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Risk Aversion Measures: Comparing Attitudes and Asset Allocation

Diane K. Schooley
Debra Drecnik Worden

Households' reported willingness to take financial risk is compared to the riskiness of their portfolios, measured as risky assets to wealth. Overall, their portfolio allocations are reliable indicators of attitudes toward risk, demonstrating an understanding of their relative level of risk taking. Multivariate regression analysis using multiply imputed data from the 1989 Survey of Consumer Finances indicates that households generally exhibit decreasing relative risk aversion. Further, investment in risky assets is significantly related to socioeconomic factors, attitude toward risk taking, desire to leave an estate, and expectations about the adequacy of Social Security and pension income.

I. INTRODUCTION

Individuals' risk preferences reflected in asset allocation choices have been explored extensively both theoretically (Arrow, 1965, 1971; Pratt, 1964) and empirically (Friend & Blume, 1975; Cohn, Lewellen, Lease, & Schlarbaum, 1975; Siegel & Hoban, 1982, 1991; Riley & Chow, 1992). Evidence on how various factors, especially wealth, impact risk aversion is mixed. This study affords an increased understanding of individuals' behavior toward risk–one of finance theory's most fundamental concepts.

The first hypothesis examined in this study is that relative risk aversion (RRA) calculated from the composition of a household's portfolio and RRA reported by the household in terms of willingness to take financial risk are directly related and can be used interchangeably to proxy risk aversion. This study is the first to compare these alternative measures of relative risk aversion. Differences between the two relative risk aversion measures may indicate that some individuals do not understand risk and therefore, may be taking more or less risk than they actually desire. The movement to defined contribution pension plans in recent years has put many individuals in the position of becoming portfo-

Diane K. Schooley • Associate Professor of Finance, Boise State University, Boise, ID 83725; *e-mail*: rmkschoo@cobfac.idbsu.edu. **Debra Drecnik Worden** • Assistant Professor of Business and Economics, George Fox University, Newberg, OR 97132-2697; *e-mail*: dworden@georgefox.edu.

lio managers by requiring them to make asset allocation decisions. If investors do not understand risk, the studies that use investors' asset allocations to measure risk aversion may not actually measure attitude toward risk. The comparison of RRA calculated from asset allocation to reported RRA will increase the understanding of how individuals determine their portfolio risk, thereby improving financial and retirement planning decisions and investor education.

In addition to comparing RRA measures, this study examines the factors that may explain variations across households' RRAs calculated from asset allocation. The second hypothesis is that RRA calculated from a household's portfolio is related to its wealth, income, full-time employment, race, gender, stage of life cycle, attitude toward risk taking, desire to leave an estate, and its expectations about the economy and the adequacy of Social Security and pension income for maintaining a standard of living after retirement.

Theory and a review of the literature are discussed next. Section III explains the data set and variables. The examination of the relationship between calculated and reported relative risk aversion is presented in Section IV and the determination of household relative risk aversion is discussed in Section V. Section VI contains the summary and conclusions.

II. THEORY AND LITERATURE REVIEW

The model used here follows Friend and Blume (1975), who estimate RRA by maximizing an investor's expected utility function using a Taylor series expansion. They define the proportion of an investor's portfolio invested in risky assets (α) as:

$$\alpha = \frac{E(r_m - r_f)}{\sigma^2(r_m)} * \frac{1}{(1-t)(1-h)C} - \frac{h}{1-h} * \beta_{h,m} \tag{1}$$

where r_m is the return on the market portfolio of all risky assets;
r_f is the return on the risk-free asset;
t is the investor's tax rate;
h is the ratio of investor's human capital to his total wealth;
$\beta_{h,m}$ is the ratio of the covariance of r_m and r_h (the return on human capital) to σ_m^2; and
C is Pratt's measure of relative risk aversion:

$$C = W\left[\frac{(-U)''(W)}{U'(W)}\right] \tag{2}$$

Because beta is estimated from time-series data to be close to zero (Fama & Schwert, 1977; Liberman, 1980), Equation 1 becomes:

$$\alpha = \frac{E(r_m - r_f)}{\sigma^2(r_m)} * \frac{1}{(1-t)(1-h)C} \tag{3}$$

Equation 3 can be rewritten as:

$$(1-t)(1-h)\alpha = MPR * \frac{1}{C} \tag{4}$$

where *MPR* is the market price of risk, assumed constant across all households. Therefore, because $(1-t)(1-h)\alpha$ is proportional to C (i.e., RRA) and can be observed, inferences about RRA can be made from $(1-t)(1-h)\alpha$.

If $(1-t)(1-h)\alpha$ increases (decreases) as wealth increases, the individual is said to exhibit decreasing (increasing) RRA. Some economists argue for utility functions whose properties reflect increasing RRA (Arrow, 1971) while others favor the log utility function, which reflects constant RRA. Because RRA depends upon the form of utility function being considered, the question of individuals' actual RRA is, for the most part, an empirical issue.

Empirical analyses of household RRA vary in results depending, in part, upon how wealth is measured. Because individuals hold residential housing for consumption as well as investment purposes, wealth has been measured as net worth excluding home equity. Using this measure, Friend and Blume (1975) find decreasing RRA and Siegel and Hoban (1982), who limit their sample to households between the ages of 50 and 64, find constant RRA. Morin and Suarez (1983) also find decreasing RRA, but include home equity in the wealth measure and treat it as a riskless asset because of the low uncertainty of the real stream of benefits it provides. They also include personal property as a riskless asset. In this study, home equity is excluded from wealth, as are other consumption goods such as personal property, vehicles and recreational craft.

Individuals exhibit decreasing RRA when wealth is measured as total assets rather than net worth (Cohn, Lewellen, Lease & Schlarbaum, 1975; Riley & Chow, 1992). This study employs a measure of wealth that is net of the debt incurred to accumulate it.

Some studies include human capital as a component of wealth. When human capital (as well as home equity) is incorporated into the model as a risky asset, Friend and Blume (1975) find constant RRA while Siegel and Hoban (1982) find increasing RRA. Bellante and Saba (1986) find the inclusion of human capital in wealth dramatically changes how RRA varies across age categories. When human capital is not included, they find that RRA increases significantly with age for heads of households over 45 years of age. However, when human capital is considered a part of wealth, RRA tends to decrease with age for all age categories. These results indicate that unless human capital is recognized as a risky asset, the human capital effects mask the life cycle effects. Thus, measures of human capital and life cycles are included in this study.

III. METHODOLOGY

All of the variables used in this study are computed from the 1989 Survey of Consumer Finances (SCF). This survey, sponsored by the Federal Reserve Board, was conducted by the Survey Research Center at the University of Michigan between August 1989 and March 1990. The purpose of the SCF was to provide a comprehensive view of the financial behavior of households. Detailed information was gathered on all assets, both real and financial, and liabilities of the household, as well as demographic characteristics such as

age, race, education, family composition, and employment status. Attitudes toward credit use, savings, and risk taking also were measured.

The survey is distinguished from other household surveys, not only because of the vast amount of information gathered, but also because of its sample design and its treatment of nonresponses. Research has shown that distribution of wealth in the United States is skewed, with a relatively small proportion of households holding a large share of the wealth. In order to obtain more detail on the financial behavior of those households holding a disproportionate share of the wealth, the SCF employed a dual-frame sampling design (see Herringa & Woodburn, 1991). The final sample of 3,143 respondents consisted of 2,277 randomly selected households from across the U.S. and 866 high-income households selected from a list developed by the Internal Revenue Service. This dual-frame sampling design prohibits the use of this sample as representative of the U.S. population. While this sample cannot be used to make statistical inferences about population means and distributions, inferences can be drawn about the relationships between variables within households.

The 1989 SCF also differs from similar surveys in its treatment of nonresponses. The method of multiple imputation, advanced by Donald Rubin, replaces each missing value with a set of values that represent a distribution of possibilities. Thus, this method attempts to simulate the distribution of missing data and provide a more realistic measure of the variability around the unknown data than simpler methods of estimating missing values. Models are used to impute five alternative values for each missing item; for nonmissing variables, the values are the same in each of five observations. The final database consists of five complete observations for each respondent, which are combined for the analysis (see Rubin, 1987; Kennickell, 1991).

The measure of actual risk taking by households is the ratio of risky assets to wealth, that is, the dollar value of risky assets per dollar of wealth. Following the typical definition of risk, a risky asset in this study is one that provides an uncertain nominal cash flow. Thus, the measure of human capital is included as a risky asset. It is recognized that the riskiness of human capital, measured by the uncertainty in income streams, varies across occupation and industry. However, these data are coded in a way that such differences cannot be accounted for. Those respondents who were currently employed full-time (64% of the sample) reported that they expected to continue working full-time for "n" years. Household human capital is calculated as the present value of an n-year annuity of the current annual salary or earnings, discounted at 7 percent. Essentially, this assumes a discount factor of 10 percent, but allows earnings to grow at a 3 percent rate for inflation. Alternative discount rates have no significant impact on the results of this study. Complete definitions of this study's asset and wealth measures are as follows:

Risky assets: the market value of all real estate held for investment purposes, the market value of mutual funds, corporate stock, and precious metals, the face value of all corporate and government bonds, amounts accumulated in all other pension accounts, loans to individuals, and an estimate of human capital.

Risk-free assets: checking and savings balances, money market accounts, U.S. Savings Bonds, cash value of life insurance, call account balances, certificates of deposit, other cash balances, and IRA/Keogh balances in CDs or money market accounts.

Wealth: Risky plus Risk-free assets minus the value of mortgage and consumer debt outstanding. The market values of those assets that could be held for consumption as well as investment purposes (vehicles, recreational craft, and residential and personal property)

are excluded, as is the value of outstanding debt incurred to accumulate these assets. Only personal assets and liabilities are included in these measures; those owned or owed by businesses are excluded.

The sampling design employed with this survey yielded a sample of households with an average of over $1 million in wealth. In order to make the results of the study more generalizable and comparable to other studies, those households with wealth greater than $1 million are excluded from further analysis. The study will focus on the 2,239 households with positive wealth of a million dollars or less. Table 1 presents the socioeconomic and attitudinal characteristics of this truncated sample.

Even with the sample truncation, the sample is relatively wealthy. Mean wealth is nearly $295,000, median wealth is almost $248,000, and average household income is about $43,000. But the median household income of $30,000 is comparable to the national 1988 median of $27,225 (U.S. Bureau of the Census, 1992). Respondents generally feel that there is only an average risk of a major depression in the U.S. economy over the next 10 years. The risk of double-digit inflation during the same time period is believed to be slightly higher. On average, respondents do not believe that their expected or current retirement income from Social Security and pensions is adequate to maintain their living standard. At the same time, 50 percent of the respondents believe that leaving an inheritance or estate is important.

TABLE 1
Socioeconomic and Attitudinal Characteristics of the Sample
(n=2239)

Financial Characteristics	*Mean Value*
Risk-free Assets	$29,586
Risky Assets	$277,616
Human Capital	$213,511
Wealth	$294,825
Risky Assets/Wealth	0.807
Household Income	$42,835
Net Worth	$162,935
(All Assets – All Debt, excluding human capital)	
Non-Employed (no full-time employment)	29.9%
Attitude – the Economy over the next 10 years	*Mean Rating*
Risk of major depression	5.24
Risk of double digit inflation	5.71
0 = no risk, 10=very great risk	
Attitude – Retirement Income	*Mean Rating*
Rating of adequacy	3.81
0=totally inadequate	
5=enough to maintain living standards	
10=very satisfactory	
Attitude – Leaving an Estate	*Distribution (%)*
Very Important	19.2
Important	30.8
Respondent and Partner differ	1.1
Somewhat Important	27.9
Not Important	21.0

TABLE 1 *(continued)*

Characteristic of Head of Household	*Distribution (%)*	*Mean Ratio Risky Assets/Wealth*
Life Cycle:		
Single, < 45 yr, no children	9.8	0.939
Single parent, any age	5.8	0.849
Married or with partner, < 45 yr	28.5	0.998
Older, in labor force, ≥ 45 yr	31.6	0.904
Older, retired, not in labor force, ≥ 45 yr	24.3	0.397
		$F = 269.9$*
Marital Status:		
Married or living with partner	65.2	0.868
Single	34.8	0.695
		$F = 92.0$*
Gender:		
Male	76.8	0.859
Female	23.2	0.639
		$F = 116.7$*
Race:		
White	81.0	0.800
Black	9.3	0.824
Hispanic	5.6	0.904
Asian/American Indian/Other	4.1	0.885
		$F = 3.98$*
Education:		
No high school diploma	21.5	0.608
High school diploma	32.0	0.824
Some college	20.1	0.870
College degrees	26.4	0.904
		$F = 55.9$*

Notes: *Mean variables are significantly different across groups, at the 1 percent level. *F* statistic is derived from the analysis of the combined multiple imputations and can be interpreted here similarly to the chi-squared statistic.

Over 50 percent of the household heads in the sample are 45 years of age or older, with over one-half of those still in the labor force. About two-thirds of the respondents are married or living as partners, and three-fourths of the households are headed by males. Only 19 percent of the respondents are nonwhite, and nearly 50 percent of the heads of household have at least some post secondary education.

A. Univariate Analysis

The univariate analysis presented in the second part of Table 1 indicates that the mean level of risk taking, as defined by the ratio of risky assets to wealth, does vary significantly across demographic groups in the sample. Older households whose head is no longer in the labor force have, on average, less than half the value of risky assets per dollar of wealth than other households. These households have less human capital than those in other cycles of life. Households consisting of couples in their family formation years exhibit the highest value of risky assets per dollar of wealth.

An examination of marital status reveals that single respondents have significantly fewer risky assets per dollar of wealth than other households. One explanation may be that households of couples are more likely to have two incomes and thus a larger amount of

human capital. In addition, 38 percent of single respondents are in the older stage of the life cycle and not in the labor force. The portfolios of households headed by females have significantly fewer risky assets per dollar of wealth than those headed by males. One reason for this result may be the coding procedure used in the creation of the data set, rather than inherent gender differences in risk aversion. The responses of opposite-sex couples were coded such that the male is the "head of household." Therefore, the marital status and gender of the household head are highly correlated. Across the race categories, white households have the lowest value of risky assets per dollar of wealth, while Hispanic households have the highest.

As the education level of the household head increases, so does the value of risky assets per dollar of wealth. While this is related to human capital (higher education is associated with higher earning streams), it may also be the case that a more highly educated household would make more financially sophisticated, and thus riskier, investments. The multivariate analysis presented in Section V will examine the relationship of each of the household's socioeconomic characteristics to the value of risky assets per dollar of wealth, holding all else constant, to provide a clearer understanding of the effect of these factors. One other determining factor in portfolio composition is the household's reported attitude toward risk taking, which is examined in the following section.

IV. CALCULATED VS. REPORTED RELATIVE RISK AVERSION

One-way analysis of variance is used to test whether the means of calculated RRA are significantly different across the household's reported attitude toward risk taking. The results indicate whether calculated and reported RRA are measuring the same construct (relative risk aversion). Calculated RRA ($(1\text{-}h)\alpha$) is the ratio of risky assets to wealth, where the numerator and denominator include human capital. While Equation 4 illustrates that observed RRA should be $(1\text{-}t)(1\text{-}h)\alpha$, the tax rate ($t$) is difficult to calculate from this data set. Bellante and Saba (1986) find that adjusting for taxes does not affect their results and Friend and Blume (1975) show that not taking tax differentials into account may only slightly bias the RRA estimate downward. Reported RRA is a categorical response variable derived from the response to the question: "Which of the statements on this page comes closest to the amount of financial risk that you (and your husband/wife) are willing to take when you save or make investments?"

1. take substantial financial risks expecting to earn substantial returns.
2. take above average financial risks expecting to earn above average returns.
3. take average financial risks expecting to earn average returns.
4. not willing to take any financial risks.

Results from the one-way analysis of variance for testing whether asset allocation is different across responses to the above question are found in Table 2. The mean values of risky assets to wealth are significantly different across the four response categories and are in the expected order of size. Those respondents willing to take no risk have the lowest mean ratio of risky assets to wealth, with the value increasing with the willingness to take risk. A t-test for differences between categories indicates that there is no significant difference in the mean values for the "substantial" vs. the "above average" responses. However,

TABLE 2
Mean Values of Risky Assets to Wealth Across Reported Risk Aversion

Risk Measure	*Reported Amount of Risk Willing to Take*				*Test Statistic*
	Substantial	*Above Average*	*Average*	*None*	
Risky assets	.982	.941	.858	.722	33.04*
Wealth (% of sample)	(3.9%)	(9.1%)	(41.1%)	(45.9%)	

Notes: *F statistic indicates significant differences in mean values across groups, at the 1 percent level. n = 2239. Risky assets are those measured assets whose cash flows are uncertain (including human capital).

there is a significant difference between the mean values for all other categories. These results indicate that the households surveyed understand their relative level of risk taking.

While the mean risk measure for those who reported that they are not willing to take any financial risk is very high (.722), it is significantly less than the mean value for the "average" risk category. One explanation for the high value is that there was no category indicating a willingness to take "less-than-average" financial risk. It is possible that many of the respondents would have chosen this category rather than the "no risk" response. Further, the definition of risky assets is quite broad; in particular, it includes all accumulated pension funds that are not IRA/Keogh balances invested in CDs or money market accounts. These funds are either invested in stock or interest-bearing accounts. Pension funds comprise a considerable proportion of the assets owned by these households; on average, accumulated pension funds equal 21.6 percent of a household's total financial assets.

V. DETERMINATION OF HOUSEHOLD RELATIVE RISK AVERSION

Multivariate regression analysis is used to test the second hypothesis that calculated RRA (i.e., portfolio composition) is a linear function of the household's socioeconomic characteristics and attitudinal factors such as its attitude toward risk taking, desire to leave an estate, expectations about the economy, and the adequacy of Social Security and pension income for maintaining a standard of living after retirement. The linear model estimated is

$$y = X\beta + \mu \tag{5}$$

where y is the household's dollar value of risky assets per dollar of wealth (with higher values indicating lower RRA), $X\beta$ is the matrix of variables and parameters determining y, and μ denotes the random component—attributes of the household that are not observed or cannot be measured, but impact the portfolio composition. Definitions of the socioeconomic and attitudinal explanatory variables included in the model are found in Table 3. Note that the univariate analysis presented in Table 1 indicates a relationship between the level of education achieved by the household head and the value of risky assets per dollar of household wealth. However, high positive correlation between education and household income prohibits the inclusion of both variables in the final analysis. Similar estimation results are

TABLE 3
Definitions of Explanatory Variables

Ln Wealth: natural logarithm of the dollar value of household wealth.

Household Income ($000): 1988 before-tax household income from all sources.

Non-Employed: 1 for those households where neither the head of household where neither head of household or partner (for couples) is a full-time wage earner; 0 otherwise.

Race – Nonwhite: 1 if head of household is Hispanic, African-American, or other nonwhite race; 0 otherwise.

Female: 1 if head of household is female; 0 if male.

Life Cycle of Household Head

Family Formation: 0 if head of household is < 45 years old, married, with or without children (in constant). Mean age = 35; mean number of dependents = 2.8.

Young Single: 1 if head of household is < 45 years old, single, without children; 0 otherwise. Mean age = 32; mean number of dependents = 0.1.

Single Parent: 1 if head of household is any age, single, with children; 0 otherwise. Mean age = 39; mean number of dependents = 2.0.

Older Working: 1 if head of household is ≥ 45 years old, in labor force; 0 otherwise. Mean age = 56; mean number of dependents = 1.4.

Older Retired: 1 if head of household is ≥ 45 years old, retired, or otherwise not in labor force; 0 otherwise. Mean age = 71; mean number of dependents = 0.7.

Estate: 1 if respondent believes it is very important or important to leave an estate or inheritance to surviving heirs; 0 otherwise.

Depression: values of 0 to 10 indicating the respondent's expectation of the U.S. economy experiencing a major depression within the next 10 years; 0 = almost no risk, 10 = very great risk.

Inflation: values of 0 to 10 indicating the respondent's expectation of the U.S. economy experiencing double digit inflation during the next 10 years; 0 = almost no risk, 10 = very great risk.

Retirement Income: values of 0 to 10 indicating the respondent's rating of the retirement income expected (or currently receiving) from Social Security and job pensions; 0 = totally inadequate, 5 = enough to maintain living standards, 10 = very satisfactory.

Risk Taking

Substantial: 1 if the respondent is willing to take substantial financial risks expecting to earn substantial returns; 0 otherwise.

Above Average: 1 if the respondent is willing to take above average financial risks expecting to earn above average returns; 0 otherwise.

Average: 1 if the respondent is willing to take average financial risks expecting to earn average returns; 0 otherwise.

None: 0 if the respondent is not willing to take any financial risk.

obtained when variables measuring the education of the household head are substituted for household income in the model.

The analysis is performed on each of the five imputations in the data set. The estimated parameters from each are combined, taking into consideration the variation across the imputations. Using the multiple imputations in this manner increases the efficiency of the estimated parameters and test statistics. The use of a single imputation for the estimation of the nonresponses leads to biased results (see Rubin, 1987). Because of this methodology, an F statistic is reported to test the significance of each estimated coefficient, rather than the traditional t-statistic. The observed level of significance, the p-value, is reported with each statistic to facilitate the evaluation of the results, which are reported in Table 4.

The model's overall explanatory power is significant, with adjusted R^2 for the separate imputations ranging from 48 to 52 percent. The estimated coefficient on the log of wealth is significantly positive, indicating decreasing RRA. That is, when other socioeconomic factors and the measured expectations and attitudes are held constant, this study finds that

TABLE 4
Regression Analysis of Risky Assets to Wealth

Explanatory Variable	*Estimated Coefficient*	*F Statistic*	*p-Value*
Ln Wealth	.061*	162.40	.000
Household Income ($000)	.000003	.00	.969
Non-Employed	–.288*	112.12	.000
Household Head Demographics			
Race – Nonwhite	.055*	11.11	.000
Female	–.025	1.83	.178
Stage of Life Cycle			
Young Single	.030	1.49	.223
Single Parent	.040	1.52	.218
Older Working	–.015	.71	.399
Older Retired	–.168*	32.28	.000
Attitudes/Expectations			
Estate	.030**	5.34	.021
Depression	–.003	.97	.325
Inflation	.003	.97	.325
Retirement income	–.007*	8.02	.005
Risk Taking			
Substantial	.129*	13.34	.000
Above Average	.029	1.51	.219
Average	.010	.48	.490
Constant	.213*	10.43	.001

Notes: Dependent Variable Mean Value = .807.
Mean Wealth = $294,825.
n = 2239.
Overall F statistic = 123.26*.
(R^2 for separate imputation regressions are reported in Appendix.)
*significant at the 1 percent level. An F statistic, rather than the traditional t-statistic, is calculated from the estimated parameters and parameter variances across the five imputations. The p-value is the observed level of significance associated with each F statistic.
**significant at the 5 percent level.

increases in households' holdings of risky assets per dollar of wealth are positively related to increases in their wealth.

While household income is not significant, whether a household head, and/or partner, are full-time wage earners is significantly related to the holdings of risky assets per dollar of wealth. The negative sign on the coefficient may indicate that those households with no full-time earnings are less willing to hold risky assets. In addition, this categorical variable reflects whether a household has estimated human capital; holding all else constant, households with a zero value for human capital are expected to have fewer risky assets. Because this variable holds constant the inclusion of human capital in risky assets, the impact of other demographic variables can be more clearly estimated. Gender of the household head is not significant, once such factors as life cycle and employment are held constant. But, nonwhites have significantly higher risky assets to wealth than do whites, holding other factors constant. Siegel and Hoban (1991) find that race does not have a significant effect on a similar risk measure. This study's results may differ because Siegel and Hoban's analysis adjusts for several socioeconomic factors not included here, such as home ownership, self-employment, health limitations, and family size. The nonwhite households in this

study's sample have significantly more dependents and less education than whites and are less likely to be homeowners.

The coefficients for the life cycle of the household head reveal that older households whose head is retired, or otherwise not in the labor force, have significantly lower risky assets relative to wealth than do households in their family formation years. In response to the question on financial risk taking, 64 percent of the older retired households reported that they would take no risk at all. Further, the mean value of risky assets to wealth for those households is .324, a value much lower than .722, the mean ratio for all households who reported that they would not take financial risk (Table 2). The fact that fewer households in this group have estimated human capital is being held constant with the inclusion of the "Non-Employed" variable. Even when the smaller percentage of pension assets for the older retired households is considered (9 percent of total financial assets vs. the overall average of 22 percent), this difference still indicates a tendency to choose less risky investments relative to wealth.

Note that other households do not differ significantly from those in their family formation years in the holdings of risky assets relative to wealth. This result may suggest that when other socioeconomic factors are held constant, family responsibilities do not impact relative risk aversion.

The desire to leave an inheritance (estate) is significantly positively related to the level of risky assets relative to wealth. This result, which Siegel and Hoban (1991) also find, provides evidence that individuals recognize the positive relationship between leaving an inheritance and investing in relatively riskier assets.

An interesting relationship that has not been explored in other studies is that between asset allocation and the rating of the adequacy of Social Security and pension income for retirement. This study finds that the less adequate those sources of retirement income are expected to be, the more risk households take in their portfolios. Again, these results provide evidence that investors recognize the need to take more risk in order to earn a higher portfolio return. Households' expectations about a future depression or about inflation are not significantly related to the ratio of risky assets to wealth.

Dummy variables capturing the household's attitude toward risk taking indicate that holding all socioeconomic factors constant, those respondents who claimed that they were willing to take substantial financial risk to earn substantial returns actually have a significantly higher ratio of risky asset to wealth, compared to those who were not willing to take any risk.

VI. SUMMARY AND CONCLUSIONS

As more households are taking responsibility for the asset allocation of their portfolios, an understanding about attitudes toward financial risk and its relationship to expected return is of growing interest. This study finds that households in this sample do allocate portfolio holdings consistent with their professed attitudes toward taking risk to increase returns. Risky assets are defined to include the value of financial assets that provide an uncertain cash flow, the market value of real estate held for investment purposes, and an estimate of human capital. These findings suggest that a household's relative risk aversion (RRA) can be assessed by responses to questions about risk aversion, as well as by measuring asset

allocation. The implication is that the households sampled do understand the basic risk/return relationship; an investor must be willing to accept more uncertainty (higher risk) to earn higher expected returns. Some have suggested that households are taking more risk by choosing "safe" investments such as CDs and savings accounts because these investments may not provide returns sufficient to maintain purchasing power, although the cash flows from the investments are relatively certain. Nevertheless, this study's results indicate that households still recognize the traditional meaning of financial risk as variability (or uncertainty) of returns.

Regression analysis of the ratio of risky assets to wealth indicates that this sample of households exhibits decreasing RRA. That is, as wealth increases, households allocate a greater portion of their portfolios to risky assets, holding constant attitudes about risk and the economy, as well as socioeconomic factors. Those households where neither the head or partner is a full-time wage earner have significantly fewer risky assets relative to wealth, a factor that may simply capture the effect of no estimated human capital. Nonwhites have higher risky assets to wealth than do whites, a topic for future research. Older retired households allocate less of their portfolios to risky assets than households in their family formation years. Of particular interest is household attitude toward Social Security and pension income. Those households who have less confidence in these sources of income for maintaining living standards have larger portions of their portfolios invested in risky assets, implying the recognition that higher expected returns are associated with higher risk. Finally, the results reveal that individuals in this sample understand the relative level of riskiness in their portfolios; those who say they are willing to take substantial risk to earn higher return do have riskier portfolios, as compared to those who are not willing to take any financial risk at all. These results provide further understanding of the factors that influence individuals' asset allocation.

As cited throughout the paper, previous evidence on individuals' RRA is mixed, which is likely due to the different samples and the measures of wealth used in each study. The determination of individuals' risk-taking attitudes and behavior may be so complex that it is not possible to characterize households as exhibiting a particular RRA.

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