe the economy will perform better, worse and about the same. When including this measure of optimism in the main regression, the parameter estimate on the tax rate differential is similar at -0.34 (std. error = 0.15). "Optimistic" households have lower dividend yields relative to households who believe the economy will perform about the same or worse. The parameter estimate on this indicator variable is -0.88 (std. error = 0.37), which is statistically significant at the 5% level.[32]

Several demographic characteristics may have had differential effects on portfolio yields over time. For example, older households may respond differently to a tax change because portfolio choices are influenced by a desire to finance current consumption. To account for this possibility, I run the instrumental variables Tobit model including interaction terms between the age categories and retired indicator variable and the treatment group indicator. In this specification, parameter estimates on the interaction terms are not statistically significantly different from zero, and the estimated tax rate differential effect remains roughly the same.

[32]There are other factors that may influence household portfolio dividend yields but are not included because they are endogenous to portfolio choices. The 2003 tax act may have changed where households locate their dividend-yielding equities, i.e., between taxable or tax-deferred accounts. See Shoven and Sialm (2003) for a discussion of the optimal location of equity securites. Also, concentrated equity holdings in mutual funds may restrict a household's ability to adjust portfolio dividend yields. That these variables are not included may cause bias if the omitted variables are correlated with the included regressors. To check for this possibility, I re-estimate the regression including these additional regressors. Though not presented here, results from these alternative specifications are available upon request from the author. In each, the magnitude of the estimate of the tax rate differential effect remains roughly the same and the parameter estimate on the additional variable is statistically insignificant. These results indicate that excluding these variables is not problematic for interpreting the main estimation results as consistent for the causal effect. There may, of course, remain other factors not considered that make such an interpretation invalid.

Predicted effect of the 2003 Tax Act sunset provisions

The Bush tax cuts of 2001 (the Economic Growth Tax Relief Reconciliation Act of 2001, which reduced ordinary income tax rates for most taxpayers and created a new tax bracket for lowest levels of income) and 2003 are set to expire at the end of 2010. If Congress does not act, dividend income will again be taxed as ordinary income at pre-2001 tax rates and long term capital gains tax rates will increase.[33] I consider the effects of these tax increases implied by the estimates of this study. I simulate marginal and average tax rates that households in the 2007 SCF would face in 2011 by adjusting income variables to 2001 dollars using Consumer Price Index from the Bureau of Labor Statistics and computing tax rates under the 2001 tax rules.[34] For comparison, I first consider the implications of the tax reversals if dividend clientele effects are ignored, i.e., assuming that households do not adjust their equity portfolios (actively or passively) in response to the tax increases. Households in the 2007 SCF received $148 billion in dividend income in 2006 and paid $22.2 billion in taxes on that income.[35] The 2011 average tax rates and dividend receipt patterns in 2007 imply that dividend tax revenue would increase to $38.3 billion in 2011.[36]

This paper shows, however, that households will shift their portfolios away from dividend paying stocks in response to the tax rate increases. Moreover, higher income

[33]Marginal tax rates on dividend income would increase from 15% to 39.6% for those in the highest tax bracket and from 0% to 15% for those in the lowest tax bracket. The top statutory capital gains tax rate will increase from 15% to 20%, and the lowest statutory capital gains tax rates of 0% will increase to 10%.

[34]I compute average dividend tax rates as the ratio of federal income tax liability to federal taxable income, both of which outputs from the TAXSIM model. For households that have negative average tax rates, I treat them as though their average tax rate is zero.

[35]Recall that all summary statistics are weighted by SCF sampling weights and income variables correspond to the calendar year prior to the survey. This level of dividend income, again, is less than the amount reported in the SOI, which reports that $199 billion in ordinary dividends was reported by individuals in 2006.

[36]This exercise holds dividend payout rates constant between 2007 and 2011. There are, however, several reasons to expect that firms will decrease dividend payments. First, Chetty and Saez (2005) find that firms increased dividend payments in response to the 2003 dividend tax cuts. Thus it is likely that firms will decrease dividend payments as dividends become more costly to their investors. This effect is somewhat hindered by evidence of negative investor responses to dividend payment decreases. Secondly, even if total dividend payments do not change, firms will likely accelerate dividend payments to 2010 so that there are lower dividend payments in 2011. Lastly, dividend payouts in 2011 may decrease for nontax reasons. In particular, the financial crisis and recession in the intervening years make profit distributions even less likely.

households will shift away from these stocks by more than lower income households because of their relatively large tax increases. For each household, I compute the change in the dividend and capital gains tax rate differential that they would face in 2011 and the predicted change in portfolio dividend yields.[37] Given the simulated change in dividend and capital gains tax rate differentials and holding the level of equity holdings constant, predicted dividend tax revenues from individuals will only increase to $23.6 billion, less than 62% of the anticipated dividend tax revenues when clientele effects are ignored. If portfolio adjustments are hindered by transaction costs or other adjustment costs, then the increase in dividend tax revenues could be higher.[38]

Longer-term response

To understand the longer-term impact of the 2003 tax act, I consider changes to household portfolios between the 2001 and the 2007 Surveys of Consumer Finances. Figure 2.7 depicts the weighted average portfolio dividend yields for the treatment groups in the 2001, 2004 and 2007 SCF samples. Where there was a large change in portfolio dividend yields immediately following the 2003 tax act, portfolio dividend yields become quite similar across treatment groups by 2007. This is expected. Because the tax treatment of dividends and capital gains is quite similar across households after the 2003 tax act, households should not choose equities based on their dividend payout policies for tax reasons. Results from the instrumental variables Tobit regression model using 2001 and 2007 data are presented in Table 2.8.

[37] A household's predicted portfolio dividend yield in 2011 is given by $\widehat{Yield}_{(i,2011)} = Yield_{i,2007} + \hat{\alpha} \cdot \Delta\tau_{(i,2011-2007)} + \hat{\eta}_{2011}$, where $\hat{\alpha}$ is the estimated effect of a 1-percentage point change in the dividend and capital gains tax rate differential, $\Delta\tau_{(i,2011-2007)}$ is the simulated change in the tax rate differential because of the tax rate reversal, and $\hat{\eta}_{2011}$ is a year fixed effect, which would include changes in market prices that result from changes in asset demand. For this simulation, I assume that $\hat{\eta}_{2011} = -\hat{\eta}_{2004}$. That is, average yields are assumed to return to their pre-treatment levels.

[38] Note that dividend tax revenues from other sources should be increasing as individual investors shed their dividend paying stocks and corporations and institutional investors buy them. This paper does not explicitly deal with the effect of dividend tax rates on dividend receipts across different types of investors, necessary for an estimate of how dividend tax revenues from other sources may change in response. If dividend payments are reduced, then even less will be collected in dividend taxes.

The coefficient on the tax rate differential is negative, as expected, but is no longer statistically different from zero. In such a long period, household responses to the 2003 tax act have become diluted so that there is not enough power to detect a tax effect.

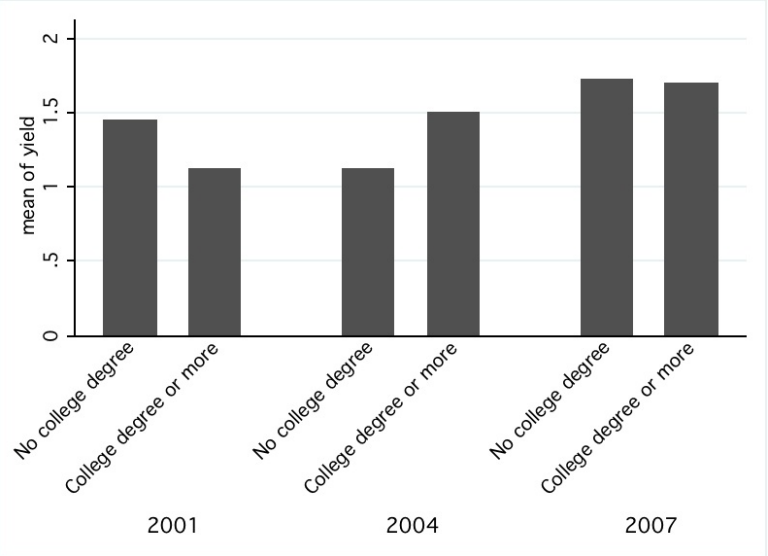

Figure 2.7: Portfolio dividend yields by educational attainment group: 2001, 2004 and 2007

Both the descriptive evidence and the econometric estimates provide insight into the nature of household responses to the 2003 tax act. Both sets of information provide evidence that prior to 2003, there was significant variation in household portfolio dividend yields that can be partly explained by differences in tax rates. After a six year window, household portfolio dividend yields become quite similar because the relative tax disadvantage of dividend income for high-income households becomes negligible. This suggests that as households add equities to their portfolios, they are indifferent to dividend payout policies. That is, the incentives to choose particular dividend yields based on taxes no longer exist.

There are several factors that contribute to the differences between the short-run and longer-run responses to the 2003 tax act. First, increases in firm dividend

Table 2.8: Instrumental variables Tobit model, 2001 and 2007

Variable	Estimated Marginal Effect	Std. Error	p-value
Tax differential	-0.07	0.05	0.12
Age 25-35	-0.31	0.57	0.58
Age 35-45	0.14	0.58	0.82
Age 45-55	0.28	0.59	0.63
Age 55-65	0.41	0.6	0.49
Over 65	0.75	0.65	0.25
Retired	-0.09	0.36	0.80
Married	-0.12	0.20	0.54
Household size	-0.25	0.19	0.17
Household size (squared)	0.04	0.04	0.23
College	0.72	0.25	0.00
Net worth 50,000-100,000	0.89	0.46	0.06
Net worth 100,000-250,000	0.73	0.42	0.08
Net worth 250,000-1,000,000	1.56	0.67	0.02
Net worth >1,000,000	2.44	0.93	0.01
Not willing to take financial risk	-1.14	0.36	0.00
Willing to take average financial risk	-0.60	0.27	0.03
Willing to take high financial risk	-0.36	0.29	0.21
SCF = 2007	-0.69	0.66	0.29
Constant	-0.48	0.95	0.61
Number of observations			
Number of uncensored observations			

Standard errors are computed using the Delta Method and are heteroskedasticity-robust. Observations are weighted by their SCF sampling weights. Estimates are corrected for multiple imputations.

payments may have been concentrated in firms that were held by high income households, which would inflate high-income households' portfolio dividend yields. Indeed, Chetty and Saez (2005) find evidence that corporations with executives who stood to gain substantially from the dividend tax rate reductions were more likely to initiate or increase dividend payments. Secondly, when the 2003 tax act was first passed, the tax rate reductions were set to expire in 2008. Given the perceived temporary nature of the tax rate reductions, households in the high treatment group may have initially responded by aggressively shifting their portfolios towards high dividend yield stocks. This effect may have dissipated as it became clear that the preferential tax treatment of dividends would last longer.[39] Third, higher income households may have been

[39]The Tax Increase Prevention and Reconciliation Act of 2005, enacted on May 17, 2006, prevented several tax provisions, including the reduced dividend and capital gains tax rates, from sunsetting. The lower rates were extended through 2010.

better informed of the implications of the 2003 tax act on their after-tax portfolio returns. The longer-term response is also consistent with lower income households adjusting their portfolios more slowly. Lastly, the efficiency of capital markets implies that changes in firm dividend policies are immediately capitalized into stock prices. Six years may be too long a period for examining longer-term responses when the equity market adjusts quite quickly. Many other factors may have changed in that period that make it difficult to interpret conditional changes in dividend yields as a tax effect.

2.6 Previous empirical evidence

This study is not the first to examine the cross-sectional relationship between the tax rate structure and individual portfolio holdings.[40] However, each of the previous studies faces at least one data limitation that makes it unlikely that its estimates are consistent for the causal effect of taxes on household portfolio dividend yields. Few data sources contain detailed information on both marginal tax rates and portfolio structures, and the proxies used likely confound the relationship between taxes and portfolio dividend yields. In addition, most studies use a single cross-section of data which provides estimates of the tax effect that are weakly identified. My analysis avoids these problems to produce a more compelling estimate of the effect of taxes on portfolio dividend yields. The SCF data contain accurate data to compute marginal tax rates and portfolio dividend yields. Using a natural experiment framework, I utilize the plausibly exogenous variation in tax rates to identify tax effects.

Tax return data is limited in the measurement of portfolio dividend yields. Be-

[40] There are cross-sectional studies that find evidence for dividend clienteles within institutional investors. Strickland (1997) finds that taxable institutions exhibit a preference for low-yield stocks, while untaxed institutions such as pension funds do not display any preference with respect to dividend payout policies. Hotchkiss and Lawrence (2003) find a positive relationship between the dividend yield on an equity security and the proportion of a firm's stock held by non-taxable institutional investors.

cause equity holdings are not reported on tax returns, realized capital gains are used to proxy for equity holdings. Capital gains can be offset against losses and taxes on such gains can be deferred while they accrue, so capital gains realizations are importantly influenced by tax rates (Feldstein, Slemrod and Yitzhaki 1980). Thus, when trying to isolate the impact of taxes on portfolio dividend yields, the effect of taxes on the timing of capital gains realizations leads to confounding variation in the dependent variable of interest. These results may also be biased if excluded factors not available from tax returns, such as wealth, demographic characteristics and risk preferences, are correlated with tax rates and portfolio choices. Two studies use tax return data and find that, consistent with the dividend clientele hypothesis, dividend yields fall as the marginal tax rate on dividend income rises (Blume, Crockett and Friend (1974), Chaplinsky and Seyhun (1987)).

Brokerage house data contain equity holding information, but marginal tax rate information is limited because individuals report their income only within a small set of ranges. In addition, data from a single firm may not be representative of a household's investments if they hold accounts outside that brokerage house. Two studies use 1960s data on individual portfolio positions from a large national retail brokerage house (Pettit (1977) and Lewellen, Stanley, Lease and Schlarbaum (1978)). The limited variation in marginal tax rates along with the differences in empirical methodologies are the likely reasons for their conflicting conclusions drawn from the same data.[41] Graham and Kumar (2006) use 1990s brokerage house data and find that the relationship between income and portfolios is consistent with the dividend clientele hypothesis. Examining stock holding patterns around the Revenue Reconciliation Act of 1993, they document that changes to dividend yields across income

[41] Pettit uses a linear regression model and finds evidence for a clientele effect, whereas Lewellen, et al. use linear discriminant analysis and conclude there is not sufficient evidence to support the dividend clientele hypothesis.

groups are consistent with tax-based dividend clienteles. While they provide the only other study to use a natural experiment, they cannot distinguish tax effects from income effects.

Scholz (1992) uses the 1983 SCF so, like my study, is able to accurately compute marginal tax rates and portfolio dividend yields. He finds that the relationship between tax rates and portfolio dividend yields supports dividend clientele effects.[42] There are limitations to using a single cross-section to study tax effects, however, as explained in section 2.5. In addition, the tax rate instrument used, the rate assuming that all households have the same portfolio dividend yield, is endogenous if households simultaneously make choices over labor and investment income.[43] He estimates a large effect of taxes on portfolio dividend yields that is three times larger than that found in this study, a magnitude that may be implausibly large (Poterba 2002b).[44]

To compare my estimates to Scholz (1992) and better understand the gains from using a natural experiments framework, I estimate my model using each SCF cross-section separately. Because the high-treatment indicator variable is no longer available as an instrument, I use an instrument based off of the tax rates that apply to the "first dollar" of investment income.[45] These results are presented in Table 2.15 in Appendix C, where they are also described in greater detail. The estimated magnitude of the tax effect is much smaller when using a single cross-section, and

[42]Scholz (1994) provides descriptive evidence for dividend clienteles by examining portfolio dividend yields by income decile and by marginal tax rate ranges in two SCF samples around the Tax Reform Act of 1986. He provides tabulations that show that households in the highest ranges of the income distribution have below-average dividend yields.

[43]The direction of bias from using this instrument is ambiguous because it depends on the relationship between labor and investment income. Absent substitution effects between dividend and non-dividend income, the tax rate will fall for marginal individuals who reduce their dividend income to reduce their tax liabilities. This would cause an upward bias in the estimated tax effect.

[44]Scholz concludes that moving from a system with no taxes to a one with a 50-percent marginal tax rate, portfolio dividend yields are predicted to increase by 5.4 percentage points. This simulation is difficult to interpret because we should expect that when tax rates are similar across households, there are no tax-based dividend clienteles.

[45]This is equivalent to the instrument in Scholz (1992) if portfolio yields are assumed to be zero. The results do not change substantively if the instrument is constructed assuming that all households receive the average yield on their portfolios.

is no longer statistically significantly different from zero when using the 2004 SCF. Together, these findings are consistent with the weaker identification of the tax effect using a single cross-section, and suggest that the instrument used when estimating on a single cross-section is endogenous. The difference in magnitude found in Scholz's (1992) study also reflects the relative prevalence of dividends as a means distributing profits to shareholders in the 1980's.

Table 2.9: Instrumental variables Tobit on single cross-sections

	2001			2004		
Variable	Est. Marg. Effect	Std. Error	p-value	Est. Marg. Effect	Std. Error	p-value
Tax differential	-0.03	0.02	0.09	0.00	0.03	0.97
Age 25-35	2.52	1.20	0.04	1.54	1.06	0.15
Age 35-45	2.61	1.27	0.04	1.48	1.13	0.19
Age 45-55	3.04	1.41	0.03	1.81	1.26	0.15
Age 55-65	3.00	1.30	0.02	1.57	1.17	0.18
Over 65	3.33	1.43	0.02	2.23	1.37	0.10
Retired	0.19	0.48	0.70	0.10	0.40	0.80
Married	0.07	0.51	0.89	-0.46	0.31	0.13
Household size	-0.61	0.33	0.07	-0.21	0.30	0.47
Household size (squared)	0.07	0.07	0.30	0.02	0.05	0.66
College	0.73	0.36	0.04	0.64	0.31	0.04
Net worth 50,000-100,000	0.23	1.19	0.85	0.44	0.85	0.61
Net worth 100,000-250,000	0.18	0.94	0.84	0.75	0.71	0.29
Net worth 250,000-1,000,000	1.41	1.03	0.17	1.60	0.83	0.06
Net worth >1,000,000	2.19	1.08	0.04	2.48	0.83	0.00
Not willing to take financial risk	-0.64	0.54	0.23	-0.68	0.36	0.06
Constant	-4.38	0.55	0.00	-4.00	0.63	0.00
F-statistic on instrument	852.77			626.61		

Standard errors are heteroskedasticity-robust. Observations are weighted by their SCF sampling weights. Parameter estimates from the probit model reported are average marginal effects. Estimates are corrected for multiple imputations.

Two studies test for dividend clienteles using the 2003 tax acts. Both of these studies focus on changes to individual equity holding patterns in the aggregate rather than differential changes in equity holding patterns across individual investors, which is done in this paper. Desai and Dharmapala (2007) exploit that the 2003 tax act lowered the tax treatment on dividends from US firms and only extended this preferential treatment to a subset of foreign firms. They estimate the impact of the tax policy change on US investor equity holdings in affected and unaffected countries

and find a large response to the 2003 tax act. Blouin, Raedy and Shackelford (2010) examine the relationship between changes in dividend payout policies and changes in equity holding patterns among insiders, mutual funds, and individual investors. They find that firm executives, but not other individual investors, rebalanced their equity portfolios in response to the dividend tax cuts. Because they collapse individual investor holdings (as the number of shares outstanding less the shares held by insiders and mutual funds), their result does not necessarily contradict the findings in this study.

Another approach to studying the dividend clientele hypothesis uses stock price movements or trade volumes to infer the tax-based preferences of stock market participants. This literature compares changes in the share price of an equity on the day in which investors are no longer eligible to receive a previously declared dividend, the "ex-dividend day", with the value of the dividend payment to infer the relative after-tax valuation of dividends and capital gains. This approach is quite different from that used in this study, but is briefly reviewed in Appendix B for completeness. Overall, these studies have provided mixed results regarding the dividend clientele hypothesis.

2.7 Sensitivity analysis

Model specification and sample selection

I perform a number of sensitivity checks of the main results, which are described in detail in Appendix C. I verify that the magnitude of the dividend and capital gains tax rate differential effect remains unchanged when using more flexible education attainment measures to instrument for marginal tax rates, using alternative cut-points to determine outliers (both to the right and left of the cut-point used in the

main analysis), dropping imputed values, and excluding households whose heads are particularly young.

Specification tests for the Tobit model are also provided in Appendix C. As a general diagnostic check, I find that coefficients from a probit model of the household being at the mass point and standardized coefficients from the Tobit model are roughly the same. The Tobit model assumes that the marginal effect of an explanatory variable is the same at both the extensive and intensive margins. To relax this assumption, I estimate a hurdle model which separately estimates the probability of being at the mass point and the relationship between the dependent and explanatory variables for observations away from the mass point. Simulations of the response to the 2003 tax act reveal that the magnitude of the estimated treatment effect is unchanged in this more flexible model.

Alternative explanations for changing dividend demand

A key identifying assumption is that non-tax factors that influence investor preferences for dividends did not change differentially across treatment groups. However, there are several events between 2001 and 2004 that may have influenced preferences. For example, accounting scandals at Enron and PriceWaterhouseCoopers may have led to higher demand for dividends as agency problems were of increasing concern.[46] The effects of such concerns should be capitalized into market prices, and likely do not affect investors differentially. However, if higher income households were relatively more responsive to changes in such non-tax factors, then these changes are included in the estimated tax effect and biases the estimate away from zero (i.e., in favor of finding a dividend clientele effect).

[46] Baker and Wurgler (2004) propose a "catering theory" of dividends, where the salient preferences of investors affect firm dividend payout policies. Interestingly, they reject that taxes influence demands for dividends in favor of other preferences. Relatedly, Becker, Ivkovich and Weisbenner (2009) find that firm dividend payout policies are related to the age of residents in the headquarters' location. These studies suggest that there is a causal link between the non-tax based dividend preferences of a firm's investors and that firm's payout policy.

To test whether non-tax preferences for dividends changed differentially across treatment groups, I identify several questions in the SCF about household attitudes that may proxy for non-tax preferences. First, because investors may associate dividends with safety, then risk-averse investors may choose equity portfolios with a higher dividend yield, *ceteris paribus*. To account for changes in risk preferences, I use the risk-averse indicator variable from the main regressions as a dependent variable. To further assess risk preferences, I use a question that asks respondents to choose on a scale from 1 to 5 how strongly they agree with the following statement, "Compared with other people of [my] generation and background, [I] have been lucky in [my] financial affairs." Those who "disagree somewhat" or "disagree strongly" are coded to consider themselves financially unlucky. I posit that those who are not willing to take financial risks and those who believe themselves to be financially unlucky prefer high dividend yield stocks.

Changes in respondents' subjective expectations over the future state of the economy may lead to changes in portfolio choices. Two SCF questions aim to ascertain such beliefs. The first asks, "Over the next five years, do you expect the U.S. economy as a whole to perform better, worse, or about the same as it has over the past five years?" The second asks, "Five years from now, do you think interest rates will be higher, lower, or about the same as today?" From these questions, I construct an indicator variables for whether the household believes the economy will get worse and an indicator variable for whether the household believes that interest rates will increase. For both of these variables, an affirmative response is associated with a higher preference for dividends.

To verify that changes to other factors do not confound my estimates, I estimate

several probit and linear probability model equations of the following form:

$$preference = \alpha_0 + \alpha_1 college + \alpha_2 college * \mathbb{I}(SCF = 2004) + \alpha_3 \mathbb{I}(SCF = 2004) + X\gamma + u. \tag{2.11}$$

I construct several dependent variables derived from survey questions that may proxy for non-tax factors that affect the demand for dividends. A test of the null hypothesis that $\alpha_2 = 0$ is a test that underlying preferences did not change for the high treatment group relative to the low treatment group. In each specification, a positive coefficient is posited to be associated with an increase in dividend yields.

Results from these regressions are presented in Table 2.10, and are quite similar across LPM and probit specifications. In most of these regressions, the parameter estimate on the treatment group is statistically insignificant. The exception is that college educated households are less likely to expect that the economy will become worse. If dividends are associated with safety, this suggests that college educated households would decrease their portfolio dividend yields relative to the low-treatment group. Together, these regressions suggest that non-tax preferences for dividends either did not change, or changed in ways that would bias against finding a dividend clientele effect. However, the included preferences are not directly related to the impact of the accounting scandals and may be inaccurately measured. Additionally, there may also be other factors not considered because they are not available from the survey questions.

2.8 Conclusion

The empirical results presented in this paper strongly support the dividend clientele hypothesis. When there is significant cross-sectional variation in dividend and capital gains tax rates prior to the 2003 tax act, dividend clienteles emerge as in-

Table 2.10: Regressions for dividend preferences

	Linear Probability Model			Probit		
Dependent variable	$\hat{\alpha}_2$	se($\hat{\alpha}_2$)	p-value	$\hat{\alpha}_2$	se($\hat{\alpha}_2$)	p-value
Economy to get worse in next 5 years	-0.09	0.04	0.02	-0.09	0.04	0.01
Interest rates to be higher in 5 years	0.03	0.04	0.45	0.05	0.04	0.16
Believes unlucky in financial affairs	0.00	0.03	0.95	0.01	0.03	0.75
Not willing to take financial risks	-0.01	0.03	0.68	-0.01	0.02	0.80

Standard errors are heteroskedasticity-robust. Observations are weighted by their SCF sampling weights. Parameter estimates from the probit model reported are average marginal effects. Estimates are corrected for multiple imputations.

dividuals rationally seek the highest post-tax return on their portfolios. Exploiting the exogenous variation in dividend and capital gains tax rates provided by the Jobs and Growth Tax Relief Reconciliation Act of 2003, the relationship between changes in portfolio dividends yields and changes in tax rates reveals a statistically significant dividend clientele effect. This analysis also provides evidence that household responses to the 2003 tax act were economically significant. Because of dividend clienteles, changes in tax rates induced by the 2003 tax act caused a 0.94 percentage point differential change in portfolio dividend yield between high and low treatment groups. Numerous sensitivity checks are performed to check model misspecification and to confirm that these changes in portfolio dividend yields are not explained by other factors, such as changes to investor optimism or risk aversion.

This paper contributes to the existing literature that examines the existence of tax-based dividend clienteles both in terms of the econometric methodology employed and in the quality of data used. Utilizing a natural experiments framework provides a more precise estimate of the dividend clientele effect than previous studies, which generally rely on variation in a single cross-section of data. This plausibly exogenous variation in tax schedules allows for a consistent estimate of the causal effect of taxes on household choices over portfolio dividend yields. The Survey of Consumer Finances provides detailed information on household equity portfolios and marginal

tax rates. This allows for a direct test of the relationship between tax rates and portfolio dividend yields, rather than providing suggestive evidence derived from correlations or inaccurately measured variables.

Because high-income households have historically received a significant proportion of dividends paid, affluent households benefitted from significant reductions in tax liabilities because of the 2003 tax act. In addition, shifts towards high dividend-paying stocks by high-income households imply that even larger tax benefits accrued to high-income households as a result of the 2003 tax act. Accounting for clientele effects is important for understanding the distributional consequences of changes to tax rates on investment income. In particular, these findings suggest that ignoring dividend clientele effects will cause estimates of the elasticity of taxable income with respect to capital tax rates to be biased.

There are limitations to this study that suggest avenues for future research. First, because I do not have panel data that contains information on the specific stocks in household equity portfolios, I am unable to separately identify active and passive portfolio rebalancing. Brokerage account data may aide in answering this question, though it would likely not include marginal tax rate information. Second, differences between the short-term and long-term responses to the 2003 tax act provide interesting insights into the nature of portfolio adjustments. Better understanding how investors internalize new information about the tax implications of their portfolio choices is an interesting extension for understanding responses to the 2003 tax act. Lastly, there may be other clienteles in the market that are important for a complete analysis of the effect of taxes on portfolio choices over dividend yields. For example, many institutional investors, a growing proportion of investors, are tax exempt and so may form another dividend clientele. To better understand the overall impact of

the 2003 tax act, future work should be done to assess the impact of the tax act on institutional investors' portfolios. In addition, this paper focuses on clientele effects within equity portfolios. There may be other tax-based clienteles that form across other financial assets.

2.9 Appendix A: Tax rate definitions

To convert public use SCF data into taxable income, I use a program provided by Kevin Moore (available at: `http://www.nber.org/~taxsim/to-taxsim/scf/`). All married or cohabiting couples are assumed to file a joint tax return. This is done because it is difficult to split income components and itemized deductions across the two filers from the SCF data. While the SCF does collect information on filing status and a few married couples report that they file taxes separately, this information cannot alone be used to get a clear understanding of tax liabilities. The group of people for whom this is an issue is relatively small. The percentage of married or cohabiting couples who claimed to file tax returns separately was 11.1% in 2001 and 10.67% in 2004.

Child tax credits are determined by the number of children under 17 years old in the household. Deductions for mortgage interest, investment interest expenses, and charitable contributions are taken. Deductions for allowable interest expenses are capped at the amount of interest income received, as per IRS regulations. Investment expenses in the SCF data include only interest paid on loans for investment so no other information on other investment expenses are available. IRS limits on total deductions and rules from the itemized deduction worksheet are imposed.

The SCF asks respondents about net gains or losses from mutual funds, the sale of stocks, bonds, or real estate in the previous year. Dividing these gains into short-term

and long-term gains is done using the following procedure. 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 gains/losses that are long and short term is determined for 3 broad AGI classes: less than 50K, 50 to 100K, and more than 100K. The shares from this computation are then applied to the data (by AGI class).

Once the input variables are constructed, a flat file of financial and demographic information is passed through the NBER TAXSIM model to compute federal marginal tax rates on ordinary income and capital gains income. The marginal tax rate on dividend income is the marginal tax rate on ordinary income in 2000 and the marginal tax rate on capital gains in 2003. The TAXSIM program takes into account the Alternative Minimum Tax.

2.10 Appendix B: Review of market-based approaches

When investors have heterogeneous after-tax valuations of dividends and capital gains, they may adjust their trading behavior around ex-dividend days to capture or avoid upcoming dividend payments. Such adjustments imply that a share's price drop around its ex-dividend day relative to the dividend payment is related to the tax rates of its investors, controlling for other market fluctuations. If tax-based dividend clienteles exist, then the tax rates implied by these price changes will differ across equities according to their dividend yields.

Using this intuition, Elton and Gruber (1970) derive a test for dividend clienteles and find strong evidence for the existence of dividend clienteles. Since Elton and Gruber's (1970) seminal study, over one hundred articles regarding ex-dividend pricing behaviors have been published, with mixed results. An incomplete list of studies includes: Litzenberger and Ramaswamy (1979) Litzenberger and Ramaswamy (1980), Litzenberger and Ramaswamy (1982) and Auerbach (1983), that find evidence in favor of dividend clienteles, and Black and Scholes (1974), and Gordon and Bradford (1980), Miller and Scholes (1982), and Michaely (1991) that find they cannot reject the null hypothesis that dividends and capital gains are valued equally.

While the ex-dividend day studies may summarize the impact of taxes on aggregate market behavior, they do not identify a direct link between investor behavior and taxes, which would require micro-level data on stock holdings and tax rates. In addition, interpreting these ex-dividend day results are complicated by several factors. First, the coincidence of ex-dividend days and dividend announcement days may lead to a spurious correlation between returns and dividend yields (Miller and Scholes (1982), Gordon and Bradford (1980)). Second, the interpretation of the ex-

dividend studies depends on whether a stock's "typical" investors are setting prices around ex-dividend days. If price changes are driven by short-term investors, the price movements contain little information about the characteristics of a firm's long-term investors. The return on a stock may be a function of the interactions between multiple classes of investors, so it is difficult to obtain information about clienteles from market price movements (Michaely and Vila 1995). Finally, these studies do not account for transaction costs or risk aversion because they are not available from stock market data.

2.11 Appendix C: Sensitivity analysis

The discretization of tax treatment intensity by an indicator for whether the household head has a college degree may be too stark. To allow a more flexible relationship between education level and tax rates, I construct additional educational attainment measures based on years of schooling and whether the household head earned a high school degree. Similar to the main specification, the instruments for a household's tax rate are the interactions of the educational attainment measures and an indicator variable for whether the observation comes from the 2004 SCF sample.

Table 2.11 presents the estimated tax effect from the instrumental variables Tobit model using these alternative instruments, along with the F-statistic on the instrument(s) from the first-stage regressions. The specification with three educational attainment categories distinguishes households according to whether household heads have a high school degree or less, some college education but no college degree, and a college degree. The specification with four categories additionally distinguishes those households in which the head has a high school degree or equivalent from those in which the household head has no degree. Years of schooling is also used as an alternative instrument. This additional flexibility for determining the intensity of tax treatment does not much change the estimates of the tax effect from the main results. Differentiating households by whether the head has a college degree approximates differences in marginal tax rates quite well, at least for that on investment income.

In addition, to purge the estimates of the effect of individuals who had not yet completed their education, I run the main regression including only households whose heads are at least 35 years old. Whether the household head has a college degree is the instrument used. Estimates from this specification are also presented in Table 2.11.

Table 2.11: Results using alternative instruments and samples

	Tax rate differential			
Instrument(s)	Est. Marg. Effect	Std. Error	p-value	First-stage F-statistic
Three education categories	-0.35	0.15	0.02	15.54
Four education categories	-0.28	0.13	0.04	10.65
Years of schooling	-0.26	0.12	0.02	24.05
				No. obs. dropped
Head over 30 years old	-0.28	0.14	0.05	180

The top panel presents select results from instrumental variable Tobit regressions using alternative instruments for the dividend and capital gain tax rate differential. The bottom panel presents select results when excluding households with a head less than 30 years of age.

Outliers and Imputed Values

In the main estimation, nine observations are dropped because their portfolio dividend yields are greater than 1000%. To analyze the sensitivity of the analysis to outliers, I re-estimate the model using other cut-points. The results from these estimations are provided in Table 2.12, with the main results in the middle row for comparison. Except for the most extreme outliers, the estimates are not sensitive to the choice of cut-off points. To check that the estimates are not sensitive to imputed values, I run regressions excluding households whose dividend income or at least one component of taxable equities were missing in the original data file. This excludes 512 observations from the 2001 SCF sample and 320 observations from the 2004 SCF sample, and omits a disproportionate number of households whose heads did not earn a college degree. Results using this selected sample are similar to the main results.

Tobit model assumptions and alternative models

As a general specification test of the Tobit model, I compare the coefficients from a probit model for being at the mass point with the coefficients from the Tobit model standardized by the estimated standard deviation of the model errors. These estimates are presented in Table 2.13. A general test of whether the Tobit model

Table 2.12: Results using different cut-offs for outliers and excluding imputed values

	Tax differential			No. of obs. deleted
	Est. Marg. Effect	Std. Error	p-value	
Include all observations	-0.97	0.78	0.21	0
Drop if yield > 2000	-1.16	0.63	0.07	6
Drop if yield > 1500	-0.29	0.15	0.06	7
Drop if yield > 1000	-0.31	0.14	0.03	9
Drop if yield > 500	-0.30	0.14	0.03	11
Drop if yield > 300	-0.28	0.12	0.02	14
Drop imputed values	-0.32	0.13	0.01	717

This table presents select results from instrumental variable Tobit regressions using different samples based on changing cut-offs for outliers and by dropping imputed values.

is mis-specified is done by comparing these coefficients. The estimated coefficients are all of the same sign, as expected. They are also generally similar in magnitude, except for the net worth categories.

The Tobit model restricts the effect of the explanatory variables to be the same for both the extensive margin of whether to receive dividends and the intensive margin of the portfolio dividend yield. To relax this assumption, I run a hurdle model that separately estimates a probit model for having a positive dividend yield and an instrumental variables regression of dividend yields on the uncensored observations. To help account for heteroskedasticity in portfolio dividend yields, the dependent variable in the instrumental variables regression is the log of a household's portfolio dividend yield. Results from the hurdle model are presented in Table 2.14.

That most coefficients are of the same sign indicates that the variables have the same directional effect on both the decision to receive dividends and the choice over dividend yields. The exceptions are the indicator variable for being retired (though not statistically different from zero) and the net worth categories. Interestingly, the tax rate differential effect is five times larger in the instrumental variables regression than in the probit model. Moreover, it is statistically significant at the 10% level in the instrumental variables regression, but not significantly different from zero

Table 2.13: Comparing probit and standardized Tobit estimates

Variable	Est. Coeff. from Probit	Std. Coeff. from Tobit
Tax differential	-0.03	-0.05
Age 25-35	0.52	0.65
Age 35-45	0.51	0.75
Age 45-55	0.60	0.89
Age 55-65	0.56	0.85
Over 65	0.64	0.82
Retired	0.13	-0.13
Married	-0.04	-0.04
Household size	-0.12	-0.08
Household size (squared)	0.01	0.01
College	0.35	0.31
Net worth 50,000-100,000	0.27	-0.06
Net worth 100,000-250,000	0.38	0.01
Net worth 250,000-1,000,000	0.89	0.43
Net worth >1,000,000	1.50	0.84
Not willing to take financial risk	-0.41	-0.30
Willing to take average financial risk	-0.09	-0.06
Willing to take high financial risk	0.09	0.01
SCF = 2004	-0.35	-0.67
Constant	-0.92	-0.52

Coefficients from the Tobit model are standardized by the estimated standard deviation of the error term. Observations are weighted by their SCF sampling weights. Parameter estimates are corrected for multiple imputations.

in the probit model. This suggests that taxes may be important for determining dividend yields at the intensive margin rather than at the extensive margin. Thus, shifts to dividend clienteles caused by the 2003 tax act are likely confined to shifts among clienteles with some dividend income, rather than inducing more households to receive dividends.

Simulations of the impact of the 2003 tax act on household portfolio dividend yields produce similar results to those generated by the instrumental variables Tobit model. The high-treatment (college educated) group is predicted to increase its portfolio dividend yield by 4.53 percentage points while the low-treatment (non-college educated) group is predicted to increase by 3.25 percentage points. Thus, there is an estimated 1.28 percentage point differential increase across treatment groups. The more flexible model provides very similar results to the Tobit model.

Table 2.14: Hurdle model for household portfolio dividend yields

Dependent variable:	Probit Indicator for yield > 0			IV Regression Log Dividend Yield		
Variable	Est Coeff	Std. Error	p-value	Est Coeff	Std. Error	p-value
Tax differential	-0.02	0.03	0.53	-0.11	0.06	0.09
Age 25-35	0.49	0.25	0.05	0.73	0.53	0.17
Age 35-45	0.48	0.26	0.06	1.03	0.53	0.05
Age 45-55	0.57	0.25	0.03	1.09	0.51	0.03
Age 55-65	0.50	0.25	0.04	1.20	0.51	0.02
Over 65	0.58	0.27	0.03	1.25	0.54	0.02
Retired	0.14	0.19	0.44	-0.36	0.26	0.17
Married	-0.03	0.10	0.76	-0.29	0.31	0.34
Household size	-0.16	0.10	0.10	-0.11	0.37	0.76
Household size (squared)	0.02	0.01	0.13	0.03	0.05	0.62
College	0.36	0.09	0.00	0.53	0.27	0.05
Net worth 50,000-100,000	0.33	0.16	0.04	-0.73	0.53	0.17
Net worth 100,000-250,000	0.41	0.14	0.00	-1.05	0.45	0.02
Net worth 250,000-1,000,000	0.91	0.18	0.00	-0.76	0.51	0.13
Net worth >1,000,000	1.49	0.28	0.00	-0.39	0.66	0.56
Not willing to take financial risk	-0.36	0.11	0.00	-0.27	0.29	0.35
SCF = 2004	-0.33	0.37	0.38	-1.49	0.79	0.06
Number of observations		3956		2379		

Standard errors are heteroskedasticity-robust. Observations are weighted by their SCF sampling weights. Estimates from the probit model are average marginal effects. Estimates are corrected for multiple imputations.

Analysis using single cross-sections

Results from regressions based on a single SCF cross-section are provided in Table 2.15. The components for the instrumental variable for tax rates are computed using TAXSIM. Specifically, I compute the marginal tax rate that applies to a household's last dollar of taxable income less capital gains, dividend income and interest income. The difference in these dividend and capital gains marginal tax rates are used to instrument for the actual dividend and capital gain marginal tax rate differential.

Using the 2001 SCF cross-section provides a much smaller, though still negative, estimate of the tax effect on portfolio dividend yields that is only statistically significant at the 10% level. As with the main results, I simulate the predicted impact of the 2003 tax act on portfolio dividend yields. Using these simulated changes to portfolio dividend yields, the average impact of the tax act between the college-educated

Table 2.15: Instrumental variables Tobit on single cross-sections

	2001			2004		
Variable	Est. Marg. Effect	Std. Error	p-value	Est. Marg. Effect	Std. Error	p-value
Tax differential	-0.03	0.02	0.09	0.00	0.03	0.97
Age 25-35	2.52	1.20	0.04	1.54	1.06	0.15
Age 35-45	2.61	1.27	0.04	1.48	1.13	0.19
Age 45-55	3.04	1.41	0.03	1.81	1.26	0.15
Age 55-65	3.00	1.30	0.02	1.57	1.17	0.18
Over 65	3.33	1.43	0.02	2.23	1.37	0.10
Retired	0.19	0.48	0.70	0.10	0.40	0.80
Married	0.07	0.51	0.89	-0.46	0.31	0.13
Household size	-0.61	0.33	0.07	-0.21	0.30	0.47
Household size (squared)	0.07	0.07	0.30	0.02	0.05	0.66
College	0.73	0.36	0.04	0.64	0.31	0.04
Net worth 50,000-100,000	0.23	1.19	0.85	0.44	0.85	0.61
Net worth 100,000-250,000	0.18	0.94	0.84	0.75	0.71	0.29
Net worth 250,000-1,000,000	1.41	1.03	0.17	1.60	0.83	0.06
Net worth >1,000,000	2.19	1.08	0.04	2.48	0.83	0.00
Not willing to take financial risk	-0.64	0.54	0.23	-0.68	0.36	0.06
Constant	-4.38	0.55	0.00	-4.00	0.63	0.00
F-statistic on instrument	852.77			626.61		

Standard errors are heteroskedasticity-robust. Observations are weighted by their SCF sampling weights. Parameter estimates from the probit model reported are average marginal effects. Estimates are corrected for multiple imputations.

and non-college-educated group is also much smaller. College-educated households are predicted to increase their yields by 0.41 percentage points, whereas non-college-educated households are predicted to increase their yields by 0.32 percentage points. The single cross-section analysis would lead us to conclude that taxes have a much smaller impact on portfolio dividend yields than the analysis using a natural experiment suggests. The estimated tax effect using the 2004 SCF cross-section is not statistically different from zero. This is likely because tax rates becomes much more homogeneous after the 2003 tax act leading to insufficient cross-sectional variation in the tax rate variable.

Overall, estimating tax effects with a single cross-section provides a very different picture of the dividend clientele effect and depends strongly on the cross-sectional variation of tax rates in the period considered. Even when there is larger cross-sectional variation in the 2001 tax rate differential, identification is much weaker

than in a natural experiments framework. In addition, using the potentially endogenous tax rate instrument may bias the estimates. When the dividend tax rate is reduced to the capital gains tax rate, households may respond by switching some labor income towards dividend income. The resulting bias in the estimated coefficients is ambiguous, as it depends on the relative changes in tax rates and dividend yields.

CHAPTER III

Taxes and financial portfolio choices: Evidence from the tax rate reductions of the 2001 and 2003 tax acts

3.1 Introduction

Under the US tax system, different tax rates can apply to income generated from different financial instruments. For example, interest earned on state and local bonds is tax-exempt, while interest earned on federal bonds and other interest-bearing instruments is taxed as ordinary income. Capital gains tax rates are also typically lower than ordinary income tax rates. In addition, the progressivity of the tax schedule implies that investors can face different after-tax returns on the same asset. Models of portfolio choice predict that these aspects of the US income tax system can importantly affect household decisions of how to construct their financial portfolios.

In this paper, I estimate the relationship between taxes and household financial portfolio choices using the exogenous variation in tax rates generated by the Economic Growth and Tax Relief Reconciliation Act of 2001 and the Jobs and Growth Tax Relief Reconciliation Act of 2003 (henceforth referred to as the 2001 and 2003 tax acts, respectively). The 2001 tax act reduced personal income tax rates, which applied to interest and dividend income. The 2003 tax act reduced long term capital gains tax rates. In addition, dividend tax rates were dramatically reduced as they

were equated to the statutory rates on long term capital gains rather than those on ordinary income. Together, these tax policies provide variation in tax rates and create a natural experiment to estimate financial portfolio responses to changing tax rates.

The combined effect of the 2001 and 2003 tax acts is that taxes on interest income increased relative to stocks (measured by the ordinary income tax rate less the capital gains tax rate). In addition, the tax advantage of nontaxable bonds relative to equity securities and taxable bonds decreased. The predicted response to these tax policies is that households shift their portfolio holdings towards equity securities and away from nontaxable bonds. If households hold their relatively heavily taxed assets in tax-deferred accounts, the tax acts also decreased the incentive to shelter equities in tax-deferred accounts. Households should have shifted their tax-deferred accounts towards bonds and away from equities.

I examine the relationship between changing tax rates and changing financial portfolio structures using the 1998, 2001, 2004 and 2007 Surveys of Consumer Finances (SCF) which contain nationally representative household data in repeated cross-section samples. The detailed financial data in the SCF allows financial portfolios to be partitioned into narrow asset classes. I construct six financial asset classes: directly held equities (the sum of directly held stock and stock mutual funds in taxable accounts), tax-deferred equity, taxable bonds, nontaxable bonds, tax-deferred bonds, and other interest-bearing assets. I consider the effect of the 2001 and 2003 tax rate reductions on the extensive and intensive margins of portfolio choices. I estimate linear probability models to test the effect of taxes on the probability of holding assets in a particular asset class. I also estimate regressions of portfolio shares to test the effect of taxes on the share of wealth allocated to each asset class.

I find evidence that households responded significantly to the increased tax advantage of equities by shifting their portfolios towards directly held equities. There is also some evidence that households shifted their tax-deferred account holdings from stocks to bonds as interest income became more heavily taxed relative to equities. These shifts were not statistically significant, however. There is little evidence that the 2001 and 2003 tax acts affected household portfolios on the extensive margin. If portfolio specialization results from information costs associated with holding different assets (King and Leape 1998), then the differences in tax effects found on the extensive and intensive margins is not surprising. These tax policies may not have affected the information costs in ways that are necessary for an individual to change the mix of the asset classes in which he invests.

This paper contributes to the literature on the effect of taxes on household portfolio choices. Most previous studies that estimate the relationship between taxes and portfolio choices use a single cross-section of data. However, because marginal tax rates are a function of labor and capital income, it is difficult to disentangle income effects from tax effects using a single cross-section of data. Instead, I use exogenous policy-induced variation in tax rates to identify tax effects. This study also provides the first (to my knowledge) examination of the effects of the 2001 and 2003 tax acts on household stock and bond holdings.

Households face many options when deciding how to structure their assets and liabilities and understanding the effect of tax policy on portfolio composition is important. Participation in financial markets is a key component to economic growth, so it is important to understand the impact of taxes on financial risk-taking. Because individuals can adjust their portfolios to reduce their tax liabilities, understanding such behavioral responses is crucial for evaluating the effect of tax policy. Such ef-

fects improve the evaluation of various tax systems. For example, such estimates are pivotal to the debate of switching to a consumption tax system because this would eliminate the differential tax treatment of investment income.

The remainder of the paper is organized as follows. Section 3.2 reviews the theoretical models of household portfolio choice. Section 3.3 summarizes the 2001 and 2003 tax acts and the predicted portfolio responses informed by the theoretical models. Section 3.4 describes the Survey of Consumer Finances data. Section 3.5 explains the estimation strategy and presents the empirical results. The previous empirical literature on the effect of taxes on portfolios is reviewed in section 3.6. Section 3.7 concludes.

3.2 Portfolio choice models

Domar and Musgrave (1944) began the theoretical work on the effects of taxation on asset demands. They show that when investors choose between a risky and a riskless asset and all individuals face the same tax rates, optimal portfolios are diversified across risky and riskless assets. The relative portfolio shares in each type of asset reflects differences in individuals risk and time preferences. Alternatively, when all assets are riskless but individuals face different tax rates on different types of assets, distinct asset holding clienteles emerge (Auerbach and King 1983). Investors naturally sort into holding the assets that are most tax advantaged for them relative to other investors.[1]

When there are both risky and riskless assets and investors face differential tax rates, optimal portfolios are a combination of the market portfolio and a portfolio that depends on tax rates. The tax-based portfolios reflect that investors will gravi-

[1]This result hinges on the ability of investors to realize any stream of pre-tax returns in the asset class that they prefer.

tate towards holding the assets that are less heavily taxed for them relative to other investors. Thus, those with the highest tax rates hold the most tax-advantaged assets and those facing the lowest tax rates hold the most heavily taxed assets (Miller (1977), Brennan (1970)). The relative weights on these two portfolios depends on the tax profile relative to other investors and risk preferences (Auerbach and King 1983). There should be a cross-sectional relationship between tax rates and portfolio composition. A related literature examines the optimal location of assets, i.e., whether assets should be held in taxable or in tax-deferred accounts. Such models predict that households hold their most heavily taxed assets in tax-deferred accounts (Shoven and Sialm 2003).

3.3 The tax acts and predicted portfolio responses

Prior to 2001, dividend and most interest income were taxed at ordinary income tax rates, while long-term capital gains were taxed at preferred rates. Because of the progressivity of the tax system, interest-bearing assets were more tax disadvantaged relative to equities for higher income households relative to lower income households. Thus, higher income households should have held a larger proportion of their portfolios in equities than lower income households. Relative to nontaxable bonds, the tax disadvantage of both equity securities and taxable bonds increases with income. Thus, higher income households should hold a larger share of their portfolios in nontaxable bonds than lower income households. The Economic Growth and Tax Relief Reconciliation Act (the 2001 tax act) and the Jobs and Growth Tax Relief Reconciliation Act of 2003 (the 2003 tax act) altered the tax treatment of interest income, dividend income, and capital gains. Together, these tax acts offer variation in tax rates that can be used to examine how investors adjust their portfolios in responses

to changing tax rates.

The 2001 tax act, signed into law on June 7, 2001, introduced a series of ordinary income tax rate reductions to be phased in by 2006 and created a new tax bracket at the lowest income levels. These marginal tax rates apply to interest income and, until 2003, dividend income.[2] A summary of the decreases in marginal tax rates on ordinary income are presented in panel (a) of Table 3.1. The 2003 tax act contained two major components. The first effect was a reduction in capital gains tax rates, which are summarized in panel (b) of Table 3.1. The second effect was that dividends were now taxed at the same statutory rate as capital gains. Thus, the marginal tax rates on dividends fell from the second row of panel (a) to the second row of panel (b). These changes impacted the tax treatment for equities held directly and dividends passed through to individuals through a mutual fund or other regulated investment company, partnership, REIT, or common trust fund.[3] The 2003 tax act also accelerated the tax rate reductions of the 2001 tax act. The maximum decreases on ordinary income tax rates that were originally scheduled to be effective in 2006 were applied retroactively to the beginning of 2003.

The main impact of the 2001 and 2003 tax acts is that the tax rates on ordinary income, dividend income and capital gains changed within a relatively short time frame. Importantly, all of these tax rates changed between 2001 and 2004, the years of the survey data that are used in this study. Thus, I propose that the difference between the ordinary income tax rate and capital gains tax rate captures the changing incentives that households faced across the two tax acts.[4] Figure 3.1 illustrates the

[2]The tax act also simplified retirement and qualified plan rules such as for Individual retirement accounts, 401(k) plans, 403(b), and pension plans.

[3]Dividend distributions from investments in tax-deferred retirement accounts remain taxed as ordinary income.

[4]This measure does not capture the change in dividend tax rates that households faced. A preferable measure would be the difference between the ordinary income tax rate and effective tax rate on directly held equities. The effective tax rate on directly held equities depends both on the dividend yield on equity portfolios and on capital gains realizations. Information on equity portfolio dividend yields is available, however households responded to the 2003 tax act by shifting equity portfolios towards dividend paying stocks (Chapter II of this dissertation). Thus,

Table 3.1: Effect of 2001 and 2003 Tax Acts

(a) Effect of the 2001 tax act on ordinary income tax rates				
In the case of taxable years beginning during calendar year:	The corresponding shall be substituted for the following percentages			
	28	31	36	39.6
2001	27.5	30.5	35.5	39.1
2002 and 2003	27	30	35	38.6
2004 and 2005	26	29	34	37.6
2006 and thereafter	25	28	33	35
(b) Effect of the 2003 tax act on capital gains tax rates				
In the case of taxable years beginning during calendar year:	The corresponding shall apply to those in the following tax brackets			
	28	31	36	39.6
2000	20	20	20	20
2003	5	15	15	15

Source: Public Law 107-16-June 17, 2001, Public Law 108-27-May 28, 2003 and author's calculations.

statutory tax rates before and after the 2001 and 2003 tax acts. In both tax regimes, the ordinary income and capital gains tax rate differential is increasing with income. The combined impact of the 2001 and 2003 tax acts was an increase in this tax differential. This change should cause individual investors to shift their portfolios towards stocks as they became relatively less taxed. Importantly, this increase was larger for lower income individuals relative to higher income individuals (bottom panel). Thus, lower income households should have increased their equity holdings by more than higher income households. In addition, because households should hold their more heavily taxed investments in tax-deferred accounts, they should shift their retirement account holdings towards taxable bonds and away from equities.

3.4 Survey of Consumer Finances

I use data from the Survey of Consumer Finances, a triennial survey conducted by the Federal Reserve Board of Governors. The survey provides repeated cross-

an attempt to use this dividend yield information to calculate an effective tax rate on directly held equities would yield an endogenous measure. Moreover, this endogeneity would remain even after instrumenting because of the instrument used.

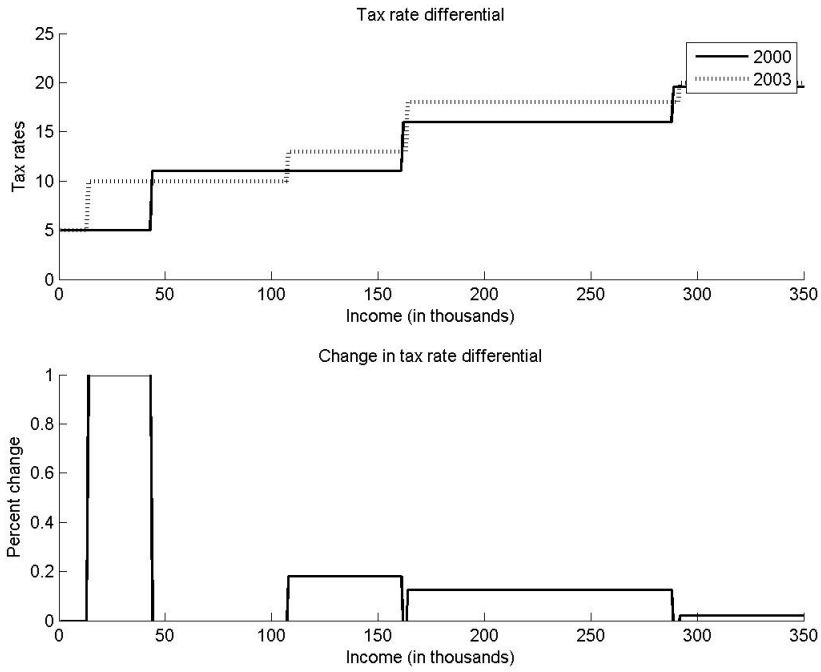

Figure 3.1: Impact of 2001 and 2003 Tax Acts on Statutory Rates

sectional data on household wealth in the United States. The SCF collects detailed household-level information on assets and liabilities, demographic characteristics, and attitudes towards risk and credit. To use the 2001 and 2003 tax acts as a source of marginal tax rate variation, I select SCF samples from before and after the tax policies. Because income variables refer to the year prior to the survey, I use the 1998 and 2001 SCFs as pre-treatment periods and I use the 2004 and 2007 SCFs as post-treatment periods.

The 1998 SCF contains 4,305 households, the 2001 SCF contains 4,442 households, the 2004 SCF contains 4,519 households, and the 2007 SCF contains 4,418 households. The sampling methodology of the SCF provides a stratified random sample. The oversampling of wealthy households is important for studying financial portfolios because financial asset holdings are typically concentrated at the top of the income distribution. The SCF provides sampling weights that can be used

to produce estimates that are nationally representative. Missing values from each survey are replaced using a multiple imputation technique.[5] All summary statistics and estimates presented are weighted by SCF sampling weights and corrected for the multiple imputations procedure using methods prescribed by the SCF.

Some households have marginal tax rates that are either negative or above the maximum statutory rate because of the interactions of various federal programs with marginal tax rates. I exclude households who receive the EITC or unemployment insurance and households with negative marginal tax rates. After this restriction, 3,727, 3,567, 3,600, and 3,458 households remain in the 1998, 2001, 2004 and 2007 SCF samples, respectively. A description of how marginal tax rates are computed is provided in section 3.4.2.

3.4.1 Financial asset classes

I define six financial asset classes according to their tax treatment and risk diversification. These categories are directly held equity (the sum of stocks and stock mutual funds), equity held in tax-deferred (retirement) accounts, bonds held in tax-deferred accounts, taxable bonds, nontaxable bonds, and other interest-bearing assets. Other interest-bearing accounts includes checking accounts, savings accounts, saving bonds, CDs and money market accounts. Following the previous literature, I focus attention on financial assets and exclude real estate, mortgages, or other assets.

For each asset classes, I construct an indicator variable that equals one if the household has positive holdings in that asset class, and zero otherwise. I also calculate portfolio shares, defined as the value of assets in that category divided by the total value of the six categories considered. All market values are converted to 2004 dollars. Table 3.2 presents the proportion of households with positive holdings in each asset

[5]For an overview of the multiple imputation methodology, see Kennickell (1998).

class. Incomplete portfolios, where households hold only a subset of available asset types, is present in these data. Less than one third of all households hold taxable equity, and only about half of the households have any stock or bond holdings. While the overall probability of stock or bond ownership is fairly stable over time, there is an apparent shift in ownership probabilities towards assets in retirement accounts and away from taxable accounts.

Table 3.2: Proportion of households holding each asset class

	1998	2001	2004	2007
Directly held equity	31.8	38.0	35.0	30.9
Taxable bonds	7.6	7.8	7.9	5.5
Nontaxable bonds	5.8	6.1	5.0	4.1
Equity in retirement accounts	43.1	53.8	51.9	55.3
Bonds in retirement accounts	34.8	37.2	50.2	53.7
Stock or bond portfolio	64.0	72.5	69.3	72.4
Other interest-bearing accounts	99.3	99.2	99.3	99.2

Source: SCF and authors calculations. All averages are weighted by SCF sampling weights and are corrected for multiple imputations. Stocks or bonds does not include savings bonds.

Table 3.3 presents the average share of financial portfolios allocated to each asset class. The top panel shows the average shares for all households and the bottom panel displays average shares conditional on holding some stock or bonds. Because the tax treatment of equities was reduced relative to taxable bonds, portfolio shares in equities should have increased. These unconditional averages show, however, that in the aggregate, such increases did not occur. Instead, households appear to have shifted their investments from taxable accounts and into tax-deferred accounts.

To examine patterns in portfolio structures by income group, Figure 3.2 and Figure 3.3 depict the proportion of households with assets in each asset class and the average share of financial portfolios in each asset class by adjusted gross income percentile in 1998. To dampen the impact of small portfolios, asset share allocations are also weighted by the household's total value of stock and bonds. In general

Table 3.3: Share of portfolio in each asset class

	1998	2001	2004	2007
Directly held equity	12.0	13.6	11.4	9.6
Taxable bonds	1.2	0.9	0.9	0.7
Nontaxable bonds	0.9	0.1	0.7	0.7
Equity in retirement accounts	18.5	24.4	20.4	22.9
Bonds in retirement accounts	13.3	13.4	17.9	20.8
Interest-bearing accounts	50.0	43.9	45.4	43.6
Share in stocks/bonds conditional on having any				
Directly held equity	25.9	25.4	23.6	19.0
Taxable bonds	2.8	1.7	2.0	1.2
Nontaxable bonds	2.2	1.8	1.2	1.2
Equity in retirement accounts	39.2	44.9	38.3	39.8
Bonds in retirement accounts	29.9	26.3	34.9	38.7
Total	100.0	100.0	100.0	100.0

Source: SCF and authors calculations. All averages are weighted by SCF sampling weights and are corrected for multiple imputations. Stocks or bonds does not include savings bonds.

ownership probabilities are increasing with income for all asset classes. This pattern reflects that there may be credit constraints or information constraints that induce households to specialize in their investments. As clientele theory predicts, the probability of stock ownership is increasing with income and increases at a faster rate than other asset classes. The share of assets allocated to directly held equities is generally increasing with income, aside from the very lowest levels of income.

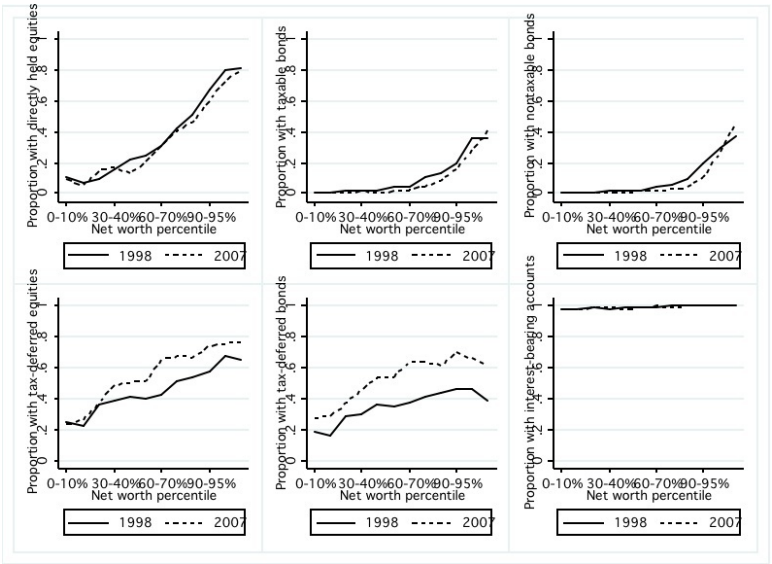

Figure 3.2: Proportion of households with positive holdings by income

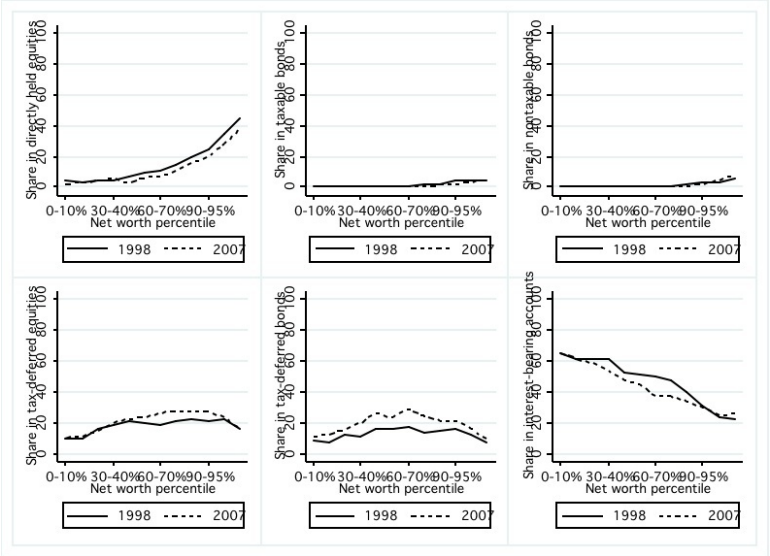

Figure 3.3: Share of financial portfolio in each asset class by income

3.4.2 Marginal tax rates

I use the income variables in the SCF data to compute adjusted gross income (AGI) and demographic information to determine filing status and itemized deductions.[6] The resulting information is passed through the National Bureau of Economic Research's TAXSIM program to compute marginal tax rates on ordinary income and long-term capital gains. These tax rates refer to federal rates and account for the Alternative Minimum Tax.

As previously noted, I compute the difference between ordinary income and capital gains marginal tax rates to capture the tax incentives for holding different types of investment securities that households face. This variable better measures the relative tax treatment of various types of income than the ordinary income marginal tax rate alone, which is typically used to examine the relationship between taxes and portfolio choices. The distribution of the tax rate differential for 1998 and 2007 is

[6] I begin with Stata programs that convert SCF data into the input variables for TAXSIM. These programs can be found at http://www.nber.org/ taxsim/to-taxsim/. To maintain the anonymity of high-income households, information on the state of residence is not available in the public data. Thus, state-level variation in tax treatments cannot be used in this analysis.

presented in Figure 3.4.[7] This difference is monotonically increasing, meaning that the tax incentives for holding equity securities increases with income. The different intensities in tax treatments of the 2001 and 2003 tax acts is also apparent in the data.

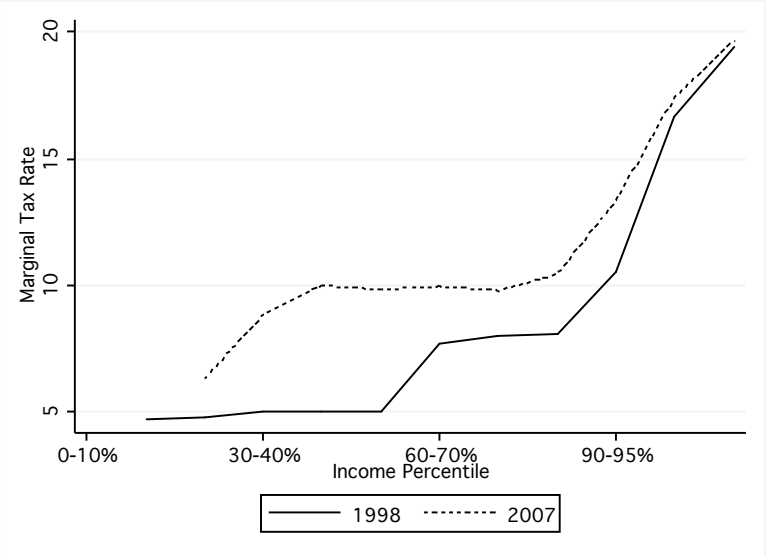

Figure 3.4: Empirical tax differential distribution

3.4.3 Other explanatory variables

In all estimation procedures, I control for several socioeconomic and demographic characteristics. The demographic variables include marital status, age, sex, retired indicator, and educational attainment measures, each corresponding to the head of household. To allow a nonlinear relationship between age and portfolio choices, I construct six categorical age variables. I also include household size (level and square). I also include net worth categories, constructed at the household level. Summary statistics of these variables are provided in Table 4.4. Responses to questions about willingness to bear financial risk are used to proxy for risk preferences. The risk-averse indicator variable is set equal to one if the respondent answered that they are

[7]Data for 2001 and 2004 are not depicted. Data from 2001 is similar to that from 1998 and data from 2004 is similar to that from 2007.

"not willing to take financial risks," and zero otherwise.[8]

Table 3.4: Frequencies of demographic characteristics

Variable	1998	2001	2004	2007
Variable	1998	2001	2004	2007
Age under 25	0.03	0.05	0.04	0.04
Age 25-35	0.16	0.17	0.16	0.16
Age 35-45	0.22	0.24	0.22	0.20
Age 45-55	0.19	0.23	0.24	0.25
Age 55-65	0.13	0.15	0.18	0.20
Age 65 +	0.26	0.16	0.17	0.16
Married	0.62	0.68	0.65	0.65
Female	0.24	0.19	0.22	0.21
Household size	2.33	2.43	2.38	2.36
High school degree	0.29	0.29	0.28	0.27
Some college	0.19	0.19	0.19	0.19
College	0.38	0.43	0.46	0.46
Self-employed	0.12	0.14	0.14	0.12
Retired	0.24	0.14	0.15	0.14
Executive	0.27	0.34	0.36	0.37
Willing to take very high financial risk	0.05	0.05	0.04	0.04
Willing to take high financial risk	0.19	0.23	0.20	0.21
Willing to take average financial risk	0.41	0.43	0.45	0.45
Not willing to take financial risks	0.35	0.29	0.32	0.29
Net worth 0-50	0.31	0.28	0.28	0.25
Net worth 50-100	0.13	0.11	0.11	0.10
Net worth 100-250	0.25	0.20	0.20	0.20
Net worth 250-1000	0.25	0.28	0.28	0.32
Net worth 1000 +	0.07	0.12	0.13	0.13
Households (millions)	82.02	74.74	76.08	77.63
Observations	3607	3457	3440	3358

Source: Survey of Consumer Finances and authors calculations. All averages are weighted by SCF sampling weights and corrected for multiple imputations. Net worth categories are reported in thousands.

3.5 Estimation strategy and results

There are two aspects of the household portfolio choice problem that I examine. The first is the choice of whether to allocate any funds to a particular asset class (extensive margin). The second is how to allocate financial wealth across these asset classes (intensive margin). After controlling for socioeconomic and demographic characteristics and risk preferences, I test whether taxes are influential in these portfolio choices. An increase in the ordinary income and capital gains marginal tax rate

[8]There are four possible responses to the question regarding willingness to take financial risks. Using the four categories does not affect the main results so they are not used here.

differential implies an increased tax preference for equity securities. In addition, investors should shelter their most heavily taxes investments in tax-deferred accounts. Thus, an increase in the ordinary income and capital gains tax rate differential should lead to: (1) an increase in equity holdings, (2) a decrease in taxable bond holdings, and (3) a higher proportion of retirement holds in taxable bonds. The sign of the tax effect should be the same on both the extensive and intensive margins.

Before turning to these questions, I first address an endogeneity issue that arises when estimating the effect of taxes on portfolio choices. Because households can affect their tax liability through their financial portfolio choices, the marginal tax rates that a household faces are endogenous. To solve this endogeneity problem, I employ instrumental variable techniques to consistently estimate the effect of taxes on portfolio choices. The instrument that I use is based off of the different intensities of tax treatments that households received because of the 2001 and 2003 tax acts. Specifically, when a tax policy differentially impacts some individuals according to an exogenous characteristic, then the grouping variable that could be used in a difference-in-differences analysis can instrument for the change in tax rates that a household faces (Moffitt and Wilhelm 2000).

A candidate for an instrument for the change in tax rates is a characteristic that separates households according to their tax treatment (i.e., is correlated with income and thus tax rates) but is not affected by the tax policy directly. The characteristic I use is the educational attainment of the head of household. Educational attainment is correlated with permanent income and thus marginal tax rates (Eissa (1996b), Blundell et al. (1998), and Moffitt and Wilhelm (2000)). Yet, it is unlikely that households manipulated their choice of education in response to the 2001 and 2003 tax acts, so educational attainment is uncorrelated with transitory income and with

behavioral responses to the tax change. I use an indicator for whether the household head has a college degree.

The following equation instruments for the change in tax rates:

$$\tau_s(x_{i,s}) = \gamma_0 + \gamma_1\{college * \mathbb{I}(post-treatment)\}_{i,s} + \gamma_2\mathbb{I}(post-treatment)_{i,s} + X_{i,s}\xi + u_{i,s} \tag{3.1}$$

where *college* is an indicator variable that equals one if the head-of-household has at least a college degree, and zero otherwise. The interaction term $college * \mathbb{I}(post - treatment)$ instruments for receiving the low tax treatment. The tax rate differential increased for all households, so the coefficient on the post-treatment indicator variable should be positive. This tax rate differential also increased by more for lower income households than higher income households, so the coefficient on the instrument should be negative.

Table 3.5 presents select results from the first-stage regressions. The estimated coefficients, standard errors and p-values presented are those for the instrument. As expected, the parameter estimates on the interaction term are negative in each of the regressions. F-statistics for the exclusion restriction are also included. The critical value of a 5% Wald test is 16.38,[9] so the hypothesis that the high treatment indicator is a weak instrument is rejected for regressions using the 2007 SCF data as the post-treatment sample.[10] For the remainder of the paper, I do not use the 2004 SCF to examine the impact of the 2001 and 2003 tax acts on household portfolio choices.

3.5.1 Extensive margin

To examine whether taxes affect the decision to allocate any funds to an asset class, I estimate linear probability models for asset ownership. The probability that

[9] See Stock and Yogo (2002) for critical values for a test of weak instruments.

[10] When instruments are not strongly correlated with the endogenous variable that they are meant to instrument for, then traditional asymptotic inference may poorly approximate the finite sample distributions of conventional test statistics and estimators (Bound, Jaeger and Baker (1995), Chernozhukov and Hansen (2005)).

Table 3.5: First-stage regression results

(Pre-period, Post-period)	(1998, 2004)		(1998, 2007)		(2001, 2004)		(2001, 2007)	
	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error
$\mathbb{I}(College = 1) * \mathbb{I}(Post - treatment = 1)$	-0.64	0.21	-1.12	0.18	-0.58	0.22	-0.99	0.19
$\mathbb{I}(College = 1)$	1.33	0.12	1.32	0.12	1.29	0.15	1.26	0.15
$\mathbb{I}(Post - treatment = 1)$	3.24	0.12	3.70	0.11	2.72	0.12	3.14	0.12
F-statistic on exclusion restriction	10.96		44.86		7.68		29.17	
No. of observations								

Authors estimates using the SCF. Estimates are weighted by SCF sampling weights and corrected for multiple imputations.

a household invests in a particular asset class is assumed to be a function of the marginal tax rate, household wealth, demographic characteristics and risk preferences. Let D_{ij} denote the indicator variable that equals one if household i holds assets in asset class j and zero otherwise. Accounting for the endogeneity of marginal tax rates using instrumental variables techniques, the following linear probability model is estimated by two stage least squares:

$$Prob(D_{ij} = 1) = a_j\tau + X_i'b_j + c_j\mathbb{I}(post - treatment) + e_{ij}$$

$$\tau_s(x_{i,s}) = g_0 + g_1\{college * \mathbb{I}(post - treatment)\}_{i,s} + g_2\mathbb{I}(post - treatment)_{i,s} + X_{i,s}h + v_{i,s} \tag{3.2}$$

The year fixed-effect controls for aggregate changes in portfolio holdings over time. Controling for the impact of changing market conditions and other macroeconomic factors is important because there were several significant events that occurred between the survey samples. Examples of such events include the dot-com bubble, Enron accounting scandals, the terrorist attacks of 9/11, and the housing bubble. If these events affected household portfolios similarly, then they will be picked up by η_j and the estimated tax effect is consistently estimated using the differential changes in portfolio changes across treatment groups.[11]

The variables contained in the vector X control for other factors that may influence portfolio choices. First, young individuals have greater flexibility over their labor supply choices because they can mitigate lower short-term returns by working more and retiring later. Thus, younger households may be more willing to invest in riskier assets (Z. Bodie and Samuelson 1992). I include six age categories and an indicator for the head of household being retired to account for this effect. One

[11] If these events affected households at different levels of income heterogeneously, then part of the estimated tax effect is due to these other factors. This is not likely to be a major concern at the extensive margin, and a discussion of the impacts on the intensive margin will be presented in the next section.

explanation for incomplete portfolios is that there may be costs associated with holding assets that cause investors to specialize in only a subset of assets. For example, household portfolio decisions may be partly based on information and transactions costs that are associated with holding various assets (King and Leape 1998). Information costs may deter some from investing in stocks (Haliassos and Bertaut (1995) and Bertaut (1998)). To account for information costs, an indicator for the head of household having at least a college degree is included.[12] As in previous studies, net worth categories proxy for the importance of transaction costs because such costs are likely to be decreasing with wealth.[13] Risk preferences are also important factors in portfolio choices. I include an indicator variable for the household being "risk-averse," i.e., that it reports they are unwilling to undertake financial risks. It is predicted that such households are less likely to hold stocks and more likely to hold bonds and other interest-bearing accounts.

Parameter estimates on the tax variables from these models are presented in Table 3.6. To facilitate interpretations of the tax effects, the parameter estimates and standard errors that are presented are multiplied by a hundred. For example, the estimated impact of a 1-percentage point increase in the ordinary income and capital gains marginal tax rate differential leads to a 7.39 (7.00) percent decrease in the probability that a household holds tax-deferred bonds (equities) using 1998 as the pre-treatment sample. These estimates are consistent with retirement accounts being less necessary for shielding their assets using tax-deferred vehicles. As predicted, the probability of holding equities is positively related to the ordinary income and capital

[12]Note that it is the interaction of college attainment and being from the post-treatment sample that instruments for the change in tax rates that a household faces.

[13]Chiteji and Stafford (1999) find that individuals were more likely to invest in the stock market if their parents invested in the stock market. Some of this effect should partly be captured by race and educational attainment factors. There are other costs that may be important but are not directly accounted for. Fixed costs associated with an initial investment may also be important. Brokerage accounts and mutual funds, for example, often require a minimum balance. The tax system may impose additional costs in that a household considering entering the stock market may be deterred from doing so because it would complicate their tax returns.

gains tax rate differential. This relationship is not statistically significant at even the 10% level, however. The tax rate changes of the 2001 and 2003 tax acts is associated with a decreased probability of investing in stocks or bonds in retirement accounts.

Table 3.6: Linear probability model results

	Est. Coeff.	Std. Error	p-value	Est. Coeff.	Std. Error	p-value
Directly held equity	1.05	2.31	0.65	2.98	2.85	0.30
Taxable bonds	2.70	1.40	0.05	-0.35	1.55	0.82
Nontaxable bonds	1.00	1.10	0.36	1.48	1.37	0.28
Equity in retirement accounts	-7.00	2.94	0.02	-1.91	2.97	0.52
Bonds in retirement accounts	-7.39	2.93	0.01	-7.52	3.59	0.04
Interest-bearing accounts	-0.59	0.46	0.20	-0.31	0.54	0.57
Pre-treatment sample		1998			2001	
Post-treatment sample		2007			2007	

Authors estimates using 1998 and 2007 Surveys of Consumer Finances. Estimates are weighted by SCF sampling weights and corrected for multiple imputations. Presented coefficients are 100 times the estimated coefficients from the LPM.

To inform the economic significance of the tax acts on household portfolio choices, I consider the predicted changes in portfolios as a percentage of holding probabilities prior to the tax changes. Because the tax acts changed the structure of the tax schedule, the predicted changes in household ownership probabilities and portfolio shares are given by the following equations:

$$\widehat{\Delta D}_j = \hat{a}_j(\tau_1 - \tau_0) + \hat{c}_j \tag{3.3}$$

Table 3.7 provides the net effect of the 2001 and 2003 tax acts on households in the highest tax bracket and those in the next three tax brackets. These effects are based off of the regression results using the 1998 and 2007 data presented in Table 3.6. The different intensities of the tax treatment are apparent in these computations. In percentage terms, there were substantial changes in ownership probabilities in response to the tax acts.

Table 3.7: Economic effects of the tax acts on ownership probabilities

For the following tax brackets in 1998				
	18	31	36	39.6
	Predicted change in ownership probabilities			
Directly held equity	28.63	18.13	18.13	16.45
Taxable bonds	33.17	6.17	6.17	1.85
Nontaxable bonds	20.47	10.47	10.47	8.87
Equity in retirement accounts	-83.52	-13.52	-13.52	-2.32
Bonds in retirement accounts	-88.67	-14.77	-14.77	-2.95
	11.87	17.77	17.77	18.71
	Predicted change as a percentage of 1998 baseline			
Directly held equity	71.92	31.30	28.03	21.20
Taxable bonds	441.49	50.71	17.04	6.73
Nontaxable bonds	361.51	91.51	149.60	24.83
Equity in retirement accounts	-135.69	-21.93	-16.84	-2.90
Bonds in retirement accounts	-198.31	-38.74	-27.09	-6.86

Author's calculation using estimates from the 1998 and 2007 SCF samples. Predicted changes are capped so that the post-treatment probabilities do not exceed 100%.

3.5.2 Intensive margin

To examine the effect of taxes on the allocation of financial wealth, I run instrumental variable regressions for the portfolio share in each asset class. Let S_{ij} represent the share of a household i's portfolio that is allocated to asset j. Conditional on net worth, demographic characteristics and risk preferences and accounting for the endogeneity of marginal tax rates, the share of financial assets allocated to each asset class is given by:

$$\begin{aligned} S_{ij} &= \alpha_j \tau_i + X_i' \beta_j + \eta_j \mathbb{I}(post - treatment) + \varepsilon_{ij} \\ \tau_s(x_{i,s}) &= \gamma_0 + \gamma_1 \{college * \mathbb{I}(post - treatment)\}_{i,s} + \gamma_2 \mathbb{I}(post - treatment)_{i,s} \\ &\quad + X_{i,s}\xi + u_{i,s} \end{aligned} \tag{3.4}$$

While nearly all households report having at least a checking account, there are a small number of households who report that they do not have financial portfolios. I exclude these 324 households (109, 72, 82, and 61) from the sample when considering

portfolio shares.

The controls in X are the same as those use for estimating models of the extensive margin and the predicted signs on their effects on portfolio shares are generally the same as on the extensive margin. In addition to the explanations provided for the impacts of these variables on the extensive choice, there is a mechanical relationship between age and portfolio shares allocated to retirement accounts. As households continue to contribute to their retirement accounts in preparation for retirement, the value of retirement savings grows. Once the household head is beyond retirement age, the household presumably begins consuming out of their retirement accounts. The year effect again controls for aggregate changes in financial markets between the years considered.[14]

Table 3.8 presents estimated coefficients and standard errors for the tax rate differential from the two-stage least squares regressions. As equities become tax preferred, households appear to have shifted their financial portfolios towards directly held equities. The estimated coefficient on the ordinary income and capital gains tax rate differential in the regression for equity portfolio shares is positive, as predicted, and is statistically significant. As the gap between the tax rates on ordinary income and capital gains increases by 1-percentage point, households shift their portfolio shares towards equities by 2.83 percentage points. That the effect of these changing tax rates did not statistically affect equity investments on the extensive margin facilitates the interpretation of the effect of these tax policies on the share of financial portfolios invested in equities. The estimated impact of taxes on portfolio shares allocated to

[14]If macroeconomic factors affected all households similarly, then these effects are captured in the year fixed effect and the estimated tax coefficient contains the differential changes in portfolio patterns due to non-tax factors. If dot-com stocks were disproportionately held at the upper tail of the income distribution, there would be a decline in equity portfolio shares among high income households because of non-tax reasons. This would bias the parameter estimates on the tax effect against finding a positive result. Moreover, it is likely that the effect of the dot-com bubble would have dampened by 2007.

equities is not affected by households becoming stock market participants because of the tax policy changes.

Table 3.8: Portfolio share model results

	Est. Coeff.	Std. Error	p-value	Est. Coeff.	Std. Error	p-value
Directly held equity	2.83	1.34	0.03	3.13	1.68	0.06
Taxable bonds	0.65	0.36	0.07	-0.11	0.34	0.74
Nontaxable bonds	-0.14	0.29	0.63	0.05	0.35	0.89
Equity in retirement accounts	-2.69	1.74	0.12	0.41	2.00	0.84
Bonds in retirement accounts	1.83	1.65	0.27	0.41	1.91	0.83
Interest-bearing accounts	-2.48	2.12	0.24	-3.88	2.70	0.15
Pre-treatment sample		1998			2001	
Post-treatment sample		2007			2007	

Authors estimates using 1998 and 2007 Surveys of Consumer Finances. Estimates are weighted by SCF sampling weights and corrected for multiple imputations. As expected, these tax rate coefficients add to zero. Shares are in percentages.

There is also evidence that households shifted their bond holdings from nontaxable (federal) bonds to taxable bonds in response to the tax acts. This is expected, as the tax rates on taxable bonds and equities are decreasing relative to nontaxable bonds. These shifts are not statistically significant at the 5% level, however. The point estimates of the relationship between the ordinary income and capital gains tax rate differential and investments in retirement accounts support the hypothesis that households shelter the relatively more heavily taxed assets in retirement accounts. An increase in the tax advantage of equities relative to interest-bearing securities is associated with shifts towards holding bonds in retirement accounts and away from holding equities in retirement accounts.[15] These estimated coefficients are not statistically significant, however.

To examine the effect of the other controls on portfolio shares, Table 3.9 provides the parameter estimates for all of the covariates included in the regression model. The relationship between age and portfolio shares is generally consistent with the

[15]The asset location model in Shoven and Sialm (2003) predicts that the location of stock portfolios depends on whether such portfolios are tax-efficient. Such detail is not available from the SCF data, however.

hypothesis that younger households are more willing to invest is risker assets. In addition, households appear to invest more heavily in their retirement accounts as they age and then consume out of these accounts during retirement. Surprisingly, women appear to hold a larger share of their portfolios in equities and a smaller share in interest-bearing accounts. This finding is inconsistent with the conventional wisdom that women are less likely to invest in risky assets. The relationship between risk-aversion and portfolio shares is as expected. Households that report that they are not willing to take financial risks hold a smaller proportion of their portfolios in equities, either held directly or in retirement accounts. Rather, these households also hold a larger share of their portfolios in interest-bearing accounts.

Because of the relative increase in the tax-preference of equity securities, these households appear to shift their equity holdings out of tax-deferred accounts. As with the analysis of the extensive margin, I compute the predicted change in portfolio shares as:

$$\widehat{\Delta S_j} = \hat{\alpha}_j(\tau_1 - \tau_0) + \hat{\eta}_j \tag{3.5}$$

The top panel of Table 3.10 provides the predicted change in portfolio shares for the four highest tax brackets. In addition, the predicted change as a percentage of the average shares in 1998 for households in that tax bracket are provided in the bottom panel.

The effects of the different tax treatment intensities are apparent in these calculations, both in levels and an in percentage terms. I focus on the predictions for directly held equities, since the tax effects are statistically significant for that asset class, but the other predicted changes are included for completeness. For households in the 18% tax bracket in 1998, they are predicted to more than double their shares in directly held equities. Recall that these predicted changes are computed as the

Table 3.9: Full results from portfolio shares model

	Directly held equities			Taxable bonds			Nontaxable bonds		
	Est. Coeff.	Std. Error	p-value	Est. Coeff.	Std. Error	p-value	Est. Coeff.	Std. Error	p-value
Tax differential	2.83	1.34	0.03	0.65	0.36	0.07	-0.14	0.29	0.63
Age 25-35	-4.24	2.42	0.08	-0.33	0.33	0.32	0.44	0.27	0.11
Age 35-45	-6.71	2.54	0.01	-0.49	0.44	0.27	0.05	0.30	0.87
Age 45-55	-7.40	2.50	0.00	-0.42	0.43	0.33	-0.03	0.28	0.92
Age 55-65	-8.17	2.52	0.00	-0.55	0.34	0.11	-0.16	0.23	0.49
Age 65 +	-2.10	3.28	0.52	1.53	0.69	0.03	0.66	0.47	0.16
College	0.28	1.24	0.82	0.01	0.24	0.95	0.20	0.27	0.46
Female	3.01	1.44	0.04	0.29	0.42	0.49	-0.14	0.34	0.68
Household size	-2.81	1.17	0.02	-0.21	0.31	0.51	0.19	0.24	0.44
Household size (sq)	0.29	0.16	0.07	0.03	0.04	0.45	-0.03	0.03	0.30
Married	2.59	1.35	0.06	-0.25	0.35	0.49	-0.46	0.33	0.16
Net worth 50-100	3.44	1.39	0.01	0.06	0.26	0.82	0.17	0.23	0.46
Net worth 100-250	3.29	1.31	0.01	0.15	0.30	0.61	0.35	0.24	0.14
Net worth 250-1000	9.18	2.18	0.00	0.18	0.56	0.75	1.37	0.50	0.01
Net worth 1000 +	11.35	6.60	0.09	-0.03	1.81	0.99	3.93	1.49	0.01
Retired	7.98	2.79	0.00	1.47	0.74	0.05	0.13	0.61	0.83
Risk-averse	-3.60	1.00	0.00	0.11	0.31	0.72	-0.07	0.29	0.80
SCF = 2007	-13.83	4.31	0.00	-2.80	1.22	0.02	0.12	0.95	0.90
Constant	-2.42	7.47	0.75	-2.89	2.01	0.15	0.85	1.58	0.59
R^2	0.03			0.00			0.03		
No. of obs.	6794			6794			6794		
	Tax-deferred equities			Tax-deferred bonds			Interest-bearing accts.		
	Est. Coeff.	Std. Error	p-value	Est. Coeff.	Std. Error	p-value	Est. Coeff.	Std. Error	p-value
Tax differential	-2.69	1.74	0.12	1.83	1.65	0.27	-2.48	2.12	0.24
Age 25-35	8.04	2.44	0.00	2.71	2.41	0.26	-6.63	3.65	0.07
Age 35-45	13.88	2.81	0.00	7.50	2.62	0.00	-14.23	3.82	0.00
Age 45-55	12.51	2.64	0.00	7.57	2.56	0.00	-12.23	3.78	0.00
Age 55-65	10.21	2.58	0.00	7.97	2.47	0.00	-9.30	3.70	0.01
Age 65 +	-0.59	3.33	0.86	5.77	3.30	0.08	-5.28	4.86	0.28
College	4.29	1.75	0.01	-2.06	1.73	0.23	-2.71	2.22	0.22
Female	-1.25	1.77	0.48	2.53	1.58	0.11	-4.44	2.21	0.04
Household size	4.94	2.03	0.01	0.57	1.97	0.77	-2.69	2.40	0.26
Household size (sq)	-0.76	0.27	0.01	-0.08	0.27	0.78	0.55	0.33	0.10
Married	-0.78	2.11	0.71	2.44	1.88	0.19	-3.53	2.46	0.15
Net worth 50-100	5.56	1.78	0.00	1.79	1.66	0.28	-11.03	2.41	0.00
Net worth 100-250	8.67	1.67	0.00	4.21	1.61	0.01	-16.67	2.22	0.00
Net worth 250-1000	12.35	2.67	0.00	3.10	2.59	0.23	-26.18	3.35	0.00
Net worth 1000 +	19.67	8.47	0.02	-8.29	8.01	0.30	-26.64	10.42	0.01
Retired	-13.45	3.33	0.00	-1.52	3.06	0.62	5.38	4.13	0.19
Risk-averse	-12.00	1.34	0.00	0.09	1.39	0.95	15.47	1.74	0.00
SCF = 2007	9.35	5.60	0.09	0.70	5.25	0.89	6.46	6.72	0.34
Constant	20.10	9.21	0.03	-6.68	8.81	0.45	91.04	11.76	0.00
R^2	0.05			0.02			0.23		
No. of obs.	6794			6794			6794		

Author's estimates using the 1998 and 2007 Surveys of Consumer Finances. Estimates are weighted by SCF sampling weights and corrected for multiple imputations.

Table 3.10: Economic effects of the tax acts on portfolio shares

For the following tax brackets in 1998				
	18	31	36	39.6
	Predicted change in portfolio shares			
Directly held equity	20.13	-8.17	-8.17	-12.70
Taxable bonds	5.00	-1.50	-1.50	-2.54
Nontaxable bonds	-1.56	-0.16	-0.16	0.06
Equity in retirement accounts	-22.93	3.97	3.97	8.27
Bonds in retirement accounts	22.66	4.36	4.36	1.43
Interest-bearing accounts	-23.30	1.50	1.50	5.47
	Predicted change as a percentage of 1998 baseline			
Directly held equity	120.17	-32.01	-18.63	-37.69
Taxable bonds	387.57	-84.74	-20.57	-58.91
Nontaxable bonds	-173.20	-14.60	-19.10	1.21
Equity in retirement accounts	-68.94	12.28	15.27	30.00
Bonds in retirement accounts	107.88	26.50	72.63	16.59
Interest-bearing accounts	-86.97	6.57	9.37	26.66

Author's calculation using estimates from the 1998 and 2007 SCF samples. Note that the predicted changes sum to zero.

change in shares because of the tax treatment and the year fixed effect. Even though the tax effect itself implies an increase in portfolio shares in directly-held equities for households in the 31%, 36%, and 39.6% tax brackets, these increases are negated once the fixed effect is accounted for. Thus, those in the highest tax bracket are predicted to have reduced their portfolio shares in equities.

There are also other aspects of portfolio choice that may be importantly affected by the changing structure of the tax schedule. Because dividend tax rates were reduced substantially more than capital gains taxes, households faced increased incentives to also adjust the types of equities that they held (Miller and Modigliani (1961), Miller (1977)). There is evidence that households responded by shifting their equity holdings towards dividend paying stocks (Chapter II of this dissertation). Together these studies indicate that households not only shifted their financial portfolios towards directly held equities, but they also adjusted the types of stocks that they chose to hold based on dividend yields.

3.6 Previous empirical evidence

This study is not the first to consider the empirical link between tax rates and portfolio structures. In the first rigorous empirical study of the effect on taxes on household portfolio structures, Feldstein (1976) uses cross-section data from 1962 to estimate asset demand equations. Income, which serves as a proxy for taxes, has a strongly significant effect on the demand for assets. Conditional on wealth, high income households hold a larger share of their portfolios in equity relative to lower-income households, attributed to the advantaged tax treatment of capital gains. Without tax data, however, this study is unable to disentangle tax effects from income effects. Moreover, excluding taxes leads to potential omitted variables bias for the other estimated parameters if they are related to taxes.

Subsequent studies using data that allow marginal tax rate calculations find that taxes influence the types of assets a household holds but have little to no effect on asset allocations. King and Leape (1998) estimate switching regressions models using data from the 1978 Survey of Consumer Financial Decisions. They find that tax rates are important for determining the probability of a household choosing a particular bundle of assets. However, when correcting for the sample selection bias in conditional ownership equations, they find that there is a relatively small (negligible) effect of taxes on the portfolio share of an asset conditional on ownership. King and Leape (1987) find similar results when considering portfolio choices over the life-cycles, while Dicks-Mireaux and King (1982) find similar results when looking at pension wealth and portfolio choices. Poterba and Samwick (2002) estimate a series of probit and Tobit models on the 1983, 1989, 1992, 1995 and 1998 Surveys of Consumer Finances. They similarly find a stronger and more statistically significant

effect on ownership probabilities than portfolio shares.

The 1983 and 1989 Survey of Consumer Finances (SCF) are linked to provide a panel that spans the tax reform act of 1986. Three studies in particular use this panel dataset in a natural experiment framework to estimate the impact of taxes on portfolio choices. Scholz (1994) uses the 1983 and 1989 surveys and provides descriptive evidence of relatively small changes in portfolio structures across the two surveys. Bakija (2001) uses a fixed effects model and finds weak evidence that the relationship between marginal tax rates and household's portfolio allocations remain, even when correcting for unobserved heterogeneity across households. Samwick (2000) finds that though there is a cross-sectional relationship between tax rates and portfolio structures, it is difficult to explain changes in portfolios based on changes in marginal tax rates over time.

In these studies, the commonly used instrument for tax rates is the marginal tax rate on the "first-dollar" of investment income, i.e., the marginal tax rate that would apply to an incremental change in income when excluding all investment income from the base level of income. The justification for this instrument is that it should be uncorrelated with the econometric error term because it is the tax rate that applies before household investment decisions are made. However, this instrument may not be appropriate. Investment income may make up a large amount of income flows for some, particularly high wealth, households. For these households, the "first-dollar" marginal tax rate measure may be only weakly correlated with actual marginal tax rates. Second, if labor supply choices and portfolio choices are jointly determined, then the "first-dollar" marginal tax rate is endogenous and not a valid instrument.

My analysis contributes to this literature by proposing an instrument for tax rates that more plausibly disentangles tax effects from income effects. The instrument for

tax rates is based off of policy-driven variation in tax treatments that provides a natural experiment setting. By using data on household portfolios and tax rates before and after the tax policy changes, I link changes in tax rates to changes in portfolio compositions to uncover the tax effect. Unlike other studies of the effect of taxes and portfolio choices that use only ordinary income tax rates, I construct a measure of tax rates that considers the relative taxation of different types of investments. Following the previous literature, the changes in portfolio holdings would have been considered the result of a decrease in ordinary income tax rates, rather than an increase in ordinary income tax rates relative to capital gains tax rates.

3.7 Conclusions

I find evidence that households adjusted their financial portfolios in response to the 2001 and 2003 tax acts. As capital gains and dividend income became increasingly tax-preferred relative to interest income, households increased the share of their financial portfolios allocated to directly held equities. These shifts were significant, both statistically and economically. The changes in tax rates also imply that the incentive to shelter equities in tax-deferred accounts decreased. I find that households responded to these changing tax incentives. In response to the tax acts, the probability of holding equities in tax-deferred accounts decreased, as did the portfolio share allocated to tax-deferred equity securities.

Previous empirical studies of the relationship between taxes and portfolio structures estimate tax effects based off of a single cross-section of data. Using repeated cross-sectional data around tax policy changes to exploit exogenous variation in tax rates, this study provides an estimate that more plausibly captures the effect of taxes on portfolio choices. The identification of tax effects comes from the differential in-

tensity of tax treatments that households faced due to the tax acts, rather than relying on nonlinearities in the tax schedule. In addition, this paper proposes that the relevant measure of tax rates for these policy changes is the difference between the ordinary income and capital gains tax rates. Because the 2001 and 2003 tax acts changed both rates, this tax measure better captures the relative tax treatments of different financial assets than the ordinary tax rate alone, which is the typical tax measure used in the previous literature.

As previous studies of taxes and portfolio choice, I exclude real estate and non-financial assets from the analysis. However, the interaction of real estate portfolios and other financial portfolios is an interesting and important area of research, particularly in the time period considered. As the housing market boomed throughout the early 2000s, households may have shifted their investments from stock or bond holdings and into real estate investments. Estimating a model that tackles the question of how taxes affected the allocation of funds between real estate investments and financial investments is left for future work.

CHAPTER IV

Does it matter who you talk to?: The role of financial advice in portfolio responses to taxes

4.1 Introduction

There is substantial empirical evidence that taxes affect the structure of household financial portfolios. Households consider taxes when determining how to allocate their wealth between stocks, bonds, and interest-bearing accounts and when determining which stocks to hold based on dividend yields.[1] In these studies of portfolio choice, investors are assumed to respond to taxes homogeneously. However, individuals may differ in their portfolio responses to tax policy changes in important ways.

In this paper, I consider financial literacy and tax saliency as factors that may lead to heterogeneous portfolio responses to taxes. For example, some investors may not adjust their financial portfolios in response to tax policy changes if they have a poor understanding of financial markets or are uncertain of the impact of tax policy on their finances. A poor understanding of financial markets or taxes may also lead others to over-react. In addition, capital income taxes may not be equally salient to all investors. That is, some investors may only consider pre-tax returns rather than

[1] Poterba (2002b) provides an overview of the literature on taxes and portfolio choices. Studies of the effect of taxes on investments in different financial asset classes include Feldstein (1976), Scholz (1994), King and Leape (1998), Samwick (2000), Poterba and Samwick (2002), and chapter III of this dissertation. Scholz (1992), Graham and Kumar (2006), and chapter II of this dissertation provide examples of empirical studies of the impact of taxes on the types of equities that individuals choose based on dividend yields.

after-tax returns when making portfolio decisions.

This paper has two goals. The first goal is to construct a novel measure of financial sophistication based on the sources of advice sought when making investment and borrowing decisions. Households list the sources of advice they use among a wide array of choices, including several financial professionals, friends and family, work colleagues, the Internet, and other media sources. I examine which of these advice sources are correlated with sophisticated financial choices, defined as stock market participation and increased portfolio diversification. I find that seeking financial advice from a broker, financial planner, the internet, or magazine and news sources is significantly correlated with investing in stocks and holding more diversified portfolios. Often, however, bankers, friends and television and radio sources are found to be correlated with unsophisticated financial portfolio choices. These patterns inform the aggregation of advice sources into those that provide sophisticated financial advice and those that do not.

My second goal is to test whether the equity portfolios of households that use sophisticated financial advice sources are more responsive to taxes. I examine equity portfolio responses to the dividend and capital gains tax rate reductions of the Jobs and Growth Tax Relief Reconciliation Act of 2003 (henceforth referred to as the 2003 tax act). According to the dividend clientele hypothesis, the change in a household's equity portfolio dividend yield should be related to its change in dividend and capital gains tax rates (Miller and Modigliani 1961). Using the 2001 and 2004 Surveys of Consumer Finances (SCF), which provide information on household wealth in the United States, I estimate the relationship between tax rate changes and equity portfolio dividend yield changes allowing for heterogeneous tax responses among those with different types of advice sources. Heterogeneous tax responses may reflect

differences in financial literacy or differences in the salience of capital income taxes that varies with financial sophistication. Less financially sophisticated households may not consider after-tax returns, but instead focus on pre-tax returns when making portfolio choices.[2]

I find little evidence of heterogeneity in the portfolio responses to tax changes. For all types of advice sought, the relationship between the tax disadvantage of dividends and portfolio dividend yields is negative, as predicted. Moreover, the magnitude of the tax effect is generally larger for households who use sophisticated financial advice sources compared to other households. In nearly all specifications, however, I am unable to reject that tax responses are the same across sophistication groups at the 5% level. In some specifications, I reject at the 10% level that the tax effects are the same for those using financial professionals as for other households.

This work is closely related to a recent literature on financial literacy. Several studies document widespread financial illiteracy in the United States. A National Council on Economic Education survey and a survey through the Jump$tart Coalition for Personal Financial Literacy (Mandell 2004) find that high school students performed poorly answering questions about personal finance and credit. A financial literacy quiz conducted through the 2001 Survey of Consumers finds that even this broader population is unfamiliar with basic aspects of the stock market and mutual funds (Hilgert, Hogarth and Beverly 2003).

In a series of papers, Annamaria Lusardi and Olivia Mitchell field financial literacy questions in the Health and Retirement Survey (HRS), the National Longitudinal Survey of Youth (NLSY), and the American Life Panel survey (ALP). Only half of the respondents in the 2004 HRS, which targets individuals 50 years of age and older,

[2]This salience argument is similar to Chetty, Looney and Kroft (2009), where they find that despite knowing which grocery store items are taxed, customers tend to focus on the posted price when shopping.

correctly answered simple questions about inflation and compound interest and only a third were able to additionally answer a simple question about risk diversification correctly (Lusardi and Mitchell 2007).[3] The ALP surveys individuals in their prime working years, with most respondents between ages 40 and 60. Even among this relatively richer and more educated respondent group, familiarity with financial concepts is severely lacking (Lusardi and Mitchell 2009a). The 1997 NLSY reveals that financial illiteracy is also pervasive among younger Americans (Lusardi, Mitchell and Curto 2009a).

This study contributes to both the literature on financial literacy and the literature on taxes and portfolio choice. This study provides the first analysis (to my knowledge) to relate information on sources of financial advice, found in the SCF, to financial sophistication. Previous studies of financial literacy rely on answers to simple questions testing economics and finance concepts to determine how knowledgeable a person is about finances. There is evidence that the wording of these quiz-like questions matters, which suggests that some respondents simply guessing. When relating these financial literacy measures to economic choices it is unclear whether the estimated effects are measuring the impact of financial literacy or other cognitive skills. The financial advice source measures developed in this paper may provide a way to measure sophisticated financial decision-making without confounding effort in responding to survey questions. An additional advantage of these new measures of financial sophistication is that sophistication need not be tied to a household's own level of knowledge. An individual who knows he is unsophisticated, and thus would perform poorly on a financial literacy quiz, may seek sources of more sophisticated advice as a result. This individual would be able to make sophisticated

[3]Similar patterns arise in the 2008 HRS (Lusardi, Mitchell and Curto 2009b), which contains a new module on financial literacy and financial sophistication that allows even further investigation of differences in financial literacy.

portfolio choices because of the advice that he receives. Thus, the results of this paper suggest that access to financially sophisticated advice sources, rather than an individual's own level of financial literacy, may be an important aspect of differences in portfolio choices and tax responses.

This study is also the first (to my knowledge) empirical link between financial sophistication and portfolio responses to taxes. There are several studies that have linked financial literacy to other aspects of household portfolio choice. Specifically, a lack of financial literacy is found to partly explain why many households do not participate in the stock market (Kezdi and Willis (2003), vanRooij, Lusardi and Allessie (2007), Kimball and Shumway (2007)) and tend to hold under-diversified portfolios (Kimball and Shumway 2007). Previous studies of the relationship between taxes and portfolio choices treat all households as though they respond to taxes uniformly. If investors respond to taxes differently, then previous estimates of the tax effect on household portfolios are an average of responses in the population. This averaging fails to capture the systematic differences in how households adjust their financial portfolios in response to tax policy changes.

It is important to note that the estimates provided in this paper should be not be interpreted as those of the causal effect of advice sources on tax responses. The results provide insights into the differences in tax responses between households that are otherwise similar (defined by a set of demographic and socioeconomic controls) but for the advice sources that they use. There are many reasons why households may choose to use particular sources of investment advice, which are not explicitly addressed here. To assess whether changing a household's access to financial advice will lead to different portfolio responses to tax policy requires exogenous variation in advice sources, most likely to be generated in an experimental setting. In conjunction

with recent studies that use experimental designs to provide evidence of a causal link between tax saliency and economic choices, experiments on the impact of access to financial advice on economic outcomes would also help determine whose financial sophistication is important.[4]

The welfare consequences of heterogeneous portfolio responses to taxes are not formally addressed in this paper.[5] Intuitively, differences in household tax responsiveness have important implications for the distribution of welfare losses due to taxes. If financially sophisticated investors are more tax responsive than others, *ceteris paribus*, they are better able to minimize their tax burdens through portfolio adjustments. A heterogeneity in responsiveness implies that capital income tax burdens (and welfare losses) fall disproportionately on unsophisticated investors. If some households do not adjust their portfolios efficiently because capital income taxes are not salient or they are unsophisticated about financial markets, then this will lead to a loss of surplus for these individuals. Thus, this area of research is of increasing importance to policy makers if policies shift towards increased personal responsibility for retirement financing.

The remainder of the paper is organized as follows. Section 4.2 describes the Survey of Consumer Finances data used. Section 4.3 examines advice sources in depth and relates such advice sources to financial sophistication. Section 4.4 describes the predicted equity portfolio responses to the 2003 tax act with both homogeneous and heterogeneous portfolio responses. Results of the model with heterogenous responses are also described in Section 4.4. The final section concludes. Appendix A

[4]Chetty et al. (2009) randomize whether grocery stores post pre-tax or after-tax prices and find that customers are more responsive to tax rates when they are included in the posted prices. Two studies deliver different treatments in training and to assess the impact of training. Using a randomized experiment with H&R block, Chetty and Saez (2009) find that increased information about the Earned Income Tax Credit affects recipients' labor market choices. In addition, Duflo and Saez (2006) find that the information of peers play an important role in pension contributions.

[5]If capital income taxes are not salient to all investors, Chetty's (2009) formulas for the efficiency costs of taxation with irrational consumers can be used to compute the welfare losses due to optimization errors.

complements the analysis in Section 4.3 and provides the unconditional relationships between household financial portfolios and advice sources, Appendix B provides an analysis similar to that in Section 4.4 where sophistication groups are made without relying on the analysis done in Section 4.3. Lastly, Appendix C presents an analysis of heterogeneous tax responses on the extensive margin of portfolio dividend choices.

4.2 Survey of Consumer Finances

I use data from the 2001 and 2004 Surveys of Consumer Finances (SCF), a triennial survey conducted by the Federal Reserve Board of Governors. The survey contains detailed household-level asset and liability information, a rich set of demographic characteristics and information regarding attitudes towards risk and credit. The SCF includes 4,442 and 4,519 households in the 2001 and 2004 surveys, respectively. The SCF provides stratified random samples along with sampling weights so estimates can be weighted to represent the U.S. household population in each year.[6] All summary statistics, regressions and their standard errors are weighted by SCF sampling weights. Missing values are replaced using a multiple imputation technique.[7] All summary statistics and estimations are corrected for multiple imputations, required because standard methods would treat multiple imputations as independent observations.

There are four broad variable categories that I construct from the SCF data: (1) sources of financial advice; (2) marginal tax rates; (3) equity portfolio data; and (4) demographic characteristics and preference proxies. I describe each of these in turn.

[6]The sampling methodology of the SCF has two parts. One sample frame is from an area probability weighted sample derived from the Census Bureau's national sampling frame. The second frame is derived from the IRS Statistics of Income Individual Taxpayer File and is used to oversample high-income households.

[7]See Kennickell (1998) for an overview of the multiple imputation methodology. The SCF codebooks describe methods to correct for multiple imputations to account for observations not being independent across imputations. These multiple imputations improve the efficiency of the point estimates by increasing the sample size, but as with any imputed values, require that the missing observations be conditionally random. I assume that these imputations are computed so that this assumption is satisfied.

4.2.1 Sources of financial advice

There are two questions in the SCF that ask respondents where they seek advice when making investment and credit decisions.[8] These questions are:

> (1) What sort of information do you (and your [husband/wife/partner]) use to make decisions about investment or savings? (Do you call around, read newspapers, magazines, material you get in the mail, use information from television, radio, an online service, or advertisements? Do you get advice from a friend, relative, lawyer, accountant, banker, broker, or financial planner? Or do you do something else?)[9]

> (2) What sort of information do you (and your [husband/wife/partner]) use to make decisions about credit or borrowing? (Do you call around, read newspapers, magazines, material you get in the mail, use information from television, radio, an online service, or advertisements? Do you get advice from a friend, relative, lawyer, accountant, banker, broker, or financial planner? Or do you do something else?)

A list of possible responses to these questions are presented in Table 4.1. Respondents are permitted to report all advice sources used, and the responses are recorded in the order in which they are reported.

Table 4.2 presents the proportion of households that report using each advice source. Friends and relatives are the most frequently sought sources of advice, fol-

[8] There are two questions that were considered but are not used in this study because their relationship to financial sophistication is ambiguous. Respondents are asked how intensely they shop around for the best terms when making credit or investment decisions. Responses may proxy for information costs associated with learning about financial instruments. In addition, some may not search intensely because of high costs associated with seeking advice.

[9] The section in parentheses is read on phone interviews. During in-person interviews, people are shown the list of options.

Table 4.1: Codes for advice sources sought

SCF code	Description
1	Call around
2	Magazines/newspapers; books
3	Materials in the mail
4	Television/radio
5	Online services/internet
6	Advertisements
7	Friend/Relative
8	Lawyer
9	Accountant
10	Banker
11	Broker
12	Financial planner
13	Self; spouse/partner
14 (b)	Never borrow
14 (i)	Do not save/invest
16	Don't shop around/always use the same institution
17	Past experience
18	Materials from business/work contact
19 (b)	Other personal research
19 (i)	Investment club
20 (b)	Real estate broker; builder
20 (i)	Investment seminars
21 (b)	Other institutional source (e.g., college, social service agency)
21 (i)	Other personal research
22	Shop around
23	Store; dealer
24	Insurance agent
25 (i)	Other institutional source
32	Telemarketer

Source: Survey of Consumer Finances Codebook. SCF codes are almost always the same for questions about borrowing and investments. Where they differ, the response to the response for borrowing is indicated by (b) and for investment is indicated by (i).

lowed by bankers. As expected, the internet has become an increasing source for financial advice over time. Telemarketers and other sources are never reported as sources of advice. Because households are permitted to report several advice sources, the rows should not necessarily sum to 100%. In fact, households report between 1 and 13 sources of advice, with an average ranging from 2 to 3. The empirical distributions of the number of sources used for borrowing and investment advice are provided in Figure 4.1. Not surprisingly, the number of sources sought for both questions follow a long-tailed distribution.

Table 4.2: Percentage of households reporting each advice source

	Investment advice		Borrowing advice	
	2001	2004	2001	2004
Call around	19.4	17.9	36.3	31.6
Magazines/newspapers	16.2	16.9	22.5	21.2
Mail	8.5	8.0	17.3	18.3
TV/radio	8.2	8.1	13.5	12.6
Internet	14.8	19.5	21.8	30.0
Advertisements	8.0	7.5	15.6	14.2
Friend/Relative	36.0	34.2	39.8	39.3
Lawyer	3.5	3.1	3.7	3.9
Accountant	7.2	7.1	7.3	7.8
Banker	26.0	26.0	29.8	29.1
Broker	12.0	11.2	5.2	6.4
Financial planner	17.7	19.4	9.1	9.6
Self/Spouse	12.7	11.4	8.1	7.7
Never borrow (b) / Do not save/invest (i)	9.3	10.0	10.9	9.9
Doesn't shop	–	–	0.2	0.3
Doesn't save/invest	0.2	0.2	–	–
Past experience	0.0	0.0	0.1	0.1
Work contact	1.7	1.7	0.3	0.2
Personal research	0.6	0.4	0.1	0.1
Real estate broker	–	–	0.2	0.1
Other institutional source	–	–	0.6	0.3
Investment club	0.1	0.0	–	–
Investment seminar	0.1	0.0	–	–
Shop around	0.0	0.2	0.1	0.1
Store/dealer	0.0	0.0	0.1	0.2
Insurance agent	0.1	0.0	0.1	0.0
Telemarketer	0.0	0.0	0.0	0.0
Number of sources	2.02	2.03	2.43	2.43
Number of obs.	4519	4442	4519	4443

Source: Author's calculations using 2001, 2004 and 2007 Surveys of Consumer Finances. Statistics are weighted by SCF sampling weights.

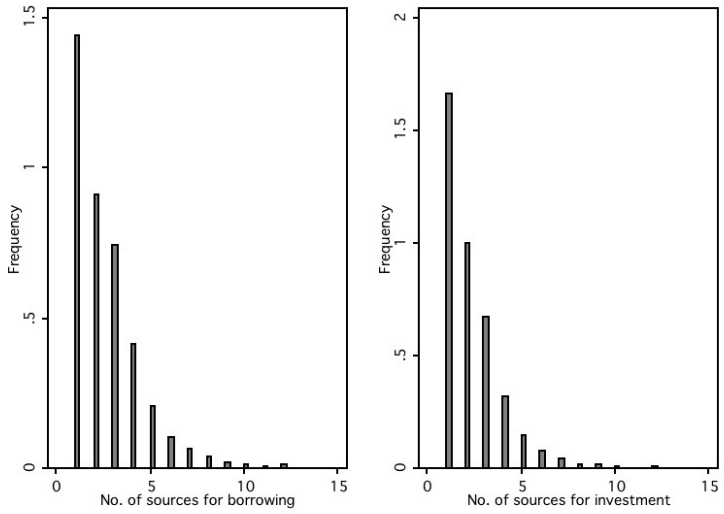

Figure 4.1: Number of sources used for borrowing and investment decisions

Table 4.3 presents the percentage of households reporting each advice source when they only report one. The most frequent response is that the household does not invest or borrow. If a household borrows or invests, they seek advice from a financial professional or personal contacts when only one source is used. For example, people are talking to friends or bankers if they use only one source for advice, rather than relying on advertisements or a lawyer. Presumably, a household will turn to a friend as its sole source of financial advice if they believe that friend is well-informed. That bankers are used more frequently than brokers or financial planners may reflect ease of access because bankers are available to customers with a bank account whereas brokers and financial planners typically require additional fees. In the 2001 SCF, 87.3% of households have a checking account. This number rose to 89.4% in the 2004 SCF. Presumably these households could ask a banker for advice at a relatively low cost. Further analysis on the determinants of advice sources and the relationship between advice sources and financial sophistication is presented in section 4.3.

Table 4.3: Proportion of households using each advice source when only one source is reported

	Investment advice			Borrowing advice	
Variable	2001	2004	Variable	2001	2004
Does not invest	18.1	20.8	Does not borrow	25.8	26.0
Friend	18.7	15.5	Banker	20.1	20.4
Banker	16.6	18.8	Friend	15.0	15.6
Self	14.0	10.7	Call around	13.0	8.9
Financial planner	8.8	9.3	Self	8.0	7.6
Call around	7.5	5.5	Mail	3.4	3.6
Broker	4.4	4.8	Internet	3.0	6.7
Magazine/news	2.5	2.7	Magazine/news	2.1	2.0
Internet	2.2	4.2	TV/radio	1.9	1.9
Work	1.9	2.0	Advertisements	1.8	1.0
TV/radio	1.5	1.3	Financial planer	1.5	1.7
Mail	0.8	1.1	Broker	1.2	0.8
Accountant	0.8	1.4	Accountant	0.6	1.2
Advertisements	0.9	0.7	Institutional source	0.8	0.5
Lawyer	0.5	0.5	Lawyer	0.5	0.7
Doesn't shop around	0.4	0.3	Doesn't shop around	0.4	0.6
Personal research	0.3	0.3	Store	0.3	0.3
Shops around	0.0	0.1	Work	0.3	0.1
Investment club	0.0	0.0	Past experience	0.3	0.1
Insurance agent	0.0	0.0	Personal research	0.1	0.1
Institutional source	0.0	0.0	Shop around	0.1	0.3
Store	0.0	0.0	Real estate agent	0.0	0.2
Telemarketer	0.0	0.0	Insurance agent	0.0	0.0
Investment seminar	0.0	0.0	Telemarketer	0.0	0.0
Past experience	0.0	0.0			
Number of obs.	4519	4442	4519	4442	

Source: Author's calculations using SCF data.

4.2.2 Marginal tax rates

I use is the difference between the effective tax rates on dividend income and long-term capital gains as a measure of the tax incentives that households face. This measure captures the tax disadvantage of stocks that deliver more of their returns in the form of dividend income relative to stocks that deliver returns in the form of capital gains. To compute marginal tax rates on dividends and capital gains, I construct household adjusted gross income and information on deductions from variables provided in the SCF. I pass these variables through the National Bureau of Economic Research's TAXSIM web program to compute statutory federal marginal tax rates for dividend income and capital gains.[10] The tax rate on dividend income is equal to the ordinary income marginal tax rate for observations from the 2001 survey sample and equal to the statutory long-term capital gains tax rate for observations from the 2004 sample.

The *effective* tax rate on long-term capital gains is lower than the statutory rate because taxes on capital gains are deferred until they are realized and because capital gains that are accrued until death qualify for a "basis step-up," which excuses the tax liability on such gains. I compute effective long term capital gains tax rates following King and Fullerton (1984), who argue that the statutory tax rate on capital gains should be halved to account for the option value of tax-deferral, and halved again to account for the step-up basis at death and the selected realization of losses.[11] Effective dividend and capital gains marginal tax rates computed from the SCF data are presented in Figure 4.2.

[10] Stata programs that convert SCF data into variables required for TAXSIM are available at the NBER website. The TAXSIM programs are found at `http://www.nber.org/~taxsim/to-taxsim/`. See Feenberg and Coutts (1993) for a description. State tax rates are a potentially useful source of tax rate variation. However, to maintain anonymity, state identifiers are omitted from the public SCF datasets so this information cannot be used.

[11] Ivkovic et al.'s (2005) simulations of effective capital gains tax rates show that such rates can vary widely depending on the assumptions of holding patterns, appreciation rates and asset location. Thus, I follow the long-established convention of using 25% of the statutory rate to measure the effective capital gains rate.

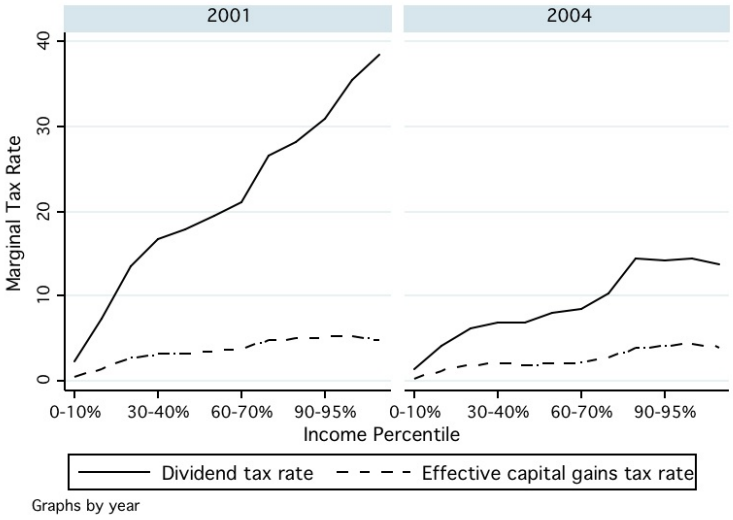

Figure 4.2: Effective marginal tax rates by income percentile, 2001 and 2004

4.2.3 Equity portfolio yields

When examining the effect of taxes on household portfolios, the dependent variable of interest is the household-specific portfolio dividend yield, defined as the dollar value of dividend income received in the previous calendar year divided by the market value of equities at the time of the survey.[12] Thus, this portfolio dividend yield measure is interpreted as the average dividend yield for every dollar of equity held. All components of this variable correspond to investments in taxable (i.e., non-retirement) accounts.

Taxable equity is the sum of stocks held directly, stocks held in mutual funds, and stocks held in trusts, annuities or other managed investment accounts. Equity held in mutual funds is the sum of the full value of stock mutual funds and half the value of combination (stock and bond) mutual funds. The full value of other

[12]The 2001 SCF was conducted between May and December 2001, while the 2004 SCF was conducted between June 2004 and February 2005. The difference in the timing between the value of equity and the equities from which dividend income is drawn may bias the yield measure. Unfortunately, there is no information that would inform on the direction of the bias. In particular, there is no information about capital gains or capital losses that could be used to infer whether households are moving in or out of stocks. For the remainder of the paper, I implicitly assume that the measurement error induced from this timing difference is zero on average.

managed assets is included if it is mostly invested in stock, half the value if it is split between stocks and bonds/money market accounts, and a third of the value if it is split between stocks, bonds and money market accounts. All variables are adjusted to 2004 dollars.

4.2.4 Demographic characteristics and preference proxies

The demographic variables are: age, and indicator variables for having earned a college degree, for being retired, for being married, for being female, and for being nonwhite. Nonwhite includes black, Hispanic/Latino, Asian, American Indian and Pacific Islander. Each of these variables corresponds to the characteristics of the head of household. Income and net worth are constructed at the household level. The SCF collects detailed information on occupation and industry for both the head of household and his or her spouse. These variables are collapsed to six occupation categories and seven industry categories for the public use version of the data.[13] Information regarding who the household works for is used to construct an indicator variable for being self-employed. A question about labor market participation is used to construct an indicator variable for being retired.

To proxy for risk preferences, I use responses to a question about the "amount of financial risk that you or your (spouse/partner) [are] willing to take when you save money or make decisions." The "average risk" indicator is set equal to one for households who respond that they "take average financial risks expecting to earn average returns" and zero otherwise. Similarly, households responding that

[13]The six occupation categories are: (1) executives/managers, scientists (physical and social), counselors, lawyers/judges/legal support, teachers, entertainers, health care professionals, media/communications; (2) sales, computer programmers, science technicians, engineers; (3) services; (4) construction/maintenance, food preparation, textiles; (5) setters, operators and transportation; and (6) farmers and ranchers. The seven industry categories are: (1) agriculture, forestry, fishing; (2) mining and construction; (3) nondurable goods; (4) wholesale and retail trade; (5) finance, insurance, real estate, data processing, leasing, employment and business support, security, repair and maintenance; (6) utilities, transportation, services (publishing, library, education, health, arts, personal, religious); and (7) public administration and armed forces. This combining of responses removes variation that may be potentially useful in identifying why some households seek particular types of financial advice. For example, there is no way to separately identify a tax preparer from a real estate agent in the public use data.

they "take above average financial risks expecting to earn above average returns" are coded as being in the "high risk" group and those responding that they "take substantial financial risks expecting to earn substantial returns" are coded as being in the "very high risk" group. Respondents that say that they are "not willing to take financial risks" (risk-averse) are the omitted category. Summary statistics for all of these variables are presented in Table 4.4.

4.3 Analyzing sources of financial advice

The first goal of this paper is to determine whether the sources of advice sought for investment and borrowing decisions are related to financial sophistication. First, I examine the determinants of the number of sources a household seeks. Excluding households who report that they do not invest, I estimate the number of advice sources used as a function of demographic characteristics, socioeconomic variables and risk preferences. Results from this regression are presented in Table 4.5.[14] The industry and occupation of the head along with the occupation of the spouse are not statistically significant predictors of the number of advice sources sought. Households at the highest levels of income, highest levels of net worth and where the head has a college degree use significantly more sources of financial advice than the average household. Thus, households that would typically be expected to be more financially sophisticated appear to use more sources than other households. The relationship between age and advice sources follows an inverted U-shape, likely reflecting that households with a head between 35-45 years of age are more actively using investments to save for retirement, as life-cycle models would predict. Households willing to take financial risks also use more sources of advice than those who are not.

[14] Because the dependent variable is a count variable, I check the robustness of these results by estimating a poisson regression model. The results are generally consistent across the two estimation methods in terms of the signs and statistical significances of the estimated coefficients.

Table 4.4: Summary of demographic and socioeconomic characteristics

Variable	2001	2004
Age (mean)	48.97	49.56
Married	0.60	0.58
Female	0.27	0.28
Non-white	0.24	0.26
Household size (mean)	2.41	2.39
Has a college degree	0.34	0.37
Not willing to take financial risks	0.40	0.42
Willing to take average financial risks	0.37	0.38
Willing to take high financial risks	0.18	0.16
Willing to take very high financial risks	0.05	0.03
Occupation		
Executive/manager	0.27	0.28
Sales	0.15	0.13
Crafts	0.10	0.13
Laborers	0.10	0.08
Services	0.08	0.09
Farmers	0.02	0.01
Self-employed	0.12	0.12
Retired	0.19	0.19
Industry		
Agriculture	0.01	0.02
Mining and construction	0.08	0.08
Nondurables	0.13	0.11
Trade	0.12	0.11
Business, finance and real estate	0.12	0.08
Utilities, transportation, education, health, religion	0.24	0.27
Public administration and armed forces	0.04	0.05
Income (thousands)		
0-15	0.14	0.14
15-25	0.11	0.12
25-50	0.27	0.26
50-75	0.16	0.18
75-100	0.12	0.10
100-250	0.15	0.17
250+	0.03	0.03
Net worth (thousands)		
0-50	0.38	0.38
50-100	0.12	0.11
100-250	0.19	0.18
250-1000	0.23	0.23
1000+	0.09	0.09
Number of households (millions)	106.5	112.1
Number of observations	4519	4442

Source: Authors' calculations using SCF data. Statistics are frequencies unless otherwise noted. Statistics are weighted by sampling weights.

Table 4.5: Results from a regression of the number of advice sources used on other characteristics

Dependent variable: Number of advice sources used

	Borrowing advice			Investment advice		
Variable	Est. Coeff.	Std. Error	p-value	Est. Coeff.	Std. Error	p-value
Age < 25	-0.05	0.10	0.61	-0.22	0.09	0.01
Age 25-35	-0.10	0.07	0.17	-0.17	0.06	0.01
Age 45-55	-0.09	0.07	0.22	-0.15	0.06	0.01
Age 55-65	-0.35	0.08	0.00	-0.39	0.07	0.00
Age > 65	-0.49	0.11	0.00	-0.56	0.09	0.00
College	0.20	0.06	0.00	0.19	0.05	0.00
Female	0.16	0.07	0.02	-0.04	0.06	0.50
Nonwhite	-0.14	0.05	0.01	-0.07	0.05	0.14
Household size	0.05	0.07	0.42	-0.03	0.05	0.63
Household size (sq)	0.00	0.01	0.56	0.00	0.01	0.94
Married	0.02	0.09	0.84	0.09	0.08	0.22
Income 15-25	0.06	0.08	0.46	-0.11	0.07	0.11
Income 25-50	0.25	0.08	0.00	-0.02	0.07	0.81
Income 50-75	0.40	0.10	0.00	-0.03	0.08	0.74
Income 75-100	0.37	0.11	0.00	-0.08	0.09	0.38
Income 100-250	0.30	0.11	0.01	-0.09	0.10	0.37
Income > 250	0.30	0.18	0.09	-0.04	0.15	0.79
Net worth 50-100	0.14	0.09	0.12	0.04	0.07	0.56
Net worth 100-250	0.14	0.07	0.06	0.02	0.06	0.73
Net worth 250-1000	0.18	0.08	0.02	0.17	0.07	0.01
Net worth > 1000	0.28	0.13	0.04	0.36	0.11	0.00
Retired	-0.10	0.11	0.39	0.05	0.09	0.55
Self-employed	-0.02	0.08	0.84	-0.11	0.07	0.08
Willing to take average financial risks	0.41	0.05	0.00	0.34	0.05	0.00
Willing to take high financial risks	0.41	0.07	0.00	0.30	0.06	0.00
Willing to take very high financial risks	0.59	0.12	0.00	0.25	0.09	0.00
SCF = 2004	0.01	0.05	0.82	0.02	0.04	0.60
Constant	1.94	0.14	0.00	2.03	0.12	0.00
Number of obs	7930			8297		

Regressions are weighted by SCF sampling weights and corrected for multiple imputations. Also included but not reported are industry indicators and occupation indicators (head and spouse), none of which are statistically significant at the 10% level.

The relationship between income and advice sources may be informative regarding access to sophisticated financial advice. Figures 4.3 and 4.4 depict the empirical distributions of advice sources by net worth decile for investment advice and borrowing advice, respectively. Advice from most financial professionals (brokers, financial planners, and to some extent, accountants) is increasing with wealth, perhaps reflecting that the relative cost of such advice (fees as a fraction of wealth) is decreasing or that the opportunity cost of managing finances within the household is increasing with wealth. Additionally, the benefits of sophisticated financial advice increases with portfolio size, which likely increases with wealth. Bankers are a fairly popular source of investment advice at all levels of income, and perhaps slightly more elevated at the middle of the net worth distribution. Bankers may be viewed as a cheaper alternative to brokers and financial planners for middle-income households.

Those who report that the household is its own source of financial advice may do so because they believe they are financially sophisticated. To explore who reports "self", I estimate a linear probability model for whether a household reports itself as a source of investment advice. Results from this regression are presented in Table 4.6. Those with higher levels of income are more likely to report that they are their own source of financial advice. However, college attainment, net worth, occupation and industry, which might reveal if reporting "self" indicates financial sophistication, are not significant predictors of such behavior.

4.3.1 Measures of sophisticated portfolio choices

I use sources of financial advice to proxy for financial sophistication. To inform this relationship, I rely on previous studies that examine the link between financial literacy and portfolio choice. Specifically, the lack of financial literacy has been related to why many households do not participate in the stock market (Kezdi and

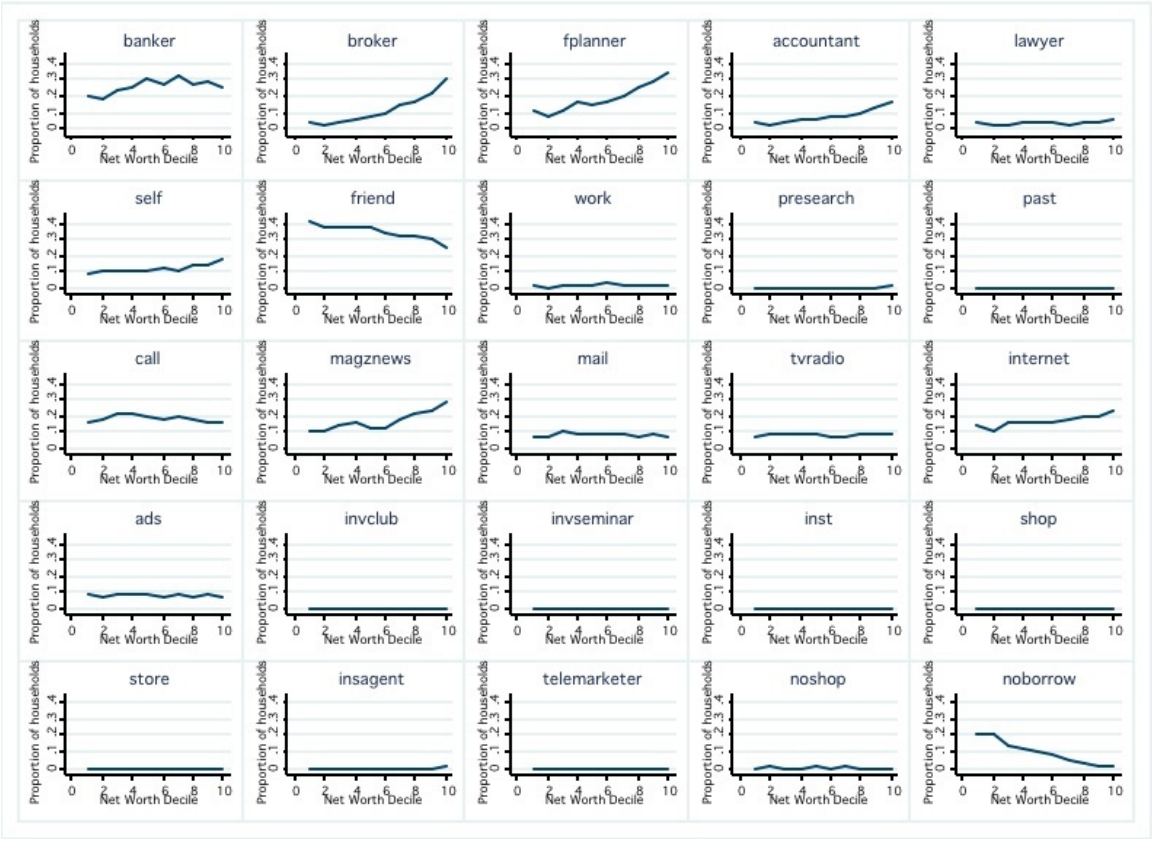

Figure 4.3: Distribution of investment advice sources by net worth percentile

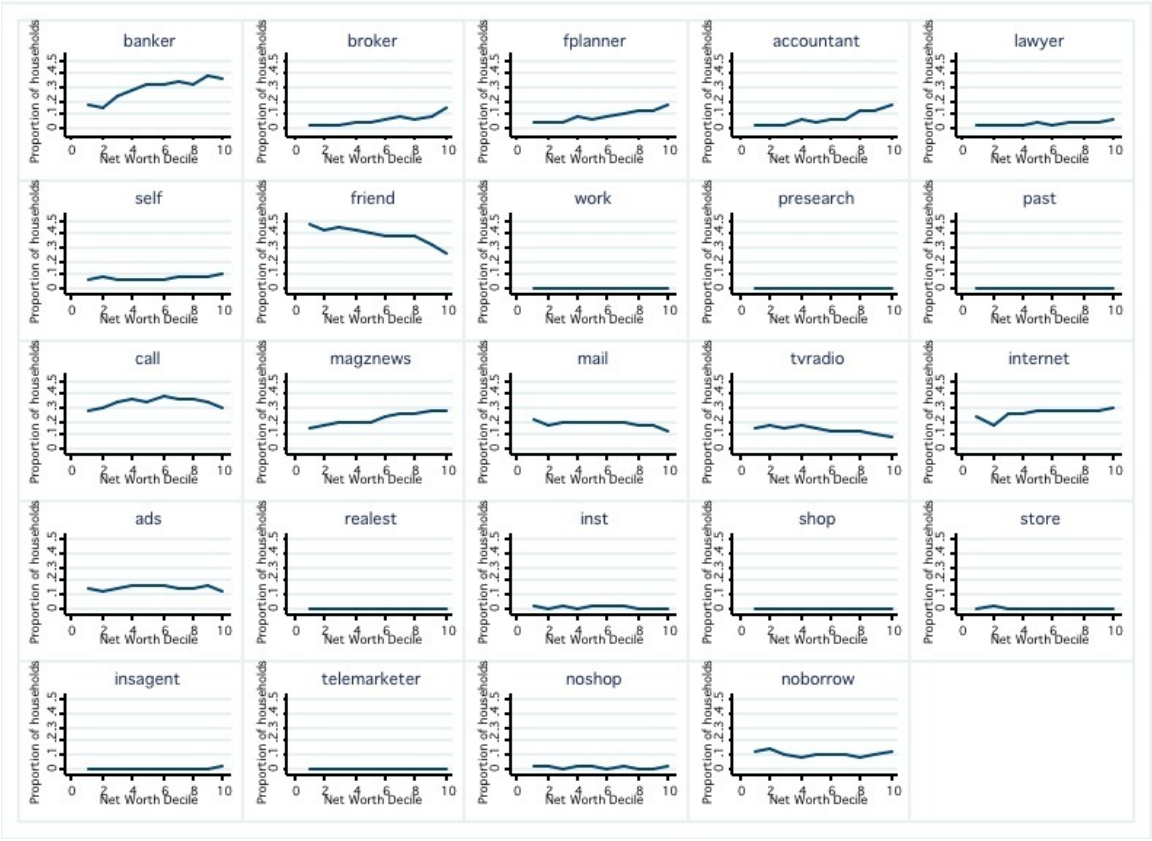

Figure 4.4: Distribution of borrowing advice sources by net worth percentile

Table 4.6: Who reports "self" as a source of advice?

Dependent variable: Indicator for reporting "self" as an advice source"

	Borrowing advice			Investment advice		
Variable	Est. Coeff.	Std. Error	p-value	Est. Coeff.	Std. Error	p-value
Age < 25	-0.02	0.02	0.15	-0.04	0.02	0.03
Age 25-35	-0.01	0.01	0.49	-0.01	0.01	0.35
Age 45-55	-0.01	0.01	0.28	0.00	0.01	1.00
Age 55-65	0.01	0.01	0.68	0.01	0.02	0.71
Age > 65	0.02	0.02	0.28	0.04	0.02	0.06
College	0.00	0.01	0.80	-0.01	0.01	0.54
Female	-0.01	0.01	0.63	-0.04	0.01	0.01
Nonwhite	0.02	0.01	0.01	0.02	0.01	0.05
Household size	0.01	0.01	0.27	0.01	0.01	0.56
Household size (sq)	0.00	0.00	0.15	0.00	0.00	0.31
Married	-0.01	0.01	0.61	-0.03	0.02	0.14
Income 15-25	0.02	0.01	0.23	0.00	0.02	0.86
Income 25-50	0.04	0.01	0.00	0.03	0.02	0.08
Income 50-75	0.04	0.02	0.01	0.03	0.02	0.10
Income 75-100	0.06	0.02	0.00	0.06	0.02	0.01
Income 100-250	0.05	0.02	0.00	0.06	0.02	0.01
Income > 250	0.10	0.03	0.00	0.11	0.03	0.00
Net worth 50-100	-0.01	0.01	0.33	-0.01	0.01	0.57
Net worth 100-250	-0.01	0.01	0.33	0.00	0.01	0.82
Net worth 250-1000	0.00	0.01	0.70	0.01	0.01	0.36
Net worth > 1000	-0.01	0.02	0.51	0.02	0.02	0.43
Retired	-0.02	0.02	0.43	0.01	0.02	0.51
Self-employed	0.00	0.01	0.82	0.02	0.01	0.09
Willing to take average financial risks	-0.02	0.01	0.01	-0.02	0.01	0.09
Willing to take high financial risks	-0.02	0.01	0.05	-0.02	0.01	0.10
Willing to take very high financial risks	0.00	0.02	0.96	-0.01	0.02	0.67
SCF = 2004	0.00	0.01	0.82	-0.01	0.01	0.12
Constant	0.05	0.02	0.01	0.11	0.02	0.00
Number of obs.	8961			8961		

Regressions are weighted by SCF sampling weights and corrected for multiple imputations. Also included but not reported are industry indicators and occupation indicators (head and spouse), none of which are statistically significant at the 10% level.

Willis (2003), Kimball and Shumway (2007), vanRooij et al. (2007)) or hold under-diversified portfolios (Kimball and Shumway 2007).[15] I examine which financial advice sources are related to sophisticated portfolio choices in the same way that financial literacy has been related to portfolio choices in the previous literature.[16]

I construct measures of household portfolios that are closely related to Kimball and Shumway's (2007) analysis of the relationship between financial literacy and financial portfolios. Three variables are meant to capture stock market participation. The first is an indicator variable for whether the household participates in the stock market. This variable is set equal to one if the household has directly held stocks or directly held stock mutual funds, and zero otherwise. In my sample, approximately 27% of the population is considered to be a stock market participant.[17] The second variable is the proportion of a household's financial portfolio that is invested in stocks. Financial assets includes liquid assets, CDs, stocks, bonds, retirement accounts, savings bonds, mutual funds, life insurance, other managed assets, and other financial assets. This measure equals zero for households with financial assets but no stocks, and is missing for households that do not have any financial assets. The third is similar to the second, except that it is the proportion of total assets invested in stocks. Total assets is the sum of financial assets and non-financial assets (i.e., the value of vehicles, housing, other real estate, businesses, and other non-financial assets). For both of these measures, the stocks included in the numerator are only those held in taxable accounts. Among respondents, the average fraction of financial assets held in stocks

[15] Relatedly, Korniotis and Kumar (2009) link cognitive ability and psychological bias to portfolio concentration, excess trading and a preference for local stocks. In addition, less financially sophisticated investors are less likely to accumulate wealth and manage wealth effectively (Stango and Zinman (2009), Hilgert et al. (2003)). Financial literacy has been linked to other economic choices such as planning for retirement, savings decisions (for example, Lusardi (1999), Lusardi and Mitchell (2009b), Yakoboski and Dickemper (1997)), and mortgage financing (Campbell (2006), Bucks and Pence (2008)).

[16] Like this study, this literature presents correlations between financial literacy and portfolio choices rather than estimates of a causal effect.

[17] Recall that all summary statistics presented in this section and throughout the paper are weighted by SCF sampling weights.

is 27% and the average fraction of total assets held in stocks is 10%. It is expected that financial sophistication is positively related to each of these variables.[18]

For risk-diversification reasons, households should not invest in stocks that are closely tied to the economic conditions of their employer. I compute the share of directly held equity that is held in the stock of a firm that employs any household member. This measure is missing for households without equity. The average proportion of assets held in an employer firm for the sample is 15%. I am unable to determine whether households are employed by firms that are publicly traded. Thus, this measure could equal zero because a household chooses to not invest in an employer firm that is publicly traded or because such an option is not available. Financial sophistication is expected to be negatively related to this variable.

The remaining variables measure equity portfolio diversification. The first measure is related to the number of directly held stocks that a household invests in, which is top-coded at 150 in the public-use survey data. Households hold 1.3 different stocks in their portfolios, on average. When focusing on equity-holding households alone, the average number of stocks held is 6.3. Following Kimball and Shumway (2007), the actual measure used is one minus the inverse of the number of stocks held. This measure is preferred because it is increasing in the number of stocks held and is concave to reflect the decreasing marginal benefits of adding stocks to a portfolio. Diversification through a mutual fund may be different from diversification through investing in many stocks. Thus, I also construct an indicator variable for holding stock mutual funds. This measure only includes stock mutual funds held in taxable accounts. On average, 13.2% of households have stock mutual funds, and 25.8% of equity holding households have stock mutual funds. To capture the diversification of

[18]Because the proportion of assets held in equities may more strongly reflect differences in risk preferences rather than sophistication, I include the risk preference proxies in analyses that relate advice sources to these portfolio measures.

a household's portfolio, I count the number of asset classes in which the household invests among stocks, bonds, retirement accounts, checking accounts and real estate. On average, households invest in 1.5 asset classes and checking accounts is the most common asset class. Financial sophistication should be positively associated with each of these diversification measures.

Table 4.7 provides the correlation matrix of these variables. All of the variables except for the share of equity held in an employer firm are arguably positively related to sophisticated financial portfolio choices. When households make sophisticated choices in one dimension of financial portfolios, they tend to make sophisticated choices in others. Indeed, all of the measures excluding the employer firm share are positively related to each other and these correlations are statistically significant. Turning to the share of equity in an employer firm, its correlation with the other variables tends to be negative, as would be expected if households consistently make sophisticated financial choices. The two exceptions are the equity shares in financial assets and the equity shares in total assets.[19]

4.3.2 How are advice sources related to financial sophistication?

The previous section indicates the hypothesized relationship between the portfolio variables and financial sophistication. To relate financial advice sources to financial sophistication, I assess the relationship between advice sources and each of the portfolio variables. First, I run separate regressions for each of the financial portfolio measures on indicators for using each advice source. These regressions include the following additional covariates: age, female indicator, college attainment indicator, household size, non-white indicator, risk preferences proxies, income and net worth categories, industry and occupation (head and spouse) categories. Estimated coef-

[19] These exceptions likely result from a mechanical relationship between equity held in an employer firm and overall equity holdings.

Table 4.7: Correlation of financial portfolio variables

	Has directly held equity	Equity share of financial assets	Equity share of assets	Equity share in employer firm	Number of stocks	Has stock mutual funds	Number of asset classes
2001 SCF Data							
Has directly held equity	1						
Equity share of financial assets	0.57 (0.00)	1					
Equity share of assets	0.48 (0.00)	0.75 (0.00)	1				
Equity share in employer firm		0.03 (0.24)	0.06 (0.01)	1			
Number of stocks	0.39 (0.00)	0.28 (0.00)	0.30 (0.00)	-0.10 (0.00)	1		
Has stock mutual funds	0.65 (0.00)	0.41 (0.00)	0.38 (0.00)	-0.28 (0.00)	0.23 (0.00)	1	
Number of asset classes	0.73 (0.00)	0.55 (0.00)	0.43 (0.00)	-0.08 (0.00)	0.36 (0.00)	0.50 (0.00)	1
2004 SCF Data							
Has directly held equity	1						
Equity share of financial assets	0.57 (0.00)	1					
Equity share of assets	0.48 (0.00)	0.74 (0.00)	1				
Equity share in employer firm		0.06 (0.03)	0.09 (0.00)	1			
Number of stocks	0.38 (0.00)	0.28 (0.00)	0.32 (0.00)	-0.10 (0.00)	1		
Has stock mutual funds	0.63 (0.00)	0.41 (0.00)	0.37 (0.00)	-0.26 (0.00)	0.22 (0.00)	1	
Number of asset classes	0.73 (0.00)	0.57 (0.00)	0.41 (0.00)	-0.10 (0.00)	0.35 (0.00)	0.46 (0.00)	1

Source: Author's calculations using SCF data.

ficients for regressions using investment advice sources are presented in Table 4.8. Results when these controls are excluded are provided in Appendix 4.6. Generally, brokers and financial planners are associated with sophisticated portfolio choices while bankers and lawyers are associated with unsophisticated choices. News and magazines remain associated with sophisticated choices and the Internet is now a significant predictor to sophisticated portfolio choices.

Table 4.9 presents similar results for borrowing advice sources. Many advice sources do not appear to have a consistent relationship with financial sophistication when controlling for other factors. Households that seek advice from a broker are significantly still more likely to make the portfolio choices associated with financial sophistication, but financial planners and bankers are sometimes associated with unsophisticated choices. Friends and television and radio sources are remain negatively associated with sophisticated portfolio choices.

In sum, these regressions provide useful insight into the possible relationships between sources of financial advice and financial sophistication as measured by stock market participation and portfolio diversification. Advice from most types of financial professionals is correlated with making sophisticated financial choices with regards to stock market participation and portfolio diversification. Brokers, financial planners and accountants are consistently related to making sophisticated portfolio choices. Bankers and lawyers, on the other hand, are often related to unsophisticated choices or fail to predict financial sophisticated at a statistically significant level. Sources of advice that are significantly related to unsophisticated choices are friends, television and radio, and calling around. The remaining sources are either not statistically significant in portfolio choices, or the direction of the relationship is ambiguous because of differences across regressions when using different portfolio

Table 4.8: Results from regressions of portfolio choice variables on investment advice sources

Dependent variable:	Has equity		Equity share of financial assets		Equity share of total assets		Has stock mutual funds		1 1/number of stocks held		Share of stock in employer firm		Number of asset classes	
	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error
Accountant	-0.03	0.02	-0.01	0.02	-0.02	0.01	-0.01	0.02	-0.03	0.03	-1.45	2.05	0.02	0.04
Advertisements	-0.03	0.02	0.00	0.01	-0.01	0.01	0.01	0.02	-0.07	0.04	-0.14	2.79	0.00	0.04
Banker	-0.04	0.01	-0.04	0.01	-0.01	0.00	-0.04	0.01	-0.01	0.02	2.66	1.71	0.00	0.03
Broker	0.15	0.02	0.07	0.01	0.03	0.01	0.11	0.02	0.12	0.02	-2.53	1.51	0.24	0.03
Calls around	-0.03	0.01	-0.03	0.01	-0.02	0.00	-0.01	0.01	0.00	0.03	0.69	2.02	-0.01	0.03
Financial planner	0.02	0.02	0.03	0.01	0.01	0.01	0.05	0.01	-0.01	0.02	-0.02	1.55	0.11	0.03
Friend	0.00	0.01	0.01	0.01	0.00	0.00	-0.01	0.01	0.01	0.02	1.68	1.53	0.00	0.02
Insurance agent	-0.02	0.07	-0.08	0.04	-0.07	0.02	0.13	0.14	-0.22	0.06	-8.00	4.00	0.27	0.17
Internet	0.04	0.02	0.04	0.01	0.02	0.01	0.01	0.01	0.03	0.02	0.08	1.73	0.10	0.03
Investment club	0.05	0.30	0.27	0.11	0.17	0.13	0.17	0.34	0.44	0.09	-12.33	4.49	-0.40	0.11
Investment seminar	-0.14	0.19	0.07	0.08	0.01	0.05	-0.07	0.18	-0.63	0.10	24.14	23.17	-0.02	0.51
Lawyer	-0.06	0.03	-0.03	0.02	-0.01	0.01	-0.05	0.02	-0.08	0.05	2.77	4.48	-0.18	0.06
Magazine/news	0.04	0.02	0.02	0.01	0.01	0.01	0.03	0.01	0.05	0.02	-2.25	1.67	0.06	0.03
Mail materials	-0.02	0.02	-0.01	0.02	0.00	0.01	-0.01	0.02	-0.08	0.04	2.33	2.90	-0.01	0.04
Does not shop around	-0.04	0.13	-0.09	0.08	-0.04	0.03	0.07	0.12	0.05	0.12	-6.85	9.40	-0.16	0.23
Past experience	-0.19	0.13	-0.06	0.11	-0.05	0.05	-0.06	0.11	0.12	0.05	-6.61	3.68	-0.22	0.26
Personal research	0.05	0.07	-0.01	0.04	-0.01	0.02	0.13	0.07	0.09	0.09	-8.89	2.77	0.06	0.13
Self	0.02	0.02	-0.01	0.01	-0.01	0.01	0.00	0.01	0.02	0.03	0.93	1.87	0.01	0.03
Shops around	0.17	0.20	0.00	0.14	-0.02	0.04	-0.13	0.04	-0.08	0.09	-18.79	4.40	0.34	0.23
Store	0.29	0.03	-0.11	0.05	-0.05	0.02	0.41	0.49	0.00	0.12	-3.40	3.02	0.52	0.06
TV/radio	-0.01	0.02	-0.03	0.01	-0.01	0.01	0.00	0.02	0.05	0.04	-0.70	2.40	-0.03	0.04
Work colleagues	-0.01	0.04	0.01	0.03	0.00	0.02	-0.01	0.03	-0.18	0.07	10.55	6.82	0.17	0.08
No. of obs.	8297		7967		8164		8297		8297		3721		8297	

Regressions are weighted by SCF sampling weights and corrected for multiple imputations. The additional controls included in the regressions are age, female indicator, college attainment indicator, household size, non-white indicator, risk preferences proxies, income and net worth categories, industry and occupation (head and spouse) categories. Parameter estimates for these variables are not included.

Table 4.9: Results from regressions of portfolio choice variables on borrowing advice sources

Dependent variable:	Has equity		Equity share of financial assets		Equity share of total assets		Has stock mutual funds		1 1/number of stocks held		Share of stock in employer firm		Number of asset classes	
Variable	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error
Accountant	0.01	0.02	0.00	0.02	0.00	0.01	0.00	0.02	-0.01	0.03	-1.02	2.19	0.03	0.04
Advertisements	0.00	0.01	0.00	0.01	0.00	0.01	-0.01	0.01	-0.06	0.03	6.16	2.22	0.05	0.03
Banker	-0.01	0.01	0.00	0.01	0.00	0.00	-0.02	0.01	-0.02	0.02	-2.02	1.49	0.09	0.02
Broker	0.06	0.03	0.03	0.02	0.01	0.01	0.04	0.02	0.09	0.03	-2.16	1.95	0.09	0.04
Calls around	0.00	0.01	-0.01	0.01	0.00	0.00	0.01	0.01	-0.02	0.02	1.55	1.50	0.04	0.02
Financial planner	-0.01	0.02	0.02	0.01	0.02	0.01	0.01	0.02	-0.05	0.03	1.19	1.96	0.05	0.04
Friend	-0.02	0.01	-0.01	0.01	-0.01	0.00	-0.02	0.01	0.00	0.02	0.50	1.56	-0.06	0.02
Insurance agent	-0.18	0.29	0.07	0.16	-0.02	0.06	0.04	0.32	-0.21	0.06	-4.90	4.32	0.00	0.18
Institutional source	-0.03	0.05	0.04	0.06	0.03	0.03	-0.05	0.05	-0.19	0.23	30.85	18.80	0.13	0.14
Internet	0.01	0.01	0.01	0.01	0.01	0.01	-0.03	0.01	0.04	0.02	1.96	1.68	0.09	0.03
Lawyer	0.00	0.03	-0.03	0.02	-0.01	0.01	0.00	0.02	-0.01	0.05	2.37	3.60	-0.12	0.06
Magazine/news	0.00	0.01	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.02	-3.31	1.69	-0.03	0.03
Mail materials	0.02	0.01	0.03	0.01	0.01	0.01	0.00	0.01	0.01	0.03	0.34	1.97	0.08	0.03
Does not shop around	0.08	0.08	0.09	0.09	0.02	0.05	0.13	0.08	0.20	0.10	-5.15	4.11	0.08	0.16
Past experience	-0.16	0.16	0.11	0.19	-0.08	0.04	-0.16	0.06	-0.34	0.08	-5.70	5.50	0.05	0.33
Personal research	-0.06	0.12	0.15	0.13	0.04	0.05	0.04	0.12	0.22	0.06	-17.71	5.51	0.12	0.25
Real estate agent	0.18	0.12	0.07	0.09	0.00	0.03	0.35	0.13	0.10	0.15	-8.25	7.29	0.29	0.20
Self	0.00	0.02	-0.02	0.01	-0.01	0.01	0.01	0.02	0.04	0.03	-1.43	2.33	-0.04	0.04
Shops around	0.02	0.11	0.01	0.08	0.05	0.06	0.09	0.12	0.33	0.07	-21.41	5.86	0.24	0.22
Store	0.04	0.10	-0.05	0.09	0.00	0.04	0.11	0.10	-0.62	0.05	-7.74	4.89	-0.26	0.26
Telemarketer	0.43	0.03	-0.07	0.30	-0.09	0.06	-0.28	0.03	-0.47	0.05	74.09	3.51	0.47	0.05
TV/radio	-0.04	0.02	-0.02	0.01	-0.01	0.01	-0.02	0.01	-0.04	0.03	1.89	2.52	-0.05	0.03
Work colleagues	0.12	0.10	0.00	0.09	0.04	0.06	0.00	0.10	0.06	0.16	9.96	16.80	0.08	0.16
No. of obs	7930		7561		7779		7930		7930		3282		7930	

Regressions are weighted by SCF sampling weights and corrected for multiple imputations. The additional controls included in the regressions are age, female indicator, college attainment indicator, household size, non-white indicator, risk preferences proxies, income and net worth categories, industry and occupation (head and spouse) categories. Parameter estimates for these variables are not included.

measures. I use these relationships to inform three sophistication groups: sophisticated, unsophisticated, and inconclusive. These groups should represent the degree of financial sophistication a household might exhibit when making portfolio choices.

In the previous analysis, the nine financial portfolio measures are separately used to assess financial sophistication. Regressions of these separate measures on advice sources sometimes yield different predictions of the relationship between advice sources and sophisticated portfolio choices. Thus, it may be useful to consider a linear combination of these proxies as a comprehensive measure of sophisticated portfolio choice. A sensible linear combination of these proxies is their first principal component, a single index that explains the largest share of the variation in these proxies.[20] The first principal component of the nine financial portfolio measures is computed as the product of the vector of financial portfolio measures and the eigenvector associated with the largest eigenvalue of the matrix of correlations among these portfolio measures.[21] This first principal component is meant to index financial sophistication by capturing the covariation in the measures that is associated with sophisticated financial portfolio choices.

The loadings for each of the financial portfolio variables for the construction of the first principal component is as follows: 0.459 on the indicator for holding equity directly, 0.418 on the proportion of financial assets invested in equities, 0.418 on the number of asset classes held, 0.389 on one minus the inverse of the number of stocks held, 0.379 on the proportion of total assets invested in equities, 0.348 on the indicator for holding stock mutual funds and 0.156 on the proportion of financial

[20] Principal component analysis (PCA) is a statistical procedure, popular in the psychometrics literature, that transforms possibly correlated variables into a smaller set of uncorrelated variables, principal components. This procedure is similar to that used in Cawley, Conneely, Heckman and Vytlacil (1997) which uses several test scores to construct an index of intelligence.

[21] An alternative method of combining these financial portfolio variables would be to average the standardized portfolio variables. This method would ignore correlations between the financial portfolio measures and assumes that each measure is equally informative of sophisticated portfolio choices.

assets invested in the stock of an employer firm.[22] To include the probability of directly holding stocks in the principal components analysis, I redefine the measure of holding an employer firm's stock as the proportion of financial assets invested in the stock of an employer firm. The first principal component accounts for over half (53%) of the variation in these portfolio measures.[23]

I use the first principal component of financial portfolio choices as a dependent variable in a regression on financial advice sources, the set of demographic characteristics, and net worth categories. These regressions provide a relationship between financial advice sources and a composite measure of sophisticated financial portfolio choices. Some results from these regressions are provided in Table 4.10. For parsimony, parameter estimates for the other controls are not presented. Many of the patterns that arose in the individual regressions also emerge when the first principal component of the financial portfolio variables is used as the dependent variable. The advice sources that are related to financial sophistication are brokers, financial planners, the internet, magazines and news. Those that are associated with financially unsophisticated choices are bankers, lawyers and calling around. When considering borrowing decisions, most of the advice sources are not statistically significantly related to the first principal component of the portfolio variables. Advice sources related to financially sophisticated choices are broker, magazine and news and the advice source related to financially unsophisticated choice is TV and radio.

Both the set of nine individual regressions that uses each portfolio variable as a dependent variable and the regression that uses the first principal component of

[22]Following standard practice, I normalize each of the proxies to be mean zero and variance one before determining the first principal component.

[23]To assess the appropriateness of using PCA, I consider the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy. This statistic ranges between 0 and 1, and small values indicate that there is not enough communality in the variables to warrant the use of PCA. For these portfolio variables, the KMO measure ranges between 0.67 and 0.85. That the KMO statistic is above 0.50 for each of these variables suggests that the use of PCA is likely appropriate.

the portfolio variables as a dependent variable provide information about the relationships between advice sources and sophisticated portfolio choices. In the next section, these relationships are used to classify households as financially sophisticated or financially unsophisticated. These classifications are then used to assess whether there were differences in household portfolio responses to the dividend tax cuts of 2003 based on financial sophistication.

Table 4.10: Results from the regression of the first principal component of the portfolio choice variables on advice sources

Dependent variable: First principal component for the portfolio variables

	Investment advice			Borrowing advice		
Variable	Est. Coeff.	Std. Error	p-value	Est. Coeff.	Std. Error	p-value
Accountant	-0.11	0.07	0.11	0.01	0.07	0.84
Advertisements	-0.05	0.06	0.42	0.01	0.05	0.81
Banker	-0.18	0.04	0.00	-0.03	0.04	0.50
Broker	0.57	0.06	0.00	0.25	0.08	0.00
Calls around	-0.12	0.04	0.00	0.01	0.04	0.71
Financial planner	0.14	0.05	0.01	0.03	0.06	0.65
Friend	0.02	0.04	0.64	-0.06	0.04	0.09
Insurance agent	-0.01	0.16	0.93	-0.12	0.44	0.78
Institutional source	–	–	–	0.04	0.24	0.86
Internet	0.19	0.05	0.00	0.03	0.04	0.42
Investment club	1.05	1.01	0.30	–	–	–
Investment seminar	-0.19	0.41	0.64	–	–	–
Lawyer	-0.24	0.10	0.02	-0.09	0.10	0.34
Magazine/news	0.16	0.05	0.00	0.04	0.04	0.37
Mail materials	-0.10	0.07	0.12	0.09	0.05	0.05
Does not shop around	-0.30	0.43	0.48	0.44	0.37	0.23
Past experience	-0.61	0.56	0.28	-0.41	0.47	0.38
Personal research	0.18	0.19	0.34	0.32	0.41	0.44
Real estate agent	–	–	–	0.65	0.43	0.13
Self	0.01	0.05	0.79	-0.03	0.06	0.56
Shops around	0.05	0.45	0.91	0.52	0.60	0.39
Store	0.70	0.46	0.13	-0.13	0.41	0.75
Telemarketer	–	–	–	0.04	0.50	0.94
TV/radio	-0.06	0.07	0.38	-0.12	0.05	0.02
Work colleagues	0.01	0.13	0.94	0.34	0.43	0.43
Constant	-1.89	0.11	0.00	-1.82	0.11	0.00
No. of obs.	7967			7561		

Regressions are weighted by SCF sampling weights and corrected for multiple imputations. Missing values reflect that there are different sources reported for borrowing choices and investment choices.

4.4 Equity portfolio responses to the 2003 tax act

The second goal of this paper is to explore the role of advice sources in portfolio responses to taxes. I focus on equity portfolio responses to the Jobs and Growth Tax Relief Reconciliation Act of 2003 (the 2003 tax act) which dramatically decreased tax rates on dividend income and capital gains. Prior to 2003, dividends were taxed at the ordinary income tax rate and capital gains were taxed at a preferred rate. Under the 2003 tax act, dividends became taxed at the same statutory rates as capital gains which were also reduced. The 2003 tax act provides exogenous variation in dividend and capital gains tax rates over time to estimate the effect of such taxes on portfolio choices. Figure 4.5 depicts the statutory dividend and capital gains marginal tax rates before and after the 2003 tax act.

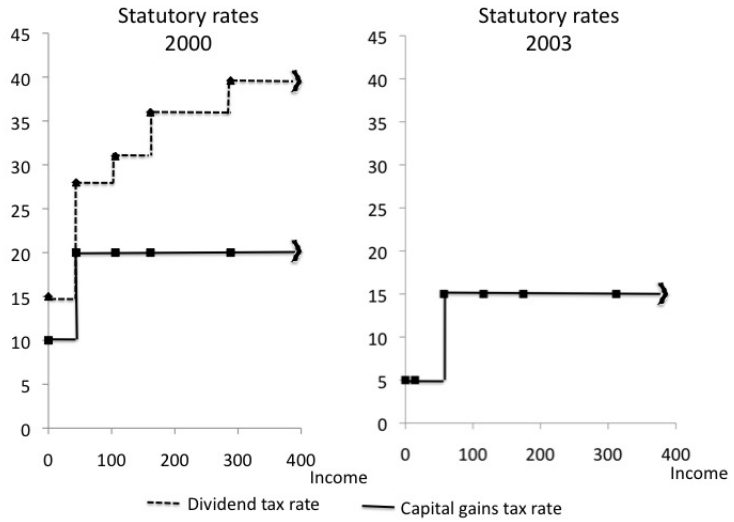

Figure 4.5: Statutory marginal tax rates for married couple filing jointly

Because the tax treatment of dividends for other investors (institutional and corporate investors) did not change, dividend paying stocks should have become more attractive to individual investors. Moreover, because the decrease in dividend tax

rates was larger for higher income households than for lower income households, high income households should have increased yields by more than lower income households, *ceteris paribus*.[24] Chapter II of this dissertation exploits these different treatment intensities to test whether the relationship between taxes and equity portfolio dividend yields is consistent with this prediction.

To test whether sources of financial advice affect the magnitude of a household's portfolio response to the 2003 tax act, I estimate the relationship between portfolio dividend yields and tax rates allowing for heterogeneous responses by sources of advice. As in previous studies of the dividend clientele hypothesis, the tax rate variable of interest is the difference in dividend and capital gains marginal tax rates (Scholz (1992), chapter II of this dissertation). This measure captures the tax disadvantage of dividends relative to capital gains. The dependent variable is the household-specific portfolio dividend yield, defined as total dividend income received divided by the market value of equities held outside of tax-deferred accounts.

Let the advice sources be labeled S_g for $g = 1, \ldots G$. Then the model of interest is:

$$yield = \sum_{g=1}^{G} \alpha_g \tau \mathbb{I}(S_g = 1) + \sum_{k=1}^{K} X_k \beta_k + \varepsilon \tag{4.1}$$

where *yield* is a household's equity portfolio dividend yield and τ is the difference between the statutory (and effective) dividend tax rate and the effective capital gains tax rate. The vector X contains the K factors other than taxes that may affect household choices over dividend yields. A test that a household using source j for financial advice is as tax responsive as a household using source k for financial advice is a test that $\alpha_j = \alpha_k$.

[24] See Miller and Modigliani (1961) and Miller (1977) for the theoretical basis for the relationship between dividend taxes and portfolio dividend yields.

There are two econometric issues that must be addressed. First, a household's tax rates are endogenous to its dividend yield, because households can alter their tax liabilities through their portfolio choices. To correct for this endogeneity, I use instrumental variable techniques. The instrument for the change in dividend and capital gains tax rates exploits that the tax rate reductions under the 2003 tax act varied across households with different levels of income. In such a setting, which is appropriate for a difference-in-differences approach, a valid grouping variable for such analysis can also instrument for the tax treatment that households received (Moffitt and Wilhelm 2000). That is, a variable that is correlated with the intensity of the tax treatment that a household received (i.e., correlated with income) but is unresponsive to the tax policy itself can instrument for tax rates.

I use educational attainment measures, specifically an indicator variable for the head of household having received at least a college degree, to construct the tax rate instrument. For parsimony, I call households with a head who has earned at least a college degree "college educated households" and households with a head who has not earned a college degree "less than college educated households" throughout. Because the SCF is a repeated cross-section dataset, the instrument for receiving the high tax treatment is the interaction of this college attainment indicator and an indicator for the observation coming from the post-treatment (2004) sample. Education should be correlated with permanent income, and thus with the tax rates associated with different levels of income. Moreover, it is unlikely that households responded to the 2003 tax act by altering education choices, particularly when considering such a short time horizon. Because college attainment is a longer-term choice, this interaction term should not have a direct effect on changes in portfolio dividend yields other than through its relationship to the tax treatment. To test for the strength of this

instrument, I run the first stage regression for all households. The F-statistic for the test that the coefficient on the interaction of the college educated indicator and the post-sample indicator is equal to zero is 27.9. This is above the cutoff value that would indicate weak instrument problems (Stock and Yogo 2002).

To allow for heterogeneity in tax responses, I instrument for tax rates with the following:

$$\tau\mathbb{I}(S_g = 1) = \gamma_g\mathbb{I}(college = 1) * \mathbb{I}(SCF = 2004)\mathbb{I}(S_g = 1) + X\xi^g + u_g, \quad \forall g = 1, \dots G \tag{4.2}$$

where *college* is an indicator variable for being a college educated household, $\mathbb{I}(SCF = 2004)$ is an indicator for an observation coming from the post-treatment sample, and $\mathbb{I}(S_g = 1)$ is an indicator for using advice source g. For this set of instruments to be valid, an additional assumption must be satisfied. Given that the college attainment choice is invariant to the tax policy change, households within an education group should also not change advice sources in response to the tax policy change. Otherwise, the estimated tax effect for a particular advice source group would include the effect of households altering their advice source choices. To test that this assumption is satisfied empirically, I run regressions of the probability of being in an advice source group on an indicator variable for being college educated, an indicator variable for being from the post-treatment sample, and an interaction of the two. For each advice source group in each group partition, I fail to reject the null hypothesis that the coefficient on the interaction term is equal to zero even at the 10% level. This result holds regardless of whether the other demographic characteristics are included as additional controls.

There may be some concern with this instrument because educational attainment often proxies for financial sophistication. Studies of financial literacy show that

education is by no means the sole determinant of financial literacy (e.g., Lusardi et al. (2009a)). In fact, much variation in financial literacy proxies in these studies remains after conditioning on educational attainment. I verify that there are substantial numbers of college educated and less than college educated households using each advice source group. In addition, I run linear probability models of the probability of using each advice source as a function of the college attainment indicator variable and the other controls. While the estimated coefficient on the college indicator variable is often statistically significant, R^2 statistics from these regressions range between 0.01 and 0.12. Thus, much variation in advice source measures remains after conditioning on college attainment.

The second econometric issue is that portfolio dividend yields have a mass point at zero. Indeed, over half of equity holding households (57%) report that they receive zero dividend income. I focus on the intensive choice over portfolio dividend yields given that some dividends are received. This restriction also excludes households who do not hold equities at all, a common restriction in studies about the relationship between dividend tax rates and equity portfolios. I estimate the following model of log portfolio dividend yields for households with positive portfolio dividend yields using two-stage least squares:

$$\log(yield)|yield > 0 = \sum_{g=1}^{G} \alpha_g \tau \mathbb{I}(S_g = 1) + \sum_{k=1}^{K} X_k \beta_k + \varepsilon \tag{4.3}$$

$$\tau \mathbb{I}(S_g = 1) = \gamma_0 \mathbb{I}(college = 1) * \mathbb{I}(SCF = 2004)\mathbb{I}(S_g = 1) + X\xi^g + u_g, \quad \forall g = 1, \ldots G$$

In the Appendix, I also examine the extensive margin of whether to receive dividends or not.[25]

[25]Together, estimates from the extensive and intensive margins comprise the two-part (hurdle) model of portfolio dividend yields. Alternatively, chapter II of this dissertation and Scholz (1992) use an instrumental variable Tobit model. The IV Tobit model's likelihood function is particularly difficult to maximize over when using multiple endogenous regressors because it becomes quite flat. In addition, the two-part model is more flexible than the Tobit

I use two sets of partitions for both investment advice sources and borrowing advice sources based off of the analysis done in section 4.3.2. The first partition derives from the regression based analysis of the relationship between advice sources and sophisticated portfolio choices. The second partition is based on the regressions that use the first principal component of the financial portfolio variables as a dependent variable. For each partition, I define four groups: (1) sophisticated advice sources; (2) inconclusive advice sources; (3) unsophisticated advice sources; and (4) non-advice seekers. Sophisticated advice sources are those that are significantly positively related to sophisticated portfolio choices, defined as stock market participation and portfolio diversification. Unsophisticated advice sources are those that are statistically significantly related to a decreased probability of stock market participation and less portfolio diversification. The remaining advice sources are either not statistically significantly related to sophistication or are sometimes related to each. Non-seekers include households who report that they do not seek advice when making investment or bororwing decisions or that they do not invest or borrow.[26] The advice sources that are associated with each group in the two partitions are detailed in Table 4.11.

Because households are permitted to report many sources of advice, I impose an implicit ordering to construct mutually exclusive groups. This choice is important for interpreting the parameter estimates.[27] All households who report that they do not invest/borrow or do not shop around are coded as being in group 4. Remaining

model because it allows the covariates to have different marginal effects on the extensive and intensive margins. When examining the coefficients in each part separately, the assumption of equal marginal effects on both margins does not seem appropriate. For both of these reasons, the two-part model is preferred.

[26]When considering borrowing advice sources, the "non-seeker" category conflates households who do not seek advice because they do not seed such information and households who do not seek advice despite having choices that could be informed by financial advice. Of households who report that they do not seek advice about borrowing decisions, approximately 35% do not have debt.

[27]The parameter estimates of α presented are the group-specific tax effects for each advice source group. If mutually exclusive groups were not imposed, then the parameter estimates of α would be interpreted as the tax effect of using a particular advice source conditional on other advice sources used.

Table 4.11: Partition of advice source groups

Investment choices							
Partition 1: Individual regressions				Partition 2: Principal components analysis			
Group 1	Group 2	Group 3	Group 4	Group 1	Group 2	Group 3	Group 4
Sophisticated	Inconclusive	Unsophisticated	Non-seeker	Sophisticated	Inconclusive	Unsophisticated	Non-seeker
Broker	Other	Banker	Does not shop	Broker	Other	Banker	Does not shop
Financial planners		Lawyers	Does not invest	Financial planners		Lawyers	Does not invest
Accountants		Friends/family		Internet			Calls around
Internet				Magainzes/news			
Magainzes/news							
Borrowing choices							
Partition 1: Individual regressions				Partition 2: Principal components analysis			
Group 1	Group 2	Group 3	Group 4	Group 1	Group 2	Group 3	Group 4
Sophisticated	Inconclusive	Unsophisticated	Non-seeker	Sophisticated	Inconclusive	Unsophisticated	Non-seeker
Accounants	Other	Friends/family	Does not shop	Broker	Other	TV/radio	Does not shop
Broker		TV/radio	Does not invest	Mail materials			Does not invest
Financial planners							
Bankers							
Magainzes/news							

households who report using any of the advice sources among those in group 1 are coded as being in group 1. Then, households in group 3 are defined as those who report using a source in group 3, but do not report any of the advice sources in group 1 or 4. The remaining households are assigned to group 2.

If there were no information about the relationship between advice sources and financial sophistication, a natural partitioning might consist of the following: (1) financial professionals (accountants, bankers, brokers, financial planners, lawyers, internet, and magazine and news), (2) self and personal contacts (self, friends and family, work colleagues, past experience and personal research), (3) other sources (call around, mail materials, TV and radio, advertisements, investment clubs and seminars, institutional sources, shops around, store, and insurance agents), and (4) non-seekers (does not seek advice or does not invest). Results using this partition are presented in Appendix B.

There are two things to note when interpreting the estimated model. First, these estimates are not necessarily estimates of the causal effect of financial sophistication on the tax responsiveness of household portfolios. Suppose, for example, that households using sophisticated advice sources are found to be statistically more tax responsive than non-seekers. Such a result does not imply that providing a broker's advice to a household who otherwise does not seek financial advice would lead to more tax responsive equity portfolios, for example. As in other studies of financial literacy, these estimates only inform different responses across households who choose to use different advice sources. Estimates that could inform such causality requires exogenous variation in advice source choices, most likely to be provided in an experimental setting. Secondly, because I have only considered data from 2001 and 2004, the estimated responses to the 2003 tax act are of relatively short-term

responses to the tax policy. Differences in financial sophistication could also be related to differences in the timing of responses. The effect of financial sophistication on the speed at which households respond to tax policies is left to future work.

Several demographic characteristics are controlled for in the regression. The following variables pertain to the head of households: age categories, an indicator for being retired, an indicator for being married, an indicator for being female, an indicator for being non-white, and an indicator variable for having at least a college degree. Risk preference proxies, as described in the Section 4.2, are included to account for differences in financial risk taking behaviors. Household size in both the level and square are also included. I exclude net worth categories from the main regressions. This omission is done because it is difficult to interpret estimates as differences in financial sophistication conditional on net worth. An indicator variable for the observation coming from the post-treatment sample is also included to account for macroeconomic changes that affected average dividend yields between 2001 and 2004.[28]

Results from estimating equation (4) for each of the two partitions of investment advice sources are presented in Table 4.12 and for borrowing advice sources in Table 4.13. In addition to parameter estimates, I present the p-values from F-tests that the tax coefficients are equals across groups, both in pairwise comparisons and across all groups jointly. Because they are not of primary interest, results from the discrete choice of receiving dividends (equation 3) are found in the Appendix. As indicated by the negative tax coefficients for each group in each partitioning, the reduction in dividend tax rates relative to capital gains tax rates caused households to increase their portfolio dividend yields. This relationship between the dividend and capital

[28]See Chetty and Saez (2005) and Brown et al. (2004) for evidence that firms changed dividend payout policies in response to the 2003 tax act.

gains tax rate differential and household portfolio dividend yields is consistent with the dividend clientele hypothesis. In addition, the smallest estimated coefficients (in absolute value) are always for households that do not seek advice. This relative tax unresponsiveness of those who do not gather information when making investment decisions supports the hypothesis that financial sophistication may influence how responsive households are to changing tax incentives. I examine the remaining tax coefficients for each of the partitions.

Table 4.12: Results from the model of portfolio dividend yields with heterogeneous responses: investment advice source partitions

Dependent variable: Log portfolio dividend yield

	Based on individual regressions			Based on principal components		
Variable	Est. Coeff.	Std. Error	p-value	Est. Coeff.	Std. Error	p-value
Tax differential (Group 1)	-0.27	0.16	0.10	-0.22	0.14	0.10
Tax differential (Group 2)	-0.22	0.16	0.16	-0.25	0.15	0.09
Tax differential (Group 3)	-0.31	0.18	0.09	-0.20	0.13	0.13
Tax differential (Group 4)	-0.09	0.20	0.65	-0.04	0.18	0.81
Age under 25	-1.60	0.88	0.07	-1.45	0.76	0.06
Age 25-35	-0.40	0.35	0.24	-0.40	0.32	0.22
Age 45-55	0.23	0.30	0.44	0.19	0.26	0.47
Age 55-65	0.30	0.28	0.29	0.32	0.26	0.23
Age over 65	0.15	0.37	0.69	0.25	0.34	0.47
College	1.15	0.68	0.09	0.99	0.59	0.09
Household size	0.24	0.48	0.63	0.10	0.43	0.82
Household size (square)	-0.01	0.06	0.88	0.01	0.05	0.89
Married	-0.56	0.39	0.16	-0.46	0.35	0.19
Retired	-0.56	0.42	0.19	-0.51	0.37	0.17
SCF = 2004	-3.60	2.07	0.08	-3.09	1.75	0.08
Constant	5.52	2.94	0.06	4.79	2.49	0.05
Number of observations	2378			2378		
p-values on tests that the coefficients on the tax differential are the same across groups						
	Group 2	Group 3	Group 4	Group 2	Group 3	Group 4
Group 1	0.14	0.09	0.13	0.42	0.45	0.16
Group 2		0.37	0.27		0.26	0.22
Group 3			0.09			0.12
p-value on the F-test that the estimated tax effects are the same across groups						
		0.13			0.31	
Group definitions						
Group 1	Accountant, broker, financial planner, Internet, magazine/news			Broker, financial planner, Internet, magazine/news		
Group 2	Others			Other		
Group 3	Banker, lawyer, friends			Banker, lawyer, calls around		
Group 4	Does not invest/shop			Does not invest/shop		

The model is estimated using two-stage least squares. Regressions are weighted by SCF sampling weights and corrected for multiple imputations.

Table 4.13: Results from the model of portfolio dividend yields with heterogeneous responses: borrowing advice source partitions

Dependent variable: Log portfolio dividend yield

	Based on individual regressions			Based on principal components		
Variable	Est. Coeff.	Std. Error	p-value	Est. Coeff.	Std. Error	p-value
Tax differential (Group 1)	-0.22	0.12	0.06	-0.25	0.14	0.07
Tax differential (Group 2)	-0.22	0.12	0.07	-0.27	0.14	0.04
Tax differential (Group 3)	-0.22	0.13	0.08	-0.22	0.12	0.08
Tax differential (Group 4)	-0.17	0.10	0.10	-0.18	0.11	0.11
Age under 25	-1.33	0.71	0.06	-1.35	0.76	0.08
Age 25-35	-0.31	0.30	0.30	-0.30	0.30	0.33
Age 45-55	0.21	0.26	0.42	0.14	0.25	0.59
Age 55-65	0.30	0.26	0.25	0.25	0.26	0.34
Age over 65	0.16	0.35	0.64	0.08	0.36	0.82
College	0.94	0.51	0.07	0.96	0.53	0.07
Household size	0.07	0.39	0.86	0.05	0.40	0.90
Household size (square)	0.01	0.05	0.82	0.01	0.05	0.80
Married	-0.38	0.32	0.23	-0.40	0.32	0.22
Retired	-0.55	0.36	0.13	-0.59	0.39	0.13
SCF = 2004	-2.94	1.50	0.05	-3.07	1.60	0.06
Constant	4.61	2.13	0.03	4.95	2.32	0.03
Number of observations	2378			2378		
p-values on tests that the coefficients on the tax differential are the same across groups						
	Group 2	Group 3	Group 4	Group 2	Group 3	Group 4
Group 1	0.76	0.83	0.13	0.63	0.15	0.08
Group 2		0.78	0.30		0.16	0.05
Group 3			0.25			0.24
p-value on the F-test that the estimated tax effects are the same across groups						
		0.54			0.14	
Group definitions						
Group 1	Accountant, broker, fin. planner, banker, magazine/news			Broker, mail materials		
Group 2	Other			Other		
Group 3	Friends, TV/radio			TV/radio		
Group 4	Does not invest/shop			Does not invest/shop		

The model is estimated using two-stage least squares. Regressions are weighted by SCF sampling weights and corrected for multiple imputations.

First consider results when using investment advice sources. In partition 1, which is based on the individual regressions of portfolio choices and advice sources, the estimated tax effects are negative and statistically significant (at the 10% level) for the sophisticated advice source and unsophisticated advice source groups. In addition, the magnitude of the estimated tax effects for these two groups is larger (in absolute value) than for households using advice sources that are ambiguously related to financial sophistication and for households that do not seek advice when making investment choices. These results suggest that seeking advice from sources that provide information about how to structure portfolios, regardless of whether this advice is good or not, leads households to be more responsive to the 2003 tax act. This evidence is only suggestive, however. In fact, I am unable to reject that the coefficients on the tax effects are the same across groups at the 5% level. In addition, I am unable to reject at even the 10% level that the tax coefficients for all groups are equal. At the 10% level, unsophisticated advice seekers are more tax responsive than those who do not seek financial advice and those who seek advice from sources with an ambiguous relationship with financial sophistication. Bankers and lawyers, while not providing sound investment advice when it comes to portfolio diversification, may be more useful when it comes to advice about dividend taxes.

In the second partition, which is based on the regression of the first principal component of portfolio variables and advice sources, the estimated tax effects are statistically significant at the 10% level for sophisticated advice source users and for households using advice sources that are not statistically related to sophistication. Households using an unsophisticated advice source are less responsive to the 2003 tax act than other households. None of the estimated tax coefficients are statistically different from each other. As with the investment advice groups, I am unable to

reject that the estimated tax effects are the same across groups.

When considering borrowing advice sources, households who seek advice at all are more tax responsive than other households as depicted by their larger estimated tax effects (in absolute value). In the second partition, the estimated tax effects for group 1 and group 2 are statistically different from those who do not seek advice at all at the 10% and 5% levels, respectively. Thus, there is some evidence that the tax responses are different across these groups. Because the link between financial sophistication and borrowing decisions is less clear, these are not interpreted as being strong evidence in favor of heterogeneity in tax responses by financial sophistication.

In summary, I find that an increase in the tax disadvantage of dividend income is associated with a decrease in a household's portfolio dividend yield, as expected, regardless of the advice sources used. The relative magnitudes of the estimated tax effects for the different advice source groups are generally consistent with the hypothesis that households who seek advice are more tax responsive than households who do not seek advice. However, in most cases I cannot reject the hypothesis that the tax responses are the same across groups. Together, I interpret these results as suggestive, though not compelling, evidence that the source of financial advice affects how responsive household equity portfolios were to the dividend tax cuts of 2003.

4.5 Conclusions

This study constructs a new measure of financial sophistication based on the sources of financial advice that a household uses when making investment and borrowing choices. The relationship between advice sources and sophisticated portfolio choices, defined as stock market participation and portfolio diversification, informs

classifications of which advice sources may be related to financial sophistication. I do not find evidence that equity portfolio responses to the 2003 tax act differed by financial sophistication, defined in this way. The relative magnitudes of the responses suggest that households using advice sources that are related to financial sophistication were generally more responsive to the 2003 tax act than households who do not seek financial advice. However, I am unable to reject the hypothesis that tax responses were equal across types of households at the 5% in nearly all specifications.

This paper makes two contributions. The first contribution is that it provides the first analysis to evaluate whether information on financial advice sources may proxy for financial sophistication. I assess which sources of advice are likely related to sophisticated portfolio choices, defined as stock market participation and portfolio diversification. I find that those who use brokers and those who use themselves as sources of financial advice are more likely to hold stocks and hold more diversified portfolios; television and telemarketers are associated with less financially sophisticated choices.

The second contribution is that this is the first study to consider whether financial sophistication affects the tax responsiveness of household portfolio choices. I find suggestive evidence that households using different sources of financial advice respond differently to the 2003 tax act. There is likely much variation in the quality of advice obtained from the same type of advice source. For example, tax attorneys are better equipped to provide advice about the tax implications of portfolio choices and changing tax policy than public defenders. Such differences in advice quality are not available in the SCF data, however.

The differences between the measures of financial sophistication used in this study and the previous literature points to an important area for continued work. That

is, a household's access to sophisticated advice may be more important than its own level of financial sophistication. Previous studies of financial literacy often prescribe increased financial training program policies. To the extent that seeking financially sophisticated advice allows people to make portfolio choices that reflect financial literacy, these are both important channels for understanding differential responses to tax policy changes. Moreover, it is important for policy makers to disentangle the two. If the sophistication of households matters, policy prescriptions may be to employ training programs that teach the implication of taxes for financial planning. If access to financial advice matters, then individuals need not receive the training themselves.

Stronger results of tax heterogeneity would not necessarily imply that providing financial advice will cause people to better respond to tax policy changes. Those who wish to better respond to tax policy changes may also seek sophisticated financial advice. To assess the causal impact of financial sophistication requires exogenous variation in financial education, likely best achieved in an experimental setting. Such research complements recent studies that use an experimental design to directly examine the saliency of the tax system (Chetty and Saez (2009), Duflo and Saez (2006), Chetty et al. (2009). In conjunction with studies on the causal effects of financial literacy training, it is feasible that the best policy for leveling the playing field with regard to portfolio responses to tax policy could be determined.

4.6 Appendix A: Relationship between financial portfolios and advice sources excluding controls

Table 4.14 provides results from the regressions of financial portfolio choices and investment advice sources excluding other covariates. Financial professionals (accountants, brokers, and financial planners) with the exception of bankers are associated with sophisticated portfolio choices. Those who report that they use the Internet, magazine and news materials and stores are also correlated with sophisticated portfolio choices. Using a banker for investment advice is statistically significantly associated with unsophisticated portfolio choices. Lawyers, calling around and friends also appear correlated with unsophisticated portfolio choices.

Similar results using borrowing advice sources are presented in Table 4.15. Many of the same patterns emerge when using borrowing advice sources. Financial professionals (accountants, brokers, financial planners) are associated with sophisticated financial choices. In contrast with the above, bankers are associated with sophisticated portfolio choices when considering borrowing decisions. This may reflect that the incentives and expertise of bankers are aligned to give better advice about borrowing than investments. Magazine and news materials remain associated with sophistication, but the Internet is ambiguously related (i.e., not statistically different from zero) to sophistication. Friends and TV/radio are typically associated with unsophisticated financial choices.

Table 4.14: Unconditional effect of investment advice sources on financial portfolio choices

	Has equity		Equity share of financial assets		Equity share of total assets		Has stock mutual funds		1 1/number of stocks held		Share of stock in employer firm		Number of asset classes	
	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error
Accountant	0.05	0.02	0.03	0.02	0.00	0.01	0.04	0.02	0.04	0.03	-4.07	2.07	0.29	0.05
Advertisements	-0.05	0.02	-0.01	0.02	-0.01	0.01	0.00	0.02	-0.07	0.05	-0.22	2.82	-0.05	0.06
Banker	-0.05	0.01	-0.06	0.01	-0.02	0.01	-0.05	0.01	-0.03	0.02	2.81	1.78	0.03	0.03
Broker	0.31	0.02	0.16	0.01	0.08	0.01	0.20	0.02	0.18	0.02	-4.41	1.51	0.79	0.04
Calls around	-0.05	0.02	-0.04	0.01	-0.02	0.01	-0.02	0.01	0.00	0.03	1.17	2.05	-0.06	0.04
Financial planner	0.15	0.02	0.12	0.01	0.06	0.01	0.12	0.01	0.03	0.02	-1.07	1.58	0.56	0.04
Friend	-0.03	0.01	0.00	0.01	-0.01	0.00	-0.03	0.01	-0.04	0.02	3.64	1.53	-0.16	0.03
Insurance agent	-0.04	0.19	-0.12	0.06	-0.06	0.04	0.15	0.22	-0.14	0.03	-10.47	2.37	-0.03	0.42
Internet	0.13	0.02	0.11	0.01	0.05	0.01	0.06	0.01	0.03	0.02	1.62	1.71	0.37	0.04
Investment club	0.28	0.26	0.43	0.11	0.24	0.13	0.30	0.29	0.38	0.03	-1.58	4.05	0.50	0.18
Investment seminar	-0.11	0.15	0.11	0.10	0.03	0.06	-0.05	0.17	-0.66	0.11	25.98	24.97	0.33	0.27
Lawyer	-0.07	0.03	-0.05	0.02	-0.01	0.01	-0.05	0.02	-0.03	0.05	1.65	4.31	-0.30	0.09
Magazine/news	0.13	0.02	0.08	0.01	0.04	0.01	0.08	0.01	0.09	0.02	-3.64	1.64	0.34	0.04
Mail materials	-0.04	0.02	-0.02	0.02	-0.01	0.01	-0.03	0.02	-0.11	0.04	3.16	3.01	-0.06	0.05
Does not shop around	-0.05	0.12	-0.08	0.07	-0.04	0.03	0.07	0.12	0.34	0.10	-14.72	1.68	-0.04	0.34
Past experience	-0.28	0.05	-0.09	0.09	-0.05	0.04	-0.12	0.05	0.43	0.03	-14.56	1.59	-0.19	0.20
Personal research	0.11	0.08	0.03	0.05	0.01	0.03	0.17	0.08	0.14	0.12	-12.11	1.46	0.26	0.18
Self	0.05	0.02	0.01	0.01	0.00	0.01	0.02	0.01	0.07	0.03	-0.48	1.95	0.15	0.05
Shops around	0.23	0.21	0.05	0.14	0.01	0.03	-0.10	0.03	-0.13	0.18	-18.56	3.05	0.42	0.50
Store	0.78	0.01	0.10	0.04	0.06	0.02	0.71	0.49	0.33	0.12	-14.81	1.72	1.90	0.03
TV/radio	-0.05	0.02	-0.06	0.02	-0.02	0.01	-0.02	0.02	0.05	0.04	-0.83	2.43	-0.19	0.06
Work colleagues	0.06	0.05	0.09	0.03	0.03	0.02	0.02	0.04	-0.22	0.07	14.22	6.87	0.55	0.09
SCF = 2004	-0.04	0.01	-0.05	0.01	-0.03	0.00	-0.04	0.01	-0.03	0.02	1.68	1.42	-0.07	0.03
Constant	0.25	0.01	0.26	0.01	0.11	0.01	0.13	0.01	0.46	0.02	13.13	1.55	2.17	0.03
No. of obs.	8297		7967		8164		8297		8297		3721		8297	

Regressions are weighted by SCF sampling weights and corrected for multiple imputations. These results are similar to those presented in Table 4.8 except that these do not include additional controls.

Table 4.15: Unconditional effect of borrowing advice sources on financial portfolio choices

	Has equity		Equity share of financial assets		Equity share of total assets		Has stock mutual funds		1 1/number of stocks held		Share of stock in employer firm		Number of asset classes	
Variable	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error	Est. Coeff.	Std. Error
Accountant	0.14	0.02	0.07	0.02	0.03	0.01	0.09	0.02	0.07	0.03	-3.56	2.18	0.43	0.05
Advertisements	-0.01	0.02	0.00	0.01	0.00	0.01	-0.01	0.01	-0.07	0.03	6.76	2.34	0.08	0.04
Banker	0.04	0.01	0.02	0.01	0.01	0.01	0.00	0.01	-0.03	0.02	-2.39	1.51	0.33	0.03
Broker	0.19	0.03	0.11	0.02	0.05	0.01	0.12	0.02	0.15	0.03	-4.04	1.95	0.48	0.06
Calls around	0.01	0.01	0.02	0.01	0.00	0.01	0.01	0.01	-0.01	0.02	1.88	1.58	0.14	0.03
Financial planner	0.07	0.02	0.07	0.01	0.04	0.01	0.06	0.02	-0.02	0.03	0.47	2.03	0.31	0.05
Friend	-0.06	0.01	-0.03	0.01	-0.02	0.00	-0.04	0.01	-0.06	0.02	2.13	1.56	-0.25	0.03
Insurance agent	0.10	0.27	0.17	0.14	0.09	0.04	0.28	0.31	-0.13	0.04	-6.67	2.80	0.67	0.09
Institutional source	-0.06	0.08	0.01	0.08	0.01	0.04	-0.08	0.04	-0.27	0.15	33.45	18.06	-0.12	0.22
Internet	0.10	0.01	0.09	0.01	0.04	0.01	0.03	0.01	0.03	0.02	3.14	1.63	0.41	0.03
Lawyer	-0.03	0.03	-0.06	0.02	-0.01	0.01	-0.01	0.03	0.01	0.05	0.10	3.59	-0.29	0.08
Magazine/news	0.07	0.02	0.06	0.01	0.03	0.01	0.06	0.01	0.08	0.02	-5.05	1.72	0.24	0.04
Mail materials	0.01	0.02	0.02	0.01	0.00	0.01	-0.01	0.01	-0.04	0.03	1.54	2.04	0.06	0.04
Does not shop around	0.04	0.13	0.07	0.12	0.02	0.06	0.12	0.12	0.39	0.13	-11.54	1.85	-0.07	0.30
Past experience	-0.04	0.15	0.25	0.17	-0.01	0.03	-0.08	0.06	-0.39	0.15	-12.03	1.57	0.55	0.37
Personal research	0.01	0.14	0.20	0.13	0.07	0.05	0.07	0.13	0.27	0.02	-13.82	1.78	0.56	0.32
Real estate agent	0.21	0.16	0.10	0.12	0.01	0.05	0.37	0.16	0.23	0.13	-10.42	3.82	0.46	0.31
Self	0.03	0.02	-0.01	0.02	0.00	0.01	0.03	0.02	0.09	0.03	-1.91	2.34	0.06	0.06
Shops around	-0.09	0.11	-0.08	0.09	0.01	0.07	0.04	0.12	0.37	0.04	-19.58	2.88	-0.32	0.37
Store	-0.05	0.12	-0.09	0.10	-0.02	0.05	0.06	0.12	-0.52	0.02	-8.01	4.11	-0.38	0.36
Telemarketer	0.80	0.02	0.21	0.29	0.02	0.06	-0.07	0.01	-0.40	0.03	77.16	1.98	1.86	0.04
TV/radio	-0.12	0.02	-0.07	0.01	-0.03	0.01	-0.07	0.01	-0.07	0.03	2.88	2.58	-0.33	0.04
Work colleagues	0.17	0.13	0.05	0.10	0.05	0.06	0.01	0.11	0.04	0.18	12.13	16.14	0.55	0.24
SCF = 2004	-0.04	0.01	-0.05	0.01	-0.03	0.00	-0.03	0.01	-0.04	0.02	1.52	1.49	-0.06	0.03
Constant	0.26	0.01	0.26	0.01	0.10	0.01	0.15	0.01	0.52	0.02	12.63	1.55	2.12	0.04
No. of obs	7930		7561		7779		7930		7930		3282		7930	

Regressions are weighted by SCF sampling weights and corrected for multiple imputations. These results are similar to those presented in Table 4.9 except that these do not include additional controls.

4.7 Appendix B: Partitions based on *a priori* groupings

The analysis of heterogeneous tax effects presented in Section 4.4 groups advice sources using the statistical relationships between advice sources and sophisticated portfolio decisions. Without such information, a natural partition of financial advice sources might consist of the following: (1) financial professionals (accountants, bankers, brokers, financial planners, lawyers, Internet, and magazine and news), (2) self and personal contacts (self, friends and family, work colleagues, past experience and personal research), (3) other sources (call around, mail materials, TV and radio, advertisements, investment clubs and seminars, institutional sources, shops around, store, and insurance agents), and (4) non-seekers (does not seek advice or does not invest). As in the main analysis, I construct these groups so that they are mutually exclusive.

Based on these advice source groups, I posit that households in group 1 and group 2 are more tax responsive than others. Results from the model in equations 4.4 using this partition are presented in Table 4.16. The relationship between the dividend and capital gains tax rate differential and household portfolio dividend yields is negative, as expected, for all advice source groups. Moreover, the relative magnitudes of the estimated tax effects are consistent with the hypothesized relative tax responsiveness between advice source groups. Both when using investment advice sources and borrowing advice sources, households seeking advice from financial professionals, the Internet and magazines or news sources, as well as households using personal contacts/self for financial advice have a larger (in absolute value) estimated tax effect than the other two groups. Additionally, these estimated tax effects are statistically different from zero at the 10% level, whereas the other two estimated tax effects

are not statistically different from zero. In the middle panel of the tables, I present p-values on the tests that the estimated tax coefficients are equal. In these tests, I am unable to reject the null that the estimated tax coefficients are equal when using investment advice sources. Using borrowing advice sources, however, I reject that the tax effects for those using financial professions and those who do not seek advice are the same at the 10% level.

Table 4.16: Results from the model of portfolio dividend yields with heterogeneous responses

Dependent variable: Log portfolio dividend yield

	Investment advice sources			Borrowing advice sources		
Variable	Est. Coeff.	Std. Error	p-value	Est. Coeff.	Std. Error	p-value
Tax differential (Group 1)	-0.24	0.15	0.11	-0.23	0.13	0.07
Tax differential (Group 2)	-0.23	0.14	0.10	-0.19	0.13	0.13
Tax differential (Group 3)	-0.23	0.13	0.08	-0.18	0.12	0.13
Tax differential (Group 4)	-0.06	0.19	0.76	-0.17	0.11	0.12
Age under 25	-1.44	0.76	0.06	-1.27	0.72	0.08
Age 25-35	-0.38	0.33	0.25	-0.32	0.30	0.28
Age 45-55	0.21	0.27	0.44	0.21	0.26	0.43
Age 55-65	0.34	0.27	0.20	0.25	0.25	0.33
Age over 65	0.22	0.34	0.51	0.16	0.34	0.63
College	1.03	0.61	0.09	0.98	0.54	0.07
Household size	0.15	0.48	0.75	0.09	0.42	0.83
Household size (square)	0.00	0.06	0.97	0.01	0.05	0.89
Married	-0.48	0.37	0.20	-0.39	0.33	0.24
Retired	-0.51	0.38	0.18	-0.59	0.39	0.13
SCF = 2004	-3.23	1.83	0.08	-2.94	1.58	0.06
Constant	4.94	2.56	0.05	4.61	2.24	0.04
Number of observations	2378			2378		
p-values on test that the tax coefficients are the same across groups						
	Group 2	Group 3	Group 4	Group 2	Group 3	Group 4
Group 1	0.88	0.81	0.16	0.34	0.30	0.10
Group 2		0.78	0.17		0.79	0.57
Group 3			0.18			0.77
Group 1	Accountant, broker, financial planner, banker, Internet, magazine/news					
Group 2	Self, friends, work colleagues					
Group 3	Others					
Group 4	Does not invest/shop					

The model is estimated using two-stage least squares. Regressions are weighted by SCF sampling weights and corrected for multiple imputations. Advice source groups are defined similarly for investment choices and borrowing choices.

4.8 Appendix C: Analysis of the extensive margin

The main analysis focuses on the effect of taxes on portfolio dividend yields for households who receive some dividends. This focus ignores the household's decision over whether to receive any dividends at all. I examine this extensive choice by estimating a linear probability model for the choice of whether to receive any dividend income. Using the same instruments for tax rates as before, the estimated model is:

$$Prob(yield > 0 | equity > 0) = \sum_{g=1}^{G} a_g \tau\mathbb{I}(S_g = 1) + \sum_{k=1}^{K} X_k \beta_k + e \tag{4.4}$$

$$\tau\mathbb{I}(S_g = 1) = c_g \mathbb{I}(college = 1) * \mathbb{I}(SCF = 2004)\mathbb{I}(S_g = 1) + Xd^g + u_g, \quad \forall g = 1, \ldots G$$

Because an increase in the dividend and capital gains tax rate differential implies a decrease in the incentive to receive firm profits in the form of dividends, the coefficient on the tax rate variable is predicted to be negative.

Results from these linear probability models for investment advice sources are presented in Table 4.17 and for borrowing advice are presented in Table 4.18. Partition 1 refers to the groupings that are constructed without the analysis of the relationship between advice sources and sophisticated portfolio choices (*a priori* groups). Partition 2 refers to the groups that are based on the individual regressions for the relationship between advice sources and portfolio choice variables. Partition 3 refers to the groups that are constructed using results from a regression of the first principal component of the financial portfolio variables on advice sources. The estimated effect of the dividend and capital gains tax differential on the probability of receiving dividends is negative, as expected, for all advice source groups. However, none of these estimated coefficients are statistically significant at conventional levels. Interestingly, in tests for the equivalence of the estimated tax effects across advice source groups the null hypothesis of cross-group equivalence is sometimes rejected.

Table 4.17: Results from LPM for each investment advice source partition

Depedent variable: Indicator for having any dividend income

	Partition 1			Partition 2			Partition 3		
Variable	Est. Coeff.	Std. Error	p-value	Est. Coeff.	Std. Error	p-value	Est. Coeff.	Std. Error	p-value
Tax differential (Group 1)	-0.01	0.01	0.50	-0.01	0.01	0.45	-0.01	0.01	0.45
Tax differential (Group 2)	-0.01	0.02	0.37	-0.02	0.02	0.23	-0.02	0.01	0.12
Tax differential (Group 3)	-0.02	0.02	0.30	-0.02	0.01	0.11	-0.02	0.02	0.26
Tax differential (Group 4)	-0.05	0.03	0.09	-0.06	0.03	0.08	-0.06	0.03	0.08
Age under 25	-0.25	0.08	0.00	-0.27	0.08	0.00	-0.26	0.08	0.00
Age 25-35	-0.09	0.05	0.06	-0.09	0.05	0.05	-0.09	0.05	0.05
Age 45-55	0.10	0.04	0.01	0.10	0.04	0.01	0.10	0.04	0.01
Age 55-65	0.13	0.04	0.00	0.13	0.04	0.00	0.13	0.04	0.00
Age over 65	0.15	0.06	0.01	0.14	0.06	0.01	0.15	0.06	0.01
College	0.22	0.06	0.00	0.22	0.06	0.00	0.21	0.06	0.00
Household size	-0.02	0.04	0.58	-0.02	0.04	0.64	-0.02	0.04	0.66
Household size (square)	0.00	0.00	0.70	0.00	0.01	0.73	0.00	0.01	0.74
Married	0.04	0.04	0.27	0.04	0.04	0.30	0.04	0.04	0.32
Retired	0.05	0.06	0.39	0.04	0.06	0.50	0.04	0.06	0.53
SCF = 2004	-0.15	0.14	0.31	-0.18	0.15	0.22	-0.18	0.15	0.23
Constant	0.46	0.23	0.05	0.52	0.24	0.03	0.52	0.24	0.03
Number of observations	3956			3956			3956		
p-values for the test that the tax coefficients are equal across group-pairs									
	Group 2	Group 3	Group 4	Group 2	Group 3	Group 4	Group 2	Group 3	Group 4
Group 1	0.48	0.46	0.09	0.23	0.05	0.08	0.06	0.26	0.08
Group 2		0.75	0.13		0.68	0.17		0.54	0.21
Group 3			0.22			0.21			0.15

Group definitions			
Group 1	Accountant, broker, fin. planner, banker, Internet, magazines/news	Accountant, broker, fin. Planner, banker, magazine/news	Broker, mail materials
Group 2	Self, friends, work colleagues	Others	Other
Group 3	Others	Friends, TV/radio	TV/radio
Group 4	Does not invvest/shop	Does not invvest/shop	Does not invvest/shop

The model is estimated using two-stage least squares. Regressions are weighted by SCF sampling weights and corrected for multiple imputations.

Table 4.18: Results from LPM for each borrowing advice source partition

Depedent variable: Indicator for having any dividend income

	Partition 1			Partition 2			Partition 3		
Variable	Est. Coeff.	Std. Error	p-value	Est. Coeff.	Std. Error	p-value	Est. Coeff.	Std. Error	p-value
Tax differential (Group 1)	-0.01	0.01	0.46	-0.01	0.01	0.54	-0.01	0.01	0.50
Tax differential (Group 2)	-0.01	0.02	0.67	-0.01	0.02	0.48	-0.01	0.02	0.59
Tax differential (Group 3)	-0.03	0.02	0.16	-0.01	0.02	0.38	-0.01	0.01	0.64
Tax differential (Group 4)	0.01	0.01	0.35	0.01	0.01	0.30	0.01	0.01	0.25
Age under 25	-0.24	0.08	0.00	-0.23	0.08	0.00	-0.22	0.08	0.01
Age 25-35	-0.10	0.05	0.04	-0.09	0.05	0.06	-0.09	0.05	0.06
Age 45-55	0.10	0.04	0.01	0.09	0.04	0.01	0.09	0.04	0.01
Age 55-65	0.11	0.04	0.00	0.11	0.04	0.01	0.11	0.04	0.00
Age over 65	0.10	0.06	0.11	0.11	0.06	0.06	0.12	0.06	0.03
College	0.22	0.06	0.00	0.21	0.06	0.00	0.21	0.06	0.00
Household size	-0.03	0.04	0.45	-0.03	0.04	0.41	-0.03	0.04	0.39
Household size (square)	0.00	0.01	0.62	0.00	0.00	0.59	0.00	0.00	0.59
Married	0.08	0.04	0.06	0.07	0.04	0.07	0.07	0.04	0.09
Retired	0.04	0.07	0.52	0.04	0.07	0.56	0.05	0.07	0.48
SCF = 2004	-0.15	0.15	0.34	-0.12	0.15	0.41	-0.09	0.14	0.50
Constant	0.46	0.24	0.06	0.43	0.24	0.07	0.39	0.22	0.08

p-values for the test that the tax coefficients are equal across group-pairs

	Group 2	Group 3	Group 4	Group 2	Group 3	Group 4	Group 2	Group 3	Group 4
Group 1	0.68	0.12	0.01	0.69	0.38	0.01	0.94	0.49	0.01
Group 2		0.14	0.08		0.81	0.03		0.77	0.11
Group 3			0.00			0.01			0.01

Group definitions

Group 1	Accountant, broker, fin. planner, banker, Internet, magazines/news	Accountant, broker, fin. Planner, banker, magazine/news	Broker, mail materials
Group 2	Self, friends, work colleagues	Others	Other
Group 3	Others	Friends, TV/radio	TV/radio
Group 4	Does not invvest/shop	Does not invvest/shop	Does not invvest/shop

The model is estimated using two-stage least squares. Regressions are weighted by SCF sampling weights and corrected for multiple imputations.

CHAPTER V

Conclusion

The three chapters of this dissertation provide evidence regarding the extent to which taxes influence household financial portfolio choices. Unlike most previous studies that examine the relationship between taxes and portfolio choice, I exploit policy-driven shifts in the tax system to more plausibly identify tax effects. The first essay offers evidence that households shifted their equity holdings to stocks with higher dividend yields in response to the dividend tax rate reductions of the 2003 tax act. The second essay presents evidence that the increase in the tax advantage of directly held equities relative to interest-bearing assets due to the 2001 and 2003 tax acts led households to increase the share of their portfolios allocated to stocks. Finally, in the third essay, I consider that households may respond to tax policies heterogeneously because of differences in financial sophistication. I construct novel measures of financial sophistication using relationships between financial advice sources and sophisticated portfolio choices. Estimating the effect of the 2003 tax act on equity portfolios, I do not find evidence of tax response heterogeneity across households with different levels of financial sophistication.

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