NBER WORKING PAPER SERIES

WEALTH AND PORTFOLIO COMPOSITION: THEORY AND EVIDENCE

Mervyn A. King

Jonathan I. Leape

Working Paper No. 1468

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
September 1984

This study was funded by the National Science Foundation (grant no. SES-8410896) and the National Bureau of Economic Research. For helpful discussions and comments, we thank Dan Feenberg, Ben Friedman, Roger Gordon, Zvi Griliches, Jerry Hausman, Adam Jaffe, Dan McFadden, Ariel Pakes, Jim Poterba, Jim Powell and David Wise. The research reported here is part of the NBER's research programs in Financial Markets and Monetary Economics, Economic Fluctuations, Pensions and Taxation and project in Government Budget. Any opinions expressed are those of the authors and not those of the National Bureau of Economic Research.

NBER Working Paper #1468
September 1984

Wealth and Portfolio Composition: Theory and Evidence

ABSTRACT

In this paper, we examine a new survey of 6,010 U.S. households and estimate a model for the allocation of total net worth among different assets. The paper has three main aims. The first is to investigate the extent to which a conventional portfolio choice model can explain the differences in portfolio composition among households. Our survey data show that most households hold only a subset of the available assets. Hence we analyze a model in which investors choose to hold incomplete portfolios. We show that the empirical specification of the joint discrete and continuous choice that characterizes household portfolio behavior is a switching regressions model with endogenous switching.

The second aim is to examine the impact of taxes on portfolio composition. The survey contains a great deal of information on taxable incomes and deductions which enable us to calculate rather precisely the marginal tax rate facing each household.

The third aim is to estimate wealth elasticities of demand for a range of assets and liabilities. We test the frequently made assumption of constant relative risk aversion.

Mervyn A. King
London School of Economics
Lionel Robbins Building
Room 404
10, Portugal Street
London WC2A 2HD
ENGLAND

Jonathan I. Leape
National Bureau of
Economic Research
1050 Massachusetts Avenue
Cambridge, MA 02138

Wealth and Portfolio Composition: Theory and Evidence

Mervyn King

Jonathan Leape

1. Introduction

Empirical studies of household savings behavior have focused primarily on the total level of savings rather than its allocation among different types of assets. Although there is a substantial theoretical literature on portfolio behavior, there are few empirical studies of the composition of household portfolios using individual data and these studies are rather dated. For example, Blume and Friend (1975), Feldstein (1976), and Projector and Weiss (1966) used the 1962 Federal Reserve Board data, and Uhler and Cragg (1971) used data from the 1960-62 Michigan Surveys of Consumer Finances. In this paper, we examine a new survey of 6,010 U.S. households and estimate a model for the allocation of total net worth among different assets.

The paper has three main aims. The first is to investigate the extent to which a conventional portfolio choice model can explain the differences in portfolio composition among households. In the finance literature the model has been tested using data on security prices rather than household asset demands. Our survey data show that most households hold only a subset of the available assets. Hence we analyze a model in which investors choose to hold incomplete portfolios. We show that the empirical specification of the joint discrete and continuous choice that characterizes household portfolio behavior is a switching regressions model with endogenous switching. This involves estimating equations both for the probability of owning particular combinations of assets (the discrete choice), and for the asset demand system conditional upon ownership (the continuous choice).

The second aim is to examine the impact of taxes on portfolio composition. The survey contains a great deal of information on taxable incomes and deductions which enable us to calculate rather precisely the marginal tax rate facing each household. Much of the current interest in tax reform, and the debate over the merits of income or consumption as the personal tax base, concerns the distortions created by the present tax system in the composition of household savings. Proposals for reform often include the elimination of deductions for a range of tax-sheltered investments. Yet there is very little empirical evidence on the effect of taxes on portfolio composition; only Feldstein (1976) has examined this issue with U.S. data.

The third aim is to estimate wealth elasticities of demand for a range of assets and liabilities. Although much attention has been paid to estimating the demand for money, less effort has been devoted to estimating the demand for other assets (primarily because of lack of data). An assumption frequently made in some macroeconomic literature is that households exhibit constant relative risk aversion. This implies unit wealth elasticities of demand. We test this hypothesis below. A change in wealth alters both the number of households that own an asset and the demand for the asset conditional upon ownership. We shall estimate wealth elasticities at both the intensive and extensive margins. We shall also estimate an aggregate elasticity for the household sector as a whole, and test the hypothesis that the impact of a change in wealth depends upon how that change is distributed among households. Because the financial structure of the private sector's net worth is an important determinant of real decisions, such as corporate investment, the macroeconomic consequences of a change in total household net worth will depend upon the magnitude of the wealth elasticities of demand for different assets. Although our results are based on microdata, they have macroeconomic implications.

In section 2, we describe the pattern of household portfolio composition that emerges from the survey and present some summary statistics. In section 3, we derive a specification for the portfolio decision and discuss an appropriate estimation procedure. The estimation and results are described in section 4. Estimates of the effects of taxes on portfolio composition are presented in section 5 and the wealth elasticities in section 6.

2. Portfolio Composition of the Sample

Our data are taken from the 1978 Survey of Consumer Financial Decisions conducted by SRI International. The survey is a stratified random sample of 6,010 U.S. households. It includes detailed information on household characteristics, such as age, education, region and area of residence, marital status and family composition, occupation, race, and housing. It also includes information on family income as well as portfolio composition and net worth. The asset data refer to market values in May and June 1978 and the income data to the calendar year 1977. The survey heavily oversampled high income families and therefore provides a rich source of information on household portfolio behavior.[1] No fewer than 2,430 households (40.4 percent of the sample) reported net worth in excess of $100,000 in 1978. The sample contains 204 millionaires and the largest value of reported net worth is $73 million.

The survey is remarkable for the information it provides on the asset holdings of each of the 6,010 households. The dollar holdings of over one hundred different specific assets and liabilities were recorded for each household. These were grouped by SRI into 23 different assets and 13 types of liability. Table 1 shows these 36 categories. They include different types of bank and savings account, money market funds, bonds of various types, stocks, mutual funds, convertible securities, owner-occupied housing, real estate and other tangibles, IRA-Keogh accounts, tax shelters and life insurance.[2] For purposes of estimation, we have grouped these thirty-six categories into eleven aggregate asset and liability classifications. These are shown as the main headings in Table 1. The survey data exclude social security and certain types of private pension wealth, ordinary consumer durables, and the expected value of future inheritances.[3] Table 1 also shows the percentage of the total net worth of the sample that is held in each of the assets. Most of the wealth of households is held in the form of homes, stocks, and investment real estate. The implausibly low percentage accounted for by home mortgages is due to a high degree of non-reporting -- close to fifty percent -- of the value of first mortgages on primary residences. This is analyzed further below.

Table 2 presents summary statistics on the portfolio composition of households in the sample. The mean level of net worth in 1978 was almost a quarter of a million dollars. This oversampling of the rich is a great advantage for the analysis of portfolio composition. Not surprisingly, certain assets are held by households with above average wealth levels, notably corporate equity, bonds and "other assets" (tax shelters, etc.). Of the 6,010 households only 593 owned municipal bonds but the mean net worth of this group was almost a million dollars. The SRI survey is particularly well suited to a study of the effects of taxes on household portfolio behavior. It provides a detailed account of the sources of income in each household and of tax-deductible expenses. Twenty-two sources of income and twenty-one types of expense are distinguished. This information, combined with the demographic data provided for each household and the specific information on the household's tax filing status, made it possible to derive accurate estimates of the marginal tax rates faced by each household. We computed these tax rates using the TAXSIM program developed at the National Bureau of Economic Research, which generated tax liabilities for each household using both the federal and state tax code relevant for the appropriate tax year.[4] The information available to construct marginal tax rates is, to our knowledge, more detailed than that used in any previous study of the incentive effects of taxation.

It is clear from rows 1 and 2 of Table 2 that most households owned incomplete portfolios. In only two cases, checking accounts and liquid savings, was an asset held by more than 90 percent of the sample. At the other extreme the proportions of the sample owning municipal bonds and taxable bonds were 9.9 and 10.5 percent respectively. Almost one-half of the sample owned corporate equity and 84 percent were home-owners. In fact, for the complete classification no household held more than 23 out of the possible 36 assets and liabilities, and for the aggregated classification only 40 households held a complete portfolio with all eleven assets and liabilities. The modal number of assets owned was eight for the complete classification and seven for the aggregated classification, accounting for 12.0 and 19.6 percent of the sample respectively. The median number owned was eight and six for the two classifications. Given that the mean net worth of the sample was almost a quarter of a million dollars, it is surprising that the number of assets held was so small. It is important, therefore, to take into account the phenomenon of incomplete ownership when estimating the demand for individual assets; this problem is the focus of section 3.

The survey provides indicators of ownership for each asset that are independent of the dollar holdings reported. Some households do not report dollar values for every asset they own and the existence of independent responses indicating ownership and dollar holdings enables us to measure the extent of this non-reporting (although not, of course, under-reporting). The additional information allows us to obtain more efficient estimates by exploiting techniques to deal with the problem of missing data. Of the 6,010 households, 2,048 provided a complete set of dollar values for the assets that they owned. In section 4 we describe how data for both the sample of 2,048 households with complete responses and the full sample of 6,010 households may be used in estimation. Although SRI used the ownership indicators to impute values in cases of non-reporting, we were able to separate out the imputed values and used only the raw data actually reported by the survey respondents in our analysis.

To test the quality of the survey data, we compared the estimated population holdings for each asset (constructed by using the grossing-up factors described in footnote 1) with the estimated aggregates shown in the year-end balance sheets published by the Federal Reserve. The comparison is of necessity inexact. The two sources use different classifications of assets and refer to different dates in the year. Moreover, the FRB estimates for the household sector are a residual in the balance sheet calculations. It was possible to make a direct comparison for seven of our eleven categories of asset and liability, and an approximate comparison for the remaining assets. For most of the assets the survey population totals are quite close to the FRB figures. The largest discrepancies were for taxable bonds and "other assets" where the survey data were only one-half and two-thirds of the balance sheet totals respectively.[5] Overall, it seems reasonable to conclude from these comparisons that the survey data used here are worthy of study.

We turn now to the specification and estimation of a model of household portfolio composition that allows for incomplete portfolios.

3. A Model of Incomplete Portfolios

It is clear from the survey data that most households own only a subset of the possible array of assets that they could hold. It is therefore necessary to model both the probability of ownership of each asset and the demand for the asset conditional upon ownership. The problems created by incomplete ownership are twofold. First, the existence of zero holdings for some assets will have "spillover" effects on the demand for the remaining assets. Conditional upon the values of observable characteristics, the demand for an asset will depend upon the particular combination of other assets in the portfolio. Second, there is the more familiar problem that estimates based on observations with positive holdings of the asset are subject to sample selection bias. Previous empirical studies of household portfolio behavior have not tackled these problems, especially the first, satisfactorily. Ignoring such problems results in a misspecification of the model and biased estimates of the parameters of interest.

Previous theoretical discussions of incomplete portfolios have not analyzed the joint discrete and continuous choice of which combinations to own and, conditional upon ownership, what fraction of net worth to invest in each asset. Brennan (1975) and Goldsmith (1976) both analyze the optimal number of securities in a portfolio (taken to be a continuous variable) in the presence of transactions costs. Optimal asset demands for a given combination have been examined by Levy (1978) and Mayshar (1981). Only Mayshar (1979) examines the choice of which assets to own.

There are several reasons for the existence of incomplete portfolios. Two of the most important are the following. First, the existence of transactions costs, interpreted broadly to include the "holding costs" in both money and time of monitoring and managing a portfolio, means that the optimal portfolio may contain only a small number of assets. Second, it is possible that the optimal portfolio may imply negative holdings of certain assets, and these may be infeasible because of constraints on short sales (Auerbach and King 1983). To prevent tax arbitrage, the revenue authorities adopt rules, such as the asymmetric treatment of gains and losses and of interest receipts and interest payments, that lead to nonlinear budget constraints. These constraints may be very similar in practice to non-negativity constraints on asset holdings. In other instances it may be very difficult or impossible to hold certain assets, such as checking accounts, pension rights and housing, in negative quantities. We shall therefore examine the optimal portfolio of a household with both positive holding costs for each asset and non-negativity constraints on asset holdings.[6]

The specification we derive involves estimating equations both for the probability of ownership of an asset and also for its demand conditional upon ownership. If the incompleteness of portfolios results from either the existence of holding costs or an optimization problem subject to non-negativity constraints on holdings of individual assets, then the demand system is a switching regressions model with as many regimes as there are distinct combinations of assets that may be owned. It is important to note that the extension of the univariate Tobit model to the multivariate case does not represent the behavior of an individual investor optimizing subject to holding costs or non-negativity constraints. This is demonstrated below.[7] The way in which the asset demand function changes according to the regime is shown to be a particular form of structural shift. These shifts represent the "spillover" effects of the absence of certain assets in the optimum portfolio on the demands for those assets that do appear.

To examine the optimal portfolio we consider an investor whose preferences can be represented by the following utility function which is assumed to be additively separable over time.

$$V = E \int_0^T U(C,t)dt \tag{3.1}$$

U is assumed to be a strictly concave function of a single consumption good, C, and time (or age), denoted by t. T is either the investor's maximum life span (uncertainty about date of death may be incorporated in the time-dependency of U) or a longer planning horizon which allows for a bequest motive. The two constraints are the initial condition for wealth and the budget constraint.

$$W(0) = W_0 \tag{3.2}$$

$$dW = \sum_{j=1}^{J} N_j(t)dP_j + Y(t)dt - C(t)dt \tag{3.3}$$

where $N_j(t)$ is the number of units of asset j held at time t

$P_j(t)$ is the price of one unit of asset j at time t

$Y(t)$ is the nonstochastic flow of labor income

$C(t)$ is the consumption flow at time (t).

The budget constraint given by (3.3) embodies two strong assumptions. First, the only source of uncertainty is assumed to be that concerning returns on the J risky assets. Second, investors are assumed to be able to trade continuously with no costs of buying or selling securities.[8]

If one further assumption is added, namely that asset prices follow a continuous time Markov process and do not exhibit jumps, then investors choose their current portfolio to maximize V subject to equations (3.2) and (3.3) as if they were optimizing over the mean and variance of the portfolio given the level of current wealth (Merton 1971, 1973, 1982). The stochastic process generating asset prices is not required to be stationary, but it must change in a way that is either random or time-dependent in a nonstochastic manner.[9] With this assumption on the way in which exogenous shocks affect asset returns, we may analyze portfolio decisions as if investors maximized the following function defined over the mean and variance of their portfolios

$$F^h = f^h[\mu^h, (\sigma^h)^2] \tag{3.4}$$

subject to the budget constraint

$$\sum_{j=1}^{J} e_j^h = W^h + b^h \tag{3.5}$$

where μ^h denotes the mean return on the portfolio of household h, $(\sigma^h)^2$ the variance of the portfolio, e_j^h the demand for asset j, W^h net worth, and b^h the amount borrowed at the nonstochastic interest rate R. For the moment we shall assume the existence of a riskless asset and return later to a model with no riskless asset.

The mean return on the portfolio is

$$\mu^h = \sum_j e_j^h \mu_j (1-t_j^h) - Rb^h(1-t_b^h) \tag{3.6}$$

where μ_j is the mean pre-tax return per dollar invested in asset j, t_j^h is investor h's effective tax rate on the return from asset j, and t_b^h is the tax rate against which interest payments may be deducted. An important determinant of portfolio composition is the way in which effective tax rates vary across both assets and households.

The variance of the portfolio is

$$(\sigma^h)^2 = \sum_i \sum_j e_i^h e_j^h C_{ij} (1-t_i^h)(1-t_j^h) \tag{3.7}$$

where C_{ij} is the covariance of the per dollar returns on assets i and j. Short sales constraints will be assumed to exist for all risky assets

$$e_j^h \geq 0 \qquad \forall\ j,h \qquad (3.8)$$

Maximizing (3.4) subject to (3.5) and (3.8) yields a set of first-order conditions together with the complementary slackness conditions corresponding to the non-negativity constraints.[10] Once it is known which assets are owned in positive amounts in the optimal portfolio then the first-order conditions can be inverted to yield a conditional asset demand system.[11] The values of asset demands conditional upon the combination of assets that is owned is given by

$$\underline{e}_k^h = A^h T_k^h V_k(\underline{\mu}_k - R\underline{\theta}_k^h) \qquad (3.9)$$

where k denotes which of the possible (2^J-1) combinations of positive asset holdings characterize the optimal portfolio. The subscript k denotes that the matrix or vector includes only those rows and columns of the original matrix which correspond to the assets contained in combination k. A^h is equal to the inverse of the investor's degree of absolute risk aversion.[12] V is the inverse of the covariance matrix C, T^h is a diagonal matrix with $1/(1-t_j^h)$ as the j^{th} element of the leading diagonal, and $\underline{\theta}^h$ is a vector with j^{th} element equal to $(1-t_b^h)/(1-t_j^h)$.

It is convenient to assume that the differences in the tax treatment of assets can be captured by the following specification for the effective tax rate on asset j

$$t_j^h = \delta_j t^h \qquad j = 1...J,b \qquad (3.10)$$

The value of t^h is the statutory marginal tax rate facing household h.

Equation (3.10) encompasses most of the important differences in effective tax rates across assets (for example, the tax-exempt nature of pension funds and the failure to tax the imputed income of home-owners).[13] With this assumption, the demand for asset j, conditional upon ownership, as a proportion of net worth (denoted by p_j^h) may be written as

$$p_j^h = \left(\frac{A^h}{W^h}\right)\left(\frac{1}{1-\delta_j t^h}\right)\sum_{i\epsilon k}\left\{\mu_i - R\left(\frac{1-\delta_b t^h}{1-\delta_i t^h}\right)\right\}v_{ij}^k \tag{3.11}$$

where v_{ij}^k denotes the ij^{th} element of the matrix V_k. Using the approximation $\ln(1+x) = x$, we have

$$\ln p_j^h = \alpha_j(k,t^h) - \ln r^h + \delta_j t^h \tag{3.12}$$

where r^h is the degree of relative risk aversion and $\alpha_j(k,t)$ summarizes the way in which demands depend upon the particular combination of assets in the household's portfolio. Risk aversion depends upon household wealth (human and non-human), age and other observable characteristics. We assume that

$$\ln r^h = X^h\beta + \varepsilon^h \tag{3.13}$$

where X^h is a vector of observable household characteristics (including net worth), and ε accounts for unobservable differences in risk aversion. The SRI survey asked households to describe their degree of aversion to risk on a scale from one to five. The responses are used as an explanatory variable in the estimation of the model discussed in Section 4.

Finally, we take a linear approximation of α_j and assume that[14]

$$\alpha_j(k,t) = \alpha_{jk} + \beta_j t^h \tag{3.14}$$

Combining (3.12), (3.13) and (3.14) yields the following equation for asset demands conditional upon ownership

$$\ln p_j^h = \alpha_{jk} + \gamma_j t^h + X^h \beta + u_j^h \tag{3.15}$$

where $\gamma_j = \beta_j + \delta_j$, and $u_j^h = \varepsilon^h + \eta_j^h$ (where η represents measurement and optimization error) is assumed to be distributed $N(0,\sigma^2)$.

The demand system (3.15) is a switching regressions model with endogenous switching. The advantage of deriving an explicit model is that the assumption of utility maximization restricts the structural shift between regimes to a rather simple form. The intercept in (3.15) depends upon the particular combination of assets (other than j) that are present in the household's portfolio. The functional form of (3.15) is independent of the regime and demands are a linear function of the same set of explanatory variables in each regime with the constant term varying according to the combination of assets owned. This form of shift is easily modelled in terms of dummy variables, d_k, denoting the combination of assets other than j in the portfolio. There are $N = (2^{J-1}-1)$ such combinations. Hence the equation which we shall estimate may be written as

$$\ln p_j^h = \textstyle\sum_{k=1}^N \alpha_{jk} d_k^h + \gamma_j t^h + X^h \beta + u_j^h \qquad j = 1 \ldots J \tag{3.16}$$

Equation (3.16) gives asset demands conditional upon ownership. To determine which combination of assets a household owns it is not sufficient to examine the first-order conditions. Rather, the levels of utility corresponding to each combination must be compared. This means that the household faces a discrete choice problem with as many alternatives as there are distinct combinations of assets, which (ignoring the null portfolio) is 2^J-1. For combination k, define the maximum level of utility (as a function of wealth, the distribution of asset returns and other household characteristics) that can be attained with that combination of assets as

$$V_k^* = V(X^h, t^h, \varepsilon^h, \underline{\mu}_k, C_k) = \max_{e_j \mid j \varepsilon k} f^h(\mu^h, (\sigma^h)^2) \tag{3.17}$$

The conditional demands that characterize the optimum at V_k^* are given by (3.9). The probability that combination k characterizes the optimum portfolio is thus

$$\Pr(k) = \Pr(V_k^* = \max_i V_i^*;\ i = 1\ldots 2^J-1) \tag{3.18}$$

The structure of portfolios varies across households because of differences in observable and unobservable household characteristics. The observables include the tax rate, wealth and other socioeconomic characteristics recorded in the survey. The unobservables include the differences in risk aversion captured by ε^h, and differences in beliefs about the distribution of asset returns. In this model taxes and heterogeneous expectations play a crucial role in producing incomplete portfolios. With homogeneous beliefs about the distribution of asset returns and in the absence of taxes, the constraints on short sales would never be binding. The separation theorem implies that with a riskless asset the two mutual funds that span the set of available returns are the riskless asset itself and a risky portfolio. All investors own the same risky portfolio and this can be chosen to be the market portfolio. By construction it has positive amounts of the risky assets. A portfolio optimum is characterized by non-negative holdings of the two mutual funds, and so no investor would wish to sell short any of the risky assets.[15] In the presence of taxes or of heterogeneity in beliefs about the distribution of asset returns, investors will no longer wish to hold the same risky portfolio, and there will be opportunities for trade to exploit differences in tax rates (or beliefs).[16] At the optimum some investors may wish to engage in short sales. With constraints on short sales the result will be that some, or more likely many, investors will hold incomplete portfolios. Another factor leading to incomplete portfolios is holding costs, and we analyze these below.

To model the household's discrete choice among the 2^J-1 mutually exclusive alternative portfolios would involve estimating the joint distribution of the unobservables (differences in (i) risk aversion, (ii) beliefs about the distribution of asset returns and (iii) holding costs), and would be computationally infeasible given the number of alternatives and assets examined here. We shall, therefore, estimate reduced form equations for the probability of owning a particular combination of assets, and also for the probability of owning a given asset j. The latter probability is given by

$$\Pr(\text{own } j) = \sum_{k \mid j \in k} \Pr(k) \tag{3.19}$$

We assume that the probabilities in (3.18) and (3.19) can be described as if they were generated by a probit model, but we provide no rigorous justification for the implied assumption of normally distributed errors. Estimates of probit models for (3.18) and (3.19) are described in Section 4.

One strong restriction implied by the model in (3.16) is that β, the coefficient vector of household characteristics, is the same in all asset demand equations. This implies that the wealth elasticities of conditional demands are the same for all risky assets. As we shall see in Section 6, the null hypothesis that wealth elasticities are the same for all assets is rejected by the data.

To generalize the model we relax two of the assumptions made above. The first is the existence of a riskless asset.[17] When all assets are risky, the wealth elasticities of conditional demands vary across assets. This is because the separation theorem now implies that the two mutual funds that span the set of returns both consist of particular combinations of risky assets. We shall regard (3.16) with β replaced by β_j as a linear approximation to the underlying demands.[18]

The second assumption is that of zero holding costs of monitoring and managing a portfolio. We can incorporate holding costs in the model in a limited fashion. Suppose that such costs comprise two components: a fixed cost that is independent of the size of the holding and a variable cost proportional to the amount owned. As far as the variable costs are concerned, the first-order conditions and the demand system (3.9) are unchanged with the single exception that θ^h is now equal to $(1-t_b^h)(1+c_j)/(1-t_j^h)$, where c_j is the variable holding cost per dollar for asset j. Assuming that investors face the same cost schedule the influence of the holding costs is absorbed into the coefficients of the ownership combination dummy variables in (3.16). The fixed costs have no effect on the conditional demand system, but both types of cost influence the decision as to which assets will appear in the optimal portfolio and affect the coefficients of the reduced form probit models (3.18) and (3.19). The existence of holding costs can, therefore, also lead to incomplete portfolios with the conditional demand system given by (3.16). Transactions costs of the more conventional kind defined over trades rather than the size of holdings are equivalent to holding costs in a one-period model. In a continuous time model, however, trading costs lead to infrequent revisions of the portfolio and thus undermine the equivalence of the mean-variance model and the life-cycle model with continuous trading.

4. Econometric Estimation and Results

With either non-negativity constraints or holding costs of the type analyzed above, the asset demand system conditional upon ownership is given by a switching regressions model with as many regimes as there are distinct combinations of assets. The way in which the demand system changes according to the regime represents the "spillover" effects of the absence of certain assets in the optimal portfolio on the demands for those assets that do appear. It would be impossible to estimate separate functional forms for each regime because with 2^J-1 regimes even a large data set such as that used here does not provide adequate degrees of freedom. To derive a model for which estimation is feasible we have tried to exploit the economic structure of the consumer's programming problem. This led to a specification in which the shift in functional form across regimes was rather straightforward in that only the intercept varied with regime. The choice of the optimal combination of assets is made by a comparison of the utility levels associated with the 2^J-1 discrete alternative combinations. Empirically we shall model this choice by estimating reduced form probits for the probability of owning particular combinations of assets.[19]

Several problems arise in the estimation of the demand system (3.16). First, since the demand equation for each asset is estimated using observations on only those households with positive holdings of the asset, there is potential sample selection bias. To correct for this, we use a standard two-stage procedure to yield consistent estimates. We first estimate reduced form probit equations for the ownership probabilities of each asset and then include the estimated hazard as an additional regressor in the demand system (Heckman 1976, 1979).[20]

Second, only a subset of the full sample, namely 2,048 households, reported the value of holdings for each asset which they owned. Provided nonreporting is either random or, more generally, "ignorable" (Griliches 1984), then estimation on the sample of 2,048 households yields consistent estimates. Nonreporting is "ignorable" if it is a function of the explanatory variables in (3.16) but not of the error term u_j. More efficient estimates can, however, be obtained by using the information contained in the remaining observations. Nonreporting of dollar values leads to the problem that reported wealth understates true net worth if values of assets are not reported, and overstates it if liabilities are not reported. Net worth is an important explanatory variable in the model, and we wish to test the hypothesis that risk aversion, as given by (3.13), is a function of net worth. Hence we must allow for the effect of nonreporting in estimation. One approach would be to treat all instances of nonreporting as missing observations on net worth and use existing methods for dealing with missing data (Dagenais 1973, Gourieroux and Monfort 1981, and Conniffe 1983). This would, however, be very inefficient because nonreporting is usually of the form where a household fails to report values for only one or two of its assets, and reported net worth contains valuable information on holdings of other assets which could be used in estimation. The values of net worth are incomplete rather than missing. In the appendix therefore we describe a two-step method for dealing with the problem of nonreporting and which exploits the information contained in recorded net worth.

Third, because of the differential tax treatment of assets, the marginal tax rate is endogenous to the choice of portfolio. Under a nonlinear tax schedule, such as that in the U.S., a household's marginal tax rate depends upon the composition of its portfolio. For example, a household can lower its marginal tax rate for a given level of net worth by investing in municipal bonds rather than taxable bonds. To deal with this we estimate (3.16) by instrumental variables. FIML estimation is infeasible here because of the number of dimensions (eleven assets) over which the nonlinear budget set is defined. We calculate the marginal tax rate that each household would face at an exogenously given hypothetical portfolio using the actual nonlinear tax schedule applicable to the household. With this constructed tax rate as an instrument for the actual marginal tax rate consistent estimates of the parameter vector may be obtained.[21] To construct the exogenous portfolio we have assumed that households hold all of their wealth in short-term government securities (3-month Treasury Bills), the return on which is taxed as ordinary income.[22]

Fourth, the theoretical specification implies that the intercept in (3.16) consists of a sum of dummy variables, each one corresponding to the ownership of a particular combination of assets other than that in the dependent variable. In principle the required number of dummy variables is $2^{J-1}-1$ (J is the number of assets), which for J = 11 is equal to 1,023. It would clearly be infeasible to estimate a demand system with that number of dummy variables in each equation. Moreover, some combinations are not held by any household in the sample, and hence some of the dummy variables would be perfectly collinear. We have, therefore, aggregated the assets into four groups for the purpose of defining the ownership dummy variables in (3.16). The four groups are (1) checking accounts and liquid savings, (2) equity, municipal bonds, taxable bonds and other assets, (3) homes, contractual and less liquid savings, and (4) home mortgages and other liabilities. The criterion for selecting the groups was that the correlation coefficient between the ownership dummies of any pair of assets within a group be greater than 0.75 and that between any pair of assets in different groups be less than 0.75. This criterion was sufficient to determine both the number and composition of our aggregate groups with one exception. Membership of contractual savings schemes was more highly correlated with positive holdings of liabilities than with holdings of assets, but we chose on a priori grounds to group contractual savings with homes and less liquid savings (which had correlation coefficients of 0.54 and 0.50 with membership of contractual savings schemes). Grouping assets in this way means that in each of the eleven conditional demand equations there are a maximum of seven ownership dummy variables. In cases where the number of households owning a particular combination was very small (well below 1 percent of the sample) the dummy corresponding to that combination was omitted to avoid problems of collinearity. The ownership dummies used in each equation are shown in Table 4.

Fifth, the ownership combination dummy variables in (3.16) are endogenous. The optimal portfolio choice determines both the combination of assets that are owned and the demands conditional upon ownership. Hence the dummy variables that enter into (3.16) are endogenous. Several estimation methods can be used to obtain consistent estimates in the presence of endogenous dummy variables (Heckman 1978, Dubin and McFadden 1984). We use the reduced form method in which probit models are estimated for each ownership combination and then ordinary least squares is applied to (3.16) with predicted probabilities replacing the ownership combination dummies. Coefficient estimates of the asset demand equations and heteroskedastic-consistent standard errors are shown in Table 4.

The estimated reduced-form probit equations are shown in Table 3 and the estimated asset demand equations in Table 4. The explanatory variables in the probit equations include terms in total net worth, current employment income, the marginal tax rate, the age of the head of household, marital status, occupation, education, employment status, and the subjective perception of aversion to risk. The explanatory variables in the demand equations include all of these variables plus the relevant set of dummy variables corresponding to the ownership of different combinations of assets. Because the dependent variable in the demand equations is the logarithm of the asset share, the adding up constraint is not imposed on the model. One equation may therefore be regarded as redundant.

We focus on the estimated tax and wealth effects in sections 5 and 6, and summarize briefly here the results for the other explanatory variables. Income from employment has (as predicted by the model in which net worth is the relevant variable) little effect on asset ownership or demands except for homes and home mortgages where the consumption services provided are likely to be correlated with employment income. Age is an important determinant of ownership. The results in Table 4 reveal a pronounced quadratic relationship.[23] In the conditional demand equations age effects are significant only for the first four assets, where a quadratic relationship is again evident. The most significant effect of marriage appears to be on the size of checking accounts. The effects of occupation and, in particular, education suggest that information costs may be an important determinant of portfolio behavior. Both occupation and education significantly affect the probability of owning corporate equities, taxable bonds, municipal bonds, and "other assets," the four asset categories for which we would expect information costs to be highest. Consistent with this explanation is the finding that neither education nor occupation play a significant role in the conditional demand equations. Being employed has a positive effect on the probability of owning most assets (except for equity and bonds). It appears, however, to have no effect on the level of conditional demands. Risk averse households are more likely both to own and to invest a higher proportion of net worth in contractual savings and taxable bonds. They invest correspondingly less in the more unusual and risky assets that are included in the "other" assets and liabilities categories.

The coefficients on the ownership combination dummies would generally be expected to be negative, either because the assets are substitutes or because the greater the number of assets in the portfolio the smaller is likely to be the share of any one asset. Positive coefficients would arise when assets were complements. Of the fifteen ownership combination coefficients that are significant at the 5 percent level, eleven are negative and four are positive. In the cases of positive coefficients the results suggest complementarily between less liquid assets and ownership group 2 (equity and bonds), contractual savings and group 4 (liabilities), and between homes and group 2.

5. Effects of Taxes on Portfolio Composition

The way in which taxes affect portfolio choices has been at the center of the recent debates about the merits of fundamental reform of the tax system. A switch to either a comprehensive income tax or a consumption tax would eliminate the differential tax treatment of assets and consequent distortions associated with the current system. Very little empirical evidence has been brought to bear on this issue. The SRI survey is well suited to an examination of the problem because of the very detailed information on the components of taxable incomes and deductions recorded for each household (see section 2 above).

In Table 5 are shown the marginal tax rates for those households owning each of our eleven categories of assets and liabilities. We show both the unweighted average for holders of each asset, and also the average marginal tax rate weighted by households' shares of the total holdings in the sample. Not surprisingly, the weighted average marginal tax rates are higher than the unweighted means. For the sample as a whole the unweighted average marginal tax rate is 27.1 percent in 1977 and the weighted (by shares of net worth) average marginal tax rate is 42.7 percent. There are larger differences in marginal tax rate among the holders of different types of asset. These are particularly pronounced for the weighted averages. For checking accounts, liquid and less liquid savings, owner-occupied housing and home mortgages, the marginal tax rates are noticeably less than the weighted average marginal tax rate for the whole sample. The two highest marginal tax rates are for holders of municipal bonds (which are tax-exempt) and corporate equity, where the weighted averages are 50.5 and 49.9 percent respectively.

There are two ways in which taxes affect portfolio composition. The first is that differences in effective tax rates among assets and households may lead to portfolio specialization in order that households can exploit their comparative advantage in the production of post-tax income streams (Auerbach and King 1983). Households with lower marginal tax rates will hold more of the taxed securities, such as liquid and less liquid savings, and those facing higher marginal tax rates will hold more of the tax-privileged securities, such as municipal bonds and equity. The second effect is that taxes alter the trade-off between risk and return. The impact of this on the demands for risky assets is theoretically ambiguous (see Feldstein 1976 for a survey of the literature).

The evidence from Table 5 bears out the predictions of the theory of comparative advantage. But this is not the whole story. Taxable bonds, for instance, are owned by households with very high marginal tax rates which contradicts the pure comparative advantage model. Moreover, Tables 3 and 4 show rather mixed results. The ownership probabilities are generally positively related to the tax rate which suggests that taxes increase the demand for risky assets. But in Table 4 the tax rate coefficients are insignificantly different from zero in most cases.

One potential difficulty with the estimated tax coefficients is the identification problem associated with including both the tax rate and current income as explanatory variables. The tax rate is a known nonlinear transformation of income and other exogenous variables, and if the way in which income enters into the true behavioral model is unknown the separate effects of the tax rate cannot be identified. This problem is likely to be less important for our data set than in many other cases because (a) we include employment income not taxable income in the model, and (b) we are able to construct accurate estimates of taxable income. The correlation coefficient between the marginal tax rate and employment income was only 0.53, and that between the tax rate and the logarithm of net worth was 0.37. Moreover, it is wealth rather than current income that should be the forcing variable behind portfolio allocation, and so the potential identification problem is unlikely to be serious.

It appears that tax rates are more important in determining the probability of ownership of an asset than its share in net worth conditional upon ownership. It is perhaps surprising that our econometric estimates do not corroborate the clientele effects apparent from Table 5. The failure of our estimation procedure, using a seemingly accurate measure of the marginal tax rate, to identify more pronounced tax effects suggests, contrary to much of the recent literature, that taxes do not play a decisive role in explaining the differences in portfolio composition across households.

6. Wealth Elasticities

The model estimated above allows us to calculate the wealth elasticities of demand for each asset, at both the intensive and extensive margins, as a function of the estimated coefficients and values of the exogenous variables. A change in wealth has two effects. First, it alters the probability that a household owns an asset. Secondly, conditional upon ownership it changes the demand for each asset. The expected demand for an asset is the product of the ownership probability, π_j and the conditional demand, e_j, and we define the total wealth elasticity as the elasticity of the expected demand with respect to wealth. This is given by (dropping household superscripts)

$$E_j = \frac{W}{\pi_j e_j} \frac{d(\pi_j e_j)}{dW} \tag{6.1}$$

This expression may be written as the sum of the intensive and extensive elasticities

$$E_j = \frac{W}{\pi_j} \frac{d\pi_j}{dW} + \frac{W}{e_j} \frac{de_j}{dW} = E_j^O + E_j^D \tag{6.2}$$

where E_j^O and E_j^D are the ownership and demand elasticities, respectively.

The ownership probability model is

$$\pi_j = \int_{-\infty}^{Z\gamma_j} f(u)du \tag{6.3}$$

where f( ) is the standard normal density, Z is the vector of values of the explanatory variables included in the probit model, and γ_j the vector of coefficients for which our estimates are given in Table 3. The specification we have used implies that

$$Z\gamma_j = \beta_{1j}\ln W + \beta_{2j}(\ln W)^2 + Z'\gamma_j' \tag{6.4}$$

Hence the wealth elasticity of the ownership probability is

$$E_j^O = (\beta_{ij} + 2\beta_{2j}\ln W)h_j \tag{6.5}$$

where h_j is the value of the hazard function for asset j (the ratio of the density of f to the ownership probability for asset j) and depends upon household characteristics, including wealth.[24]

The asset demand equations shown in Table 4 also include ln w and $(\ln w)^2$ as explanatory variables and if their coefficients are denoted by α_{1j} and α_{2j}, respectively, then the conditional demand wealth elasticity is

$$E_j^D = \frac{\partial \ln e_j}{\partial \ln W} = 1 + \alpha_{1j} + 2\alpha_{2j} \ln W \tag{6.6}$$

Hence the total wealth elasticity is

$$E_j = 1 + (\alpha_{1j} + \beta_{1j}h_j) + 2(\alpha_{2j} + \beta_{2j}h_j)\ln W \tag{6.7}$$

This expression shows that the estimated model allows a reasonably flexible specification for the wealth elasticities. They depend upon the level of wealth itself both directly (though the linear dependence on ln W) and indirectly through the value of the hazard h_j. Household characteristics other than wealth enter via their influence on the hazard. Because the hazard appears in (6.7), the wealth elasticity is a nonlinear function of the estimated parameters. If all four of the wealth coefficients are zero then the wealth elasticity is unity. This is useful because a natural null hypothesis to test is that the wealth elasticity is equal to unity. If household preference orderings exhibit constant relative risk aversion then the wealth elasticities of all assets will be equal to unity. It is clear, however, that the hypothesis of constant relative risk aversion is strongly rejected by the data, contrary to the findings of Blume and Friend (1975). Only in the case of taxable bonds are all four of the estimated wealth coefficients insignificantly different from zero at the 1 percent level. One caveat to this conclusion is that neither we nor Blume and Friend included social security wealth in the measure of net worth. Given the high wealth levels of our sample this may not be of great importance. An additional caveat is that we ignore the possibility that households see through the "institutional veil," and condition their portfolios on the assets in which their defined contribution pension plans and IRA/Keogh accounts are invested.

For the conditional demand equations Table 6 shows the value of the chi-square statistic to test the null hypothesis that the coefficients on both wealth terms are zero. The critical values of chi-square with two degrees of freedom are 5.1 at the 5 percent level and 9.21 at the 1 percent level. The hypothesis of constant relative risk aversion can be rejected for all assets except equity and bonds at the 1 percent level.[25]

Table 7 presents point estimates of the ownership, demand, and total wealth elasticities for each asset evaluated for two representative households. The first is a household with wealth equal to the estimated population mean net worth of $57,408, and the second is one with wealth equal to the sample mean net worth of $223,188.[26] In both cases the households are assumed to have values of other household characteristics equal to the sample mean. The ownership elasticities are small for most assets but for corporate equity, taxable bonds, municipal bonds and other assets, an increase in wealth has a sizeable positive impact on the probability of ownership. In Figure 1 we plot the predicted ownership probabilities as a function of wealth implied by the probit estimates reported in Table 3. The probabilities are evaluated at sample means for all household characteristics other than wealth. The plots show clearly that the relationship between ownership and wealth differs across assets. Of particular interest are the sigmoid-shaped curves for equity and "other assets."

The demand elasticities also vary significantly across assets. At the sample mean level of net worth the demand elasticities for equity and municipal bonds are very close to unity. For checking accounts (a large component of money demand) and liquid savings the elasticities are around one-half, in contrast to the presumption in much of the macroeconomic literature that they are close to zero. The elasticity for contractual savings is also around one-half and that for housing about one-third. The only negative elasticity is that for taxable bonds and here none of the estimated wealth coefficients were significantly different from zero. At the opposite end of the spectrum, the largest total elasticities are for municipal bonds, corporate equity and other assets, and at the sample mean value for net worth all three exceed unity.

For both types of liability the elasticities are less than unity. From this and the balance sheet constraint that net worth equals assets minus liabilities we may deduce that the wealth elasticity of the nine assets taken as a group is less than unity. Both assets and liabilities are measured as positive amounts. Let A denote total assets, L denotes total liabilities, E_A and E_L the wealth elasticities of assets and liabilities (averages of the individual asset and liability elasticities weighted by the shares of each asset (liability) in total assets (liabilities)). Then the condition that $W = A - L$ implies that

$$E_A = E_L(1-\frac{W}{A}) + \frac{W}{A} \tag{6.8}$$

Since $0 < W/A < 1$, if both liability elasticities are less than unity, then $E_L < 1$ and by (6.8) $E_A < 1$. It is not surprising, therefore, that for most of the assets the elasticities in Table 7 are less than unity.[27]

Because the magnitude of the wealth elasticities depends upon wealth and other household characteristics, the aggregate effect of a change in wealth depends upon how that change is distributed among the population. Table 7 shows that the elasticities are different for households with different levels of net worth.[28] In Table 8 we show the aggregate wealth elasticity for each asset under the assumption that the proportionate change in wealth is uniform among the sample. The predicted aggregate demand for asset j is

$$a_j = \sum_h \pi_j^h e_j^h \tag{6.9}$$

The aggregate wealth elasticity is

$$E_{aj} = \sum_h (E_{jh}^O + E_{jh}^D) s_{jh} = E_{aj}^O + E_{aj}^D \tag{6.10}$$

where s_{jh} is the predicted share of household h's demand for asset j in the aggregate demand for the asset $(\pi_j^h e_j^h / \sum_h \pi_j^h e_j^h)$. The first three columns of Table 8 show the aggregate ownership, demand and total elasticities for the full sample of households with positive net worth. For those households which did not report the dollar values of all asset holdings, the predicted level of net worth (as described in the discussion of missing data in Section 4) was used to calculate the elasticities.

The broad pattern of elasticities shown in Table 7 holds also for the aggregate elasticities in Table 8. Taking into account the variation in wealth and other characteristics among the sample leads to somewhat larger elasticities for equity, "other assets," and liabilities other than mortgages. Because the sample is drawn heavily from upper-income groups, we calculate also aggregate elasticities for the population as a whole where the individual elasticities are weighted not only by predicted asset shares but also by population weights. The population estimates of the aggregate elasticities are displayed in the final three columns of Table 8. These are our best estimates of the elasticities relevant for macroeconomic behavior. The largest elasticity is for municipal bonds, followed by equity and other assets. The smallest elasticities are for owner-occupied housing, home mortgages and less liquid savings.

7. Conclusions

Examining the pattern of household portfolio composition that emerges from a new survey of 6,010 U.S. households, we have found that the vast majority of households hold only a subset of the available assets. This has implications for both the theoretical modelling of portfolio behavior and the econometric estimation of asset demand equations that have not been dealt with satisfactorily in earlier studies. We have shown that if the incomplete portfolios are the result of an optimization subject to holding costs and constraints on short sales then the asset demand system is a switching regressions model with as many regimes as there are distinct possible portfolios. The specification we derived involved equations both for the probability of owning each asset and combination of assets and for the asset demand system conditional upon ownership. An estimation procedure was developed to respond to the problems caused by incomplete portfolios, non-reporting of dollar holdings, and the endogeneity of the tax rate and of the portfolio composition dummies.

We have used this model to examine the impact of taxes on portfolio composition. The information provided by the survey on taxable incomes and deductions has enabled us to calculate the marginal tax rate facing each household. Our results show that tax rates are a significant determinant of asset ownership but, surprisingly, not of the share of net worth invested in the asset. Though far from conclusive, this finding suggests that the magnitude of the distortion induced by capital taxation on household portfolio choices may be less than previously thought.

We have estimated wealth elasticities of demand for a range of assets and liabilities at both the intensive and extensive margins. The presumption that the wealth elasticity of demand for money is zero and that for other assets is unity was shown to be unjustified. For corporate equity, municipal bonds and "other assets," the estimated wealth elasticities were greater than unity. Other assets, such as wealth in contractual savings schemes and short-term financial assets, had elasticities of around one-half. These estimates suggest that changes in total household net worth will change the structure of household balance sheets and consequently affect real decisions, such as corporate investment, in the economy.

Finally, this study suggests that the differences in portfolio composition across households cannot be fully explained within the framework of the conventional portfolio choice model. The households in our sample, though wealthy, own a surprisingly small number of assets and liabilities and this lack of diversification was found to be important when estimating asset demand equations. Given that the mean net worth of the sample was almost a quarter of a million dollars in 1978, it is hard to imagine that transactions costs, as traditionally defined, played a decisive role in producing incomplete portfolios.

One alternative explanation is that some assets produce joint products. For example, housing produces both a stream of returns on the investment and a consumption flow of housing services. Other assets may be held as part of a labor contract, either on the part of senior managers or in own businesses, in which case the desire to diversify portfolio risks may be constrained by contracts that preserve incentives for managers. Still others may offer liquidity, as in the case of checking accounts or liquid savings, or insurance, as in the case of contractual savings. The joint nature of the services provided by some assets means that the separation of the optimal consumption plan and the optimal portfolio allocation no longer holds. Differences in consumption patterns across households could therefore lead to incomplete portfolios.

A second and more compelling explanation of this phenomenon is the existence of significant holding costs in the management of a portfolio that increase with the number of assets owned. In particular, our results suggest that a major factor affecting household portfolio behavior may be the costs of acquiring and processing the information required to make decisions about how best to allocate resources across different assets. We would expect such costs to vary among households and, in particular, with observable variables such as the level of educational attainment and occupation. Our results show that education and occupation are important determinants of the ownership decision for corporate equities, taxable bonds, municipal bonds, and "other assets"--the four types of assets for which we would expect information costs to be highest. The existence of such household-specific information costs casts doubt on the traditional assumption of homogeneous expectations and suggests the need for greater attention in both theoretical and empirical work on portfolio behavior to the process and costs of acquiring information.

Appendix

We describe here a two-step procedure for dealing with the problem of nonreporting of asset values. At the first stage we estimate an equation for the logarithm of net worth as a function of exogenous and observable household characteristics using data for the sample of 2048 households which report values for all assets owned.

$$\ln W = Xb + e \tag{A.1}$$

As explanatory variables we include a piece-wise linear function of age (using the method proposed in King and Dicks-Mireaux 1982), income from employment, marital status, education, occupation, household composition, religion, pension status, and a farm family dummy. The sample selection bias induced by using only observations with positive values of net worth was corrected by a standard two-step procedure (Heckman 1976, 1979). The parameter estimates, $\hat{b}$, can be used to construct estimates of the logarithm of net worth for households with incomplete responses. In fact, if we stopped at this point and used $X\hat{b}$ as an estimate of ln w in (3.16) for nonreporting households, then this procedure would be equivalent to a Dagenais estimator for the missing data problem (Dagenais 1973). But because net worth is not missing but only incompletely recorded we use a second step which improves efficiency. We assume that we may approximate the relationship between recorded and true net worth (denoted by W^R and W, respectively) by

$$\ln W^R = \ln W - \Sigma_{j=1}^{J} a_j d_j + u \tag{A.2}$$

where $d_j = 1$ if asset j is owned <u>and</u> value of holding is not reported

= 0 otherwise.

We obtain estimates of the coefficients $\hat{a}_j$ by regressing $(\ln W^R - X\hat{b})$ on the nonreporting dummies using observations on households where the value of at least one holding is not reported ((A.2) holds exactly for households which report all holdings). Our estimate of net worth for households with incomplete reporting is given by

$$(\ln \hat{W}) = \ln W^R + \Sigma_{j=1}^{J} \hat{a}_j d_j \tag{A.3}$$

If nonreporting is "ignorable" (Griliches 1984), then the nonreporting dummy variables are exogenous and (A.2) can be estimated by OLS. Where this condition is not satisfied instrumental variables estimation can be employed. In the estimation of both the reduced form probits and the asset demand system (3.16), we use predicted net worth as given by (A.3).

Footnotes

1. The sample has two parts. The "NFO" file consists of 3,804 households with incomes of less than $30,000. The "Gallup" file consists of 2,206 households with incomes of $30,000 or more. Weighting factors for each household are provided on the tape that allow us to gross-up sample totals to provide population estimates.

2. The recorded data on the value of partnerships and unquoted businesses of which the household was the principal owner were imputed using sales figures. Because of the arbitrary nature of the imputation we excluded "own business value" from our analysis.

3. Durables such as boats, planes, works of art, etc. are included in the category "other assets".

4. For a description of TAXSIM see Feldstein and Frisch (1977) and Feenberg and Rosen (1983).

5. A detailed discussion of the comparison of the two sets of estimates for personal sector asset holdings may be found in King and Leape (1984).

6. A further reason might be the existence of a number of "mutual funds" (less than the number of assets and liabilities distinguished in our survey) which in themselves are sufficient for a portfolio optimum. Given the nature of the eleven assets and liabilities used in this study (see Table 1) the existence of such mutual funds is improbable. The number of funds that would be required depends upon the stochastic process generating asset returns.

7. For further discussion of this point see King (1984).

8. It is important to distinguish between transactions costs of trades and "holding costs" of different assets. The latter are discussed below; the former we shall ignore.

9. If preferences are restricted such that U belongs to the HARA (hyperbolic absolute risk aversion) class, then the one-period portfolio problem equivalence result holds for a more general nonstationary stochastic process (Merton 1971).

10. The second-order conditions will be satisfied if f^h is a concave function of the equity holdings and a suitable constraint qualification holds.

11. This model and its relationship to the econometric literature on multivariate tobit and related models is discussed in more detail in King (1984).

12. In the continuous time model underlying (3.4), A^h is equivalent to the inverse of the degree of absolute risk aversion of the derived utility of wealth function. This function is defined below in (3.17).

13. One exception is that the effective tax rate on equity, which depends upon the treatment of capital gains, varies with the frequency of trading because the tax is based on realizations. The trading frequency may, in turn, be a function of household characteristics.

14. We ignore here the effect of the combination of assets owned on the coefficient of the tax rate in order to reduce the problems of collinearity discussed in Section 4.

15. We assume that none of the risky assets are redundant in the sense that its returns are a linear combination of the returns on other assets.

16. See also Tobin's (1958) early discussion of the effect of taxes on optimal

portfolios.

17. Bodie (1982) has argued that short-term Treasury Bills are reasonably close to a riskless investment.

18. This is not entirely satisfactory because when all assets are risky the demand for asset j conditional upon ownership of combination k is

$$p_j^h = a_j(k,t^h) + b_j(k,t^h)(r^h)^{-1}$$

where a_j and b_j are functions of the means, covariances, and tax rates. The logarithmic transformation of the dependent variable was made to reduce the otherwise severe heteroskedasticity. The influence of the combination of assets owned was limited to the constant term as in (3.16) to reduce to manageable proportions the number of coefficients to be estimated.

19. For a very small number of assets the likelihood function corresponding to the Kuhn-Tucker conditions for the investor's programming problem can be evaluated using approximations to the multivariate normal distribution (Wales and Woodland, 1983). But for the number of assets which it is economically interesting to examine this approach is infeasible.

20. The theoretical model implies that the function of observable characteristics which determines whether a household owns an asset is not the same as the function which describes demands conditional upon ownership. Hence we estimate a probit ownership model and demand system separately rather than a tobit model. Because we provide no rigorous justification for the probit specification, the assumption of joint normality of the errors in the ownership and conditional demand equations must be regarded as a maintained hypothesis.

21. The nonlinearity of the tax schedule means that the instrument is a nonlinear function of the exogenous variables. In this case instrumental variables estimation is not equivalent to two-stage least squares. For further discussion of estimation with nonlinear budget constraints see Hausman (1981, 1982).

22. The interest rate was taken to be the mean of the quarterly rates for 1977 published in The Federal Reserve Bulletin, a figure of 5.27 percent per annum.

23. Life cycle aspects of portfolio composition are discussed further in King and Leape (1984).

24. For the probit model where f( ) is the standard normal density the hazard is equal to the inverse of Mills' ratio.

25. We do not present a test statistic for the asset demand system as a whole because the number of observations used in estimation varied across assets.

26. The population mean value of net worth was estimated using the sample weights described in fn. 1.

27. Because we are using cross-section data, we are unable to distinguish between permanent and transitory shocks to wealth which, in the presence of conventional transactions costs, would have different effects on asset demands. Transactions costs are, however, unlikely to be of major importance for wealthy households such as those in our sample.

28. The condition that the aggregate wealth elasticity is independent of the distribution of wealth is $\alpha_{2j} = \beta_{1j} = \beta_{2j} = 0$. Only in the case of taxable bonds would this null hypothesis fail to be rejected at the 1 percent level.

References

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

Blume, M.E. and I. Friend (1975), "The Asset Structure of Individual Portfolios and Some Implications for Utility Functions," Journal of Finance 30, 585-603.

Bodie, Z. (1982), "Investment Strategy in an Inflationary Environment," in (ed.) B.M. Friedman, The Changing Roles of Debt and Equity in Financing U.S. Capital Formation, University of Chicago Press.

Brennan, M.J. (1975), "The Optimal Number of Securities in a Risky Asset Portfolio When There are Fixed Costs of Transacting: Theory and Some Empirical Results," Journal of Financial and Quantitative Analysis 10, 483-496.

Conniffe, D. (1983), "Small-Sample Properties of Estimators of Regression Coefficients Given a Common Pattern of Missing Data," Review of Economic Studies 50, 111-120.

Dagenais, M.G. (1973), "The Use of Incomplete Observations in Multiple Regression Analysis," Journal of Econometrics 1, 317-318.

Dubin, J.A. and McFadden, D.L. (1984), "An Econometric Analysis of Residential Electric Appliance Holdings and Consumption," Econometrica 52, 345-362.

Feenberg, D.R. and Rosen, H.S. (1983), "Alternative Tax Treatments of the Family: Simulation Methodology and Results," in (ed.) M.S. Feldstein, Behavioral Simulation Methods in Tax Policy Analysis, University of Chicago Press.

Feldstein, M.S. (1976), "Personal Taxation and Portfolio Composition: An Econometric Analysis," Econometrica 44, 631-650.

__________ and D. Frisch (1977), "Corporate Tax Integration: Estimated Effects on Capital Accumulation," National Tax Journal 30, 37-51.

Goldsmith, D. (1976), "Transactions Costs and the Theory of Portfolio Selection," Journal of Finance 31, 1127-1139.

Gourieroux, C. and A. Monfort (1981), "On the Problem of Missing Data in Linear Models," Review of Economic Studies 43, 479-586.

Griliches, Z. (1984), "Data Problems in Econometrics," mimeo.

Hausman, J.A. (1981), "The Effect of Taxes on Labor Supply," in (eds.) H. Aaron and J. Pechman, How Taxes Affect Economic Behavior, Brookings Institution, Washington.

__________ (1982), "The Econometrics of Non-Linear Budget Sets," mimeo, MIT.

Heckman, J.J. (1976), "The Common Structure of Statistical Models of Truncation, Sample Selection and Limited Dependent Variables and a Simple Estimator for Such Models," Annals of Economic and Social Measurement 5, 475-492.

__________ (1978), "Dummy Endogenous Variables in a Simultaneous Equation System," Econometrica 46, 931-959.

__________ (1979), "Sample Selection Bias as a Specification Error," Econometrica 47, 153-162.

King, M.A. (1984), "The Structure of Discrete and Continuous Choices: Modelling Asset Demands," mimeo.

__________ and L-D.L. Dicks-Mireaux (1982), "Asset Holdings and the Life Cycle," *Economic Journal* 92, pp. 247-267.

__________ and J.I. Leape (1984), "Household Portfolio Composition and the Life Cycle," National Bureau of Economic Research Working Paper.

Levy, H. (1978), "Equilibrium in an Imperfect Market: A Constraint on the Number of Securities in the Portfolio," *American Economic Review* 68, 643-658.

Mayshar, J. (1979), "Transactions Costs in a Model of Capital Market Equilibrium," *Journal of Political Economy* 87, 673-700.

__________ (1981), "Transactions Costs and the Pricing of Assets," *Journal of Finance* 36, 583-597.

Merton, R.C. (1971), "Optimum Consumption and Portfolio Rules in a Continuous-Time Model," *Journal of Economic Theory* 3, 373-413.

__________ (1973), "An Intertemporal Capital Asset Pricing Model," *Econometrica* 41, 867-887.

__________ (1982), "On the Microeconomic Theory of Investment Under Uncertainty," in (eds.) K.J. Arrow and M.D. Intriligator, *Handbook of Mathematical Economics*, Vol. 2, North-Holland, Amsterdam.

Projector, D.S. and G.S. Weiss (1966), *Survey of Financial Characteristics of Consumers*, Federal Reserve Board, Washington, D.C.

Tobin, J. (1958), "Liquidity Preference as Behavior Towards Risk," *Review of Economic Studies* 26, 65-86.

Uhler, R.S. and J.G. Cragg (1971), "The Structure of the Asset Portfolios of Households," *Review of Economic Studies* 38, 341-357.

Wales, T.J. and A.D. Woodland (1983), "Estimation of Consumer Demand Systems with Binding Non-Negativity Constraints," Journal of Econometrics 21, 263-285.

Table 1: Asset Classifications

	Mean Asset Holding (in dollars)	Percentage of Total Wealth
I. CHECKING ACCOUNTS	2,419	1.1
1. Checking accounts	2,419	1.1
II. LIQUID SAVINGS	11,236	5.0
2. Savings accounts	10,336	4.6
3. Credit union share accounts	835	0.4
4. Money market funds	65	0.0
III. LESS LIQUID SAVINGS	8,520	3.9
5. Savings certificates	6,589	3.0
6. U.S. Savings Bonds	913	0.4
7. Money market instruments	1,018	0.5
IV. CONTRACTUAL SAVINGS	14,459	6.5
8. Pension or retirement plan account	10,485	4.7
9. Single-premium annuities (excluding IRA's)	811	0.4
10. Cash value of life insurance	3,163	1.4
V. EQUITY	52,102	23.3
11. Stocks	49,833	22.3
12. Stock mutual funds	2,269	1.0
VI. TAXABLE BONDS	5,217	2.4
13. Corporate bonds	3,059	1.4
14. Federal government bonds	2,158	1.0
VII. MUNICIPAL BONDS	6,860	3.1
15. Municipal bonds	6,860	3.1
VIII. HOMES	74,342	33.3
16. Value of primary residence	70,293	31.5
17. Value of secondary residence	4,049	1.8

Table 1, continued

	Mean Asset Holding (in dollars)	Percentage of Total Wealth
IX. OTHER ASSETS	86,087	38.6
18. Tax shelters and equipment leases	1,910	0.9
19. Closely-held stock	19,020	8.5
20. Convertible securities, REITS, boats, and planes	9,452	4.2
21. Investment real estate	49,982	22.4
22. Tangibles (marketable art, gold, etc.)	4,022	1.8
23. Other assets	1,701	0.8
X. HOME MORTGAGES	18,529	8.3
24. First mortgage on primary residence	8,281	3.7
25. Second mortgage on primary residence	257	0.1
26. Mortgage on second home	869	0.4
27. Home improvement loan	9,122	4.1
XI. OTHER LIABILITIES	19,524	8.7
28. Personal loans	1,813	0.8
29. Cash value loans	956	0.4
30. Revolving bank card account	564	0.3
Liabilities against:		
31. Tax shelters	456	0.2
32. Closely-held stock	1,549	0.7
33. Convertible securities, REITS, boats and planes	306	0.1
34. Investment real estate	13,700	6.1
35. Tangibles	20	0.0
36. Other assets	160	0.1
NET WORTH	223,188	100.0

Source: Own calculations based on SRI survey.

Table 2: Portfolios of Sample of 6010 U.S. Households

	Checking Accounts	Liquid Savings	Less Liquid Savings	Contractual Savings	Corporate Equity	Taxable Bonds	Municipal Bonds	Owner-Occupied Housing	Other Assets	Home Mortgages	Other Liabilities	Net Worth
Number Holding the Asset	5558	5438	3255	4596	2915	632	593	5051	2610	3341	3714	6010
Percentage of Total Sample	92.5	90.5	54.2	76.5	48.5	10.5	9.9	84.0	43.4	55.6	61.8	100.0
Mean Asset Share*,† (percent)	4.9	16.8	12.9	17.1	18.1	12.3	10.5	82.1	40.4	61.1	21.8	100.0
Mean Net Worth* ($)	229,339	217,071	247,083	238,482	392,030	744,202	969,941	258,006	399,743	200,349	221,984	223,188

* Conditional on ownership of the asset.
† Percent of net worth (reported only for households with positive net worth).

Source: Own calculations based on SRI survey.

Table 3: Probit Model for Ownership of Assets
(asymptotic standard errors in parentheses)

Explanatory Variable[a]	Checking Account	Liquid Savings	Less Liquid Savings	Contractual Savings	Corporate Equity	Taxable Bonds	Municipal Bonds	Homes	Other Assets	Home Mortgages	Other Liabilities
Constant	.866 (.315)	.885 (.302)	-1.599 (.231)	-2.704 (.246)	-2.266 (.271)	-3.172 (.516)	-3.001 (.477)	-5.635 (.387)	-1.315 (.256)	-4.951 (.294)	-.718 (.228)
ln (Net Worth)	.145 (.057)	.397 (.051)	.375 (.052)	.399 (.051)	-.119 (.063)	.169 (.126)	-.084 (.109)	1.146 (.105)	-.058 (.060)	1.049 (.070)	.112 (.045)
$[\ln(\text{Net Worth})]^2 \times 10^{-1}$	-.107 (.049)	-.283 (.043)	-.198 (.041)	-.221 (.043)	.413 (.053)	.146 (.085)	.333 (.075)	-.453 (.091)	.347 (.049)	-.749 (.053)	-.106 (.037)
Income from Employment $\times 10^{-6}$	-.747 (.978)	-1.931 (.760)	-1.046 (.645)	.034 (.837)	.975 (.905)	1.248 (.719)	1.560 (.719)	3.109 (1.317)	.093 (.758)	3.518 (.833)	.047 (.682)
Marginal Tax Rate	.544 (.202)	1.139 (.183)	.544 (.129)	.864 (.153)	.310 (.149)	-.133 (.165)	.057 (.167)	-1.107 (.232)	.491 (.137)	.309 (.143)	.734 (.134)
Age $\times 10^{-1}$	-.128 (.124)	-.562 (.124)	-.119 (.082)	.646 (.090)	.335 (.090)	-.154 (.126)	.151 (.135)	.671 (.111)	.008 (.088)	.779 (.096)	.344 (.088)
$(\text{Age})^2 \times 10^{-3}$	.149 (.121)	.568 (.120)	.173 (.080)	-.750 (.087)	-.267 (.088)	.270 (.118)	-.048 (.127)	-.717 (.011)	-.119 (.087)	-1.074 (.096)	-.574 (.087)
Married	.130 (.082)	.208 (.077)	.117 (.055)	.124 (.061)	-.049 (.060)	-.110 (.076)	-.308 (.078)	.641 (.083)	.062 (.059)	.408 (.059)	.244 (.057)
Occupation: Managerial	-.051 (.074)	-.171 (.070)	-.076 (.047)	-.065 (.055)	.290 (.050)	.035 (.070)	.152 (.071)	-.164 (.078)	.244 (.048)	.134 (.050)	.137 (.049)
Occupation: Professional	-.114 (.086)	-.063 (.083)	-.078 (.054)	.123 (.066)	.172 (.058)	.189 (.075)	.164 (.078)	-.137 (.086)	.257 (.056)	.137 (.058)	.014 (.056)
Education: College or Above	.300 (.067)	.072 (.062)	.062 (.042)	.085 (.048)	.505 (.045)	.472 (.061)	.399 (.062)	-.163 (.066)	.082 (.043)	.164 (.045)	.007 (.044)
Employed	.161 (.079)	.202 (.075)	.072 (.054)	.306 (.058)	-.181 (.059)	-.226 (.078)	-.254 (.080)	.091 (.085)	-.073 (.058)	-.007 (.058)	.162 (.055)
Risk Averse	-.003 (.068)	-.067 (.065)	.067 (.043)	.223 (.051)	-.047 (.048)	-.100 (.058)	.004 (.060)	.078 (.075)	-.051 (.046)	.041 (.048)	.020 (.046)
No. Holding the Asset	5246	5149	3144	4342	2819	621	581	4875	2514	3185	3394
No. Not Holding the Asset	365	462	2467	1269	2792	4990	5030	736	3097	2426	2217
Chi-square (12)	83.9	195.4	293.7	941.3	1752.5	769.4	784.9	1748.0	1304.8	1678.6	918.6

[a] Dummy variables take the value unity when the description applies to the household, zero otherwise. Individual variables refer to the head of a household.

Table 4, continued

Explanatory Variable[a]	Checking Account	Liquid Savings	Less Liquid Savings	Contractual Savings	Corporate Equity	Taxable Bonds	Municipal Bonds	Homes	Other Assets	Home Mortgages	Other Liabilities
Ownership Dummies:											
01COM3	-0.131 (0.402)	-0.372 (0.440)									
01COM23	0.705 (0.563)	0.844 (0.666)									
01COM34	-0.917 (0.221)	-2.753 (0.246)									
01COM234	-2.737 (0.442)	-3.206 (0.513)									
02COM13					-0.334 (2.637))	0.582 (7.937)	6.882 (6.540)		3.234 (2.171)		
02COM134					-0.824 (2.677)	1.570 (8.518)	7.709 (6.958)		3.299 (2.151)		
03COM1			-2.177 (0.738)	-3.097 (0.703)				-0.623 (0.189)			
03COM12			2.300 (1.035)	-3.074 (1.071)				0.877 (0.345)			
03COM14			-3.784 (0.536)	0.287 (0.388)				-0.757 (0.226)			
03COM124			-3.437 (1.074)	1.926 (0.910)				0.859 (0.323)			
04COM13										-0.035 (1.416)	2.623 (1.568)
04COM123										1.074 (1.767)	3.982 (2.246)
MILLS RATIO (inverse)	6.931 (2.799)	-2.838 (1.206)	-5.644 (4.369)	2.730 (0.847)	-0.780 (0.418)	-3.143 (1.948)	0.227 (1.547)	-0.070 (0.189)	-1.170 (0.499)	0.540 (0.559)	-0.193 (1.268)
R-squared	0.366	0.239	0.223	0.211	0.106	0.140	0.070	0.625	0.075	0.629	0.205
Degrees of freedom	5086	4852	3026	3506	2281	477	438	4724	2106	1637	3230
Standard error of the equation	1.179	1.279	1.695	1.270	1.471	1.281	1.255	0.485	1.286	0.875	1.602

[a] Dummy variables take the value unity when the description applies to the household, zero otherwise. Individual variables refer to the head of a household.

Note: The dummy variables of the form 01COM23 take the value unity if, given that it contains an asset in group 1, the household's portfolio also contains assets from groups 2 and 3; and zero otherwise.

Table 4: Asset Demand Equations
(asymptotic standard errors in parentheses)

Explanatory Variable[a]	Checking Account	Liquid Savings	Less Liquid Savings	Contractual Savings	Corporate Equity	Taxable Bonds	Municipal Bonds	Homes	Other Assets	Home Mortgages	Other Liabilities
Constant	-3.177 (0.902)	0.362 (0.765)	10.693 (8.652)	-3.645 (1.974)	3.647 (1.888)	11.780 (9.864)	-6.348 (8.396)	4.505 (0.936)	4.012 (1.405)	5.814 (2.386)	1.718 (1.812)
ln (Net Worth)	-0.525 (0.128)	-0.498 (0.194)	-2.089 (1.199)	-0.577 (0.251)	-1.255 (0.423)	-1.289 (1.389)	-0.916 (1.207)	-0.727 (0.188)	-1.805 (0.340)	-1.245 (0.394)	-2.153 (0.321)
$[\ln(\text{Net Worth})]^2 \times 10^{-1}$	0.052 (0.087)	0.002 (0.131)	0.808 (0.651)	0.046 (0.140)	0.813 (0.260)	0.031 (0.738)	0.555 (0.619)	-0.015 (0.104)	1.082 (0.198)	0.178 (0.252)	1.205 (0.189)
Income from Employment $\times 10^{-6}$	1.556 (1.081)	2.482 (1.164)	4.199 (2.942)	0.382 (1.428)	0.721 (0.756)	-2.915 (2.066)	-1.191 (1.752)	1.533 (0.615)	-0.109 (0.579)	2.021 (0.863)	1.331 (1.356)
Marginal Tax Rate	1.819 (0.335)	0.473 (0.375)	-1.446 (1.302)	0.743 (0.389)	-0.139 (0.279)	-0.260 (0.667)	-0.794 (0.608)	-0.049 (0.093)	-0.585 (0.277)	0.734 (0.211)	0.267 (0.538)
Age $\times 10^{-1}$	0.424 (0.170)	1.215 (0.210)	1.545 (0.419)	0.898 (0.380)	-0.223 (0.320)	-0.033 (0.496)	0.089 (0.679)	-0.001 (0.102)	0.175 (0.259)	-0.113 (0.324)	0.296 (0.392)
$(\text{Age})^2 \times 10^{-3}$	-0.401 (0.210)	-1.296 (0.239)	-1.599 (0.580)	-0.541 (0.458)	0.357 (0.385)	-0.126 (0.646)	0.070 (0.729)	-0.085 (0.130)	-0.254 (0.339)	-0.282 (0.418)	-0.427 (0.560)
Married	0.456 (0.119)	0.130 (0.124)	-0.284 (0.364)	-0.431 (0.155)	-0.154 (0.205)	-0.142 (0.485)	-0.410 (0.446)	0.057 (0.068)	-0.223 (0.173)	0.117 (0.159)	0.214 (0.223)
Occupation: Managerial	0.485 (0.075)	0.321 (0.082)	0.412 (0.239)	-0.287 (0.122)	-0.030 (0.133)	-0.099 (0.259)	0.229 (0.297)	-0.017 (0.047)	0.062 (0.118)	0.229 (0.090)	0.235 (0.138)
Occupation: Professional	0.307 (0.088)	0.306 (0.072)	0.398 (0.227)	0.155 (0.109)	-0.082 (0.115)	-0.426 (0.354)	0.123 (0.279)	0.051 (0.036)	-0.042 (0.117)	0.183 (0.082)	0.414 (0.096)
Education: College or Above	0.770 (0.188)	0.183 (0.077)	-0.120 (0.222)	0.060 (0.116)	0.285 (0.154)	-1.128 (0.728)	0.213 (0.539)	-0.009 (0.040)	-0.169 (0.079)	0.191 (0.105)	0.068 (0.129)
Employed	0.218 (0.128)	-0.260 (0.098)	-0.226 (0.204)	0.329 (0.152)	-0.014 (0.163)	0.120 (0.510)	-0.746 (0.415)	-0.041 (0.031)	-0.223 (0.132)	-0.206 (0.103)	-0.287 (0.189)
Risk Averse	-0.153 (0.045)	-0.041 (0.055)	-0.270 (0.187)	0.303 (0.083)	-0.131 (0.078)	0.575 (0.208)	-0.158 (0.131)	-0.022 (0.021)	-0.247 (0.067)	-0.056 (0.055)	-0.339 (0.076)

Table 5: Marginal Tax Rates of Clienteles

Asset	Number Holding the Asset	Average Marginal Tax Rate of Clientele (percent)	
		Unweighted	Weighted
1. Checking Accounts	5558	27.8	35.0
2. Liquid Savings	5438	28.1	35.1
3. Less Liquid Savings	3255	28.1	32.3
4. Contractual Savings	4596	29.9	39.8
5. Corporate Equity	2915	32.7	49.9
6. Taxable Bonds	632	36.1	45.9
7. Municipal Bonds	593	37.5	50.5
8. Owner-Occupied Housing	5051	28.4	34.8
9. Other Assets	2610	33.6	45.6
10. Home Mortgages	3341	31.4	33.1
11. Other Liabiities	3714	30.1	45.1
Total Net Worth	6010	27.1	42.7

Note: The weighted average marginal tax rates are weighted by the household's share of the total holdings of the asset in the sample.

Source: Own calculations based on SRI survey.

Table 6: Test Statistic for Constant Relative Risk Aversion

Asset	Chi-Square Statistic
1. Checking Account	109.00
2. Liquid Savings	83.40
3. Less Liquid Savings	35.58
4. Contractual Savings	43.72
5. Equity	8.12
6. Taxable Bonds	3.98
7. Municipal Bonds	0.60
8. Home	929.56
9. Other Assets	19.46
10. Home Mortgages	256.22
11. Other Liabiities	64.20

Source: Own calculations.

Table 7: Wealth Elasticities for Two Representative Households

Asset	Predicted Elasticity Evaluated at the Population Mean Wealth of $57,408			Predicted Elasticity Evaluated at the Sample Mean Wealth of $223,188		
	Ownership	Demand	Total	Ownership	Demand	Total
Checking Account	.001	.541	.542	-.003	.555	.552
Liquid Savings	.006	.504	.510	-.007	.504	.498
Less Liquid Savings	.087	-.063	.025	.049	.157	.206
Contractual Savings	.046	.481	.527	.023	.493	.516
Equity	.323	.778	1.101	.412	.999	1.411
Taxable Bonds	.605	-.250	.355	.673	-.242	.431
Municipal Bonds	.589	.789	1.378	.746	.939	1.685
Owner-occupied Housing	.138	.351	.489	.108	.312	.420
Other Assets	.338	.540	.908	.421	.864	1.285
Home Mortgages	.067	-.019	.048	-.073	.029	-.043
Other Liabilities	-.014	.377	.363	-.032	.704	.672

Note: Totals may not equal sum of components because of rounding errors.

Source: Own calculations.

Table 8: Aggregate Wealth Elasticities

Asset	Sample			Population		
	Ownership	Demand	Total	Ownership	Demand	Total
Checking Account	-.002	.570	.568	.000	.534	.534
Liquid Savings	-.006	.508	.502	.002	.505	.507
Less Liquid Savings	.263	-.179	.083	.252	-.231	.021
Contractual Savings	.008	.504	.512	.023	.495	.518
Equity	.038	1.541	1.579	.200	1.120	1.320
Taxable Bonds	.718	-.307	.411	.749	-.309	.441
Municipal Bonds	.378	1.172	1.550	.558	1.025	1.584
Owner-occupied Housing	.067	.252	.320	.118	.255	.373
Other Assets	.079	1.531	1.610	.249	.975	1.244
Home Mortgages	-.005	.004	-.001	.073	-.035	.039
Other Liabilities	-.070	1.312	1.241	-.022	.537	.515

Note: Totals may not equal sum of components because of rounding errors.

Source: Own calculations.

FIGURE 1: Effect of Wealth on Probability of Ownership

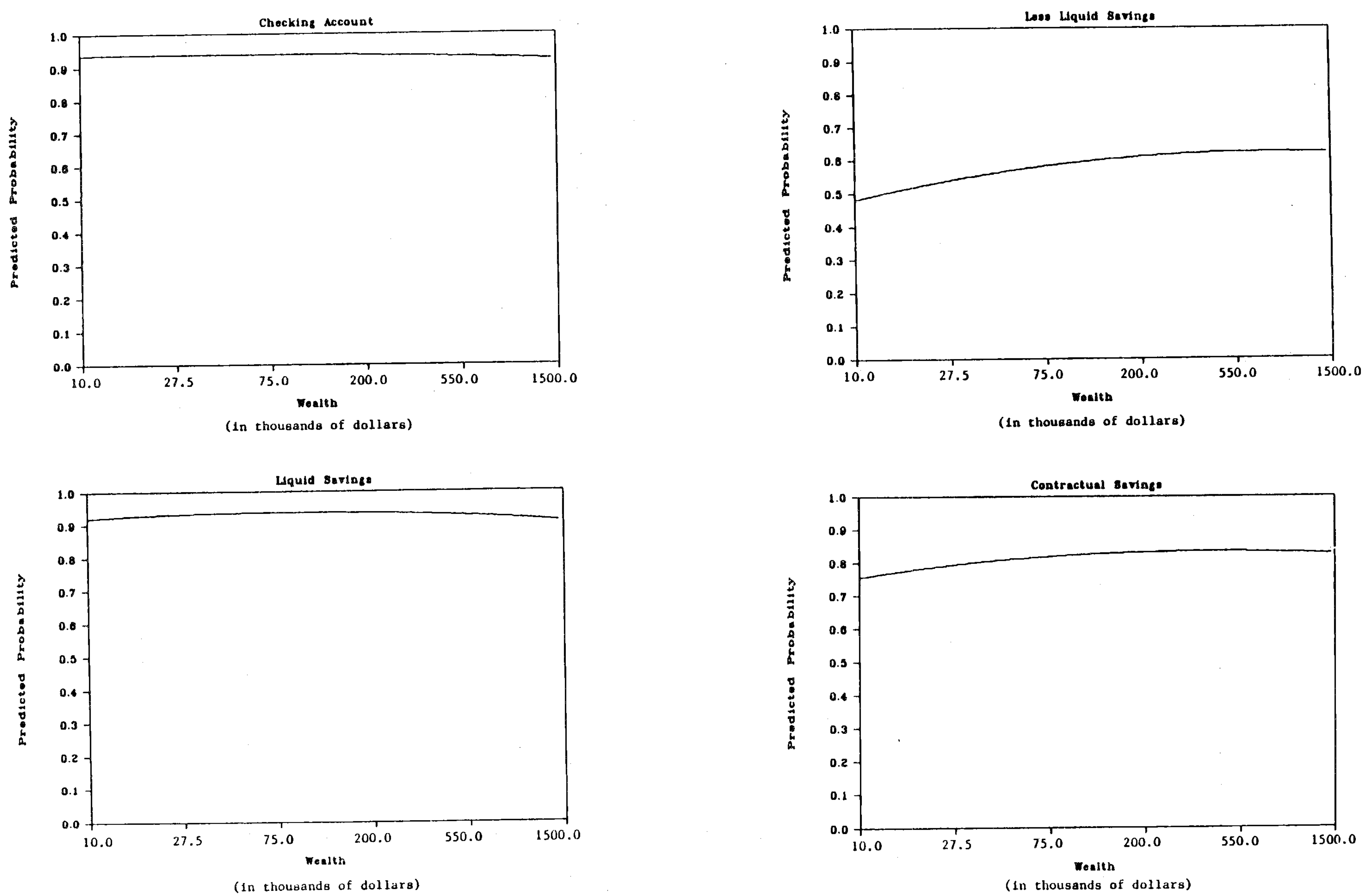

Figure 1, continued

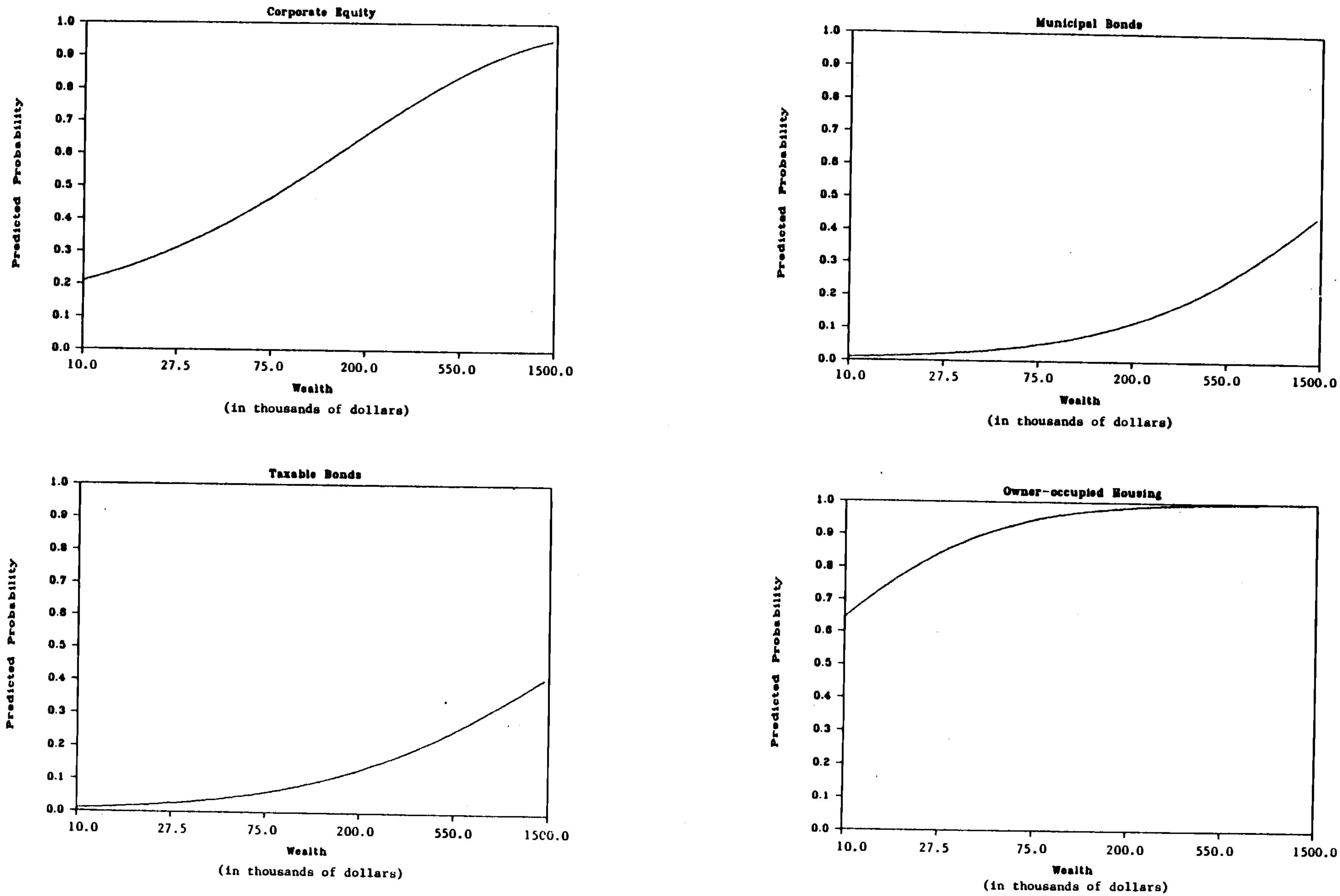

Figure 1, continued