HOUSEHOLD PORTFOLIO CHOICE AND RETIREMENT

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Abstract—This study examines household portfolio choice through the retirement transition. I show that couples significantly decrease their stock allocations after retirement, whereas singles' allocations remain relatively unchanged. Reallocations are concentrated among couples in which the wife is more risk averse than her husband. Husbands' and wives' respective retirement events are followed by opposite-signed changes in stock allocations. These findings are consistent with a model of collective household decision making in which spouses have heterogeneous risk preferences, and suggest that dynamics in the distribution of intrahousehold bargaining power generate time-varying household risk aversion.

I. Introduction

U.S. households' financial assets represent a large and growing class of investment holdings, totaling $68.9 trillion as of the end of Q3 2015. Directly and indirectly held stocks totaling $20.6 trillion make up an important fraction of both these holdings and total U.S. corporate equities.[1] In addition to the size of the household sector, its demographics make it an important object of study. In particular, the oldest members of the baby boom generation, born between 1946 and 1964, have recently begun entering retirement. While baby boomers currently represent about 30% of the total U.S. population, they control a disproportionate 50% to 60% of household financial wealth.[2] The large demographic shift that will occur with the retirement of this relatively wealthy group, coupled with related portfolio reallocations, holds potentially important consequences for financial asset returns. It is therefore important to understand the financial decisions households make during the transition into retirement.

One channel through which the baby boom generation's retirement could affect asset markets is an increase in risk aversion of the representative investor. For example, Bakshi and Chen (1994) present evidence that aggregate risk aversion is positively correlated with the U.S. population's average age, with a persistent increase in the average age of market participants predicting an increase in risk premiums.[3] Supporting this notion, Abel (2001) and Poterba (2001) find evidence that the high stock returns of the 1990s were driven by the baby boomers' peak savings years. Further, Goyal (2004) shows that outflows from the stock market increase with the fraction of the population age 65 and over. Despite this aggregate evidence supporting the risk aversion channel of Bakshi and Chen, surprisingly little is known about retirement-related decisions at the household level. Moreover, the majority of studies using household data have found little support for time-varying risk aversion (Dynan, 2000; Sahm, 2012; Brunnermeier & Nagel, 2008).

In this paper, I aim to both empirically characterize the portfolio choices of households through the retirement transition, as well as provide evidence of a mechanism by which household risk aversion increases after retirement. My analysis draws on collective models of household decision making in which husbands and wives jointly make household decisions while maximizing individual utility (McElroy & Horney, 1981; Manser & Brown, 1980; Chiappori, 1988, 1992).[4]

To motivate my empirical analysis, I develop a three-period dynamic model of a household consisting of two individuals who each derive utility from household consumption. This setup closely follows that of Lundberg, Startz, and Stillman (2003), who examine the consumption-savings decisions of a two-person household through the retirement transition. My model extends the household's problem to include a standard portfolio choice decision (e.g., Campbell & Viceira, 2001).

I derive an analytical solution to the household's portfolio choice problem, which yields the intuition that if individuals within the household exhibit differing levels of risk aversion, then as individuals' relative degrees of control over household resources vary, so should observed household-level risk aversion. Combining this intuition with the stylized fact that, on average, women's risk aversion exceeds that of men (Hudgens & Fatkin, 1985; Levin, Snyder, & Chapman, 1988; Barsky et al., 1997), the model predicts that a shift in the

Received for publication September 4, 2014. Revision accepted for publication June 27, 2016. Editor: Yuriy Gorodnichenko.

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I am grateful to Michael Brandt, Simon Gervais, Marjorie McElroy, and David Robinson for invaluable advice, support, and discussions. I also thank two anonymous referees, Hengjie Ai, Ravi Bansal, John Beshears, Alon Brav, John Campbell, Alexander Dyck, Esther Eiling, Kenneth French, Yuriy Gorodnichenko (the editor), Campbell Harvey, Andrew Hertzberg, Alok Kumar, George Korniotis, Lisa Kramer, Howard Kung, Rafael La Porta, Annamaria Lusardi, Brigitte Madrian, Alexander Michaelides, Alessandro Previtero, Manju Puri, Tarun Ramadorai, Adriano Rampini, Luis Viceira, Vish Viswanathan, Stuart Webb, and Kent Womack for helpful comments and discussions. Helpful comments and valuable suggestions from participants at the Household Behavior in Risky Asset Markets conference at Harvard Business School and seminar participants at Arizona State University, Dartmouth College, Duke University, Federal Reserve Board, University of Alberta, University of Miami, University of Toronto, University of Western Ontario, and Virginia Tech are also appreciated. Any errors are my own.

A supplemental appendix is available online at http://www.mitpressjournals.org/doi/suppl/10.1162/REST_a_00643.

[1] Figures come from tables L.101 and L.223 of the Federal Flow of Funds Accounts release for Q3 2015.

[2] For example, estimates from the 2010 Survey of Consumer Finances indicate that baby boomers own about 56% of financial assets and 54% of stocks held by U.S. households.

[3] This channel is consistent with theories suggesting that time-varying risk aversion is at the heart of stock market return dynamics (Constantinides, 1990; Bakshi & Chen, 1996; Campbell & Cochrane, 1999; Chetty and Szeidl, 2007).

[4] Generally, these models imply a household-level utility function, which is a weighted-average of each individual's utility. These models of household decision making have been successful in explaining the consumption choices studied in labor and development economics (Browning et al., 1994; Lundberg, Pollak, & Wales, 1997; Duflo, 2003; Lundberg, Startz, & Stillman, 2003; Ashraf, 2009).

The Review of Economics and Statistics, December 2017, 99(5): 870–883

doi:10.1162/REST_a_00643

degree of control over household resources toward the wife during retirement should be accompanied by an observable shift in the household portfolio away from stocks.

Using panel data on household-level asset allocations from the Health and Retirement Study (HRS), I test this implication by examining the portfolio choices of couples as they transition into retirement. Even in households where both individuals work full time prior to retirement, the gender wage gap suggests that when both husbands and wives retire, the degree of control over household resources shifts toward wives on average. To accurately identify the impact of time-varying risk aversion on observed asset allocations, I exploit a control group in which the retirement transition should have no effect on risk aversion: singles. Comparing the retirement of couples and singles generates a natural experiment, in that retiring singles face retirement- and aging-related risks similar to those faced by couples but continue to possess full control over household decisions.

Controlling for time-varying household characteristics such as income, net worth, and out-of-pocket health care expenditures, I jointly estimate the effect of retirement on singles' and couples' portfolio allocations using a difference-in-differences approach. I find that couples significantly decrease their stock allocations after retirement. In contrast, singles maintain a relatively constant allocation to stocks after retiring. Relative to the behavior of singles, the average reallocation away from stocks among couples is both statistically and economically significant, representing about 8% of total financial assets and 20% of average stock holdings.[5]

I find a similar dichotomy with respect to the stock participation decisions of retiring singles and couples. Specifically, I find that retirement has virtually no effect on singles' average propensity to invest in stocks, whereas retirement is associated with about a 4% decrease in the average couple's stock market participation rate. I interpret these results as providing support for intrahousehold dynamics as a source of time-varying risk aversion at the household level.

The results of several additional tests provide support for the interpretation that these effects are driven by an increase in couples' household-level risk aversion after retirement. First, using risk-aversion estimates unique to each member of a couple, I show that reallocations away from stocks following the husband's retirement are concentrated among households in which the wife is more risk averse than her husband. Second, I show that husbands' and wives' retirement events have opposite-signed effects on the share of stock in couples' portfolios. While the husband's retirement is accompanied by a decrease in stock allocations, the wife's retirement is associated with an increase. Third, like husbands' and wives' retirement events, I show that their deaths also have opposite-signed effects on risky asset shares. Fourth, I show that during both the pre- and postretirement periods, couples' stock allocations exhibit a negative relationship with a time-varying measure of wives' intrahousehold bargaining power.

I conduct a host of robustness tests to rule out alternative explanations. First, I show that the main results are robust to the definition of risky assets included in the financial portfolio. My baseline specifications consider the allocation to stocks. Following Guiso, Jappelli, and Terlizzese (1996), I augment stocks with private business and investment real estate holdings to show that my results do not merely reflect a tendency by couples to reduce their stock exposures in response to increased private business and investment real estate holdings during retirement. Instead, I find that including private business and investment real estate holdings in the financial portfolio strengthens the economic magnitude of the results.

Further, I show that the results cannot be explained by observable changes in couples' circumstances and background risks surrounding retirement. I examine the effects of consumption risk (Bodie, Merton, & Samuelson, 1992; Guiso, Japelli, & Terlizzese, 1996) and health risk (Rosen & Wu, 2004; Love & Smith, 2010; Yogo, 2011), finding that these retirement-related risks have very little ability to explain couples' postretirement reallocations. I also consider the effects of children, the age of retirement, entrepreneurial status, cognitive ability, and life expectancy on the main results, finding that they cannot be explained along these dimensions.

This paper contributes to the growing literature that studies households' stock allocation and participation decisions. Prior studies have documented the importance of age, education, income, wealth, and marital status on portfolio choice (Campbell, 2006; Curcuru et al., 2009). Further, the importance of household-level background risks such as income risk (Bodie et al., 1992; Guiso et al., 1996; Heaton & Lucas, 1997, 2000a, 2000b; Viceira, 2001; Cocco, Gomes, & Maenhout, 2005; Bonaparte, Korniotis, & Kumar, 2014) and health risk (Rosen & Wu, 2004; Love & Smith, 2010; Yogo, 2011) have also been highlighted. Other papers have documented the importance of nonbackground risk determinants such as social interaction and information sharing (Hong, Kubik, & Stein, 2004; Brown et al., 2008; Li, 2014), optimism (Puri & Robinson, 2007), and stock return experiences (Malmendier & Nagel, 2011) on household portfolio decisions.

A recent strand of the literature most related to this paper studies the effect of intrahousehold bargaining power on observed portfolio choice decisions. In particular, Friedberg and Webb (2006) use data from the 1992 HRS to show that households in which the husband's bargaining power is high exhibit an increased tendency to participate in the stock market and allocate more of their financial wealth to stocks. Yilmazer and Lich (2015) extend this evidence to an HRS sample covering the 1992 to 2006 period. In both papers, the

[5] Based on this result, a rough estimate of baby boomers' total reallocations away from stocks is $1.147 trillion. Over a period of two decades, holding all else constant (i.e., disregarding passive reallocations due to changes in financial wealth), this figure represents an average annual outflow from the stock market of about $57 billion. See section IVB for details of this calculation.

measure of the husband's bargaining power is the couple's response to a question about whether the husband has the "final say" over household decisions. Using a different measure of bargaining power based on spouses' relative years of education, Neelakantan et al. (2013) use data from the 2000 HRS to show that the share of risky assets in the household's portfolio increases as this measure of bargaining power tilts toward the husband.

While these papers document the effect of bargaining power on observed portfolio choice decisions, an important caveat is that their conclusions are limited to explaining the cross-sectional variation across households. Despite its intuitive nature, the "final say" question was asked in only the 1992 wave of the HRS. Further, the years of education among HRS participants exhibit very little variation over time, owing to the survey's focus on the population over age 50. In contrast, my paper highlights the importance of dynamics in the distribution of intrahousehold bargaining power in explaining the evolution of household portfolio decisions over time. Further, I show that these bargaining dynamics are an important driver of couples' portfolio reallocations as they transition into retirement.[6]

Finally, my findings also suggest that dynamics in the distribution of intrahousehold bargaining power can generate time-varying risk aversion at the household level. This evidence contributes to a strand of the literature testing for time-varying risk aversion at the individual and household levels (Dynan, 2000; Ravina, 2005; Sahm, 2012; Brunnermeier & Nagel, 2008; Guiso, Sapienza, & Zingales, 2013). In addition to providing evidence of an alternative mechanism via which risk aversion varies over time, my results suggest that events with long-lasting effects on the intrahousehold distribution of bargaining power can generate persistent changes in household risk aversion.

II. Theoretical Motivation

My empirical analysis is motivated by collective models of household decision making in which husbands and wives jointly make household decisions while maximizing individual utility functions (McElroy & Horney, 1981; Manser & Brown, 1980; Chiappori, 1988, 1992). In general, these models imply a household-level utility function that is a weighted average of each individual's utility, where weights are a function of individual incomes. These models of household decision making have been successful in explaining the consumption choices studied in labor and development economics.[7]

To motivate my empirical analysis, I consider a three-period dynamic model of a household consisting of two individuals, individual 1 and individual 2, who derive utility from total household consumption, C_t. This setup closely follows that of Lundberg et al. (2003), who examine the consumption-savings decisions of a two-person household through the retirement transition. The individuals have respective power utility functions, $U_1(C_t)$ and $U_2(C_t)$, which are specified as follows:

$$U_i(C_t) = \frac{C_t^{1-\gamma_i}}{1-\gamma_i}, \text{ for each } i \in \{1,2\}, \tag{1}$$

where γ_i is individual i's time-invariant coefficient of relative risk aversion.[8]

Household members are assumed to jointly maximize a utility function $U_H(W)$ given by

$$U_H(C_t) = U_1(C_t)^{\phi_t} U_2(C_t)^{1-\phi_t}, \tag{2}$$

where $\phi_t \in [0,1]$ captures the degree of influence individual 1 has over household decision making at time t.[9] Given this specification, the household's utility function can be rewritten as

$$\begin{aligned} &U_H(C_t) = A_t \frac{C_t^{1-\gamma_t}}{1-\gamma_t}, \text{ where} \\ &\gamma_t = \phi_t\gamma_1 + (1-\phi_t)\gamma_2, \text{ and} \\ &A_t = \frac{1-\gamma_t}{(1-\gamma_1)^{\phi_t}(1-\gamma_2)^{1-\phi_t}}. \end{aligned} \tag{3}$$

To define the household's portfolio choice problem, I assume that there are two assets available to investors. The first is riskless, with gross return from time t to $t+1$ given by $R_{f,t+1}$. The second is risky, with gross return given by R_{t+1}. The return on the risky asset has conditional mean E_tR_{t+1}, with conditional variance σ_t^2. Then, with A_t and γ_t defined as above, the household's problem is

$$\begin{aligned} &\text{max: } E_t \sum_{i=0}^{3} \delta^i U_H(C_{t+i}) = E_t \sum_{i=0}^{3} \delta^i A_t \frac{C_{t+i}^{1-\gamma_t}}{1-\gamma_t}, \\ &\text{subject to: } W_{t+1} = R_{p,t+1}(W_t - C_t), \\ &R_{p,t+1} = \alpha_t R_{t+1} + (1-\alpha_t)R_{f,t+1}, \end{aligned} \tag{4}$$

[6] Addoum, Kung, and Morales (2015) also demonstrate that within-household variation in bargaining power is an important determinant of portfolio allocations among households in the PSID. However, they do not examine the retirement transition. Instead, the focus of their paper is a life cycle portfolio choice model in which the distribution of intrahousehold bargaining power is determined endogenously.

[7] For example, Browning et al. (1994) show that relative spending on men's and women's clothing depends on partners' household income shares. Lundberg et al. (1997) study the effects of a U.K. policy change altering the payment of child benefits. They find that when the benefit starts being paid to the mother instead of the father, there is a coincident shift in household spending toward women's and children's clothing.

[8] My analysis relies on the milder assumption that the gap between household members' risk aversion coefficients remains constant over time. This is consistent with the findings of Sahm (2012), who shows that differences between individuals' risk aversion estimates are persistent. In contrast, she finds that individual risk aversion changes only modestly over time.

[9] An assumption implicit in both my setup and that of Lundberg et al. (2003) is that couples cannot fully commit to agreements over the distribution of bargaining power in the future, admitting the possibility of period-by-period bargaining. Also, I note that the initial household matching decision for couples is outside the scope of my analysis.

where $\delta \in (0, 1)$ is the rate of time preference, α denotes the portfolio weight on the risky asset, and W_t is the household's wealth at time t.[10]

I solve the model by backward induction, assuming that $C_3 = W_3$ (i.e., all wealth is consumed at the end of the terminal period), which leads to the following propositions:

Proposition 1. *Defining r_{t+1} and $r_{f,t+1}$ as the logarithm of the gross return on the risky and riskless assets, respectively, the optimal portfolio rule is given by*

$$\alpha_t = \frac{E_t r_{t+1} - r_{f,t+1} + \sigma_t^2/2}{\gamma_{t+1}\sigma_t^2}, \text{ for each } t \in \{0, 1, 2\}. \quad (5)$$

Proof. See appendix A.

Proposition 2. *Without loss of generality, assume that $\gamma_1 > \gamma_2$. Then,*

$$\frac{d\gamma_{t+1}}{d\phi_{t+1}} > 0 \text{ and } \frac{d\alpha_t}{d\phi_{t+1}} < 0. \quad (6)$$

Proof. See appendix B.

That is, as the more risk-averse agent's degree of influence over household decision making increases, so does effective risk aversion at the household level. In turn, the household's optimal allocation to the risky asset decreases.

Proposition 2 provides the intuition that as individuals' degrees of control over household decision making vary, so should the household's observed household portfolio allocations. Combining this intuition with the stylized fact that, on average, women's risk aversion exceeds that of men (e.g., Hudgens & Fatkin, 1985; Levin et al., 1988; Barsky et al., 1997), my conjecture is that an observable shift in the degree of control over household resources toward the wife should be accompanied by a corresponding shift in the household portfolio away from stocks.

A. *Theoretical Predictions*

Following Lundberg et al. (2003), I define three periods during which the household makes consumption and portfolio choice decisions. At time 0 and during the first period, the husband (the less risk averse agent) is working in a career job. At time 1, the husband retires and remains so through the end of the second period. Finally, at time 2, accounting for wives' higher average survival probabilities, I assume that the husband dies and the wife makes consumption and portfolio choice decisions on her own. At the end of the third period, the wife consumes all of her wealth and dies.

In the dynamic context of portfolio choice through the retirement transition, the husband's degree of control over household resources will tend to drop after he retires. Further, because retirement can be thought of as an absorbing state that can often be postponed but not easily reversed (e.g., Viceira, 2001, and Farhi & Panageas, 2007), the accompanying shift in bargaining power will not begin until postponement of retirement is unlikely.[11]

In the notation of the model, this can be written as $0 < \phi_1 < \phi_2 < 1$, and according to proposition 2, the husband's retirement should be accompanied by a detectable shift away from risky assets in the household's financial portfolio. In contrast, because singles make their portfolio decisions on their own, the retirement event should have no effect on their risky asset allocations.[12]

A second implication of the model is that after the death of the husband, all decision-making power rests with his widow, which can be written as $\phi_2 < \phi_3 = 1$. Thus, according to proposition 2, the husband's death should be followed by a decrease in the allocation to the risky asset. In contrast, the wife's death should be followed by an increase in the household risky asset allocation. I empirically test these implications of the model in the rest of the paper.

III. Data and Summary Statistics

I use data from the Health and Retirement Study (HRS), a nationally representative longitudinal survey following more than 22,000 Americans over the age of 50.[13] The HRS collects data on these individuals' income, assets, pension plans, and many other dimensions of financial life. In addition, it provides data on these individuals' health outcomes, health care expenditures, life expectancy, and responses to risky gambles, as well as demographic information on children, age, and gender. This rich set of longitudinal responses makes the HRS ideal for studying households' portfolio choices as individuals transition from their working years into retirement.

With respect to financial assets, the HRS provides comprehensive information on households' holdings in stocks and equity funds; checking, savings, and money market accounts; certificates of deposit; government savings bonds; T-bills; bonds; and bond funds. The study also reports households' holdings in less liquid investments, including private businesses and investment real estate.[14]

[10] Addoum et al. (2015) also solve a dynamic life cycle model of portfolio choice incorporating marital bargaining. While they do not examine the transition into retirement, their results suggest similar predictions.

[11] The assertion of retirement as an absorbing state is reasonable even for individuals who return to work after retiring. In particular, Ruhm (1990) and Maestas (2010) demonstrate that those retirees who return to work are typically employed in a different industry from their career job and earn a significantly lower hourly wage.

[12] In online appendix C, I provide empirical evidence supporting the assertion that, on average, women's risk aversion exceeds that of men in the HRS sample. I also verify the link between risk aversion and stock allocations.

[13] The HRS is sponsored by the National Institute on Aging (grant number NIA U01AG009740) and is conducted by the University of Michigan.

[14] Though the HRS reports the total balance of IRA and defined contribution (DC) retirement accounts, the allocation of these balances to stocks is not reported prior to 2006. I address this potential source of measurement error in the online appendix.

TABLE 1.—HRS HOUSEHOLD SUMMARY STATISTICS (1992–2012 WAVES)

	Mean: Couples	Mean: Singles
Characteristics of the household head		
Age (years)	68.47	73.80
Education (years)	13.90	13.66
Labor income ($)	42,433	32,431
Pension income ($)	17,151	13,057
Children	3.04	2.05
Risk aversion	8.00	8.24
Household wealth statistics ($)		
Net worth	814,975	574,669
Home equity	259,559	169,412
Private business holdings	72,449	29,164
Additional real estate holdings	97,824	54,130
Financial portfolio statistics		
Stock allocation (%), stockholders	40.62	48.35
Total financial wealth ($)	430,743	304,176
Intrahousehold bargaining measures		
Wife's share, total nonwage income	0.30	NA
Wife's share, social security income	0.32	NA
Wife's share, pension income	0.22	NA
Total observations	17,064	7,274

This table displays summary statistics for the sample of couple and single households. Data are from the 1992–2012 waves of the Health and Retirement Study (HRS). Observations are required to have positive financial wealth (cash + stocks + bonds), positive stockholdings, and nonmissing net worth (financial wealth + home equity + private business + real estate + vehicle equity − other debts). Education is measured in years, with 12 representing high school graduation, 16 representing completion of an undergraduate degree, and 17 representing at least some postgraduate education.

An empirical investigation of portfolio decisions requires defining risky and relatively safer asset classes. I adopt the approach of Guiso et al. (1996) in defining both narrow and broad risky asset definitions in order to ensure the robustness of my analysis. First, I define the standard financial portfolio to consist of the sum of household holdings in stocks and equity funds; checking, savings, and money market accounts; certificates of deposit; government savings bonds; T-bills; bonds; and bond funds. I then define the share of risky assets as the proportion of the financial portfolio held in stocks and equity funds. A broader definition of the financial portfolio adds the net value of private business holdings to both the value of the portfolio and the value of risky assets. The third definition of the risky asset share further adds the net value of investment real estate holdings.

Table 1 presents unconditional summary statistics for the entire sample of 17,064 couple and 7,274 single-member household observations. Table 2 presents dynamic summary statistics for the sample of couples and singles in their pre- and postretirement years.[15] In both tables, all values in levels are inflated to year 2012 dollars using CPI data from the Bureau of Labor Statistics. The education variable measures the years of education of the respondent, where twelve years indicates completion of high school, sixteen years represents completion of a bachelor's degree, and seventeen years represents a top-coded value for having at least some postgraduate education. Net worth is calculated as the sum of home equity, vehicle equity, holdings in private business and real estate, and the value of the standard financial portfolio, less the value of debts other than mortgages and car loans. Observations are required to have nonmissing net worth and positive standard financial portfolio value in both tables. Further, I focus on the subsample of HRS respondents who participate in the stock market, since changes in risk aversion should directly affect participants' stock allocations, whereas the participation decision may not be driven by risk aversion alone.[16]

In table 1, couple household heads, defined to be the husband, have similar education levels to those of singles, with husbands having fourteen years of education on average. Relative to singles, couple households have average per capita net worth that is comparable to that of singles ($407,488 versus $574,669). A similar relationship holds for home equity, private business, and investment real estate holdings. However, couples are much more likely to hold stocks in their financial portfolios, with a participation rate of about 41.0% versus 26.3% for singles. In contrast, couples who do hold stocks allocate about 40.6% at the mean versus about 48.4% among singles.

Given the dynamic nature of the study, I also present dynamic summary statistics in table 2. I compare pre- versus postretirement portfolio, income, and wealth statistics for both couples and singles. Examining couples' portfolio statistics, it is apparent that there is a statistically significant decrease in the allocation to stocks among those who participate. Specifically, couples who are stock market participants reduce their allocation to stocks by an average of 3.24%, from 43.06% to 39.82%, following the husband's retirement. In contrast, singles do not exhibit economically or statistically significant changes in their stock allocations.[17] Together, these univariate findings are consistent with the predictions of the model.

Examining the wealth and income statistics reveals another interesting finding with respect to the difference in wealth accumulation between couples and singles. Specifically, couples' average financial wealth increases following retirement, while singles' does not. Further, couples' average total net worth increases by about 45%, while singles' increases by only about 37%.[18] Finally, these differences

[15] I also present summary statistics by gender for single-member households in appendix table A1. In order to account for a gradual transition into retirement, throughout the paper, I define the pre- (post-) retirement period to be the period preceding (following) the year of retirement by more than three years. See section 4.1 for details.

[16] For example, Vissing-Jorgensen (2002) finds that participation and transactions costs are an important factor in explaining the nonparticipation of many households. For robustness, I also consider the participation decision and find similar results on this margin. See appendix table A2. I discuss and analyze the potential problems related to attrition and compositional changes in the estimation sample in online appendix D. I show that the baseline results hold in a sample free of concerns due to attrition and compositional changes documented by Poterba, Venti, and Wise (2011).

[17] Examining stock participation rates yields similar findings. Specifically, the rate of stock participation among couples drops by about 4.28%, from 43.98% during the preretirement period to 39.70% following the husband's retirement, and this decrease is statistically significant at the 1% level. In contrast, the stock participation rate among singles remains relatively constant.

[18] Specifically, couples' average net worth increases by about $271,000, from $598,000 to $869,000, whereas singles' average wealth increases by about $160,000, from $436,000 to $596,000. Among couples, the increase in net worth comprises a $115,000 average increase in financial wealth and

TABLE 2.—PRE- AND POSTRETIREMENT SUMMARY STATISTICS AND UNIVARIATE TESTS

	Couples			Singles		
	Mean Preretirement	Mean Postretirement	Difference (Post – Pre)	Mean Preretirement	Mean Postretirement	Difference (Post – Pre)
Portfolio statistics						
Stock allocation (%), stockholders	43.06	39.82	−3.24***	47.85	48.53	0.68
Total financial wealth ($)	330,562	445,568	115,006***	322,570	297,223	−25,347
Income and wealth levels ($)						
Labor income (head)	45,279	5,510	−39,769***	28,786	3,632	−25,154***
Pension income (head)	1,475	10,331	8,856***	569	8,325	7,756***
Net worth	597,832	868,614	270,782***	436,179	596,646	160,467***
Home equity	150,370	292,975	142,605***	112,021	181,043	69,022***

This table displays pre- and postretirement dynamic summary statistics for couple and single households in the estimation sample. Data are from the 1992–2012 waves of the Health and Retirement Study (HRS). Observations are required to have positive financial wealth (cash + stocks + bonds), positive stockholdings, and nonmissing net worth (financial wealth + home equity + private business + real estate + vehicle equity − other debts).

arise despite the fact that couples exhibit lower allocations to stocks than singles in the sample unconditionally and that couples decrease their allocations and stock participation following retirement. In contrast, singles' average allocations to, and participation in, stocks do not change following retirement. Taken together, these patterns suggest that couples exhibit lower consumption-wealth ratios than singles following retirement, which is the subject of a large literature examining the retirement consumption puzzle (e.g., Banks, Blundell, & Tanner, 1998; Bernheim, Skinner, & Weinberg, 2001; Lundberg, Startz, & Stillman, 2003; Aguiar & Hurst, 2005).

IV. Main Results

In this section, I present my main empirical findings. First, I outline the econometric strategy for identifying the retirement-induced difference in portfolio rebalancing between singles and couples and present the baseline results of the paper. Next, I present the results of tests validating the assumptions of my empirical methodology. In particular, I examine the dynamics of the portfolio rebalancing difference and show that it is centered on the retirement event. Finally, I address the effects of potential measurement error on the baseline results by controlling for the effects of social security wealth and assets held in IRA and defined contribution (DC) retirement accounts.

A. *Identification Strategy*

I am interested in identifying whether, controlling for observable household characteristics, couples exhibit postretirement portfolio rebalancing that differs from their single counterparts. Econometrically, I estimate difference-in-differences specifications of the following form:

$$\begin{aligned} w_{risky,i,t} = {} & \alpha_i + \alpha_t + \theta\left(Retired_{i,t} \times Married_{i,t}\right) \\ & + \eta\left(Retired_{i,t}\right) + \delta\left(Married_{i,t}\right) \\ & + \lambda\left(\pm 3 yrsRetirement_{i,t}\right) \\ & + \nu\left(\pm 3 yrsRetirement_{i,t} \times Married_{i,t}\right) \\ & + \Gamma X_{i,t} + \varepsilon_{i,t}. \end{aligned} \tag{7}$$

I regress the risky asset share of household i at time t on indicator variables for retirement of the household head (the husband in couple households), marital status of the household head, the interaction between these indicators, and a vector of control variables $X_{i,t}$. I also include household and time dummies to respectively capture household and time fixed effects.[19]

To account for the potential bias induced by a gradual transition between couples' and singles' preretirement and long-run postretirement allocations, I include a transition indicator $\pm 3 yrsRetirement$, equal to 1 during the ± 3 years surrounding retirement and 0 otherwise. I interact this with the indicator for marital status to account for the gradual difference that emerges between singles and couples during this period. The coefficient of interest, θ, captures the difference between couples and singles in post- versus preretirement risky asset shares outside of the transition period.[20]

B. *Baseline Results*

Table 3 presents estimates from running regressions of the form outlined in equation (7). To ensure the robustness of the

a $142,000 increase in home equity. Among singles, a $69,000 average increase in primary home equity is offset by a $25,000 decrease in financial wealth and bolstered by increases in secondary home equity and business holdings.

These increases in net worth are consistent with the notion that consumption is more than offset by the returns to financial wealth in the early years of retirement, especially among the wealthy who invest in stocks. This observation is consistent with the empirical findings of Jappelli (1999) and Cagetti (2003), who document wealth profiles that continue to increase in the years after retirement. Similarly, the simulated wealth profiles of Cagetti (2003) and Cocco et al. (2005) suggest that households continue to accumulate wealth in the first decade of retirement.

[19] Since I define the head of household in couples to be the male, the household identifier for males remains constant through transitions into and out of marriage. Any associated changes in the household portfolio due to such transitions are picked up by the *Married* indicator. To ensure that this choice does not somehow drive the results, I confirm that the main results hold when I restrict the control group to include only men or women.

[20] My empirical specification is similar to that of Lundberg et al. (2003), who document that married couples in the PSID decrease food expenditures after retirement of the male household head, while singles do not exhibit such a decrease after retirement. They attribute this finding to marital bargaining over the consumption-savings decision.

TABLE 3.—HOUSEHOLD ASSET ALLOCATIONS AND RETIREMENT, DIFFERENCE-IN-DIFFERENCES SPECIFICATIONS

	Stock Allocation (%)	Stock + Private Business Allocation (%)	Stock + Private Business + Investment Real Estate Allocation (%)
	(1)	(2)	(3)
Retired indicator × married indicator	−8.443***	−10.624***	−10.468***
	(2.264)	(2.289)	(2.280)
Retired indicator	1.755	1.706	2.325
	(2.187)	(2.214)	(2.213)
±3 Yrs retired indicator × married indicator	−4.282**	−6.538***	−5.702***
	(1.969)	(2.022)	(2.015)
±3 Yrs retired indicator	0.815	0.732	0.682
	(1.823)	(1.874)	(1.890)
Married indicator	6.854***	8.479***	8.093***
	(2.403)	(2.417)	(2.468)
Family labor income	0.432***	0.533***	0.492***
	(0.096)	(0.097)	(0.092)
Family net worth	0.040***	0.080***	0.089***
	(0.009)	(0.009)	(0.008)
Family pension income	−0.038	0.035	0.020
	(0.233)	(0.230)	(0.223)
Number of children	−0.283	−0.964*	−0.428
	(0.526)	(0.538)	(0.513)
Age-squared/100 of head	2.819***	3.810***	3.766***
	(0.387)	(0.562)	(0.496)
Family health care expenditures	0.161	0.116	0.067
	(0.178)	(0.180)	(0.176)
Household fixed effects	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes
Observations	24,338	24,565	24,895
Households	6,210	6,350	6,577

This table presents the results of difference-in-difference specifications regressing risky asset class allocations on an indicator for retirement of the head of household (defined as the husband in couples), an indicator for the head of household being married, as well as the interaction between the retirement and married indicators. In column 1, the dependent variable is the allocation to stocks. The dependent variable in column 2 is the allocation to equity and private business holdings. Finally, the dependent variable in column 3 is the allocation to equity, private business, and real estate holdings. Standard errors are heteroskedasticity robust and clustered at the household level. Statistically significant at ***1%, **5%, *10%.

results, I consider alternative definitions of the financial portfolio and share of risky assets, following Guiso et al. (1996). In the first column, the financial portfolio is defined as the sum of holdings in stocks, bonds, and cash. The dependent variable w_{risky} is then defined as the share of stocks in the financial portfolio. In the second column, I add households' private business holdings to the financial portfolio, and w_{risky} is then defined as the share of equity and private business holdings in the financial portfolio. Finally, I add the reported value of investment real estate to the financial portfolio and the share of risky assets in the third column.[21] In all specifications, I include controls for households' labor income, net worth, pension income, number of children, the squared-age of the household head (the husband in couple households), and out-of-pocket health care expenditures.[22]

These control variables are motivated by past studies of household portfolio decisions, most notably Campbell (2006). Since all specifications include household fixed effects, I do not control for time-invariant measures such as race and education. The inclusion of out-of-pocket health care expenditures is motivated by Rosen and Wu (2004), who find that those in poor health allocate less to risky assets.[23] In all specifications, reported standard errors are clustered by household, correcting for within-household serial correlation and heteroskedasticity.[24]

Table 3 shows that θ, the estimated difference-in-differences, is consistently negative, with statistical significance at the 1% level in all specifications. Additionally, the coefficient on *Retired*, η, is uniformly estimated as being statistically indistinguishable from 0. Together, these two estimates constitute my main result: controlling for time-invariant household fixed effects, household-invariant time fixed effects, and an array of observable household characteristics, retirement does not have a significant effect on the share of risky assets in single stockholders' portfolios. Couple households' postretirement behavior differs markedly from singles: they decrease their risky asset shares after the husband retires. This difference is economically

[21] I also investigate how accounting for Social Security, IRA, and DC retirement wealth affects the baseline results. See online appendix E for evidence confirming that the baseline results are robust to these sources of measurement error.

[22] For couples, household labor income is defined as the sum of labor income for heads and their spouses each year, scaled by 10,000. Similarly, pension income is defined as the sum of individual pension incomes each year, scaled by 10,000.

[23] In untabulated results, I also consider specifications in which all control variables are interacted with the *Married* and *Retired* indicators, allowing for coefficients to vary between singles and couples as well as the pre- and postretirement periods. I find that the results remain qualitatively unchanged.

[24] As a robustness check, I verify that all results hold when using block bootstrapped standard errors with resampling at the household-level, as suggested by Bertrand, Duflo, and Mullainathan (2004).

large, representing about 8.5% to 10.5% of the financial portfolio.[25]

As an alternative assessment of the economic significance of this baseline result, I calculate the potential total reallocation away from stocks implied by the baby boom generation's transition into retirement. A conservative estimate that baby boomers own 50% of the $20.6 trillion of U.S. corporate equities held by American households implies that boomers' stock holdings total about $10.3 trillion.[26] Further, the HRS summary statistics in table 1 suggest that stockholding couples control about 73.6% of this balance. Then, based on the point estimates in column 1 of table 3, a rough estimate of baby boomers' total reallocations away from stocks is $1.147 trillion.[27] Over a period of two decades, holding all else constant (i.e., disregarding passive reallocations due to changes in financial wealth), this figure represents an average annual outflow from the stock market of about $57 billion.

Finally, though the stock market participation decision may not be driven by risk aversion alone (Vissing-Jorgensen, 2002), I also consider the differential effect of retirement on the within-household participation decision among singles and couples. For brevity, I report the results in appendix table A2. The results in the table provide similar conclusions to those from table 3. Specifically, retirement has virtually no effect on singles' average propensity to invest in stocks. Retired couples, however, exhibit a 4.8% decrease in the propensity to participate in the stock market. Further, this difference in behavior is statistically significant at the 1% level. Taken together, the evidence supports my main conjecture of household bargaining as the mechanism driving time-varying household risk aversion among couples at retirement.

C. *Validation of Identification Strategy*

In addition to the comparison of couples' and singles' household characteristics, I verify that the retirement event is the driver of the results and formally test the parallel trends assumption of the difference-in-differences estimator.[28]

[25] This basic result remains true when I consider subsets of single stockholders (e.g., nonwidows, divorcees, and those never married in the sample) in appendix tables A3 and A4. I also consider the sample restrictions of including only household heads who are married throughout the sample and singles who are never married throughout the sample, as well as restricting the control group to include only males or females. In all cases, the main results hold.

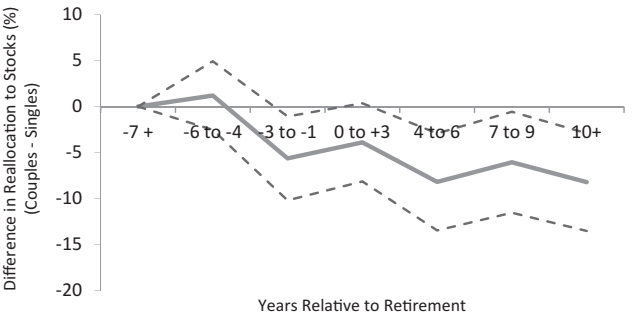
[26] Total U.S. household stockholdings are from table L.101 of the Federal Flow of Funds Accounts release for Q3 2015.

[27] These calculations are based on couples' average stock holdings of $174,976 (= $430,762 × 40.62%) and singles' average stock holdings of $147,069 (= $304,176 × 48.35%). I then weight these averages by the relative number of household-year observations among stock participants in the data (17,064 for couples versus 7,274 for singles). Finally, the total reallocation away from stocks is calculated as follows: $[(-8.433\% + 1.755\%) \div 40.62\% \times 73.6\% + 1.755\% \div 48.35\% \times 26.4\%] \times \$10.3 \text{ trillion} = -\$1.147$ trillion.

[28] In online appendix F, I also conduct a falsification test in which I examine the coefficients of interest obtained by randomly reassigning retirement dates across households over 1,000 trials. The results of this analysis suggest that the assumptions of the difference-in-differences methodology are satisfied. I thank an anonymous referee for suggesting these formal tests.

[29] I repeat the analysis with period lengths of two and four years and find no qualitative difference in results.

FIGURE 1.—FIRST DIFFERENCES BETWEEN SINGLES' AND COUPLES' RISKY ASSET SHARES SURROUNDING RETIREMENT



This figure displays the first difference between couples' and singles' reallocations during each period relative to retirement. The plotted points are the θ_j's, surrounded by ±2 standard error bands, estimated from regression equation (8):

$$w_{risky,i,t} = \alpha_i + \alpha_t + \sum_{j=1}^{6} \left[\theta_j \left(Period_{j,i,t} \times Married_{i,t}\right) + \eta_j \left(Period_{j,i,t}\right)\right] + \delta \left(Married_{i,t}\right) + \Gamma X_{i,t} + \varepsilon_{i,t}.$$

A key assumption in my analysis is that retirement is the driving force behind the difference in singles' and couples' behavior. To validate the retirement event as the driver of the results, I consider the dynamics of the difference between singles' and couples' stock allocations surrounding retirement. I estimate a dynamic form of the within-household difference-in-differences regression:

$$w_{risky,i,t} = \alpha_i + \alpha_t + \sum_{j=1}^{6} \left[\theta_j \left(Period_{j,i,t} \times Married_{i,t}\right) + \eta_j \left(Period_i\right)\right] + \delta \left(Married_{i,t}\right) + \Gamma X_{i,t} + \varepsilon_{i,t}. \quad (8)$$

The difference between this and equation (7) is the replacement of the retirement indicator with a set of six period indicator variables. The period indicators are defined as follows, where τ denotes the time in years relative to retirement (negative [positive] values before [after] retirement): $Period_1 = 1$ if $-6 \leq \tau \leq -4$ and 0 otherwise, $Period_2 = 1$ if $-3 \leq \tau \leq -1$ and 0 otherwise, $Period_3 = 1$ if $0 \leq \tau \leq 3$ and 0 otherwise, $Period_4 = 1$ if $4 \leq \tau \leq 6$ and 0 otherwise, $Period_5 = 1$ if $7 \leq \tau \leq 9$ and 0 otherwise, and $Period_6 = 1$ if $\tau \geq 10$ and 0 otherwise.

The coefficients of interest, each of the θ_j, capture the difference between couples' and singles' allocations during the ith period. Identifying a pattern in the θ_j can inform whether the retirement event is the driver of the main results and, in turn, provide evidence supporting the parallel trends assumption of the difference-in-differences estimator.[29]

For ease of interpretation, I plot the θ_j's with ±2 standard error bands in figure 1. The figure can be interpreted as plotting the first difference between couples' and singles' stock allocations during each period relative to retirement. I

also present the regression estimates in column 1 of appendix table A5. During the period from four to six years prior to retirement, we see a negligible difference between singles and couples. In the two buckets spanning the period from three years pre- to three years postretirement, the difference between singles and couples dips into the negative range slightly, with statistical significance just below the 5% level. The difference drops further, to about −8%, in the period from four to six years after retirement, with statistical significance at the 1% level. This difference remains economically stable and statistically significant as the time since retirement increases to seven years and beyond.[30]

Together, the negligible difference between singles and couples during the period 4+ years before retirement and the steady difference 4+ years after retirement provide evidence that the parallel trends assumption of the difference-in-differences estimator is satisfied.

V. Additional Evidence: Time-Varying Risk Aversion

To establish that the baseline results are driven by a redistribution of bargaining power and an accompanying increase in effective risk aversion among couples, I conduct three additional tests in this section. First, using risk aversion estimates unique to each member of a couple, I test whether the postretirement decrease in stock allocations is strongest for households where the disparity in individual risk aversion estimates is the largest. Second, using heterogeneity in the individual retirement dates of couple household members, I estimate the persistent effects of husbands' and wives' individual retirement events on household stock allocations. If the baseline results are driven by a net increase in risk aversion when the husband retires, then the retirement events of husbands and wives should generate different effects on the risky share of couples' portfolios. Finally, I adopt a measure of intrahousehold bargaining power from the theoretical literature in labor economics to test whether dynamics in couples' risky asset allocations respond to fluctuations in the within-household distribution of bargaining power.

A. *Within-Couple Difference in Risk Aversion*

To further establish evidence of an increase in the effective risk aversion of couple households after retirement, I exploit responses to income-gamble questions answered separately by husbands and wives within a household. Specifically, respondents are asked a series of questions pertaining to whether they would be willing to accept equal-probability gambles that would either increase or decrease their income. Kimball, Sahm, and Shapiro (2008) develop a method for exploiting individuals' repeated responses over multiple survey waves to eliminate measurement error and allow imputation of reliable risk aversion estimates for all respondents.

[30] In online appendix G, I show that wives' financial sophistication drives more rapid rebalancing of couples' portfolios surrounding the retirement of the husband.

TABLE 4.—WITHIN-COUPLE DIFFERENCE IN RISK AVERSION

	Stock Allocation (%)	
	(1)	(2)
Husband retired indicator:	−4.869***	−4.388***
Wife more risk averse	(1.453)	(1.460)
Husband retired indicator:	−2.688	−2.061
Wife equally risk averse	(1.668)	(1.675)
Husband retired indicator:	−1.902	−1.601
Wife less risk averse	(1.466)	(1.472)
±3 Yrs retirement indicator	−0.691	−1.017
	(0.927)	(0.931)
Family labor income		0.509***
		(0.101)
Family net worth		0.107***
		(0.010)
Family pension income		0.434*
		(0.258)
Number of children		1.215
		(0.838)
Age-squared/100 of head		−0.028
		(0.067)
Family health care expenditures		−0.058
		(0.089)
Household fixed effects	Yes	Yes
Time fixed effects	Yes	Yes
Observations	16,896	16,599
Households	2,057	2,057
F-statistic (p-value): Husband retired wife more risk averse versus wife less risk averse	4.86 (0.028)	4.36 (0.037)

This table presents the results of specifications regressing couples' risky asset class allocations on an indicator for retirement of the husband (equal to 1 if the husband has been retired for more than three years at time of observation, and equal to 0 otherwise). This indicator is interacted with indicators for the difference in risk aversion among spouses. The dependent variable is the allocation to stocks in the financial portfolio. Reported below the regression estimates is the F-statistic (p-value) from a test of equality of regression coefficients between the wife more versus less risk averse categories. Standard errors are heteroskedasticity robust and clustered at the household level. Statistically significant at ***1%, **5%, *10%.

Using their risk aversion imputations, I calculate the difference in risk aversion within each couple household as a measure of the strength of the potential change in effective household risk aversion at retirement. If the main results are truly driven by an increase in couples' effective risk aversion levels after retirement, then the magnitude of the effect should be largest among households where husbands and wives have the largest risk aversion differential.

Table 4 presents the results of examining how the decrease in the average stock allocation among couples varies with the within-household risk aversion difference. I sort couple households into three groups on the basis of whether the wife is more, equally, or less risk averse than her retiring husband. I then examine whether couples in which the wife is much more risk averse than her husband choose to reallocate away from stocks to a greater extent after the husband's retirement.

From the table, it is clear that the difference in risk aversion is an important driver of the postretirement decrease in stock holdings among couples. Specifically, the reallocation away from stocks following the husband's retirement is statistically and economically significant only among households where the wife is more risk averse than her husband. In addition, the difference in reallocations between households in which the wife is more versus less risk averse than her husband is highly statistically different, with F-statistics ranging from 4.36 to 4.86 (p-values of 0.028 to 0.037).

This is evidence of an increase in the postretirement effective risk aversion of couple households, consistent with the predictions of the intrahousehold bargaining mechanism.

As a further test of the proposed bargaining mechanism, I evaluate whether the imputed changes in average risk aversion are sufficiently large to account for the observed decreases in risky asset shares. Among the group of spouses in which the wife is more risk averse than her retiring husband, I find that the average difference in risk aversion is about 2.9. To assess whether the estimated average reallocation of 4.4% away from stocks among this group is reasonable, I use the optimal portfolio rule in equation (5). Denoting the change in the allocation to stocks from time t to $t+1$ as $\Delta\alpha_{t+1}$, the following simple formula applies under the assumption that the expected moments of asset returns are time invariant:

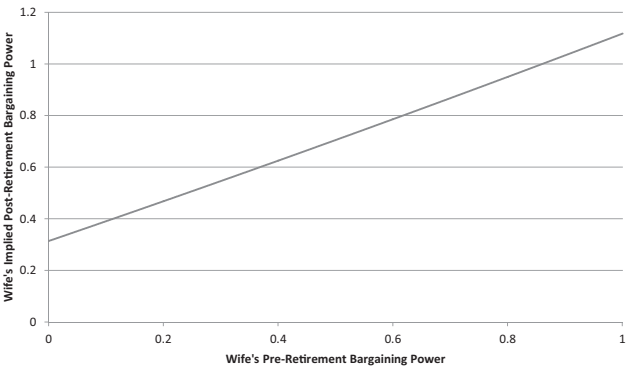
$$\Delta\alpha_{t+1} = \left(\frac{1}{\gamma_{t+2}} - \frac{1}{\gamma_{t+1}}\right)\frac{\bar{r} - r_f + \sigma^2/2}{\sigma^2}, \tag{9}$$

where $\bar{r}$ and σ^2 respectively represent the unconditional mean and variance of the log return on the risky asset. This equation relates the change in the household's optimal risky asset allocation to the change in household-level risk aversion. In turn, the change in household-level risk aversion is determined by the evolution of the distribution of bargaining power between the husband and the wife.

Setting the husband's risk aversion equal to 7.17 (the average among men in the group of interest) and the wife's risk aversion equal to 10.07 (2.9 higher than that of men), I numerically solve for the shift in the wife's bargaining power (ϕ) in retirement as a function of the wife's bargaining power when her husband was working.[31] The solution is the wife's postretirement bargaining power that would generate a 4.4% reallocation away from stocks.

The relationship between the wife's bargaining power before and after her husband's retirement is plotted in figure 2 and appears reasonable. For example, if the wife's bargaining power parameter was 0.30 when her husband was working (i.e., equal to women's average share of nonwage income in the sample), then her bargaining power would have to shift to 0.55 following his retirement in order to justify the observed shift away from stocks. Alternatively, an initial bargaining power of 0.40 for the wife would imply that her postretirement bargaining power would be 0.63. Overall, these results suggest that the differences in risk aversion between husbands and their wives can reasonably account for the observed decreases in risky asset shares following the husband's retirement.

FIGURE 2.—WIFE'S IMPLIED POSTRETIREMENT BARGAINING POWER



This figure displays the relationship between the wife's bargaining power before and after her husband's retirement that can account for the observed decreases in risky asset shares. For each value of the wife's preretirement bargaining power, her implied postretirement bargaining power is the solution to equation (9), with $\Delta\alpha = -0.044$, $\gamma_1 = 7.17$, and $\gamma_2 = 10.07$. I also set the expected annual equity risk premium equal to 6% (e.g., Mehra & Prescott, 1985) and the annual stock market index volatility equal to 19% (e.g., Bansal & Yaron, 2004).

B. Do Husbands' and Wives' Retirement Effects Differ?

To this point, I have focused on the effect of the husband's retirement in couple households. If a large majority of couples coordinate their retirement dates, focusing on the husband's retirement is nearly equivalent to estimating the effect of the simultaneous retirement of both partners in a couple household. However, if there is variation in the distribution of husbands' and their wives' relative retirement dates, then it is possible to disentangle the individual-specific effects of husbands' and wives' retirements on household-level risk aversion. In particular, a testable implication of the proposed intrahousehold bargaining mechanism is that husbands' and wives' retirements should have markedly different effects on risky asset shares. While husbands' retirement events would be associated with an increase in average household-level risk aversion and a decrease in risky asset shares, wives' retirement events would be associated with opposite-signed effects on average household risk aversion and risky asset shares.[32]

I separately estimate the effects of husbands' and wives' retirement events on within-household risky portfolio shares using the respective indicators $Retired_H$ and $Retired_W$, allowing transition periods for both:

$$\begin{aligned} w_{risky,i,t} = {} & \alpha_i + \alpha_t + \theta_W\left(Retired_{W,i,t}\right) + \theta_H\left(Retired_{H,i,t}\right) \\ & + \nu_W\left(\pm 3 yrsRetirement_{W,i,t}\right) \\ & + \nu_H\left(\pm 3 yrsRetirement_{H,i,t}\right) + \Gamma X_{i,t} + \varepsilon_{i,t}. \end{aligned} \tag{10}$$

Given the predictions of the proposed intrahousehold bargaining mechanism, I am interested in testing whether the difference between the estimated θ_W and θ_H coefficients is statistically significant.

Column 1 of table 5 presents the results of estimating equation (10). The husband's retirement continues to be associated with a statistically significant reallocation away

[31] As in online appendix D, I set the expected annual equity risk premium equal to 6% (e.g., Mehra & Prescott, 1985) and the annual stock market index volatility equal to 19% (e.g., Bansal & Yaron, 2004).

[32] Though couples generally retire together, a significant minority retire at different times. Figure A2 in the online appendix displays the kernel density of the difference in spouses' retirement dates.

TABLE 5.—DO HUSBANDS' AND WIVES' RETIREMENT EFFECTS DIFFER?

	Stock Allocation (%)	
	Unconditional Effects	Conditional on Relative Earnings
	(1)	(2)
Wife retired indicator	−0.110	
	(1.265)	
Wife retired indicator:		2.348
Wife's relative earnings: top tercile		(2.052)
Husband retired indicator:		−0.144
Wife's relative earnings: middle tercile		(1.345)
Wife retired indicator:		−2.076
Wife's relative earnings: bottom tercile		(1.771)
Husband retired indicator	−5.094***	−4.709***
	(1.145)	(1.163)
Wife ±3 yrs retirement indicator	−0.775	−0.867
	(0.966)	(0.969)
Husband ±3 yrs retirement indicator	−2.524***	−2.300***
	(0.853)	(0.860)
Family labor income	0.408***	0.399***
	(0.093)	(0.093)
Family net worth	0.031***	0.031***
	(0.008)	(0.008)
Family pension income	−0.003	−0.003
	(0.235)	(0.235)
Number of children	0.366	0.362
	(0.574)	(0.574)
Age-squared/100 of head	2.585*	2.589*
	(1.468)	(1.468)
Family health care expenditures	0.060	0.063
	(0.205)	(0.205)
Household fixed effects	Yes	Yes
Time fixed effects	Yes	Yes
Observations	17,194	17,194
Households	4,334	4,334
F-statistic (p-value): H. retired = W. retired	7.07	
	(0.008)	
F-statistic (p-value): H. retired = W. retired—		8.94
wife's relative earnings: top tercile		(0.003)
F-statistic (p-value): H. retired = W. retired—		5.45
wife's relative earnings: middle tercile		(0.020)
F-statistic (p-value): H. retired = W. retired—		1.29
wife's relative earnings: bottom tercile		(0.256)
F-statistic (p-value): W. retired = W. retired—		3.96
top versus bottom tercile		(0.047)

This table presents the results of specifications regressing couples' stock allocations on indicators for the respective retirements of the husband and wife (equal to 1 if the husband (wife) has been retired for more than three years at time of observation and equal to 0 otherwise). Reported below the regression estimates are F-statistics (p-values) from tests of equality of regression coefficients between retirement indicators. Standard errors are heteroskedasticity robust and clustered at the household level. Statistically significant at ***1%, **5%, *10%.

from stocks. In contrast, the wife's retirement has a statistically insignificant effect on couple households' relative postretirement stock allocations. Importantly, the effects of the spouses' retirement events are very different statistically, with an F-statistic of 7.07 and associated p-value of less than 1%.[33]

To push the implications of the bargaining mechanism further, I condition the effects of wives' retirement events on the importance of their labor income within the household before retirement. Standard household bargaining theory links higher shares of income to higher bargaining power (e.g., Manser & Brown, 1980; McElroy & Horney, 1981). This suggests that the postretirement drop in bargaining power will be larger among wives whose preretirement income was a larger component of overall household income. To test this hypothesis, I sort couples into terciles based on the importance of the wife's annual labor income before retirement relative to her husband's. I then examine whether couples in which the wife was the dominant earner reallocate differently after the wife's retirement than couples in which the husband was the dominant earner.

Column 2 of table 5 presents the results of this analysis. From the estimates, we can see that among couple households where the wife earned more than her husband before retirement, the persistent effect of her retirement on the household's risky share has a larger magnitude, of about 2.3%, than the baseline effect in column 1. There is also a monotonic pattern across relative earnings groups. The F-statistics and associated p-values at the bottom of the table show that the effect of the husband's retirement is statistically different from the wife's retirement in the top and middle terciles (i.e., when the wife's earnings exceed or are approximately equal to her husband's). This difference is no longer significant when considering wives whose retirement did not have a large impact on total household labor income. More important, the difference between the effect of the wife's retirement when the wife versus the husband is the dominant earner is statistically significant at the 5% level, with an F-statistic of 3.96.[34] Taken together, these results provide further evidence favoring the bargaining mechanism as a driver of time-varying household risk aversion.

C. *Nonwage Income Shares and Stock Allocations*

In the next test of household bargaining as a driver of time-varying household risk aversion, I adopt a measure of intrahousehold bargaining power from the labor economics literature and relate it to fluctuations in households' risky asset allocations. The standard measure of intrahousehold bargaining power in the labor literature is each individual's share of total nonwage income in the household.[35]

Nonwage income is thought to be invariant to marital status, whereas labor income can vary significantly when spouses split up. Hence, partners' nonwage income is thought to vary directly with their utility outside marriage,

[33] In online appendix H, I find a similar effect associated with spousal death. Specifically, widowers (widows) tend to increase (decrease) the share of stocks in the financial portfolio following the death of their spouse.

[34] I find a similar pattern when examining the effect of the husband's retirement among couples where the wife was a homemaker. Specifically, couples where the wife was a homemaker reallocate about 3.2% more of their financial portfolios away from stocks after the husband's retirement than other couples. See online appendix H for details and related discussion.

[35] A large literature in labor economics analyzes and documents the effect of household bargaining on real economic decisions. Manser and Brown (1980) and McElroy and Horney (1981) pioneer the Nash-bargaining approach to household decision making in couple households, showing that nonwage income shares determine intrahousehold bargaining power. See, for example, Browning et al. (1994), Lundberg and Pollak (1996), Lundberg et al. (1997), Duflo (2003), Mazzocco (2007), and Ashraf (2009) for empirical evidence.

TABLE 6.—HOUSEHOLD STOCK ALLOCATIONS AND WIVES' NONWAGE INCOME SHARES

	Stock Allocation (%)				
	Total Nonwage Income			Social Security Income	Pension Income
	Unconditional	Preretirement	Postretirement		
	(1)	(2)	(3)	(4)	(5)
Wife's income share	−4.224***	−10.066*	−4.285**	−6.102***	−3.369**
	(1.573)	(5.853)	(1.813)	(1.760)	(1.705)
Family labor income	0.395**	−0.059	0.379*	0.243	0.228
	(0.158)	(0.470)	(0.201)	(0.188)	(0.180)
Family net worth	0.059***	0.032	0.063***	0.063***	0.064***
	(0.012)	(0.058)	(0.013)	(0.013)	(0.013)
Family pension income	0.396	−2.539	0.555*	0.530*	0.017
	(0.312)	(1.866)	(0.318)	(0.318)	(0.381)
Number of children	−0.001	8.426**	−0.303	−0.154	0.308
	(0.688)	(3.859)	(0.715)	(0.744)	(0.624)
Age-squared/100 of head	2.355***	−0.274	3.080***	2.779***	−2.125
	(0.790)	(0.442)	(0.871)	(1.061)	(2.653)
Family health care expenditures	0.171	−0.969	0.221	0.192	0.369
	(0.235)	(1.304)	(0.247)	(0.247)	(0.261)
Household fixed effects	Yes	Yes	Yes	Yes	Yes
Time fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	13,462	969	12,493	12,025	12,851
Households	4,315	587	4,087	3,826	4,346

This table presents the results of specifications regressing couples' stock allocations on the wife's share of income. Income shares are alternately calculated using total nonwage income (column 1–3), social security income (column 4), and pension income (column 5). Standard errors are heteroskedasticity robust and clustered at the household level. Statistically significant at ***1%, **5%, *10%.

and therefore their share of nonwage income with their bargaining power inside marriage (Manser & Brown, 1980; McElroy & Horney, 1981). For each couple in which either the husband or wife has positive nonwage income, I calculate the following measure of intrahousehold bargaining power:

$$WifeNonwageShare = \frac{WifeNonwageIncome}{HusbandNonwageIncome + WifeNonwageIncome}. \quad (11)$$

Using this measure, I estimate within-household regressions of the following form:

$$w_{risky,i,t} = \alpha_i + \alpha_t + \rho WifeNonwageShare_{i,t} + \Gamma X_{i,t} + \varepsilon_{i,t}. \quad (12)$$

If intrahousehold bargaining can explain changes in the time series of couples' risky portfolio shares, then the household portfolio's risky share should covary negatively with the wife's share of nonwage income, and ρ should take a negative value.

Table 6 presents the results of regressing couple households' risky portfolio shares on the wife's share of nonwage income over time. In columns 1 to 3, the nonwage income share is calculated using all sources of government transfer income available in the data.[36] Since most nonwage income for couples in the data comes from social security retirement income, in column 4, I calculate the wife's nonwage income share using only social security retirement income. In column 5, I use a source of nonwage income other than government transfers by focusing on retired couples with positive pension income to calculate nonwage income shares. This measure can serve to reduce potential measurement error, since retirement is a period during which each partner's nonwage pension income represents a larger proportion of his or her total income.

The estimates in table 6 show strong statistical evidence in favor of intrahousehold bargaining as a driver of within-household risky asset shares. Specifically, the estimate from the unconditional sample in column 1 indicates that a complete shift in intrahousehold bargaining power from the husband to the wife would result in a statistically significant decrease in the household's share of risky assets of about 4.2%. Further, in subsamples of households where the husband is still working versus retired (columns 2 and 3), estimates of ρ are statistically significantly negative at the 10% and 1% levels, respectively.[37] In columns 4 and 5, I focus on retired couples drawing social security and pension income. In both cases, I find that estimates of ρ are statistically significant and range from −3.4% to −6.1%. Overall, the estimates in table 6 lend further support to the proposed

[36] Specifically, I calculate nonwage income as the sum of supplemental security income (SSI), social security disability income (SSDI), social security retirement income, unemployment and worker's compensation income, and other government transfer income.

[37] Most measures of nonwage income in the HRS are from sources accruing primarily to retirees, making it difficult to test the effect of nonwage income on portfolio allocations among preretirees. Despite this limitation, the results in column 2 demonstrate such a relationship. Supporting this conclusion, Addoum et al. (2015) find a strong negative relationship between wives' nonwage income shares and households' risky asset allocations using data on preretirees in the PSID.

mechanism of household bargaining as an important driver of time-varying household risk aversion.

VI. Robustness Tests: Alternative Channels

Portfolio choice theory broadly asserts that heterogeneity in asset allocation decisions must be driven by heterogeneity in preference parameters, heterogeneity in circumstances, or a combination of these factors (Brandt, 2009; Curcuru et al., 2009). To this point, I have presented evidence supporting the preference parameter channel as the driver of the time variation in couples' risky asset allocation decisions after retirement. In this section, I consider alternative channels that could motivate retiring couples to actively reallocate away from stocks. In particular, I consider the effects of background risks such as health risk and consumption risk as alternative explanations of the baseline results. I also consider the differential effects of having children, the age of retirement, entrepreneurial status, cognitive ability, the time period of the retirement event, and the wife's life expectancy. For brevity of exposition, I present and discuss the effects of these characteristics in detail in online appendix I. Here, I briefly note that none of these characteristics is able to explain the cross-sectional heterogeneity of couples' postretirement stock reallocations.

VII. Summary and Conclusion

Drawing on intuition from models of collective decision making in labor and development economics, I provide theoretical motivation and empirical evidence of a mechanism through which risk aversion can vary at the household level even when the risk aversion of individuals is time invariant. My conjecture is that if wives are more risk averse than their husbands on average, then an observable shift in the degree of control over household resources toward the wife should be accompanied by an implicit increase in household risk aversion. Further, this increase in household risk aversion should lead to an observable shift in the household financial portfolio away from stocks.

To test this conjecture, I examine the portfolio choices of households as they transition into retirement. To address potential bias in estimating the impact of time-varying risk aversion on observed asset allocations, I use singles as a natural control group in which the retirement transition should have no effect on risk aversion. Using a differences-in-differences approach controlling for household fixed effects and time-varying household characteristics, I find that couples significantly decrease their stock allocations after retirement, while singles maintain a relatively constant allocation to stocks. This difference in behavior is economically significant, representing about 8% of total financial assets and 20% of average stock holdings. With respect to the large demographic shift that will occur with the retirement of the baby boom generation, my results suggest that a rough estimate of baby boomers' total reallocations away from stocks is $1.147 trillion. Over a period of two decades, holding all else constant (i.e., disregarding passive reallocations due to changes in financial wealth), this figure represents an average annual outflow from the stock market of about $57 billion.

I further argue that these effects are driven by an increase in couples' household-level risk aversion by conducting several additional tests. First, using risk-aversion estimates unique to each member of a couple, I show that the decrease in risky allocations is strongest for couples where the wife is more risk averse than the husband. Second, using heterogeneity in the individual retirement dates of couple household members, I show that the retirement events of husbands and wives generate persistent opposite-signed effects on the risky share of couples' portfolios. Third, I find similar opposite-signed effect associated with husbands' and wives' death events. Surviving husbands tend to increase their stock allocations, whereas surviving wives tend to exhibit decreases in the risky share of their portfolios. Fourth, I show that during both the pre- and postretirement periods, couples' risky asset allocations exhibit a negative relationship with a time-varying measure of wives' intrahousehold bargaining power.

While a growing number of studies explain stock market returns using time-varying aggregate risk aversion, there is relatively little support for time variation in risk aversion at the microlevel. The findings in this paper suggest that dynamics in the distribution of intrahousehold bargaining power can generate time-varying risk aversion at the household level.

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