Household Portfolios and Taxation: Canadian Evidence from 2005

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Abstract

This paper examines a survey of 5,282 Canadian households and estimates a model for the household demand of financial assets with the marginal income tax rate as the explanatory variable of most interest. An effort is made to increase the robustness of this type of estimation when done with a two-step Heckman (1979) procedure by adding a selection control variable in the first stage. Differences in the portfolio response to tax rate increases between Canadian and U.S. households are also evaluated. Household responses to taxation of investment income on both the asset selection and allocations are estimated by exploiting provincial variation in marginal income tax rates. The asset habitat decision is also examined due to the availability of data on the composition of RRSP accounts.

1. Introduction

The effect of taxation on household saving is a popular topic in empirical finance; however, the effect of taxation on how savings are allocated remains a relatively neglected topic (Poterba, 2001). This seems odd as investment portfolios can be a significant source of income affecting both wealth and well-being. Even modern portfolio theory has been developed without the presence of taxes on investment income (Poterba, 2002). Theoretical models of portfolio choice that have adjusted to account for income taxes generally provide clear results. The few empirical studies undertaken fail to produce conclusive results in some key areas, especially in determining the effects of taxation on asset portfolio shares.

How taxes affect portfolio choice is important for several reasons.[1] Macroeconomic models typically highlight the negative effects of taxing capital income. Understanding how our income tax system changes investor behaviour could provide insight into the degree of inefficiency imposed by it. Income taxes may change the optimal portfolio owned by households, which in turn distorts the pattern of investment in the economy (Feldstein, 1976). Many stylized patterns are also found when looking at the holdings and distribution of household portfolios. The most cited pattern is the large probability that high wealth and income individuals directly hold stock relative to the rest of the population. Although this behaviour is thought to be determined by risk aversion, it may also be determined by tax incentives. Finally, taxes may significantly influence the number of households who hold assets in tax-deferred accounts.

The wider topic of taxation and portfolio choice can be divided into narrower fields of inquiry. Poterba (2001) breaks down the effect of taxes into six different areas: asset

[1] See Poterba (2001).

selection, asset allocation, borrowing, asset habitat, choice of financial intermediaries, and timing of asset transactions. In this paper I study how taxes affect the asset selection (which assets to own) and asset allocation (how much of each asset to own) decisions in Canada. The popularity of tax-deferred accounts in Canada such as RRSPs imply that the asset habitat (whether or not to hold assets in special accounts) decision is considered as well.

Several empirical studies have attempted to model the asset selection and allocation decisions. Agell and Edin (1990), Feldstein (1976), King and Leape (1998), and Poterba and Samwick (2002) all find that marginal tax rates (MTRs) play an important role in the household asset selection decision. In regard to the asset allocation problem, Agell and Edin (1990), Barlow, Brazer and Morgan (1966), Butters, Thompson and Bollinger (1953), King and Leape (1998) and Scholz (1994) did not find a statistically significant relationship between MTRs and portfolio asset shares. Aside from Agell and Edin (1990), who use Swedish data, all the aforementioned papers use American data. Milligan (2002) investigates the role of taxes on the asset habitat decision in Canada, and finds MTRs have a statistically significant effect on RRSP participation.

The research above confirms two of the three theoretical expectations of household behaviour. MTRs significantly influence asset selection and asset habitat decisions. Tax increases cause investors to seek ownership of tax-preferred assets and hold them in tax-deferred accounts. Only Poterba and Samwick (2002) find MTRs to have an impact on the asset allocation decision.

This paper presents evidence on the effects of income taxes on household portfolio selection and allocation in Canada.[2] It will be organized as follows: Section 2 provides a brief overview of the theory of portfolio choice under taxation, while Section 3 outlines the Canadian tax environment. Section 4 describes the data being used, and in Section 5, I outline my empirical model. Sections 6 and 7 present the empirical results, and Section 8 provides a conclusion.

[2]Milligan (2002) investigates the effect of marginal tax rates on the household decision to contribute to RRSPs.

2. Theory of Taxation and Portfolio Choice

Different models of portfolio theory include Arrow-Debreu security models,[3] the Capital Asset Pricing Model (CAPM)[4], and more general modern portfolio theory (MPT).[5] Theoretical models of taxation and portfolio structure have been created with three different concepts of asset demand in mind (Poterba, 2002). These models are taxation and asset demands with risky returns, asset demand in clientele models, and the after-tax capital asset pricing model.

2.1 Risky Assets

Domar and Musgrave (1944) wrote one of the earliest papers to investigate the impact of capital income taxes on the choice to hold risky assets. They used a taxation and asset demand model in the context of risky returns, taking a general equilibrium approach. The results of their model depended on the degree to which investors could deduct capital losses from their taxable income. When there is no offset, net yield is reduced while risk is not. Risk taking becomes less attractive but investment income has decreased. These two factors work against each other, since investors would like to simultaneously decrease holdings due to higher risk relative to return, and increase holdings to make up for the lower level of after tax income. Investment in risky assets could move in either direction. With full loss deduction the government effectively shares the risk and return with the investor. Risk and yield have not changed relative to one another: the investor will increase holdings in risky assets to achieve the previous expected level of income. The behavior when partial loss offset occurs is unclear for the same reasons under no offset, although holdings of risky assets will increase as the degree of loss offset does.[6]

In Canada, capital losses can offset capital gains to produce a taxable net capital gain. A net capital loss, however, cannot be deducted from other types of taxable income. Domar and Musgrave (1944) do not distinguish between capital gains/losses and other income gains/losses. This implies that the practical limitation of being able to offset capital losses only against capital gains is ignored. Despite this, Canada's system would fall into the category of partial loss offset, although to a relatively high degree. Holdings of risky assets are expected to increase, especially as marginal tax rates increase and the possibility of loss offset becomes more attractive. Because all individual tax payers in the cross-section face the same offset rules, no explicit effort is made to examine the effects of capital loss offset in this paper.

[3]Arrow and Debreu (1954).
[4]Developed independently both by Litner (1965) and Sharpe (1964).
[5]MPT was developed by many contributors, with a key contribution made by Markowitz (1991).
[6]Although risk aversion is not explicitly mentioned, the assumptions Domar and Musgrave (1944) make about utility imply that utility is CRRA.

2.2 Clientele Models

Clientele models of portfolio choice are most closely related to the asset selection decision. Miller (1977) applies the clientele model approach to the demand of financial assets. Both demand and supply equations for debt and equity assets are derived from the firm's capitalization problem and the investor's portfolio optimization problem. Though the paper focuses on the corporate equity vs. debt financing decision, it has important implications for household portfolio choice. Miller creates a simple two good model where investors have the choice of purchasing a single debt or equity security, or a combination of both. Pre-tax returns on both assets are assumed to be the same in all states of nature. If both assets are taxed differently but all agents face the same tax rules (and rates), prices adjust and both assets have the same after-tax return. Investors are indifferent between the two goods.

If tax rules and rates between individuals change, a different set of results emerge. Miller (1977) assumes both assets are riskless, and that a tax exists on interest income but not on personal income from the equity asset, although firms still pay corporate taxes. In equilibrium, firms gross up the return on corporate bonds (interest) to the tax rate of the marginal bondholder. The rate of return on equity will be the same as the after tax return on bonds (for the marginal bondholder). The result is that two groups or clienteles of investors emerge, where each one invests only in debt or equity. High income investors hold only equity, while low income investors hold only debt. According to Poterba (2001) Miller's predictions do not hold empirically with regard to actual household portfolios or corporate debt-equity ratios. Since Miller's model is rather simple and makes use of unrealistic assumptions, it should not be expected to hold up on its own when tested against actual data. The clientele model of asset demand still provides us with basic intuition about investor behavior under a progressive tax rate system.

2.3 The After-tax Capital Asset Pricing Model (CAPM)

Auerbach and King (1983) use an after-tax CAPM to explore the behavior of households and firms faced with risk and taxation. They show that the response of investors depends highly on their level of risk aversion. Agents hold a mix of two market portfolios, one being the optimal portfolio before tax (all non-systematic risk is diversified away) and another chosen on the basis of tax minimization. More risk-averse agents will hold a higher weight in the diversified portfolio and care less about after-tax optimization (Poterba, 2001). As taxes increase, so does the incentive to weight a portfolio with tax-advantaged assets.

Within the tax optimized portfolio, investors with a tax preference for equity will hold as much of it as possible. In order to hold more equities without bearing an excessive amount of risk, they will choose less risky equities. Investors with a tax preference for debt securities will hold as little equity as possible. To do this and maintain an acceptable level of expected return, they will choose to hold riskier equities. Changes in the *allocation* between debt and equity will depend on the risk aversion of agents.

Another important result of Auerbach and King (1983) is that the response of households depends largely on their tax treatment relative to each other and between assets. Proportional taxation between agents that does not change the relative net yield and risk of assets should not have an effect on equilibrium results. These conclusions, however, depend on some perhaps unrealistic assumptions. There are no constraints on households taking short positions on assets, nor is asset habitat considered.

The features of the Canadian income tax system will ensure that tax on interest income will rise faster relative to the tax on dividends and capital gains as MTRs increase. Ceteris paribus, all agents will have a tax preference for equities. With a tax preference for equities and concave utility, as marginal tax rates increase a higher portfolio share in equity is expected. Risk averse agents compensate for the higher share of equity by replacing higher risk stocks with lower risk ones. Corner solutions where investors invest only in equity are also possible. Higher MTRs should increase both the probability of owning equities and the portfolio share associated with them.

2.4 Tax-Deferred Accounts

The work summarized above does not consider the existence of tax deferred accounts. Poterba and Samwick (2002) provide a very simple explanation of how investors should behave in an environment where such accounts are available. Consider an investor facing an income tax rate of τ and investment time horizon T. The investor holds an asset paying an annually compounding rate of return r. The after-tax wealth per dollar generated from this asset will be $e^{r(1-\tau)T}$. An investor who allocates $1/(1-\tau)$ dollars (the amount of pre-tax income generating 1 dollar of after-tax income) to a tax-deferred account has e^{rT} after retirement. The asset's ratio of wealth in a tax-deferred environment to a taxable environment is $e^{r\tau T}$. We can see this amount is increasing with τ. The investor clearly benefits from holding assets in a tax-deferred account, and this benefit increases with the MTR rate.

The theoretical work available provides a good base from which to conduct empirical research, even though many of the assumptions used are somewhat unrealistic.[7] Heterogeneous tax treatment of assets and the rates facing individuals should provide incentives for investors to seek ownership of tax advantaged assets and hold them in tax-deferred accounts if possible. For a comprehensive literature review on the subject see Poterba (2001).

3. The 2004 Canadian Tax Environment

In Canada, income taxes are imposed by the federal government under the *Income Tax Act*. In addition, each Canadian province has its own legislation which imposes provincial income tax on its residents and on non-residents who are permanently established or conduct business in the province. The federal government collects personal

[7]This includes the assumption of riskless equities, the lack of an environment with tax-deferred accounts, and the failure to place short selling restrictions on households.

income taxes for all provinces except Quebec. In 2004, progressive income tax rates were imposed on taxable income by the provinces and federal government.[8]

Calculating income tax involves four basic steps[9]: First, all sources of income from employment, businesses and investments are calculated. Allowable deductions are then made to calculate taxable income, from which the gross tax payable is derived. Net tax payable is calculated after any applicable tax credits are claimed.

Financial assets typically produce three types of income: dividends, capital gains, and interest payments. These three income flows are all taxed at different rates. Several tax-deferral accounts also exist that allow individuals to effectively transfer income from one period to another, changing the tax burden placed on investment income. These accounts include Registered Retirement Savings Plans (RRSPs), Registered Retirement Income Funds (RRIFs), Locked-In Retirement Accounts (LIRAs), and Registered Education Savings Plans (RESPs).

3.1 Taxation of Investment Income

Individuals receiving dividend income from taxable Canadian corporations receive preferential tax treatment. Dividend payments from Canadian corporations are grossed-up to 125% in order to make them equivalent to what a corporation would have earned before tax. This grossed-up amount is the taxable dividend income. A dividend tax credit of 13.33% of the grossed-up amount is provided to the taxpayer. Dividends from foreign corporations are taxed as regular income. Reinvested dividends are treated the same way as cash dividends.

Capital gains arise from the sale of a capital property for more than its cost, and are also considered a tax-preferred income flow. 50% of net capital gains are taxable as regular income. Net capital gains can be carried back three years, while net capital losses can be carried forward indefinitely. Interest income is considered regular income and is taxed as such. Reinvested interest is taxed the same way as interest payments received. Although tax liability can be reduced through specializing in assets that provide dividends and capital gains, high income investors may be subject to a minimum tax if they significantly reduce their tax liability through tax-preferred income or tax credits.

3.2 Registered Retirement Savings Plans (RRSPs)

RRSPs are one of the more popular types of tax deferment plans in Canada. Individuals are able to make tax deductible contributions up to a $15,500 annual limit, and any unused contribution space can be carried over into the future. Contributions can also be made to a spousal RRSP, to the extent that an individual's contribution limit is not exceeded. Investment income accrues inside RRSPs tax free. Any funds withdrawn qualify as taxable income and are subject to a withholding tax in addition to provincial

[8]See Appendix A for federal and provincial income tax schedules.
[9]From the Canadian Securities Course Text Volume II.

and federal income tax rates. When a plan holder reaches the age of 69, they must de-register their RRSP during that calendar year.

3.3 Registered Retirement Income Funds (RRIFs)

Once a RRSP holder reaches the age of 69, they can continue to shelter their funds from taxes by transferring the de-registered RRSP funds into a RRIF. RRIF plan holders are required to withdraw and pay income tax on an annual minimum amount of their RRIF. No maximum withdrawal amount exists.

3.4 Locked-In Retirement Accounts (LIRAs)

The purpose of LIRAs is to allow those eligible for deferred pension income at the time they withdraw from a registered employee pension plan to transfer the funds into a tax sheltered account. LIRAs are subject to all the same rules as RRSPs under the *Income Tax Act*. The difference is that funds cannot be withdrawn at any time and are locked in until retirement. The conditions regarding when and how funds in a LIRA can be withdrawn vary between provinces.

3.5 Registered Education Savings Plans (RESPs)

RESPs are tax-shelter plans designed to help save for the post-secondary education of a child or grandchild. Contributions are limited to $4000 per year per beneficiary and are not tax deductible, however income accrues inside the account tax-free. There is also a $42,000 lifetime contribution limit per beneficiary. Complications may arise if the designated beneficiary does not attend any qualifying education programs.

3.6 Comparisons with the U.S. Tax System

Both King and Leape (1998) and Poterba and Samwick (2002) use U.S. data from the 1997 tax year. In 1997 both dividend and interest income are taxed as normal income by the IRS, however municipal, state, and federal bonds are exempt from federal income taxes. How capital gains are taxed depends both on the individual's income and the length of time the asset was held before it was sold. U.S. taxpayers in the 15% federal income tax bracket pay taxes on short term capital gains (on assets held for one year or less) at the normal rate. Long term capital gains (on assets held for longer than one year) are taxed at a marginal rate of 10%. Taxpayers above the 15% tax bracket are taxed at the normal federal rate (between 28 and 39.5%) on short term capital gains and a constant rate of 20% on long term capital gains.

The U.S. tax-deferred environment shows similarities to the Canadian system. Traditional 401(k) and Investment Retirement Accounts (IRAs) allow for post-tax contributions to be made, and income accumulates tax-free until it is withdrawn, tax credits are provided for contributions. Traditional 401(k) and IRA accounts are very similar to RRSPs. Both 401(k) and IRA accounts allow for post-tax contributions to be made but income is

withdrawn tax free (tax credits are not given for contributions). Withdrawals from both types of 401(k) and IRA accounts before the age of 59.5 are subject to taxation at the normal rates in addition to a 10% penalty.[10]

U.S. treatment of capital gains in 1997 is more favourable than that of Canada in 2004, while Canada treats dividend payments more favourably. Based on the relative tax treatment of equity between the two countries, a prediction cannot be made as to how Canadian equity responses to taxation differ from those in the United States. The existence of tax-exempt bonds in the United States could provide an interesting opportunity for comparison. These bonds act as a substitute for both taxable bonds and bonds in tax-deferred accounts. As MTRs increase there is greater incentive to stop holding or to hold less of taxable bonds when tax-exempt bonds are available. Since tax-exempt bonds are available, bonds in tax-deferred accounts may become relatively less attractive. I will be sure to look for signs of these effects when comparing my results to past American papers.

While U.S. and Canadian federal tax rates are similar, state income taxes in 1997 usually varied between 1-6%, with none higher than 9%.[11] Because of lower state taxes, total U.S. income tax rates are typically lower than those in Canada. Higher Canadian tax rates provide a greater incentive to utilize tax-advantaged assets and tax-deferred accounts. This is also something to keep in mind when looking at the regression results discussed in Sections 6 and 7.

4. Data

This study uses detailed micro data from the 2005 Survey of Financial Security (SFS).[12] The SFS is conducted by Statistics Canada and is designed to provide an in-depth picture of the net worth of Canadians in 2004. It contains individual and household information on the value of all major financial and non-financial assets and on the money owing on mortgages, vehicles, credit cards, student loans and other debts. The survey was conducted in all ten provinces (territories were excluded) and is intended to be representative of 98% of the population in the provinces. Asset and debt information was collected for families as a whole. For individuals over the age of 15, information was collected on demographics, ethnicity and culture, education, employment, and income.

The cross-section consists of 9,000 households drawn from two sub-samples.[13] A stratified, multi-stage area sample of 7,500 dwellings was taken in addition to a high income sample of 1,500 dwellings. The second sample was taken from geographic areas which had a large proportion of "high income" families as defined by Statistics Canada.

[10]See http://www.irs.gov/ for U.S. tax information.
[11]http://www.taxadmin.org/FTA/rate/ind_inc.html (Accessed March 2008).
[12]Access to the 1999 SFS was also available, but was not used because it did not provide sufficient detail on mutual fund and tax-deferred asset holdings.
[13]The data set in the RDC provided by StatsCan only contains observations for approximately 5,200 households.

The high income cut off was total family income of $200,000 or investment income of at least $50,000.

The use of this dataset has several advantages. As mentioned the SFS oversamples high-income families. This quality is desirable when analyzing household portfolios, because it reduces the degree of non-participation bias from low-income families (King and Leape, 1998). Over-representation of high-income families also helps to increase the probability that each dollar of wealth in the economy, rather than each household, appears in the sample (Samwick, 2000).

A flaw with many of the American datasets used is that the household's state of residence is suppressed. Income tax rates in the United States are set at both the state and federal level. The inability to determine a household's state (or provincial) income tax reduces the variation of tax rates among observations greatly. Greater cross-sectional variation in the marginal tax rate allows the effect of taxes to be further separated from income (Milligan, 2002). Since the SFS does not suppress provincial variables, the robustness of the results is increased.

4.2 Asset Categories

In order to properly model the effect of taxation on asset holdings, assets must be categorized by the type of income they produce, which in turn determines how they are taxed. Nine broad asset categories have been constructed containing a total of thirty-five asset types. These categories are directly held equity, directly held equity mutual funds, directly held fixed income, directly held fixed income mutual funds, other directly held assets, liquid assets, RRSP equity, RRSP fixed income, and other tax-deferred assets.[14]

4.3 Summary Information on Portfolio Holdings

Here some descriptive statistics on household asset holdings are briefly presented. Table 1 summarizes the probability that each asset is held in the population.[15] Aside from holdings of liquid assets, none of the assets are held by even a third of Canadians. The low probabilities shown here provide motivation for the model of incomplete portfolios presented in Section 5. Table 2 displays the probability that an asset is held conditional on the probabilities of each other asset being held. This table allows us to look for the presence of asset clienteles as described in Section 2. Looking at Table 2 we can see that about 30% of homes who own RRSP equity also own it outside of a tax sheltered account. Approximately 40% of homes who own fixed income assets inside of a tax-deferred account also own fixed income assets outside of one. The figures shown in Table 2 suggest that Canadian households do not exhibit tax-clientele behavior, since none of the conditional probabilities are very low (individuals are willing to hold the same asset inside and outside of tax-deferred accounts, and portfolios containing equity still have a high probability of holding fixed income assets).

[14]See Appendix B for variable construction.
[15]Calculations are made using the sample weights provided with the SFS.

Table 1: Probability of ownership (percent) of each of seven asset classes

Equity	Equity Mutual Funds	Fixed Income	Fixed Income Mutual Funds	Liquid Assets	Other	RRSP Equity	RRSP Fixed Income	Other Tax-Deferred
10.90	4.10	24.40	4.96	86.09	11.11	14.22	22.91	29.01
(0.44)	(0.28)	(0.60)	(0.30)	(0.48)	(0.44)	(0.49)	(0.59)	(0.63)

Source: Author's tabulations based on data in the 2005 Survey of Financial Security. Households are weighted by sample weights in each year. Standard deviations in parenthesis.

Table 3 lists the portfolio share each asset has both across the entire sample and in sub-samples conditional on positive ownership of the asset. Portfolio shares in every asset category increase significantly once they are conditioned on ownership. This implies that households do not hold more than a few different assets in their portfolios. When conditioning on ownership the smallest increase in portfolio shares is seen in both of the equity categories (aside from liquid assets and fixed income mutual funds). This reflects the risk aversion of agents in our population as owners of riskier equity assets are diversifying their portfolios.

4.4 Estimating Marginal Tax Rates

The marginal income tax rate will be considered our most important explanatory variable. It is not the only tax variable households take into account, but most of the variation in tax liability across provinces is due to the cross-sectional variation in MTR (Poterba and Samwick, 2002). MTRs are estimated using the income, expense, and demographic variables in the SFS.[16] [17] [18]

[16]MTR is estimated using the Canadian Tax and Credit Simulator (CTaCS) generously provided by Kevin Milligan. See Appendix C for tax calculation details.
[17]MTRs and all demographic control variables refer to those of the household head, as self identified in the 2005 SFS Questionnaire.
[18]In my draft paper I stated that a graph of provincial MTR distribution will be included and discussed in the final draft. I was unable to include these graphs due to disclosure issues with the RDC.

Table 2: Conditional ownership probabilities (percent) for seven asset classes: 2005

	Equity	Equity Mutual Funds	Fixed Income	Fixed Income Mutual Funds	Other	Liquid Assets	RRSP Equity	RRSP Fixed Income	Other Tax-Deferred
Equity	100.00	14.94	44.85	13.07	26.50	95.38	42.97	42.50	49.93
Equity Mutual Funds	39.73	100.00	52.51	46.49	52.94	95.21	54.28	46.56	60.35
Fixed Income	20.03	8.82	100.00	9.93	16.84	95.10	19.05	35.06	39.38
Fixed Income Mutual Funds	28.72	38.42	48.88	100.00	65.52	92.33	38.74	46.52	53.95
Other	25.98	19.52	36.97	29.24	100.00	93.78	25.19	28.90	43.09
Liquid Assets	12.07	4.53	26.96	5.32	12.10	100.00	15.39	24.29	31.19
RRSP Equity	32.91	15.64	32.67	13.50	19.68	93.15	100.00	52.49	60.26
RRSP Fixed Income	20.21	8.33	37.34	10.07	14.02	91.27	32.59	100.00	45.00
Other Tax-Deferred	18.75	8.52	33.13	9.22	16.51	92.55	29.55	35.54	100.00

Notes: Each entry indicates the probability that a household owns the asset class indicated at the column head, conditional on owning the asset class indicated at the beginning of the row. Entries are based on the author's tabulations using the 2005 Survey of Financial Security, weighting households by their sampling weights.

Table 3: Average portfolio shares (percent) of each of seven asset classes

	Equity	Equity Mutual Funds	Fixed Income	Fixed Income Mutual	Other	Liquid Assets	RRSP Equity	RRSP Fixed Income	Other Tax-Deferred
Unconditional Average	3.23	0.92	9.87	1.32	4.62	48.03	5.82	10.90	15.29
Conditional Average	27.18	21.01	37.12	24.72	38.04	50.87	37.48	43.68	48.25

Notes: Unconditional averages refer to the entire sample, while conditional averages refer only to households with positive holdings of the indicated asset class. Tabulations are based on the author's calculations using data from the 2005 Survey of Financial Security, weighting each household by its sampling weight.

5. Econometric Specification

In this section, the specification for asset selection and allocation decisions is discussed. Problems that arise in specifying these types of models are also considered, along with possible solutions. Separating income from the marginal tax rates, creating a suitable instrument for MTRs, and dealing with simultaneity and sample selection biases are all challenges that are presented in this type of estimation.

5.1 Separating Income Effects from Marginal Tax Rate Effects

According to Triest (1998), one of the biggest challenges in properly identifying tax effects is ensuring that MTR coefficients do not capture non-linear income effects. To offset this problem, variation in tax rates that is independent of the other explanatory variables is required in the data. One potential source is the variation in tax rates across states (or provinces).[19] The combined federal and provincial marginal tax rate will have variation that is exogenous of the other independent variables. If federal and provincial tax rates are combined, it must be assumed that: i) household responses to provincial taxation are identical to responses to federal taxes and, ii) the provincial tax code is independent of other factors determining relevant household behavior. If these assumptions are presumed to be true, provincial dummies cannot be used as control variables. If provincial dummies are added and assumptions i) and ii) hold, one runs the risk of entirely eliminating the ability of provincial variation in tax rates to explain household behavior. I operate under the assumption that i) and ii) are true in order to combine federal and provincial marginal tax rates into one variable, therefore provincial dummies are not be included in my specification.

Another problem with the estimated MTR coefficients pointed out by King and Leape (1998) is the possibility of an identification problem that arises from including both the EMTR and income as independent variables (MTRs are a non-linear transformation of income). Using a similar solution to the one presented in their paper, my income variable is total household wage and self-employment income. This excludes some other types of income that will be used to estimate MTRs. The use of *household* income further separates this income variable from the *individual* income measure used to estimate MTRs.[20]

5.2 Endogeneity of Marginal Tax Rates

A household's marginal tax rate is not determined exogenously. In particular, the portfolio chosen by a household will determine its taxable investment income and in turn its marginal tax rates. RRSP withdrawals and deductions, the claiming of various tax credits, pension contributions, and other household behavior will also determine the MTR it faces. A proper instrument must be found that is correlated with MTR but not with the error term.

[19]Poterba and Samwick (2002) provide an additional method to test for non-linear income effects in the MTR.
[20]Note that investment income is not included in this variable, further reducing potential endogeneity.

I will adopt an instrument for MTR similar to that used by Agell and Edin (1990), Feldstein (1976), King and Leape (1998), Milligan (2002) and Poterba and Samwick (2002). The method common to all of these papers is the calculation of MTRs based on a definition of taxable income that ignores endogenous variables such as investment income, RRSP contributions, etc. A generalization of this method is illustrated effectively by Poterba and Samwick (2002):

$$[T\,(Y_B+\Delta) - (Y_B)]\,/\Delta\,, \qquad (1)$$

where Y_B is the base level of income, $T(Y_B)$ is the tax liability on base level of income, Δ is an increment, and $T\,(Y_B+\Delta)$ is the tax liability at base level plus the increment. Equation (1) gives the estimated marginal tax rate (EMTR).

I will calculate the taxable income base using a similar approach to Milligan (2002) and Poterba and Samwick (2002).[21] The increment Δ can be calculated in several ways. Estimations of MTRs designed to look solely at participation decisions have used an increment of one, this produces what is known as the first-dollar marginal tax rate. The first-dollar increment is inappropriate, since this rate does not consistently account for income from large investment portfolios that could push an individual into a higher tax bracket. If a household is pushed into a higher tax bracket, the EMTR will be the average between the two brackets. Papers by Agell and Edin (1990) and Poterba and Samwick (2002) use an exogenous approximation of portfolio income as the increment. This is usually total household financial assets multiplied by the appropriate discount rate for the sample's country and time frame. I use the average annual return on 3-month federal T-bills in 2004 to approximate portfolio income. If (Y_B) is properly calculated the EMTR will be purged of endogeneity.

5.3 Endogeneity and Sample Selection Bias

The data shows that households exhibit significant non-participation in many asset categories. The two most popular explanations for incomplete portfolios are transaction costs and constraints on shortsells and negative holdings of assets by households (Auerbach and King, 1983). The presence of transaction costs will have effects on the household's selection choice, while constraints on negative holdings will prevent households from allocating assets in an optimal way. These facts cause us to focus on the relationship between asset selection and allocation. Namely, the specification determining the two problems is not identical, but as this section shows, both decisions are simultaneous and cannot be entirely separated.

Portfolio selection and allocation is generally a two part problem. Households choose which assets to own and how much to own simultaneously. Agell and Edin (1990) explain that conceptually this is a two stage optimization problem. First, the household chooses the asset proportions that maximize expected utility in portfolios of every possible combination of assets. Next, the particular portfolio is chosen that maximizes

[21] See Appendix C for details.

expected utility. The asset ownership (or selection) decision can be referred to as the *discrete* choice, while the asset allocation decision can be referred to as the *continuous* choice.

Estimation of a multivariate Tobit model seems like a possible solution to this problem. But as previously mentioned the reasons behind non-participation imply that the function determining the discrete choice is unlikely to be the same as the one determining the continuous choice (conditional on ownership). For this reason a single equation cannot be used and separate models for the two decisions must be generated.

Following in the footsteps of King and Leape (1998) I will estimate a model of incomplete portfolios. They assume that incomplete portfolios and transaction costs do cause non-participation, so the continuous choice decision is a switching regressions model. This switching regressions model contains as many intercepts as there are combinations of asset holdings.[22] The household demand used to derive this switching model is characterized as:

$$p_{h,} = f_{j,}(X_h) \qquad (2)$$

where $p_{h,j}$ is household h's portfolio share of asset j and X_h is the vector of independent variables. The functional form of the asset demand depends on which portfolio is chosen. The effects different combinations of portfolios have on the continuous choice are known as "spillover" effects, and any empirical model should take account of them.

King and Leape (1998) use the notion of asset demand in (2) to arrive at the equation which should be estimated:

$$\ln p_{h,j} = \Sigma_{k=1}\ \alpha_{j,k}\, d_{k,h} + \beta_j X_h + \varepsilon_{h,j};\ \mathrm{k} = 1,\ldots,2^{J-1};\ j = 1,\ldots, J \qquad (3)$$

Where $d_{k,h}$ is a dummy equal to unity if household h owns portfolio k and $\alpha_{j,k}$ is the demand intercept of asset j given portfolio k is held. The intercept $\alpha_{j,k}$ incorporates "spillover" effects into the regression model. This equation produces *conditional* asset demand (upon ownership).

Although (3) does model "spillover," it is only regressed on households with non-zero holdings of asset j and may suffer from sample selection bias. Further, it does not account for the simultaneity of the discrete and continuous decisions. That is to say, the shift dummies $d_{k,h}$ are endogenous.

Sample Selection Bias

Both King and Leape (1998) and Agell and Edin (1990) include the inverse Mill's ratio as an independent variable in the ownership model and proceed with a Heckman (1979) two-step procedure. I follow this procedure in order to yield consistent estimates

[22]Given J assets, there are (2^J-1) different portfolios, excluding the null.

in the presence of incomplete household portfolios. One omission made by King and Leape (1998) and Agell and Edin (1990) is the exclusion of a selection variable in the first stage probit (selection) model. Finding an appropriate variable (aside from transaction costs and shortsale restrictions) that influences the decision to hold assets while not affecting the level of the assets held is an issue that has been tackled by literature on portfolio choice to no avail.

A recent working paper by Brown, Ivkovic, Smith and Weisbenner (2004) suggests that geography is a significant determinant in stock market participation. In particular, the presence of "peer groups" of other investors and the close proximity of publicly-traded firms greatly increase the likelihood that an individual will choose to hold equity assets. Though they do not make inferences about these effects on the ownership of other financial assets, ownership of one financial asset is likely to increase the probability that other assets are owned, due to the reduction of transaction costs and benefits from experience (Poterba and Samwick, 2002). Indeed, this is reflected in Table 2 where ownership of equity assets significantly increases the probability of owning other assets over their unconditional values.

Because industry tends to be concentrated in urban areas, and individuals are more likely to come into contact with stock owners in densely populated areas, I introduce an urban geography (city) dummy as a selection variable in the first stage probit model.[23] The introduction of this variable is also in accordance with theory that suggests the vector of independent variables in the discrete choice should be different from those in the continuous decision.

Endogeneity

As noted, straight estimation of (3) can lead to simultaneity bias since the portfolio intercept dummies $d_{k,h}$ are generated endogenously. Agell and Edin (1990) note the ideal solution would be to generate the shift dummies with a multivariate probit model. This would eliminate the sample selection and simultaneity problems. Because of the large number of portfolio combinations (2^J-1) this is not possible (in this case $J = 9$, so $2^J-1 = 511$ possible portfolios exist). Such a large number of portfolios would imply that some are likely to be held by few or no households. Dummy variables corresponding to these portfolios would introduce high (or perfect) collinearity. Instead, the ownership of each asset is modeled separately. This requires the estimation of:

$$Pr(own\ j) = \Sigma_{k|\, j \epsilon k}\, Pr(k). \qquad (4)$$

Equation (4) is the probability that a given household owns asset j. This is the sum of the probabilities that a household owns each portfolio k containing asset j. Estimates of (4) are generated by a simple probit model, but no justification will be given for the implied assumption that errors are distributed normally.

[23]See Appendix B for a precise definition of this variable.

Agell and Edin (1990) and King and Leape (1998) estimate (3) with spillover intercepts constructed from the fitted values generated by the probit estimation. This eliminates the endogeneity problem but introduces a new problem. Namely, Stata will treat the portfolio dummies as data and not as predictions with error. I estimated two sets of regressions for equation (3): one using actual values and the other using fitted values for the portfolio intercepts. I present results of estimation which includes the population values for the selection intercepts, since estimation using the fitted values produced coefficients with much lower economic and statistical significance. As a result, my estimation procedure may suffer from endogeneity bias.

5.4 The Model

I run a two-step Heckman (1979) model to estimate the response of portfolio shares to taxation. Probit models showing marginal effects (evaluated at the population mean) are also estimated for the ownership decision for each asset. Assets have been aggregated into four groups in order to estimate the demand intercepts in (3). This reduces the total number of portfolio intercepts to fifteen, with no more than seven applying to each one of the nine asset categories. I intended to follow the method used by King and Leape (1998) to aggregate the asset categories by grouping assets with a correlation of 0.75 or more. King and Leape (1998) included assets such as home mortgages which have much higher participation rates, while this paper examines financial assets only. Asset correlations are all considerably lower than 0.75 and do not vary significantly across assets. I aggregated asset categories that displayed relatively high correlations, but this was done in an otherwise arbitrary manner. Asset correlations are presented in Appendix D.

In regressions of (3) the natural logarithm of each asset's portfolio share is used as the dependent variable. The logarithm of the portfolio share is taken to reduce potentially significant heteroskedasticity. Ideally a constraint would be implemented that ensures that the coefficients on each independent variable sum to zero across all asset models. The logarithmic form of the estimation model prevents this. For this reason, one of the asset allocation models should be considered residual (King and Leape, 1998).

Both the probit and Heckman (1979) models regress the dependent variable against a vector of control variables in addition to the EMTRs. This includes age, education, sex, marital status, retirement status, household size, financial industry employment, self-employment, employee pension plan participation, and household net wealth and income. The probit regressions include a dummy variable indicating whether or not the household is located in an urban area. The allocation regression in the second stage of the Heckman (1979) model includes portfolio spillover dummy variables and the estimated inverse Mill's ratio.[24] All estimation is done using sample weighted variables.

[24]More detailed descriptions of how the portfolio dummy variables were constructed are found in Appendix B.

6. Empirical Results: Asset Selection

Table 4 displays the probit coefficients and standard errors for each of the nine asset selection regressions. Marginal tax rate coefficients are positive and statistically significant in the models for equity, fixed income, RRSP equity, and RRSP fixed income. These results support the hypothesis that ownership of tax preferred assets increases with MTRs. The coefficients on the assets with the most favourable tax treatment (equity, RRSP equity, and RRSP fixed income) are all significant at the 1% level. The significant positive coefficient on fixed income assets is not consistent with the theory presented in Section 2. This is not a surprise as previous empirical work by Agell and Edin (1990) and Poterba and Samwick (2002) also produced significant positive coefficients on interest bearing assets. Poterba and Samwick (2002) suggest that this is due to fixed costs for initial ownership in any asset that reduces the marginal cost of owning additional assets. Another reason suggested for this is that individuals who invest are more skilled at conducting research, and are therefore likely to invest in many asset categories.

Coefficients on income are insignificant for all asset categories except equity. Net wealth coefficients are positive and significant for *all* asset categories. Coefficients show especially large increases in ownership for households moving into the $250,000 and $1,000,000 wealth categories. Most age coefficients are insignificant across all regressions, although they increase in magnitude and significance as age increases. Higher levels of education are associated with statistically significant increases in ownership across all categories except fixed income. The hypothesis that living in an urban area is an important determinant of asset ownership seems to be rejected by the data. The coefficients corresponding to the city dummy variable are insignificant in seven of the nine asset ownership regressions.

Table 5 presents estimates of the marginal effects of the tax rate on asset ownership. The value of $g(\beta_0 + \beta \bar{X})$ is included in Table 4 for each probit regression, where (.) is the standard normal density function. This allows for the marginal effect $g(\beta_0 + \beta \bar{X})\beta_j$ of each variable x_j to be calculated. One asterisk indicates statistical significance at the 5% level, and two asterisks indicate significance at the 1% level. The upper portion of Table 5 shows the marginal effect of a unit increase in the MTR (evaluated at the population mean) on the expected probability of ownership. The lower section of Table 5 shows the marginal effect of a ten percentage point increase in the MTR, relative to the population ownership probability for each asset category. For example, a 1% increase in the marginal tax rate is associated with a 0.305% increase in the probability of holding a RRSP fixed income asset. A 10% increase in the marginal tax rate is then associated with a 0.305% increase in the probability of owning fixed income inside of an RRSP account. Table 1 illustrates that 22.91% of the population hold RRSP fixed income, so (3.05/22.91)*100 = 13.31%.[25]

[25]This number differs from the one shown in Table 5 because values in Table 5 were derived without rounding down estimates or probabilities.

Table 5: Marginal effects of changes in marginal tax rate on probability of asset ownership probit models

Estimate of Marginal Effect	*Percentage Point Increase*
Equity	0.090**
Equity Mutual Funds	0.014
Fixed Income	0.100*
Fixed Income Mutual Funds	0.018
Other	-0.034
Liquid Assets	0.222
RRSP Equity	0.149**
RRSP Fixed Income	0.305**
Other Tax-Deferred	0.424

Effect of a 10-percentage point MTR increase on ownership (as a percent of baseline ownership probabilities)

Equity	8.26
Equity Mutual Funds	3.44
Fixed Income	4.08
Fixed Income Mutual Funds	3.57
Other	-3.02
Liquid Assets	2.57
RRSP Equity	10.50
RRSP Fixed Income	13.32
Other Tax-Deferred	16.63

Notes: The top section shows the marginal effect of a unit increase on the marginal tax rate on the expected probability of ownership. The lower section multiplies the top section by 10 then divides by the probability that a household owns the asset class, as shown in Table 1. (**) indicates significance at the 1% level, (*) indicates significance at the 5% level.

When the marginal effect of the estimated MTR is evaluated relative to the baseline ownership probabilities of each asset, expectations regarding asset selection responses are reflected in the data. A ten percentage point increase in the MTR leads to significant increases in the ownership of equity, RRSP equity, RRSP fixed income, and other tax-deferred assets.

The hypothesis put forward in Section 3 that as MTRs rise, Canadian ownership of tax-deferred fixed income (RRSP fixed income) assets should increase more than U.S. ownership of tax-deferred bonds, appears to be verified. Poterba and Samwick (2002) predict that for a ten percentage point increase in the MTR, tax-deferred bond ownership will increase 9.2% relative to baseline ownership. I estimate that RRSP fixed income ownership will rise 13.32% in response to the same change in the MTR.

7. Empirical Results: Asset Allocation

Table 6 displays the results from the second stage of the Heckman (1979) model estimation, along with coefficients and standard errors for each of the nine asset allocation regressions. Marginal tax rate coefficients are insignificant at the 10% level for all asset categories. With the exception of those estimated in the liquid asset model, the coefficients on *all* variables are insignificant. Coefficients for many explanatory variables are smaller than their standard errors.

Table 7 shows the estimated marginal effect of increases in MTRs on the portfolio share of each asset. P-values are also included to remind the reader that the coefficients are statistically insignificant, and should be interpreted with caution. Since the dependent variable estimated in each asset allocation model is the natural logarithm of an asset's portfolio share, the MTR coefficients represent the tax semi-elasticity. These semi-elasticities are presented in the upper half of Table 7. For example, the semi-elasticity of the MTR on RRSP fixed income is 5.579. This means that a unit increase in the MTR is associated with a ($0.05579*p_j$ x 100) percentage point increase in asset j's portfolio share, where p_j is the level of the portfolio share being evaluated. The lower half of Table 7 shows the estimated marginal effect of a 10 percentage point increase in the MTR on the allocation decision, evaluated at the population mean portfolio share of each asset as shown in Table 3.

The estimated changes shown in Table 7 do not correspond with theoretical expectations of portfolio behavior. Equity and fixed income mutual funds are shown to increase by more than directly held equity and fixed income, respectively. Fixed income holdings are expected to decrease, but only by a small amount. Portfolio holdings of all RRSP and tax-deferred assets increase, but the increase in RRSP fixed income appears to be excessively high.

Table 10: Marginal effects of changes in marginal tax rate on asset portfolio shares (conditional on ownership)

MTR Semi-elasticities		*P-values*
Equity	0.470	0.608
Equity Mutual Funds	2.844	0.743
Fixed Income	-0.750	0.280
Fixed Income Mutual Funds	1.090	0.286
Other	-0.430	0.674
Liquid Assets	-0.110	0.542
RRSP Equity	1.015	0.119
RRSP Fixed Income	5.579	0.320
Other Tax-Deferred	1.906	0.130

Effect of a 10-percentage point MTR increase on allocation evaluated at the mean portfolio share of each asset

Equity	1.28
Equity Mutual Funds	5.98
Fixed Income	-1.85
Fixed Income Mutual Funds	2.69
Other	-1.64
Liquid Assets	-0.53
RRSP Equity	3.80
RRSP Fixed Income	24.37
Other Tax-Deferred	9.20

Notes: The top section displays the marginal tax rate semi-elasticity. For example, a 1 unit increase in MTR will increase holdings of RRSP Equity by 1.015 percent of their current (portfolio share) level. The bottom section evaluates the percentage point change in an asset's portfolio share given a 10 percentage point increase in the marginal tax rate. This is evaluated at the conditional portfolio share mean shown in Table 3.

One possible reason for the unconvincing asset share results generated by the estimation procedure is inaccurate estimation of the marginal tax rates. Analysis of the EMTRs for each province showed that although the EMTR distribution across income levels generally conformed to the combined federal and provincial tax schedule, there were many outliers. These outliers appeared to be distributed randomly across all income levels and in some cases were quite substantial. Many observations had EMTRs up to and above 100% for the lowest levels of income, and at zero and below for some of the highest income levels. Observations with EMTRs outside of the 0-100% range were dropped, these observations accounted for approximately 3% of the sample size/population. Even after these extreme observations were dropped, a considerable amount of outliers within the 0-100% EMTR range remained. I am unsure of the reason for this variation, but clawbacks of social assistance payments, old age security, and other government transfers are possible sources. This excessive variation in EMTRs may contribute to the insignificant results of the asset share estimation.

Inaccurate EMTR variable construction may be a source of large errors on the MTR coefficients, but other problems exist. Nearly all of the control variable coefficients were insignificant at the 10% level. This suggests that my estimation procedure may be flawed in a fundamental way. Poterba and Samwick (2002) generate the only model yielding significant results on the asset allocation decision. Their model constrained the total portfolio change across assets to zero. The procedure used in this paper, along with estimation produced by Agell and Edin (1990) and King and Leape (1998) all fail to impose this constraint and also produce insignificant results. It may be the case that imposing this restriction is more important when attempting to model asset allocation than commonly thought.

The draft of this paper estimated the allocation decision using a simple OLS regression where the dependent asset share variables were not logged.[26] In that type of linear estimation, the adding-up constraint is satisfied by the data, and perhaps coincidentally (or not) many control variable coefficients and even some MTR coefficients were significant at the 10% and 5% levels.

8. Conclusion

The factors determining a household's demand for a broad range of financial assets is studied using a previously unanalyzed sample of 5,282 Canadian households. My specification considers equations for both the household's selection of financial assets and the household's allocation of each asset. Asset habitation is also examined. A procedure is used to account for both incomplete portfolio holdings and endogenous marginal tax rates; however the endogeneity of the portfolio composition dummies is not accounted for. The results suggest that after adjusting for wealth, education, income, and a set of demographic variables, marginal income tax rates have a strong effect on the set of financial assets that households choose to hold. As tax rates increase, equity holdings

[26]That regression used very rough estimates of the MTR and did not take into account selection simultaneity. It also included provincial dummies which may have captured MTR effects.

are expected to rise significantly. Canadian households are also shown to respond strongly to tax incentives by taking advantage of RRSP accounts. At the same time, my analysis does not show taxes to have a significant effect on the household allocation of portfolio shares.

I use recent research by Brown, Ivkovic, Smith, and Weisbenner (2004) suggesting the importance of local firms and higher stock market participation rates among peers to introduce urban location as a dummy variable that could add to the robustness of portfolio allocation estimation using a two-step Heckman (1979) model. This variable does not appear to have a significant effect on the portfolio selection decision or the second stage allocation decision.

Failure to find tax effects in the allocation decision supports the hypothesis put forward by King and Leape (1998) that information and processing costs may prevent households from allocating financial assets in an optimal way. Another possibility implied by my results is that constraining the marginal effect of portfolio share coefficients to zero across all asset equations is important if significant tax effects are to be observed. Consequently, future empirical research on the effects of marginal tax rates on portfolio selection and allocation should attempt to include this constraint in specifications which account for selection endogeneity.

A. Income Tax Rates

A.1 Federal Income Tax Schedule 2004

Federal Income Tax

16% on the first $35,000 of taxable income +
22% on the next $35,000 of taxable income +
26% on the next $43,804 of taxable income +
29% of taxable income over $113,804

Source: CRA

A.2 Provincial Income Tax Schedules 2004

Newfoundland & Labrador

10.57% on the first $29,590 of taxable income +
16.16% on the next $29,590, +
18.02% on the amount over $59,180

Prince Edward Island

9.8% on the first $30,754 of taxable income, +
13.8% on the next $30,755, +
16.7% on the amount over $61,509

Nova Scotia

8.79% on the first $29,590 of taxable income, +
14.95% on the next $29,590, +
16.67% on the next $33,820, +
17.5% on the amount over $93,000

New Brunswick

9.68% on the first $32,183 of taxable income, +
14.82% on the next $32,185, +
16.52% on the next $40,280, +
17.84% on the amount over $104,648

Quebec

16% on the first $27,634 of taxable income, +
20% on the next $27,646 +
24% on the amount over $55,280

Ontario

6.05% on the first $33,375 of taxable income, +
9.15% on the next $33,377, +
11.16% on the amount over $66,752

Manitoba

10.9% on the first $30,544 of taxable income, +
14% on the next $34,456, +
17.4% on the amount over $65,000

Saskatchewan

11% on the first $36,155 of taxable income, +
13% on the next $67,145, +
15% on the amount over $103,300

Alberta

10% of taxable income

British Columbia

6.05% on the first $32,476 of taxable income, +
9.15% on the next $32,478, +
11.7% on the next $9,621, +
13.7% on the next $15,980, +
14.7% on the amount over $90,555

Source: CRA

B. Variable Construction

B1. Dependent Variables Equity

Equity

This category contains Canadian and foreign publicly traded stocks and money invested in privately held companies. The main sources of income from these assets are dividend payments and capital gains. Canadian and foreign equity holdings were not listed separately in the SFS. This could potentially pose a problem as only dividends paid out by Canadian companies are eligible for the dividend tax credit, while foreign dividends are taxed at the normal income tax rate. Fortunately there is a significant tendency across all countries for individuals to heavily weight their stock portfolios in domestic rather than foreign companies, which is known as the home equity bias.[27] In 2001 only 16%[28] of Canadian equity holdings were in foreign companies, so I assume that the majority of dividend income is entitled to the tax credit.

Equity Mutual Funds

Mutual fund managers attempt to allocate resources to maximize return for investors, but for obvious reasons are not able to minimize taxation for individuals. Even though assets inside of a mutual fund are taxed in the same way as those held directly by individuals, they do not necessarily optimize tax liabilities (Poterba and Samwick, 2002). For this reason they have been separated from the equity category, since they are likely to respond more to changes in MTRs than directly held stock. In particular, the tax-inefficiency of mutual funds increases the incentive to hold less of a portfolio in equity mutual funds relative to direct stock ownership as tax rates rise. The main sources of income from equity mutual funds are dividends and capital gains.

Fixed Income

This category contains term deposits and Guaranteed Investment Certificates (GICs), Canadian and provincial savings bonds, federal and provincial Treasury bills, Canadian and foreign bonds and debentures, bond funds, and asset backed securities (ABS). The main source of income from these assets is interest.[29]

[27]First documented by French and Poterba (1991).
[28]Amadi (2004). An updated number is available in *Standard and Poor's Global Stock Markets Factbook 2005*, but I was unable to find access to it.
[29]Treasury bills do not pay interest but sell at a discounted price and then mature at par. This difference is considered income rather than capital gains under the Income Tax Act and is subject to the same rate of taxation as interest.

Fixed Income Mutual Funds

For the reasons stated previously mutual funds are once again separated from the fixed income category. This asset classification includes bond mutual funds, money market mutual funds, and balanced mutual funds. The main source of income from these assets is interest.

Liquid Assets

This category contains chequing and savings accounts. Although these assets are also interest bearing, they are much more liquid than the other fixed income assets. Since nearly all households have non-zero holdings in chequing and savings accounts, inclusion in the fixed income category would trivialize our model of the fixed income ownership decision. This category is more related to transactions than investment, since liquid assets usually do not yield high returns.

Other Assets

This category contains annuities, income trusts, income trust funds, amount in foreign pension plans, money owed in the form of mortgages held, money owed other than from mortgages held, other money held in trust, other (unidentified) mutual funds, and other investments or financial assets (derivatives, short term paper, etc.). The type of income flows from these assets cannot be determined with certainty. Since this category contains miscellaneous types of income flows, it is more of a residual category than one of economic interest.

RRSP Equity

This category contains Canadian and foreign publicly traded stocks, money invested in privately held companies, and equity mutual funds held in RRSPs. The main sources of income from these assets are dividend payments and capital gains. Income inside all Canadian tax-deferred accounts accumulates tax free until it is removed. Since income accrues tax-free, mutual funds inside an RRSP are not less tax-efficient than directly owned stocks.

RRSP Fixed Income

This category contains term deposits and Guaranteed Investment Certificates (GICs), Canadian and provincial savings bonds, federal and provincial Treasury bills, Canadian and foreign bonds and debentures, and bond funds held in RRSPs.

Other Tax Deferred Assets

This category contains balanced funds, income trusts, income trust funds, amounts in foreign pension plans, other (unidentified) mutual funds, and other registered plan investments. The type of income flows from these assets cannot be determined with

certainty. Canadian and foreign publicly traded stocks, money invested in privately held companies, equity mutual funds, term deposits and Guaranteed Investment Certificates (GICs), Canadian and provincial savings bonds, federal and provincial Treasury bills, Canadian and foreign bonds and debentures, and bond funds held in RESPs, LIRAs, and RRIFs are also included. The type of income flows from these assets cannot be determined with certainty. This should also be considered a residual category, as predictions cannot be made as to how this category will be affected by taxation relative to the other tax deferred assets.[30]

B2. Independent Variables

Age: The age of the household head.
High School: Household head's highest level of education is a high school diploma.
Trade/Voc/Appr: Household head's highest level of education is a trade certificate, vocational certificate, or apprenticeship.
College: Household head's highest level of education is a community college diploma, or a university diploma/certificate below a BA.
Bachelor: Household head's highest level of education is a Bachelor of Arts.
Graduate: Household head's highest level of education is a university degree, certificate, or diploma above a BA.
Female: Equal to one if the household head is female.
City: Equal to one of the household is located in a city with a population greater than or equal to 50,000.
Self Employed: Equal to one if respondent identified the primary source of household income as self employment income.
Married: Equal to one if the household head is married (includes common-law marriage). Retired: Equal to one if the household head is retired.
HH Size: Number of family members including household head.
Financial Industry: Equal to one if the household head has a job in financial services or the financial industry.
Defined Benefit: Household head currently participates in a defined benefit employee pension plan.
Defined Contribution: Household head currently participates in a defined contribution employee pension plan.
Deferred Pension: Household head's only pension plan is a deferred pension plan.
Net Wealth: Dummy variables based on family net wealth. The excluded dummy is the range of negative wealth.
Family Income: Total household wage and self employment income.

[30]As described in Section 3, RESPs, RRIFs, and LIRAs have restrictions that would make their responses to changes in taxation less responsive.

Aggregated Asset Categories

A: Household owns at least one of *equity mutual funds or fixed income mutual funds.*

B: Household owns at least one of *equity, RRSP equity*, or *other*.

C: Household owns at least one of *fixed income* or *liquid assets*.

D: Household owns at least one of *RRSP fixed income* or *other tax-deferred*.

AB: Equal to one if a household owns assets in A and B but not C and D.

AC: Equal to one if a household owns assets in A and C but not B and D.

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ABCD: Equal to one of a household owns an asset in each different aggregation.

C. Marginal Tax Rate Estimation

MTRs are estimated using the Canadian Tax and Credit Simulator (CTaCS) generously provided by Kevin Milligan. As shown in Section 5.2, the estimated marginal tax rate (EMTR) is equal to:

$$[(+\Delta) - T(Y_B)] /\Delta \qquad (1)$$

C.1 Calculation of Δ

The increment Δ is equal to the greater of $100 or a household's portfolio income at the average annual return on 3-month federal T-bills in 2004.

C.2 Calculation of $T(Y_B)$

The Canadian Tax and Credit Simulator (CTaCS) is a package that simulates the Canadian personal income tax and transfer system. It comprises the CTaCS database of tax parameters and a set of computer programs. I use the CTaCS to calculate (Y_B) , which is a household's tax-liability given a vector of explanatory variables.

My input Y_B is comprised of tax year, province of residence, age, sex, disability status, child care expenses, child support payments, wage and salary income, self-employment income (both farm and non-farm), retirement pension income, Canada Pension Plan (CPP)/Quebec Pension Plan (QPP) benefits, worker's compensation, and other income.

C.3 Calculation of $(Y_B + \Delta)$

Calculations for the taxable income and increment are made in the same way as previously mentioned, except that the increment Δ is added to other income.

D. Other Tables

Table 8: Asset Correlations

	Equity	Equity Mutual Funds	Fixed Income	Fixed Income Mutual Funds	Other	Liquid Assets	RRSP Equity	RRSP Fixed Income	Other Tax-deferred
Equity	1.000								
Equity Mutual Funds	0.191	1.000							
Fixed Income	0.167	0.135	0.130	1.000					
Fixed Income Mutual Funds	0.131	0.395	0.130	1.000					
Other	0.171	0.275	0.104	0.395	1.000				
Liquid Assets	0.094	0.055	0.148	0.041	0.079	1.000			
RRSP Equity	0.288	0.237	0.078	0.160	0.111	0.083	1.000		
RRSP Fixed Income	0.163	0.116	0.164	0.128	0.050	0.082	0.287	1.000	
Other Tax-deferred	0.161	0.143	0.130	0.126	0.110	0.119	0.281	0.192	1.000

Source: Author's tabulations based on data in the 2005 Survey of Financial Security. Households are weighted by their sample weight.

Table 9: Independent Variable Means

	Mean		Mean
EMTR	24.703		
Age		*Net Wealth ($K)*	0.095
25-34	0.177	50-100	0.191
35-54	0.428	100-250	0.318
55-64	0.149	250-1000	0.087
65-68	0.045	1000+	
69+	0.143		
		Family Income ($K)	45962.270
Education			
High School	0.266	*Portfolio Combinations*	
Trade/Voc/Appr	0.118	AB	0.054
College	0.158	AC	0.067
Bachelor	0.170	AD	0.052
Graduate	0.076	ABC	0.053
		ABD	0.042
Female	0.390	ACD	0.050
City	0.668	ABCD	0.041
Married	0.583	BC	0.256
Retired	0.195	BD	0.173
HH Size	2.372	CD	0.388
Financial Sector	0.042	BCD	0.166
Self Employed	0.059		
Defined Benefit	0.163		
Defined Contribution	0.028		
Deferred Pension	0.022		

Source: Author's tabulations based on data in the 2005 Survey of Financial Security. Households are weighted by their sample weight.

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References

Agell, J., and P. Edin. 1990. Marginal Taxes and the Asset Portfolios of Swedish Households. *Scandinavian Journal of Economics* 92 (1): 47-64.

Arrow, K.J., and G. Debreu. 1954. Existence of an Equilibrium for a Competitive Economy. *Econometrica* 22 (3): 265-290.

Amadi, A.A. 2004. *Equity Home Bias: A Disappearing Phenomenon?* Working Paper. In the Social Science Research Network. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=540662 (Accessed March 2008).

Auerbach, A.J., and M.A. King. 1983. Taxation, Portfolio Choice, and Debt-equity Ratios: A General Equilibrium Model. *Quarterly Journal of Economics* 98 (4): 587-609.

Barlow, R., H. Brazer, and J. Morgan. 1966. *Economic Behavior of the Affluent*. Washington: Brookings Institution.

Brown, J.R., Z. Ivkovic, P.A. Smith, and S.J. Weisbenner. 2004. The Geography of Stock Market Participation: The Influence of Communities and Local Firms. Working paper no. 10235. National Bureau of Economic Research, Cambridge, MA. http://www.nber.org/papers/w10235 (Accessed April 2008).

Butters, J., L. Thompson, and L. Bollinger. 1953. *Effects of Taxation: Investment by Individuals*. Cambridge, MA: Graduate School of Business Administration, Harvard University.

Domar, E.D., and Richard A. Musgrave. 1944. Proportional Income Taxation and Risk-taking. *The Quarterly Journal of Economics* 58 (3): 388-422.

Dubin, J.A., and D.L. McFadden. 1983. An Econometric Analysis of Residential Electric Appliance Holdings and Consumption." *Econometrica* 52 (2): 345-362.

Feldstein, M.S. 1976 Personal Taxation and Portfolio Composition: An Econometric Analysis. *Econometrica* 44 (4): 631-50.

Heckman, J. 1979. Sample Selection Bias as a Specification Error. *Econometrica* 47 (1): 153-61.

King, M., and J. Leape. 1998. Wealth and Portfolio Composition: Theory and Evidence. *Journal of Public Economics* 69 (1): 155–193.

Leape, J.I. 1987. Taxes and Transaction Costs in Asset Market Equilibrium. *Journal of Public Economics* 33 (1): 1-20.

Litner, J. 1965. The Valuation of Risk Assets and the Selection of Risky Investments in Stock Portfolios and Capital Budgets. *Review of Economics and Statistics* 47 (1): 13-37.

Markowitz, H.M. 1991. Foundations of Portfolio Theory. *Journal of Finance* 46 (2): 469-477.

Miller, M.H. 1977. Debt and Taxes. *Journal of Finance* 32 (2): 261-275.

Milligan, K. 2002. Tax-Preferred Savings Accounts and Marginal Tax Rates: Evidence on RRSP Participation. *The Canadian Journal of Economics* 35 (3): 436-456.

Milligan, K. 2007. *Canadian Tax and Credit Simulator*. Database, Software and Documentation, Version 2007-2.

Poterba, J.M. 2001. Taxation and Portfolio Structure: Issues and Implications. In *Household Portfolios*, ed. L. Guisio, M. Haliassos, and T. Jappelli, 103-141. Cambridge: MIT Press.

Poterba, J.M. 2002. Taxation, Risk-taking, and Household Portfolio Behavior. In *Handbook of Public Economics,* vol. 4, ed. A.J. Auerbach, and M. Feldstein, 1109-1171. Amsterdam: Elsevier Science, North-Holland.

Poterba, J.M., and A.A. Samwick. 2002. Taxation and Household Portfolio Composition: US Evidence from the 1980s and 1990s. *Journal of Public Economics* 87 (1): 5-38.

Samwick, A.A. 2000. Portfolio Responses to Taxation: Evidence from the End of the Rainbow. In *Does Atlas Shrug? The Economic Consequences of Taxing the Rich*, ed. B. Joel, and J. Slemrod, 289- 323. Cambridge: Harvard University Press.

Scholz, J. 1994. Portfolio choice and tax progressivity: Evidence from the Surveys of Consumer Finances. In *Tax Progressivity and Income Inequality*, edited by J. Slemrod. New York: Cambridge University Press.

Sharpe, W. 1964. Capital Asset Prices: A Theory of Market Equilibrium under Conditions of Risk. *Journal of Finance* 19 (3): 425-442.

Triest, R.K. 1998. Econometric Issues in Estimating the Behavioral Response to Taxation: A Nontechnical Introduction. *National Tax Journal* 51 (4): 761-772.

Table 4: First Stage Probit Estimates for Portfolio Asset Ownership

Independent Variables	Equity		Equity Mutual Funds		Fixed Income		Fixed Income Mutual Funds		Other		Liquid		RRSP Equity		RRSP Fixed Income		Tax-deferred Other	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
EMTR	0.0066	0.0023	0.00302	0.0033	0.00358	0.0018	0.00363	0.0029	-0.0023	0.0022	0.00309	0.0021	0.00895	0.0022	0.01137	0.0019	0.01341	0.0018
Age																		
25-34	-0.0600	0.1684	-0.1293	0.2472	0.10611	0.1307	-0.0007	0.2216	-0.1437	0.1367	0.17385	0.1116	0.00587	0.1608	0.05801	0.1288	0.45247	0.1446
35-54	-0.3561	0.1634	-0.4114	0.2416	-0.0733	0.1248	-0.161	0.2143	-0.3261	0.1300	-0.0694	0.1029	-0.1051	0.1557	0.04013	0.1234	0.35451	0.1401
55-64	-0.3230	0.1720	-0.5147	0.2521	-0.06	0.1327	-0.2625	0.2246	-0.3642	0.1403	-0.0026	0.1166	-0.2086	0.1640	0.05685	0.1314	0.17764	0.1475
65-68	-0.2637	0.2007	-0.7632	0.2922	0.03766	0.1590	-0.2445	0.2574	-0.4829	0.1768	0.17949	0.1664	-0.3862	0.1964	-0.008	0.1602	0.15386	0.1737
69 +	-0.3608	0.1909	-0.7407	0.2773	0.30882	0.1476	-0.2357	0.2461	-0.3837	0.1608	0.33147	0.1477	-0.7638	0.1904	-0.8165	0.1572	0.4772	0.1626
Education																		
High School	0.2397	0.0948	0.04286	0.1377	0.0246	0.0657	0.32997	0.1203	0.26221	0.0835	0.24253	0.0678	0.26037	0.0937	0.06556	0.0726	0.14623	0.0671
Trade/Voc/Appr	0.2397	0.1076	0.03009	0.1587	0.01218	0.0773	0.1837	0.1421	0.09199	0.1010	0.20845	0.0798	0.28289	0.1056	0.15367	0.0819	0.23103	0.0767
College	0.3405	0.1050	0.19857	0.1474	0.08217	0.0763	0.37316	0.1337	0.22547	0.0976	0.35007	0.0826	0.45439	0.1004	0.31812	0.0799	0.37537	0.0759
Bachelor	0.4261	0.0978	0.27698	0.1368	0.02882	0.0734	0.24706	0.1285	0.32844	0.0907	0.43798	0.0845	0.53281	0.0963	0.22969	0.0784	0.29566	0.0732
Graduate	0.3959	0.1075	0.4298	0.1441	-0.0761	0.0858	0.48932	0.1361	0.47189	0.1003	0.34134	0.1077	0.59138	0.1050	0.19088	0.0893	0.3648	0.0844
Female	-0.0618	0.0573	-0.1364	0.0783	0.18313	0.0455	-0.0318	0.0711	-0.0832	0.0544	-0.0327	0.0504	-0.0493	0.0537	-0.0152	0.0468	-0.0858	0.0448
City	0.0854	0.0555	0.02206	0.0754	0.02413	0.0432	0.12191	0.0707	0.01121	0.0531	0.15896	0.0481	0.12566	0.0521	0.00817	0.0449	0.04629	0.0426
Married	0.0293	0.0709	0.12635	0.0990	0.16789	0.0556	0.02911	0.0882	-0.0586	0.0668	0.04672	0.0624	0.27837	0.0680	0.11907	0.0577	0.07945	0.0548
Retired	-0.0088	0.0943	0.06496	0.1250	-0.0023	0.0779	0.12964	0.1186	0.0429	0.0928	0.03347	0.1019	-0.0919	0.0965	0.01208	0.0846	0.00185	0.0797
HH Size	-0.0474	0.0250	-0.0845	0.0339	-0.0299	0.0202	-0.0714	0.0321	-0.0455	0.0242	-0.028	0.0221	-0.0676	0.0231	-0.0603	0.0202	0.01429	0.0193
Financial Sector	0.3353	0.1006	0.25087	0.1250	-0.1791	0.0986	0.36319	0.1165	0.09734	0.1065	0.15697	0.1359	0.16185	0.0981	0.10824	0.0927	0.2753	0.0907
Self Employment	-0.0633	0.0943	-0.102	0.1220	-0.2546	0.0860	0.05834	0.1130	0.12106	0.0889	-0.1527	0.0979	0.04259	0.0882	0.11988	0.0800	-0.1292	0.0797
Defined Benefit	-0.1002	0.0694	0.11503	0.0874	0.12271	0.0569	-0.0544	0.0886	-0.1219	0.0714	-0.1396	0.0691	0.04724	0.0619	-0.0044	0.0563	0.05373	0.0550
Defined Contribution	-0.0852	0.1412	-0.05	0.1929	0.19689	0.1111	0.07724	0.1667	-0.1885	0.1507	-0.2182	0.1290	-0.1141	0.1305	0.0588	0.1111	-0.0885	0.1107
Deferred Pension	0.1463	0.1562	0.25556	0.1930	-0.0439	0.1420	0.10482	0.1937	0.2849	0.1446	-0.1769	0.1521	-0.0115	0.1493	-0.0093	0.1354	0.16757	0.1290
Net Wealth ($K)																		
50-100	0.4015	0.1355	0.52545	0.2184	0.31597	0.0896	0.22291	0.1837	0.15805	0.1153	0.29271	0.0835	0.40382	0.1172	0.33644	0.0903	0.36662	0.0857
100-250	0.6024	0.1136	0.57999	0.1963	0.66585	0.0734	0.54431	0.1426	0.30019	0.0942	0.43061	0.0726	0.59163	0.0991	0.58368	0.0752	0.577	0.0719
250-1000	1.0197	0.1096	1.16527	0.1853	0.89333	0.0736	0.85689	0.1379	0.6684	0.0900	0.61266	0.0751	0.9708	0.0960	0.6707	0.0750	0.85414	0.0711
1000 +	1.8451	0.1219	1.73599	0.1975	1.2556	0.0899	1.16718	0.1544	1.20848	0.1057	0.80608	0.1120	1.39612	0.1095	0.86888	0.0915	0.92383	0.0874
HH Income ($10K)	0.0038	0.0016	-0.0007	0.0014	-0.0007	0.0011	0.00145	0.0011	-0.0001	0.0011	0.00783	0.0041	0.00026	0.0010	0.00013	0.0010	-0.0011	0.0011
Constant	-2.1945	0.1801	-2.4128	0.2652	-1.601	0.1357	-2.5081	0.2368	-1.4168	0.1461	0.28427	0.1171	-2.2951	0.1737	-1.6062	0.1364	-2.136	0.1519
$g(\beta + \beta\mathbf{X})$ at mean	0.1354		0.0468		0.2780		0.0488		0.1456		0.7179		0.1669		0.2685		0.3166	

Source: Author's estimates based on the 2005 Survey of Financial Security. g(.) is the standard normal density function.

Table 6: Second Stage OLS Estimates for Portfolio Asset Allocation

Independent Variables	Equity		Equity Mutual Funds		Fixed Income		Fixed Income Mutual Funds		Other		Liquid		RRSP Equity		RRSP Fixed Income		Tax-deferred Other	
	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.	Coeff.	S.E.
EMTR	0.0047	0.0092	0.02844	0.0868	-0.0075	0.00695	0.0109	0.01021	-0.0043	0.01012	-0.0011	0.00181	0.01015	0.00651	0.05579	0.0561	0.01906	0.01259
Age																		
25-34	0.1036	0.4401	-0.9101	4.8704	-0.0452	0.35854	-0.3748	0.61901	0.25933	0.62978	-0.0482	0.11474	0.49541	0.31976	0.39169	0.92228	0.7817	0.53058
35-54	0.1105	0.5667	-3.4459	10.7010	-0.2219	0.2919	-0.5796	0.65211	0.60986	1.32247	-0.2961	0.10468	0.8506	0.31306	0.31491	0.86206	0.76626	0.44584
55-64	-0.0389	0.5562	-4.5153	12.9277	-0.0391	0.29198	-0.8551	0.7315	0.57992	1.47998	-0.2924	0.11238	0.7374	0.33368	0.48738	0.92065	0.6906	0.3457
65-68	-0.0053	0.5594	-7.0166	18.5016	-0.0099	0.3287	-1.1935	0.77591	0.46412	1.91648	-0.4808	0.14204	0.66834	0.40802	0.12109	1.07253	0.682	0.3666
69 +	-0.0592	0.6037	-6.4469	17.8755	0.01901	0.62565	-0.9261	0.74036	0.65673	1.54611	-0.4259	0.13831	0.80263	0.55003	-4.1525	4.20428	0.94848	0.55342
Education																		
High School	-0.4149	0.3628	0.99887	2.4382	-0.0157	0.12542	0.07481	0.63444	-0.0503	1.07218	-0.1293	0.07928	-0.1958	0.25075	0.51822	0.61054	0.20023	0.17792
Trade/Voc/Appr	-0.5552	0.4208	0.66963	2.4075	-0.0584	0.14004	-0.1145	0.48389	-0.0889	0.44083	0.02926	0.08283	-0.2408	0.26374	0.96212	0.94481	0.39326	0.24454
College	-0.3099	0.4486	2.5454	5.3042	-0.1741	0.20237	0.31186	0.70676	0.03021	0.93764	-0.1694	0.09901	-0.095	0.34337	1.56105	1.62177	0.32592	0.3559
Bachelor	0.0043	0.5143	3.31098	6.9320	-0.0479	0.13839	0.02303	0.5513	-0.285	1.32351	-0.1003	0.10625	-0.2072	0.37627	1.11614	1.2333	0.18844	0.29378
Graduate	-0.2050	0.4999	4.62165	10.1746	-0.0922	0.1929	-0.0394	0.85474	-0.3595	1.84028	-0.1379	0.10856	-0.0882	0.40413	0.88778	1.10181	0.28509	0.34921
Female	-0.1100	0.1324	-1.1406	3.1802	0.09995	0.33748	-0.0436	0.17947	0.10003	0.34005	-0.0144	0.04301	-0.0977	0.08766	-0.1518	0.30916	-0.044	0.09977
Married	-0.0964	0.1546	1.2341	3.1431	-0.0394	0.31156	0.17965	0.22598	-0.1891	0.2628	0.06272	0.05271	0.04997	0.19067	0.6251	0.67143	-0.0232	0.11151
Retired	0.1649	0.1813	0.47557	2.0766	0.20088	0.12763	0.54504	0.35704	0.09569	0.24214	0.07074	0.07557	-0.1448	0.1631	-0.0261	0.54002	0.0631	0.12443
HH Size	-0.0691	0.0654	-0.8098	1.9692	-0.0446	0.0631	-0.1749	0.12973	0.10972	0.18196	0.0107	0.01936	-0.0012	0.05036	-0.3085	0.31111	0.03177	0.03251
Financial Sector	0.0270	0.3671	2.03277	5.7491	-0.1995	0.36124	0.33604	0.56799	0.11968	0.40367	-0.1401	0.09421	0.19349	0.15442	0.4756	0.73172	-0.0182	0.26328
Self Employment	-0.1833	0.1822	-0.8901	2.7258	0.10639	0.49216	0.07851	0.26726	-0.1286	0.48223	0.21485	0.08173	0.17312	0.11922	0.63598	0.70832	-0.2069	0.16632
Defined Benefit	-0.2280	0.1776	0.94059	2.7618	0.03186	0.24233	0.07237	0.22876	-0.0659	0.47783	0.14219	0.0591	0.00199	0.09295	0.02763	0.35341	0.04548	0.09409
Defined Contribution	-0.0610	0.3134	-0.8753	2.9129	-0.0299	0.40579	0.83728	0.41229	0.00061	0.80125	0.25027	0.1172	0.21193	0.20925	0.07446	0.74845	-0.1487	0.18659
Deferred Pension	0.2001	0.3252	2.6704	6.1053	-0.0241	0.26729	0.03474	0.46163	-0.6473	1.06815	0.21125	0.13413	-0.0588	0.22089	0.01568	0.85635	0.2556	0.24524
Net Wealth ($K)																		
50-100	-0.4954	0.6080	4.32829	13.2998	0.06393	0.67283	0.22048	0.66134	0.02892	0.69655	-0.1925	0.09834	-0.3481	0.34339	1.77626	1.80685	0.26171	0.38775
100-250	-0.3234	0.7306	4.67257	14.1624	0.06331	1.32624	0.06146	0.92128	-0.0127	1.22505	-0.2768	0.1087	-0.2521	0.41639	2.85611	2.9227	0.50949	0.56236
250-1000	-0.5851	1.1645	10.2633	27.7685	0.20315	1.74457	0.26811	1.33453	-0.3501	2.66858	-0.4011	0.13468	-0.4577	0.62409	3.27202	3.32327	0.68152	0.80258
1000 +	-0.5428	1.9712	15.2795	40.5600	0.42679	2.35912	0.32215	1.78791	-0.7094	4.68117	-1.0815	0.16238	-0.7929	0.85461	3.7341	4.18435	0.53361	0.85753
HH Income ($10K)	0.0007	0.0023	-0.0073	0.0238	-0.0057	0.00223	-0.0004	0.00266	0.00371	0.00225	-0.0023	0.00101	-0.0022	0.00113	-0.0041	0.00579	-0.0052	0.00198
Portfolio Dummies																		
AB	-0.8786	1.3851	-1.2039	4.0610	-	-	-1.721	1.33369	-0.8317	0.81799	-	-	-0.0596	0.62776	-	-	-	-
AC	-	-	-1.7658	2.9671	-0.7073	0.33974	-0.3099	0.64467	-	-	-1.8329	0.22549	-	-	-	-	-	-
AD	-	-	0.1685	3.6808	-	-	0.34826	0.90418	-	-	-	-	-	-	-1.2537	1.56733	-1.6794	0.72964
ABC	0.51857	1.4041	1.44274	4.29533	0.4471	0.41727	1.121	1.36351	0.41691	0.8427	0.92388	0.27291	-0.4775	0.65028	-	-	-	-
ABD	1.30707	1.63411	-1.9288	5.65137	-	-	0.79233	1.64517	-	-	-	-	-0.0178	0.88263	0.84979	2.50263	-0.9447	0.92352
ABCD	-1.2237	1.65615	1.25682	5.97291	-0.23	0.50923	-0.8518	1.68381	0.06664	0.23749	-0.533	0.33999	0.34275	0.90415	-0.7471	2.59906	0.84253	0.94468
BC	-1.2796	0.3654	-	-	-1.4012	0.12641	-	-	-0.7885	0.28641	-1.6568	0.07003	-0.0667	0.25168	-	-	-	-
BD	-2.4918	0.53181	-	-	-	-	-	-	-0.4837	0.52265	-	-	-0.8113	0.30733	-0.7534	0.82835	-0.8187	0.24069
BCD	1.77767	0.54468	-	-	0.81213	0.15882	-	-	-0.3142	0.52873	1.02589	0.09026	-0.1464	0.32549	-0.0378	0.85361	0.13024	0.24665
CD	-	-	-	-	-1.0547	0.09579	-	-	-	-	-1.8226	0.05059	-	-	-0.5188	0.4477	-0.6002	0.12943
ACD	-	-	-0.4574	4.10004	0.26149	0.42729	-1.0915	0.959	-	-	1.24793	0.28932	-	-	0.82829	1.68812	1.4991	0.75105
Constant	1.24226	3.3785	-29.93	73.9564	-0.9357	4.95472	-2.2075	4.93662	0.26311	9.03478	0.36254	0.29892	-0.9331	1.99309	-12.843	12.6249	-3.6605	2.97098
Inverse Mill's Ratio	-0.3583	1.32865	10.9547	27.1004	0.41137	2.49163	0.8872	1.72963	-0.4126	4.80912	-0.4238	0.51364	-0.0508	0.75979	6.1824	6.29753	1.25985	1.24498
Chi-Square (57)	857.43		266.92		1068.43		269.23		493.17		3479.7		840.22		588.51		1021.87	
Uncensored Obs.	736		268		1328		287		632		4356		856		1213		1572	

Source: Author's estimates based on 2005 Survey of Financial Security.