Spousal Risk Preferences and Household Investment Decisions

Michael Brady
School of Economic Sciences and IMPACT Center
Washington State University

Bidisha Mandal
School of Economic Sciences
Washington State University

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Abstract

Most adults are married, plan for retirement with their spouse, and pool assets to a significant degree. How then are each individual's risk preferences combined in choosing the portfolio that represents for them the optimal tradeoff between risk and return? There are two pathways through which marriage could amplify the expression of individual risk preferences at the household level. First, if people choose spouses in part based on their appetite for risk, or another characteristic correlated with risk tolerance, then there could be polarization of household level risk preferences towards extremes. Second, spouses may strategically adjust their decisions to compensate for their spouse's preferences. Is an only mildly risk averse person that is married to someone that is nearly risk neutral motivated to choose a very low risk low return asset allocation to compensate for their spouse's risky behavior? In this paper we explore the influence of marriage on the expression of individual risk preferences by examining both sorting in the marriage market and strategic decision making. Using data from the Health and Retirement Survey we find a positive correlation between the risk preferences of spouses. We also develop a theoretical model that determines optimal investment allocations conditional on own and spousal risk tolerance. Optimal asset allocations from this model are compared to a naïve model that only includes own risk tolerance. In related research the explanatory power of the naïve and spousal models are evaluated for prediction ability based on actual asset allocation decisions for couples using the HRS data.

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Introduction

By observing actual behavior and asking hypothetical questions, economists have learned a great deal about the distribution of individual risk preferences in various populations. This has proven useful for explaining behavior with respect to savings, consumption, and investing. However, most adults are married, plan for retirement with their spouse, and pool assets to a significant degree. How then are each individual's risk preferences combined in choosing the portfolio that represents for them the optimal tradeoff between risk and return?

Economists have long recognized the complexities inherent to family life that complicate economic decision making beyond what is captured in traditional models that are based on a lone decision-maker (Bergstrom, 1996; Samuelson, 1956). The role of social interactions has received less attention than anonymous market interactions (Manski, 2000). This trend has been reversed somewhat with the development of fields such as noncooperative game theory and behavioral economics. As with nearly all economic research on families, the literature on intra-household dynamics begins with Becker (see Becker 1991 for a review), whose approach was to model households as if they were unitary agents with a single complete set of preferences and beliefs. This has given way to non-unitary models that explicitly account for the fact that multiple individuals with heterogeneous preferences, incentives, and influence constitute a household. More recent research has begun to examine the role of private information and limited communication, and also to try and explain why household allocations have been found to not be Pareto optimal or efficient (Manser and Brown, 1980; McElroy and Horney, 1981; Lundberg and Pollack, 1994; Chiappori, 1992; Browning and Chiappori, 1998). To our knowledge, this is the first paper to look specifically at risk preferences and retirement planning considering both partner selection and intra-household strategic decision making.

There are two pathways through which marriage could distort the expression of individual risk preferences; sorting and strategic behavior. Sorting is the process through which people select partners. The question is, do "likes marry likes", do "opposites attract", or neither? Spivey (2010) finds that more risk averse people tend to get married when they are younger. Given that people tend to marry someone of a similar age there is reason to believe that there would be positive correlation in spouses' risk preferences. Strategic behavior refers to the process through which spouses influence each others' decisions. This includes both indirect and direct influence. By indirect we mean the process of one person adjusting their behavior to account for what they believe their spouse decides to do. This has a direct game theoretic formulation. Direct influence refers to one spouse actively seeking to persuade or bargain with their spouse. Direct influence could involve differences in household roles particularly based on occupational differences which are often correlated with gender. While the movement of women into the labor force has reduced differences in marriage roles based on gender, significant differences in wages and employment remain. Research has also found systematic differences in risk preferences between men and women. Even when controlling for income, women have been found to be systematically more risk averse than men (Neelakantan, 2010).

In order to empirically measure how individual preferences are combined into total household investment decisions it is necessary to account for both sorting and strategic behavior. We use data from the Health and Retirement Survey that provides a measure of individual risk preferences for both spouses using income gamble questions. This allows us to measure whether people tend to marry someone with similar risk preferences. While it would be useful to have data on risk preferences prior to marriage previous research has shown that people tend to change little even in response to dramatic life events (Sahm, 2007). Therefore, the existence of a relationship between spousal preferences is likely a result of selection rather than a convergence in spousal preferences over time.

We do find positive correlation between the risk preferences of spouses. Strategic models predict this would be the case because it reduces conflict that results when preferences are different. We also analyze stock holdings in hypothetical individual accounts under different circumstances – when own utilities as functions of own wealth are maximized and when own utilities as functions of total household wealth are maximized.

Review of Relevant Literature

Models of intra-household bargaining are either unitary (Becker, 1991) or non-unitary. Unitary models assume that households maximize a single objective function according to a single set of preferences, beliefs, and information. Non-unitary models permit each individual to have their own preferences so that the problem is to maximize a weighted sum of utility functions. Bergstrom (1996) provides a survey of early work modeling household decisions as the outcome of a collective process. Manser and Brown (1980), McElroy and Horney (1981), and Lundberg and Pollack (1993) lay the groundwork for non-unitary models of households and use Nash cooperative bargaining models. Core aspects of these papers that have proven problematic are the assumptions that commitments are binding, there is full information, agents are able to communicate completely, and that outcomes are Pareto optimal. Udry (1996), Jones (1986), Duflo and Udry (2004), and Rangel (2006) all find at least some evidence that outcomes are not efficient. The use of cooperative models also proved to be problematic, in large part because they used different threat points, divorce versus a noncooperative marriage, but the theory provided no basis for choosing between them. Alternatively, noncooperative theory arrives at the appealing conclusion that extreme outside options, such as divorce, are not legitimate threat points in day to day disagreements (Rubenstein, 1982; Binmore, 1985). As long as there are gains from a marriage that are shared in such a way that both people are better off than if they were divorced the divorce threat is not credible (Bergstrom, 1996). Because of this, and other beneficial qualities, intra-household bargaining models have come to rely on noncooperative theory.

Intra-household bargaining models have been applied to a range of household decisions. Browning and Chiappori (1999) look at demand and expenditures and ask whether previous research that has found neoclassical demand theory to be violated in practice have incorrectly attributed this result to problems with the theory. Instead, they posit that the problem lies with assuming households can be treated as representative individuals. Their hypothesis is supported by the finding that violations persist with two-person households but not one-person households. The effect of private information on household decision making has received attention recently, particularly in developing country contexts where spouses often migrate great distances for work. Chen finds that the wives of husbands that migrate seek to conceal resource allocation decisions from their husbands in a way that is consistent with the wife having increased bargaining power, suggesting a non-cooperative model of households. Ashraf (2009) investigates how varying information asymmetries and communication between spouses affects the extent to which someone shares resources with their spouse. Duflo and Udry (2004) use income shocks to one spouse as a tool for identifying individual preferences within households. Ligon (2002) develops a more complex dynamic bargaining model.

Models of spousal choice take the form of search models where an individual compares potential spouses based on a vector of desirable traits. While there are many people in the world that have little control over who and when they marry, the marriage sorting process is largely self determined in the U.S., which is the focus of this paper. The seminal papers on marriage markets are Gale and Shapley (1962), Koopmans and Beckmann (1957), and Becker (1991). Roth and Sotomayor (1990) provide a survey. It is important to note that results from marriage market models depend on assumptions made about bargaining. Each person makes an assessment of what their utility would be if they were to marry someone at a particular point in time. This option is then weighed against marrying someone else, as well as their utility if they remained single.

Spivey (2010) provides the most detailed examination of the extent to which risk plays a part in selecting for a spouse. The model used in the study proposes that the more risk averse someone is the lower is their reservation quality, so they are likely to find someone that is acceptable faster. It is also argued that risk aversion makes one more eager to get married so that they can pool resources and share risk with someone. Both of these points are supported by empirical analysis that shows more risk averse people getting married at a younger age. However, this is not consistent across genders. Risk attitudes do a better job of explaining when men get married. Another implication of the model that is borne out by the data is that more risk averse men will have spouses with less desirable qualities.

The recent explosion in studies in the behavioral economics literature on group decision making has produced a number of findings that are relevant to our research question. This strand of research generally focuses on identifying how groups influence the expression of individual preferences under a range of situations reflecting authority, rules, and preferences. A majority of papers in this area have relied on laboratory experiments to test in a very controlled setting how groups perform relative to individuals, what processes are most important in understanding group dynamics, and how group formation and functioning affects results. Cason and Mui (1998) report the first study on groups in economics that is based largely on concepts developed in social psychology. This study and subsequent ones have significantly improved understanding of how group behavior differs from individual behavior both in terms of cognitive tasks (Cooper and Kagel, 2005) and in preference based decisions (e.g., Sutter, 2009). Similar to the intra-household bargaining literature, research on groups was motivated by the recognition that decisions in a wide array of economic contexts are the result of a collective process. With respect to risk, Charness, Karni, and Levin (2007) found groups to act in accordance with monotonicity in terms of first-order stochastic dominance and Bayesian updating.

Model and Results

We start with a 2-person 2-period model where each individual chooses how to allocate a fixed amount of wealth between risky and riskless assets. This ignores a number of other factors such as income, consumption, and savings decisions that are influenced by infinitely repeated decisions with a strong intertemporal nature. These factors are interesting and important but the simple asset allocation decision alone is still rich enough to capture the fundamental question posed in this paper.

Each person has an initial wealth that can be invested in either a risky or risk-free asset where the proportion in the risky asset is denoted by s which earns a return $\tilde{r}_s$ which is a random variable. The amount in the riskless asset is $\left[(1-s)W\right]$ which earns a return r_b which is known with certainty. The essential assumption that makes the problem interesting is that wealth following the realization of the return on investment is shared equally by both people in the household. This follows intuitively from the fact that the goods that are the largest household expenditures have public goods characteristics within the household, such as houses and vacations.

Each individual's decision is to allocate their wealth between the risky and risk-free assets where their utility is based on total wealth of both spouses.

Husband $(h): \max_{s_h} EU_h(W)$

Wife $(w): \max_{s_w} EU_w(W)$

$0 \leq s \leq 1$

$W = \left[\left(\tilde{r}_s s_h W_h + r_b (1 - s_h) W_h \right) + \left(\tilde{r}_s s_w W_w + r_b (1 - s_w) W_w \right) \right]$

The spouses must simultaneously decide how much of their own wealth to allocate towards the risky asset and how much to put in the riskless asset. It is assumed that they have full information on their spouse's risk preferences but not on their allocation due to the simultaneity.

Data from the Health and Retirement Study (HRS) surveys are used. The biennial surveys that started in 1992 are fielded to a nationally representative sample of older Americans. Particularly, data from 1992, 1998, 2000, 2002, 2004 and 2006 surveys are used as hypothetical income gamble questions were fielded in these years. For the purposes of this study only married couples are considered, resulting in a sample size of 7,094.

The hypothetical income gamble questions, that elicit risk attitudes, asked the respondents to compare two hypothetical job scenarios and to choose between a job that guarantees present family income and a job that offers higher income but also carries the risk of losing income. The exact wording of the question was as follows:

> Suppose that you are the only income earner in the family. Your doctor recommends that you move because of allergies, and you have to choose between two possible jobs. The first would guarantee your current total family income for life. The second is possibly better paying, but the income is also less certain. There is a 50–50 chance the second job would double your total lifetime income and a 50–50 chance that it would cut it by a third. Which job would you take – the first job or the second job?

If the respondent chose the riskier option, then the same scenario was repeated but with higher risks. Similarly, if the respondent chose the guaranteed income, then the same scenario with less risky odds was presented. These questions resulted in grouping respondents in the following four levels of income risk aversion, listed from least to most risk-averse. The respondent would:

1. take a job with even chances of doubling income or cutting income by 50%,
2. take a job with even chances of doubling income or cutting income by a third,
3. take a job with even chances of doubling income or cutting income by 20%, or

4. take the job that guarantees current income given any of the above alternatives.

In Table 1 we present the distribution of spouses' risk aversion. The Pearson's chi-square test-statistic is 188.38 (p-value = 0.00) indicating that a null hypothesis of independence of risk aversion between the spouses may be rejected. Moreover, we conclude from a Wilcoxon's signed-rank test that husbands are significantly less risk averse than their respective wives. In other words, from the survey data we find that like marry likes.

[Table 1 here]

Following Barsky et al. (1997) and Kimball et al. (2008), we assume that risk tolerance or the inverse of risk aversion is lognormally distributed and that individuals have objective functions with constant relative risk aversion. Thus,

(1) $$\log\left(\frac{1}{\gamma}\right) \sim N\left(\mu, \sigma^2\right)$$

where γ is the relative risk aversion parameter, and the utility function for each individual with wealth W is

(2) $$U(W) = \frac{W^{1-\gamma}}{1-\gamma}$$

Using expected utility theory and CRRA utility functional form, Barsky et al. (1997) and Kimball et al. (2008) find that an individual accepts the risky job with downside risk λ if

(3) $$\frac{1}{2}2^{1-\gamma} + \frac{1}{2}(1-\lambda)^{1-\gamma} \geq 1$$

Then the lower and upper bounds $\left(\text{denoted as } 1/\underline{\gamma} \text{ and } 1/\overline{\gamma}\right)$ of relative risk tolerance corresponding to the four categories of the income gamble questions, from least risk averse to most risk averse, are (0,0.27), (0.27,0.50), (0.50, 1), and (1, ∞). As in the above mentioned studies, we assume that the variance of the observed log relative risk tolerance distribution is the sum of the variance of the true log relative risk tolerance and the variance of the random noise. In other words,

(4) $$\sigma^2 = \sigma_{true}^2 + \sigma_{error}^2$$

Repeated responses to the income gamble questions from at least a subsample allows us to estimate σ^2 and σ_{true}^2. The parameter estimates μ, σ^2 and σ_{true}^2 whether computed separately for husbands and wives or jointly as log risk tolerance parameter estimates of couples (distributed as bivariate normal) are quite similar. However, the latter allows us to calculate and test the significance of the correlation between a pair's estimated risk tolerances. We estimate that $\mu_{husband} = -1.751$, $\sigma_{husband} = 1.640$, $\sigma_{true,husband} = 0.900$, $\mu_{wife} = -1.910$, $\sigma_{wife} = 1.490$, and $\sigma_{true,wife} = 0.756$. The correlation between husbands' and wives' risk aversion is estimated to be 0.182. Standard errors of all parameter estimates are small (between 0.02 and 0.04).

We convert the log relative risk tolerance estimates into relative risk aversion values by calculating the expected value of relative risk aversion conditional on the category of the income gamble response as

$$(5) \qquad E\left(\gamma \mid \text{category} = k\right) = \mathrm{e}^{\left(-\mu + \sigma_{true}^2/2\right)} \frac{\Phi\left(\dfrac{\log {}^{1}\!/\!_{\bar{\gamma}} - \mu + \sigma_{true}^2}{\sigma}\right) - \Phi\left(\dfrac{\log {}^{1}\!/\!_{\underline{\gamma}} - \mu + \sigma_{true}^2}{\sigma}\right)}{\Phi\left(\dfrac{\log {}^{1}\!/\!_{\bar{\gamma}} - \mu}{\sigma}\right) - \Phi\left(\dfrac{\log {}^{1}\!/\!_{\underline{\gamma}} - \mu}{\sigma}\right)}$$

Using the parameter estimates, $E\left(\gamma \mid k\right)$ has four values – 3.58, 5.05, 6.12 and 11.07 for the husbands, and four values – 4.31, 5.63, 6.64 and 10.73 for the wives.

Jagannathan and Kocherlakota (1996) show that a household chooses its stock (S) and bond (B) holdings such that in each time period it solves the maximization problem

$$(6) \qquad \max_{S_t, B_t} E \frac{\{W_t\}^{1-\gamma}}{(1-\gamma)}$$

subject to

$$(7) \qquad \begin{aligned} &S_t + B_t \leq \left(1+\tilde{r}_s\right) S_{t-1} + \left(1+r_b\right) B_{t-1}, \quad 1 \leq \text{t} \leq \text{T-1} \\ &W_T = \left(1+\tilde{r}_s\right) S_{T-1} + \left(1+r_b\right) B_{T-1} \\ &S_0 + B_0 = W_0 \end{aligned}$$

where $\tilde{r}_s$ is a stochastic return to risky assets, r_b is a fixed return to risk-free assets, W_t is the wealth in time period t and W_0 is the initial wealth of the household. For estimation purposes, we assume that r_b is 1% and $\tilde{r}_s$ is either 23%, 14% or −13% with equal probability and is independent over time. This yields a mean return of 8% with standard deviation of 18.73%, which is similar to the S&P 500 for 1871-2006. Using this setup and a CRRA utility function, Jagannathan and Kocherlakota (1996) find that it is optimal for a household to invest a constant share of wealth s in the risky assets in every time period that solves

(8) $$E\left\{\left[\left(1+\tilde{r}_s\right)s+\left(1+r_b\right)\left(1-s\right)\right]^{-\gamma}\left(\tilde{r}_s-r_b\right)\right\}=0$$

Replacing γ in equation (8) by $E(\gamma\,|\,k)$ as calculated in equation (5), we can numerically solve s for the household. However, in our study each household consists of a husband and wife. Thus, we compute s in three distinct ways. First, we average the $E(\gamma\,|\,k)$ values of husband and wife in each household and solve s. Next, we assume that couples do not interact and optimize their risky asset allocations independently. In other words, each individual maximizes own utility and obtain optimal $s_{husband}$ and s_{wife}. Lastly, we assume that couples do interact and optimize $s_{husband}$ and s_{wife} in such a way that they maximize individual utilities as functions of total household wealth.

Consider a simple 2-period model of a household consisting of a husband and a wife. Each individual starts with an initial wealth W_0, such that the total household wealth is $2W_0$. Each individual also owns an account and decides a mix of stock and bond holdings. However, both individual maximize total household utility, instead of own utilities. Denote wife's share of risky assets in her account as $s_w = S_w / W_0$ and husband's share of risky assets in his account as $s_h = S_h / W_0$. Then wife's maximization problem is

(9) $$\max_{s_w} E\,\frac{\left[\left(1+\tilde{r}_s\right)\left(s_w+E\left(s_h\right)\right)W_0+\left(1+r_b\right)\left(1-s_w+1-E\left(s_h\right)\right)W_0\right]^{1-\gamma_w}}{\left(1-\gamma_w\right)}$$

And husband's maximization problem is

(10) $$\max_{s_h} E\,\frac{\left[\left(1+\tilde{r}_s\right)\left(s_h+E\left(s_w\right)\right)W_0+\left(1+r_b\right)\left(1-s_h+1-E\left(s_w\right)\right)W_0\right]^{1-\gamma_h}}{\left(1-\gamma_h\right)}$$

In the numerical analysis, γ_w in equation (9) is replaced by $E(\gamma_w \mid k)$ and γ_h in equation (10) is replaced by $E(\gamma_h \mid k)$ as calculated from equation (5). Each spouse is aware of the other's level of risk aversion and first calculates $E(s_i)$, $i = w, h$ by maximizing the other's individual utility, and then equations (9) and (10) are solved simultaneously. Constraints as in (7) apply. Additionally, we do not allow any lending or borrowing and restrict s_i between 0 and 1. In Table 2 we present the solutions to the three situations. In column (1) the optimal risky asset allocation corresponds to the situation where spouses first average their risk aversion levels, and they then maximize household utility as a single entity. In columns (2) and (3) the optimal risky asset allocations correspond to husbands and wives where each spouse maximizes own utility independent of the other. In columns (4) and (5) the optimal risky asset allocations correspond to husbands and wives where each spouse maximizes total household utility.

[Table 2 here]

As expected, stock holdings decrease with increase in levels of risk aversion. However, we find evidence of polarization. If a husband is less risk averse than his wife then he holds larger share of risky assets under total household utility maximization compared to what he would have held if he maximized his own utility independently from his wife's utility. Similarly, the wife holds lesser risky assets compared to what she would have held if she maximized her own utility independently.

Conclusion

Our objective in this paper is to develop a theoretical model of individual investment behavior that accounts for the fact that most adults are married and pool assets with their spouse. The goal is to develop a model that more accurately predicts observed investment decisions for married individuals. First, based on data from the 2006 HRS survey, we find significant evidence of correlation between the risk preferences of spouses. In other words, likes marry likes. This could be evidence that either people choose spouses based on risk preferences, or that they choose a spouse based on another characteristic that is correlated with risk preferences. We then proceed to develop a theoretical model that we use to numerically solve for the optimal asset allocation conditional on one's own risk preferences and the spouse's risk preference. Results from simulations are discussed. In future work we will evaluate the predictive power of this model to a naïve model that predicts investment allocations based only on individuals' own risk preferences.

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Table 1: Distribution of spouses' risk aversion

Risk aversion 1 = least risk averse 4 = most risk averse	Wife				Total
Husband	1	2	3	4	
1	178	116	132	586	1012
2	83	126	121	426	756
3	109	103	201	555	968
4	390	367	545	3056	4358
Total	760	712	999	4623	7094

Table 2: Optimal share of risky assets

Risk aversion 1 = least risk averse 4 = most risk averse	Joint (with average risk aversion)	Individual (single player)		Individual (two players)	
		Husband (H)	Wife (W)	Husband (H)	Wife (W)
H=1, W=1	0.73	0.81	0.67	0.95	0.53
H=1, W=2	0.63	0.81	0.51	1.00	0.22
H=1, W=3	0.56	0.81	0.43	1.00	0.06
H=1, W=4	0.40	0.81	0.27	1.00	0.00
H=2, W=1	0.62	0.57	0.67	0.47	0.77
H=2, W=2	0.54	0.57	0.51	0.63	0.45
H=2, W=3	0.49	0.57	0.43	0.71	0.30
H=2, W=4	0.36	0.57	0.27	0.88	0.00
H=3, W=1	0.55	0.47	0.67	0.27	0.87
H=3, W=2	0.49	0.47	0.51	0.43	0.55
H=3, W=3	0.45	0.47	0.43	0.51	0.40
H=3, W=4	0.34	0.47	0.27	0.67	0.06
H=4, W=1	0.37	0.26	0.67	0.00	1.00
H=4, W=2	0.34	0.26	0.51	0.01	0.76
H=4, W=3	0.32	0.26	0.43	0.08	0.61
H=4, W=4	0.26	0.26	0.27	0.25	0.28