Among Retirees, What is the Relationship Between Asset Allocation of Financial Assets and Retirement Satisfaction Among Retirees?

by

Douglas A. Brown
Texas Tech University

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Abstract

This study investigates the relationship between financial asset allocation, focusing on equity ownership as a percentage of non-housing wealth, and retirement satisfaction among retired Americans. The research utilized Wave 15 of the Health and Retirement Study (HRS) and was grounded in Modern Portfolio Theory (MPT). The analysis explores how varying equity allocations influence self-reported retirement satisfaction among 4,248 retirees. Three models were estimated: ordered logistic regressions using binary (>50%) and categorical stock allocation thresholds, and a generalized ordered logit model treating stock allocation as a continuous, quadratic predictor.

The results demonstrate a statistically significant nonlinear association between stock ownership and retirement satisfaction. Retirees with 25% to 75% of their non-housing wealth in equities reported higher satisfaction, with diminishing marginal gains at the upper levels. The results confirmed the hypothesis that retirees with greater than 50% of their financial portfolio in equities experienced higher retirement satisfaction. The optimal stock allocation was estimated at approximately 52% to avoid low satisfaction. Marginal effect analysis confirmed that moderate equity allocations substantially increase the likelihood of reporting "very satisfied" with retirement.

The findings highlight the importance of strategic asset allocation in enhancing retirement satisfaction. Consistent with many retirement asset allocation models, moderate stock ownership seems to boost satisfaction, aligning with the efficient frontier in MPT. These insights provide valuable implications for financial planners and policymakers aiming to promote retirement satisfaction through informed investment guidance and educational initiative.

Introduction

A record-breaking 11,400 Americans are turning 65 each day in 2025, marking a significant retirement milestone in the United States (Lee, 2024). This trend is expected to continue through 2027, with 4.1 million Americans retiring annually (Fichtner, 2018). Retirement is supposed to be your golden years, during which you can do whatever you want. However, fewer than half of retired Americans between the ages of 62 and 75 report being very satisfied with life in retirement (Ermey, 2024). As many Americans retire, a substantial number feel financially unprepared for retirement, making this research particularly timely (Scott, 2024). Many Americans are not saving enough for retirement (Copeland, 2024). By 2022, nearly 50% of households with a worker aged 55 or older had no retirement savings, while 32% lacked both retirement savings and a defined benefit plan (GOA, n.d.).The Employee Benefit Research Institute (EBRI) reports that nearly 40% of U.S. households are at risk of depleting their funds during retirement (Copeland, 2024). The Social Security Administration (SSA) estimates that benefits account for approximately 40% of pre-retirement income for an average worker (Reno, 2016). However, for two out of three seniors who receive it, Social Security constitutes more than half of their total income (Reno, 2016). Retirement has become more complex as traditional pension plans, which guaranteed income during retirement, have largely been substituted with 401(k)-style plans that shift the responsibility of saving and investing to individuals. (Bond & Doonan, 2020). Pension income, savings, and Social Security have historically been referred to as the three legs of retirement planning, but now only 17% of private-sector workers have a pension (Bond & Doonan, 2020).

Another issue in retirement is the increasing cost of health care, despite expenses remaining stable for the first time in a decade in 2023 (Fidelity Investments, 2023). Americans

frequently misestimate their health care costs in retirement. From a 2022 survey, Fidelity Investments (2023) found that couple's anticipate their health care costs will only be $41,000 post-retirement, a stark contrast to Fidelity's projections of $157,500 for an average 65-year-old and $315,000 for a retiring couple. These challenges make retirement savings and asset allocation even more important for retirees today. Gaining a better understanding of the relationship between asset allocation and retirement satisfaction among retirees will help us learn how to improve retirement for Americans.

Research Question

This study aimed to answer this research question:

Among retirees, what is the relationship between asset allocation of financial assets and retirement satisfaction?

This research offers a deeper understanding of the relationship between financial asset allocation and retirement satisfaction by examining this association. This research will focus on equity allocation percentage relative to other financial investment options.

Literature Review

Research indicates that retirement satisfaction is low in the United States. The relationship between financial asset allocation and retirement satisfaction is a crucial area of study due to its potential broad impact on retirees, who represent a growing demographic. The of this literature examines current research on how asset allocation influences retirement satisfaction and related measures.

Asset Allocation and Financial Security in Retirement

Most financial planning professionals recommend diversified retirement portfolios that distribute your investments across various asset classes to reduce risk and enhance potential

returns (Koumou, 2020). A combination of stocks and bonds can help you withstand market fluctuations more effectively and stabilize your financial future (Ilmanen, 2003). Traditionally, the negative correlation between stocks and bonds has been one of the attractions of including them both in a retirement portfolio (Ilmanen, 2003). This inverse relationship has supported diversified investment portfolios, as gains in one asset class can offset losses in another, reducing the portfolio's overall risk. Research by Portelli and Roncalli (2024) suggests a positive correlation between stocks and bonds in the U.S. stock market before 2001, a negative correlation until 2022, and a positive correlation since August 2022. To achieve appropriate asset allocation, a common recommendation is to subtract your age from 100 to determine your asset allocation. (O'Connell, 2024). For example, a 65-year-old would allocate 65% of their retirement assets to bonds, money markets, and cash, while 35% would be designated for equities (O'Connell, 2024). With longer life spans, another common formula uses 120 as the baseline (Kilroy, 2022). According to this method, a 65-year-old would allocate 55% to equities and 45% to bonds (Kilroy, 2022). With increasing life spans, O'Connell (2024) believes a 70/25/5 retirement strategy may be better for younger, more financially stable retirees. This more aggressive portfolio allocates 70% of your portfolio to stocks, 25% to low-risk investments like short-term bonds or money market funds, and 5% to cash for retirement distribution (O'Connell, 2024). Like the above examples, most financial planners suggest that retirement portfolios should hold between 25% and 50% in bonds, with the remainder primarily in equities. This suggestion is based on the model Bengen (1994) used to establish the 4% rule. By utilizing a bond/equity mix of 25% to 50%, Bengen (1994) determined that withdrawing 4% of assets would allow a portfolio to provide a continuous income throughout retirement. This approach aligns with Modern Portfolio Theory (MPT), which highlights a diversified portfolio that

maximizes returns for a given level of risk (Markowitz, 1952). This approach of utilizing a well-balanced mix of equities and bonds can enhance long-term financial stability while optimizing risk-adjusted returns retirement in line with Markowitz's theory.

Financial Security and Retirement Satisfaction

Financial security has a significant impact on retirement satisfaction (Hershey et al., 2010). The authors found that a sense of financial security relates to how individuals perceive the adequacy of their retirement savings. Those who believe they have saved sufficiently often report higher levels of retirement satisfaction (Hershey et al., 2010). Lim et al. (2025) found that those with higher net worth reported better life satisfaction than those with lower net worth. The analysis shows that increased financial resources enhance a sense of security and well-being among older adults, emphasizing the significance of financial stability in improving life satisfaction in later years (Lim et al., 2025). Amorim and França (2019) also found that financial circumstances had a significant impact on retirement satisfaction. According to 2022 data from the Employee Benefits Research Institute, one key factor that drives happiness among retirees is guaranteed income (Employee Benefit Research Institute, 2022). Pensions significantly contribute to guaranteed income in the public sector (Ermey, 2024). A recent CNBC article suggested utilizing annuities, dividend income, and real estate to generate income for retirees without pensions (Ermey, 2024). Adjusting asset allocation to achieve a desired return in retirement while maintaining an acceptable level of risk is consistent with the principles of MPT (Markowitz, 1952).

Impact of Conservative vs Aggressive Portfolios on Long-Term Financial Security

(Ameriks et al. (2003) found individuals who maintain excessively conservative portfolios overlook potential growth opportunities, hindering their overall wealth accumulation.

They theorize that such decisions frequently stem from inadequate financial planning or a fear of losses, which can adversely affect financial well-being, preventing them from achieving their desired wealth goals over time. On the other hand, overly aggressive portfolios can put individuals at considerable risk, possibly resulting in severe financial consequences during market declines (Ameriks et al., 2003). Without sufficient planning skills and measures to curb behavioral influences, these individuals may find it challenging to manage those risks effectively, which can negatively impact their financial stability (Ameriks et al., 2003). Studies show that retirees who take a balanced approach to asset allocation are more likely to attain financial security and lessen the stress linked with depleting their resources (Munnell et al., 2012). A key tenet of MPT is the efficient frontier, which is the collection of assets that allows you to maximize your return for the level of risk you are willing to take (Markowitz, 1952).

Behavioral Aspects of Retirement Planning

The MPT assumes that people exhibit rational behavior, but real-world investment decisions are influenced by behavioral finance and psychological biases (Ando & Modigliani, 1963). Behavioral finance studies how psychological factors affect the financial behaviors and decision-making processes of individuals, groups, and organizations (Ricciardi & Simon, 2000). In contrast to traditional finance, which presumes investors act rationally based solely on available information, behavioral finance recognizes that emotions, cognitive biases, and social factors can lead to irrational actions and consistent judgment errors (Ricciardi & Simon, 2000). Research in behavioral finance shows how cognitive biases lead to suboptimal asset allocation, affecting retirement outcomes (Benartz & Thaler, 2001). One behavioral concern when investing for retirement is the overuse of shortcuts or heuristics to make judgments and decisions quickly

while utilizing limited cognitive resources (Simon, 1956; Tversky & Kahneman, 1974). One example is “the stock market is too risky; I only invest in CDs.”

Loss aversion, another concept from behavioral economics that influences investment decisions, refers to people's tendency to prioritize avoiding losses over obtaining equivalent gains. (Kahneman & Tversky, 1979). In other words, the discomfort of losing something is psychologically more impactful than the pleasure of gaining something of equal value. Another concept in behavioral economics that can affect asset allocation is overconfidence (Kahneman & Tversky, 1979) . Overconfidence is the inclination of individuals to overrate their knowledge, skills, or the precision of their forecasts. This bias may lead to flawed decision-making, including underestimating risks or overestimating one's influence on events. (Kahneman & Tversky, 1979). Framing effects, a critical aspect of prospect theory, demonstrate that how information is presented can impact people's decisions more than the content itself. (Tversky & Kahneman, 1981). Identical choices can result in varying decisions based on whether framed as gains or losses. (Tversky & Kahneman, 1981). The above examples illustrate how behavioral economics can cause investors to deviate from MPT and act irrationally.

Impact of Asset Allocation on Financial Performance

The impact of asset allocation and financial return is a debatable topic. Research by Brinson et al. (1986) suggested that asset allocation could explain approximately 93.6 percent of a portfolio's return variation. Ibbotson (2009) emphasizes that while asset allocation is crucial for performance, its impact is often overstated. Ibbotson (2009) suggested that much of the return variation in the Brinson et al. (1986) research is attributed to overall market movements rather than specific asset allocation decisions. Ibbotson (2009) argues that the real impact of a fund’s

asset allocation is more modest, representing around half or less of the variations in returns, depending on market conditions. Further research by Ibbotson and Kaplan (2000) suggests that only about 40 percent of the variation in returns among funds is explained by asset allocation, while Vardharaj and Fabozzi (2007) findings say 33 percent to 75 percent of the variance in fund returns can be attributed to differences in asset allocation. The choice between high-cost and low-cost assets in a retirement portfolio can affect the net returns (Sharpe, 1991). The way investments are structured in tax-advantaged accounts (like Roth IRAs and 401(k)s) versus taxable accounts affects after-tax returns (Dammon et al., 2004). To avoid overconcentration in high-risk assets, regularly rebalancing a portfolio helps ensure that risk levels stay aligned with long-term financial goals. (Arnott & Bernstein, 2002). Data from (Pfau, 2013) indicate that increased equity exposure in early retirement can improve portfolio longevity, while a gradual transition to bonds lessens volatility and safeguards against market fluctuations downturns. Asset allocation clearly plays a role in returns, but there are other factors that influence performance.

Other Factors Affecting Retirement Satisfaction

Several factors influence retirement satisfaction. Davis (2007) found that having a robust social support system, financial satisfaction, and personal goals and activities all contribute to higher levels of satisfaction. A recent study examining life satisfaction among individuals aged 50 and older found that being partially or completely retired, having strong social support from spouses, partners, and friends, and possessing financial resources were positively associated with life satisfaction (Lim et al., 2025). Overall retirement satisfaction has been shown to strongly correlate with health status and net worth (Poterba et al., 2011). The authors discovered that a one percent decline in health status was linked to an $18,744 decrease in net worth (Poterba et al., 2011). They also found that physical health was a contributing factor to retirement

satisfaction; in fact, it was the most significant factor in their study. Research by van Rooij et al. (2011) demonstrated that financial literacy plays a crucial role in retirement planning and security. Low financial literacy can result in inadequate retirement preparedness (van Rooij et al., 2011). Their data shows that individuals with limited financial knowledge, especially women and the elderly, might shy away from investing in the stock market, which can limit their wealth accumulation (van Rooij et al., 2011). Dorfman (1989) found that planning for retirement, reading about it, and exposure to radio or television programs related to retirement were significant factors influencing retirement satisfaction for both genders. The same study found that planning for retirement was the second strongest predictor of retirement satisfaction for men, after health (Dorfman, 1989). Data from Hershey et al. (2010)found that retirees with clear retirement goals tend to plan better and feel more secure about their financial situation, which positively contributes to their overall satisfaction in retirement. Ameriks et al. (2003) found a strong positive correlation between planning and net worth and gross financial assets, which correlates with retirement satisfaction. This research will utilize various factors identified as contributing to retirement satisfaction as control variables.

Theoretical Framework

This research utilizes Modern Portfolio Theory (MPT) developed by Markowitz in 1952 to investigate the relationship between asset allocation and retirement satisfaction (Markowitz, 1952). One of the key concepts of MPT is diversification with negatively correlated assets that allow you to maximize your return while minimizing your risk. This study investigates how a portfolio with a higher allocation toward equities and a lower allocation toward bonds aligns with MPT principles and influences retirement incomes.

MPT indicates that equities, which come with increased risk, should provide greater potential returns in the long term compared to bonds, positioning them as a vital component in a retirement portfolio (Markowitz, 1952). The primary reasons retirees need to look for ways to increase their expected returns is because of increasing lifespans and longer retirements (OECD, 2019). These longer retirements put retirees at risk of outliving their savings. Historically, equities have been the primary driver of capital growth in a retirement portfolio (Siegel, 2002). A portfolio with increased equity exposure can help sustain income by taking advantage of market growth. According to MPT, bonds offer stability and lower volatility, but excessive exposure to fixed-income investments may limit long-term returns, potentially resulting in insufficient funds during retirement. Ameriks et al. (2003) found that an equity-heavy portfolio can enhance portfolio longevity, minimizing the risk of prematurely depleting retirement assets. MPT demonstrates that an efficient portfolio balances risk and return through diversification. Longer retirement periods would suggest the need and demand for more significant returns.

The second reason for suggesting that retirees take on more risk in retirement is to achieve greater returns. The efficient frontier outlined in (MPT) illustrates how accepting more risk can lead to higher returns across the efficient frontier curve. Pearson and Guillemette (2023) found that increases in retirees' risk ratio positively associated with their retirement satisfaction. They theorized that this satisfaction stemmed from holding riskier assets, which led to larger returns.

The goal of this research is to determine the ideal allocation of stocks and bonds to maximize retirement satisfaction. The third and final reason that MPT may support retirees holding more equities to increase retirement satisfaction is based on the idea that equities become less risky over longer holding periods (Estrada, 2013). Retirement is on average a long period of

time, lasting 18 years for males and 22 years for females (OECD, 2019). MPT is designed for investors to achieve the highest return for the given level of risk they are willing to accept (Markowitz, 1952). Estrada's (2013) data clearly demonstrates that stocks are riskier than bonds over short periods of time, one to five years. His research also documents that in investment periods longer than ten years, stocks become less risky than bonds. While MPT did not include the length of holding periods in the standard deviation analysis used for the efficient frontier, Esrada's evidence of reduced risk over time cannot be overlooked. Having a longer time horizon may enable retirees to achieve greater returns with less risk.

MPT outlines the significance of asset allocation by constructing portfolios that seek to maximize expected returns while minimizing risks. A retirement portfolio with a higher equity allocation is consistent with these principles, allowing retirees to attain greater long-term returns, increased income, and sustained financial stability throughout lengthier retirements, thereby improving overall retirement satisfaction. By exploring the relationship between asset allocation and retirement satisfaction through the lens of MPT, this study enhances the understanding of how investment decisions affect retirement satisfaction.

The hypothesis for this research is as follows:

H1: Retirees with greater than 50% of their non-housing financial portfolio in equities experience higher retirement satisfaction.

Methodology

Data Sources

This study used secondary data from the Health and Retirement Study (HRS) Rand files. The HRS (Health and Retirement Study) is sponsored by the National Institute on Aging (grant numbers NIA U01AG009740 and NIA R01AG073289) and is conducted by the University of

Michigan. The data was generated using the RAND HRS Longitudinal File 2020 (V2). This longitudinal dataset spans from 1992 to 2020, but this research focuses on Wave Fifteen, which only uses data collected in 2020 and released in May 2024. HRS compiles detailed information on various participant attributes, including demographic, socioeconomic, social, psychological, economic, employment, and health factors. It also gathers in-depth information regarding retirement, which includes assessments of retirement satisfaction. Data collection was conducted through telephone or face-to-face interviews, employing proxy interviews when participants were unavailable (RAND HRS Longitudinal File 2020 (V2), 2024).

The RAND data file originally included 42,405 participants from 1992 to 2020. This research focused on participants' retirement satisfaction response from 2020, which reduced the observations by 34,762 to 7,643 (RAND HRS Longitudinal File 2020 (V2), 2024). Only participants with a positive stock position in the (h15astck) variable were included. This eliminated one observation, leaving the study with 7,642 observations. Two participants listed their education as “other” with no further details, so they were dropped, bringing the observation count to 7,640. The data was further refined to include only household-level data. “HwPICKHH=1” was used in the regressions to select all individuals in single-respondent households and just the financial respondent in couples, eliminating duplicate responses from the same households. This process eliminated 881 observations. This study utilizes the percentage of non-housing wealth that is invested in equities as an independent variable. There were 1,799 observations with zero non-housing wealth; these were also eliminated in order to calculate the percentage of non-housing wealth in equities. There were 46 control variables with missing observations: income was missing 22 observations, health status was missing 6 observations, marital status was missing 10 observations, and race was missing 6 observations, which were

also eliminated from the study. The final sample consisted of 4,248 observations (RAND HRS Longitudinal File 2020 (V2), 2024).

Table of Variables

Table 1:

Variable Specifications and Coding Plan

Role in the Regression Models	Name of Construct	Dataset Variable Name/Number	Questions in the Surveys	Possible Answers in the Surveys	Coding Plan
Dependent Variable	Retirement Satisfaction	r15retsat	All in all, would you say that your retirement has turned out to be very satisfying, moderately satisfying, or not at all satisfying?	1. Very 2. Moderately 3. Not at all	Reverse code
Independent Variables	Net value of stocks, mutual funds, and investment trusts	h15astck	(Aside from anything you have already told me about. . .) do you (or your (husband/wife/partner)) have any shares of stock or stock mutual funds?	Reported or imputed dollar net value of stocks and mutual funds	Amounts are converted to % of non-housing assets using h15astck_perc = h15astck/total_nh_wealth
	Non-housing wealth stock allocation >50%	high_stock	Generated variable using h15stck and total_nh_wealth to establish percentage of non-housing wealth in equities, and then limiting that to observations that were >50%		gen high_stock =(h15astck_perc > 0.5)
	Non-housing wealth stock allocation in four groups 0-25%, 25.01% - 50%, 50.01% - 75%, and 75.01% - 100%	stock_cat	Generated variable using h15stck and total_nh_wealth to establish percentage of non-housing wealth in equities. Then observations are put into 4 allocation groups 0-25%, 25.01% - 50%, 50.01% - 75%, and 75.01% - 100%.		g stock_cat = 1 if h15astck_perc<=0.25 replace stock_cat = 2 if h15astck_perc

					<= 0.5 & mi(stock_cat) replace stock_cat = 3 if h15astck_perc <= 0.75 & mi(stock_cat) replace stock_cat = 4 if mi(stock_cat)
	Non-housing wealth stock allocation %	h15astck_perc	Generated variable using h15stck and total_nh_wealth to establish the percentage of non-housing wealth in equities		g h15astck_perc = h15astck/total_nh_wealth
Control Variables	Age	r15agey_b	Age at the beginning of the interview, calculated from the Respondent birth date and beginning interview date.	Age in years (RwAGEY_B) is the integer portion of the number of months old divided by 12.	Generate age_categ 1 <=64 2 > 64 & <= 79 3 >80
	Gender	ragender	Gender is taken from the Tracker file.	1. Male 2. Female	Keep original coding
	Race	raracem	Race is assigned by looking at reports from Tracker and all waves of data.	1. White/Caucasian 2. Black/African American 3. Other	Keep original coding
	Education	raedegrm	The highest degree is assigned by looking at reports from Tracker and all waves of data.	0. No degree 1. GED 2. HS 3. HS/GED 4. AA/Lt BA 5. BS	Generate educ_group 1. No degree, ged, or hs/ged" 2. AA/Lt BA 3. BS

				6. MA/MBA 7. Law/MD/PhD 8. Other	4. MA/MBA & 4. Law/MD/PhD Drop if other
	Self-report of health	r15shlt	Rate general health status?	1. Excellent 2. Very good 3. Good 4. Fair 5. Poor	Keeping original coding
	Marital status	r15mstat	Marital status	1. Married 2. Married, spouse absent 3. Partnered 4. Separated 5. Divorced 6. Separated/divorced 7. Widowed 8. Never married	Keep original coding,
	Homeownership	h15atoth	The net value of housing HwATOTH is calculated as the value of the primary residence less mortgages and other home loans	Equity dollar value	Coded to label as homeowner if they were not missing a value or value greater than 0. homeowner = h15atoth >0 & !mi(h15atoth)
	Net worth – total non-housing wealth	hin_wealth	The net value of total wealth HwATOTB is calculated as the sum of all wealth components less all debt and less non-housing wealth	Dollar Value	This was a created variable. h15atotb minus total_nh_wealth = netwealth_minus_nhwealth.

					Hyperbolic inverse of this variable was used hin_wealth
	Income	log_h15itot	HwITOT reflects total income for the last calendar year. HwITOT is set to the sum of respondent and spouse earnings (RwIEARN, SwIEARN), pensions and annuities (RwIPENA, SwIPENA), SSI and Social Security Disability (RwISSDI, SwISSDI), Social Security retirement (RwISRET, SwISRET), unemployment and workers compensation (RwIUNWC, SwIUNWC), other government transfers (RwIGXFR, SwIGXFR), household capital income (HwICAP), and other income (HwIOTHR).	Dollar Value	The log of this variable was used log_h15itot

Source: RAND HRS Wave 15

Model Specifications

Dependent Variables: Retirement Satisfaction Indicator. In the current research, the dependent variable was retirement satisfaction based on the Health and Retirement Study (HRS), which evaluated self-reported retirement satisfaction. Retirement satisfaction was assessed by asking participants, "All in all, would you say that your retirement has turned out to be very satisfying, moderately satisfying, or not at all satisfying?" (RAND Center for the Study of Aging, 2024 p. 1718). This variable was reverse-coded, with very satisfying being the highest category, equal to 3.

Independent Variables: Percent of Non-housing Wealth in Equities. Three different independent variables were created from the HRS data and modeled in the present. The first independent variable was the percentage of non-housing wealth invested in stocks and stock funds (h15astck_perc). Total non-housing wealth (total_nh_wealth) included the respondents' financial assets that were not invested in IRA or Keough accounts. This variable did include the net value of stocks and stock funds (h15astck), the net value of bonds and bond funds (h15abond), the value of CDs, government savings bonds, and treasury bills (h15acd), the net value of checking, savings, and money market accounts (h15achck), and the net value of any other savings or assets (h15aothr). The second independent variable was created from the data to test the hypothesis, where the percentage of respondents with more than 50% of their non-housing wealth invested in equities (high_stock) experience higher retirement satisfaction. The final independent variable was designed to indicate which percentage of non-housing wealth stock allocation was more likely to report higher retirement satisfaction. To assess this, the non-housing wealth stock allocation (h15astck_perc) was divided into four categories (stock_cat): 1.

0-25%, 2. 25.01% - 50%, 3. 50.01% - 75%, and 4. 75.01% - 100%. (See Table 2: Variable Specifications and Coding Plan).

Control Variables: Demographics and Other Relevant Variables. Marital status included eight categories that captured diverse financial dynamics. The coding for health and marital status remained unchanged. Homeownership was a created variable, coded as binary (1 = yes, 0 = no). Net worth was a calculated variable that excluded non-housing wealth to avoid multicollinearity issues. The hyperbolic inverse of the value was used to reduce the influence of outliers and improve model stability. Household income was the final control variable, a continuous variable that was log-transformed to diminish the influence of outliers and enhance model stability.

Model Specification and Estimation Approach

The regression models aimed to assess the impact of equity asset allocation on retirement satisfaction while controlling for demographic and socioeconomic factors. For the first two models, ordered logistic regression was used for the ordinal variable (retirement satisfaction), which included categories like "Not at all," "Moderately," and "Very." Model 1, the ordered logistic regression, was specified as:

$$Log(P(Y_{1j} \leq j) = \alpha_j - \beta_1 * high_stock_i - \gamma * X_i - \varepsilon_i \qquad (1)$$

where Y_{1j} represented overall retirement satisfaction across categories, j, $high - stock_i$ stock allocation >50%, X_i included control variables, and ε_i was the error term.

Model 2, the ordered logistic regression, was specified as:

$$Log(P(Y_{1j} \leq j) = \alpha_j - \beta_1 * stock_cat_i - \gamma * X_i - \varepsilon_i \qquad (2)$$

where Y_{1j} represented overall retirement satisfaction across categories j, $stock_cat_i$ stock allocation among 4 categories, X_i included control variables, and ε_i was the error term.

These models estimated the coefficients of the independent and control variables, offering insights into how an equity asset allocation exceeding 50% or belonging to one of the four equity asset allocation categories influenced retirement satisfaction. The coefficients from the regression models were interpreted to grasp the impact of equity asset allocation on financial well-being. Marginal effects were calculated to illustrate the discrete changes in probabilities associated with each category of the independent variable. This approach provided a comprehensive understanding of the relationships between equity asset allocation and retirement satisfaction.

Results

Descriptive Statistics

The final sample included 4,248 observations. The final dataset's summary statistics are in Table 2.

Table 2:

Summary of Variables

Variable	Obs	Percentage
N	4,248	
Retirement Satisfaction		
1. Not at all	281	6.60%
2. Moderately	1,700	40.00%
3. Very	2,267	53.40%
Percent Invested in Equities		
1. 0% - 25%	3358	79.00%
2. 25.01% - 50%	164	3.90%
3. 50.01% - 75%	217	5.10%
4. 75.01% - 100%	509	12.00%

Gender		
1.Male	1696	39.90%
2.Female	2552	60.10%
Race		
1.White/Caucasian	3315	78.00%
2.Black/African American	695	16.40%
3.Other	238	5.60%
Education		
1. High school degree or less	2760	65.00%
2. Associate Degree	266	6.30%
3. Bachelor Degree	718	16.90%
4. Advanced Degree	504	11.90%
Age		
1. Under 64	556	13.10%
2. 65-79	2180	51.30%
3. 80+	1512	35.60%
Marital Status		
1.Married	1729	40.70%
2.Married,spouse absent	26	0.60%
3.Partnered	162	3.80%
4.Separated	52	1.20%
5.Divorced	633	14.90%
7.Widowed	1409	33.20%
8.Never married	237	5.60%
Self-Report of Health		
1.Excellent	228	5.40%
2.Very good	1230	29.00%
3.Good	1582	37.20%
4.Fair	908	21.40%
5.Poor	300	7.10%
Homeownership		
0. No	1043	24.60%
1. Yes	3205	75.40%

Variable	**Mean**	**Std. dev.**
Netwealth - Non-housing wealth	438,605.02	798,970.38
Income	56,921.95	78,320.32
Stocks & Mutual Fund % of Assets	16.30%	32.00%

Bond & Bond Fund % of Assets	1.70%	9.60%
CDs, Saving Bonds, & T-Bills % of Assets	5.00%	17.40%
Checking & Savings Account % of Assets	70.40%	39.50%
Other % of Assets	6.60%	

Source: RAND HRS Wave 15

Table 2 showed that the overall retirement satisfaction of participants was categorized into "Not at all" (6.6%), "Moderately" (40%), and "Excellent" (53.4%). The average respondent had 16.3% of their non-housing wealth invested in stock and stock funds. When evaluating the stock allocation as a percentage of non-housing wealth in four categories, it varied dramatically, with 79.0% having 0% - 24.99%, 3.9% having 25% - 49.99%, 5.1% having 50% - 74.99%, and 12.0% having 75% - 100%. This meant those with more than 50% of their non-housing wealth in equities represented 17.1% of the sample, while those with less than 50% made up 82.9%.

In addition, the sample demographics indicated that the majority of participants were female, comprising 60.01%. From a racial perspective, most were White at 78.0%, followed by 16.4% Black and 5.6% Other. Educational attainment varied, with 65% having less than a high school degree, 6.3% holding an associate's degree, 16.9% a bachelor’s degree, and 11.9% possessing an advanced degree. Most participants were older, with ages ranging from 44 to 102, and a mean age of 75.21 years. Marital status also displayed a variety of results: 40.7% were married, 33.2% were widowed, 14.9% were divorced, and the rest fell into other categories. Most participants owned their homes, with a homeownership rate of 75.4%. Self-reported physical health status was the most balanced, with most respondents falling in the middle categories of very good (29.0%), good (37.2%), or fair (21.4%). The data included observations from 2020.

Multivariate Analysis

Before proceeding with the regression analysis, it is crucial to assess multicollinearity among the independent variables. The VIF analysis for the percentage categories of non-housing wealth

invested in equities revealed values ranging from 1.04 to 1.11, which are below the commonly used threshold of 5, indicating no significant multicollinearity concerns (See Table 3). Two additional VIF analyses were conducted for the regression evaluating the independent variable of having >50% of non-housing wealth invested in equities and the continuous variable of non-housing wealth percentage invested in equities. Both showed a similar trend; the VIF for these variables was also below the threshold at 1.12 and 1.14 respectively.

Table 3:

Variance Inflation Factor (VIF) Analysis

Variable	VIF	1/VIF
Non-housing Wealth % Equities		
1. 0% - 25%		
2. 25.01% - 50%	1.04	0.963792
3. 50.01% - 75%	1.06	0.947392
4. 75.01% - 100%	1.11	0.900051
Gender (female)	1.18	0.848958
Race (White)		
Black	1.12	0.889978
Other	1.06	0.946711
Education (HS or less)		
Associate's degree	1.04	0.957060
Bachelor's degree	1.16	0.862906
Master's degree or higher	1.2	0.833548
Age (64 or under)		
65-79	2.53	0.395109
80+	2.84	0.352253
Marital Status (Married)		
Married,spouse absent	1.02	0.983905
Partnered	1.07	0.931208
Separated	1.07	0.936054
Divorced	1.41	0.710386
Widowed	1.73	0.577967
Never married	1.19	0.839037
Physical Health (Poor)		

Variable	VIF	1/VIF
Excellent	1.73	0.576822
Very Good	3.79	0.263625
Good	4.03	0.248299
Fair	3.18	0.314468
Homeowner (No)	1.59	0.628736
HI Netwealth - NH Wealth	1.53	0.652193
Log Income	1.54	0.648389
Mean VIF	1.68	

Source: RAND HRS Wave 15

In Model 1, ordered logistic regression analysis was conducted to examine the relationship between having more than 50% of your non-housing wealth invested in stocks and stock funds and retirement satisfaction. To ensure the strength of the findings from Model 1 and to obtain more specific details on the influence of equity allocations on retirement satisfaction, an additional ordered logistic regression analysis was conducted (Model 2). Model 2 also tested the relationship between non-housing wealth invested in stocks and stock funds and retirement satisfaction, but focused on four different categories of equity allocation. These categories included 0% - 24.99%, 25% - 49.99%, 50% - 74.99%, and 75% - 100% of non-housing wealth invested in stocks and stock funds. This additional analysis aimed to validate the initial findings and provide more specific evidence regarding the impact of equity allocation on retirement satisfaction.

Table 4 shows the odds ratios for predictors of retirement satisfaction in both models (Model 1 and Model 2). The regression results are similar in both models, indicating that a non-housing wealth stock allocation greater than 50% (OR1 = 1.41 in Model 1) and a non-housing wealth stock allocation in a category greater than 24.99% (OR2 = 1.58 for 25.01% - 50%, OR2 = 1.42 for 50.01% - 75%, and OR2 = 1.46 for 75.01% - 100% Stock in Model 2) significantly improved retirement satisfaction, supporting the importance of having a diverse portfolio as

outlined in Modern Portfolio Theory (Markowitz, 1952). Being part of a racial group categorized as Other (OR1 = 0.63 OR2 = 0.64) was linked to lower retirement satisfaction compared to White counterparts. Higher education levels significantly corresponded to higher retirement satisfaction, with a bachelor's degree (OR1 = 1.23 OR2 = 1.22) and a master's degree or higher (OR1 = 1.60, OR2 = 1.59) showing significantly positive effects compared to having a high school degree or less. Being older was associated with higher retirement satisfaction, with being aged 65-79 (OR1 = 1.32 OR2 = 1.33) and 80 years old or greater (OR1 = 1.98, OR2 = 1.98) showing significantly positive effects compared to being 64 or younger. The only significant impact of marital status came from being divorced (OR1 = 0.77, OR2 = 0.77), which led to lower retirement satisfaction than married participants. Across all categories, better physical health was associated with statistically significant higher retirement satisfaction. Being a homeowner led to significantly higher retirement satisfaction (OR1 = 1.30, OR2 = 1.29). Having a higher net worth minus non-housing wealth (OR1 = 1.28, OR2 = 1.28) and a higher income (OR1 = 1.34, OR2 = 1.33) was also associated with increased retirement satisfaction. This study did not find evidence of significant relationships between gender and retirement satisfaction in this sample.

Odds Ratios for Predictors of Ordered Logit Regression of Retirement Satisfaction

Table 4.

	Model 1 – High Stock Allocation			**Model 2 – Stock Category Allocation**		
Predictors	***Odds Ratio***	***SE***	***p***	***Odds Ratio***	***SE***	***p***
High Stock Allocation						
>50% Stock Allocation	1.41	0.133	0.000			
Stock Category Allocation						
< 25% Stock				1.58	0.285	0.011
25.01% - 50% Stock				1.42	0.226	0.027
50.01% -75% Stock				1.46	0.160	0.001

	Model 1 – High Stock Allocation			Model 2 – Stock Category Allocation		
Predictors	***Odds Ratio***	***SE***	***p***	***Odds Ratio***	***SE***	***p***
75.01% - 100% Stock						
Gender *(Male)*						
Female	0.92	0.065	0.246	0.92	0.065	0.266
Race *(White)*						
Black	1.07	0.095	0.473	1.08	0.097	0.365
Other	0.63	0.088	0.001	0.64	0.089	0.001
Education (=<*High school degree)*						
Associate's degree	0.89	0.116	0.363	0.89	0.116	0.362
Bachelor's degree	1.23	0.114	0.024	1.22	0.113	0.030
Master's degree or higher	1.60	0.185	0.000	1.59	0.184	0.000
Age *(64 or under)*						
65-79	1.32	0.132	0.006	1.33	0.133	0.005
80+	1.98	0.221	0.000	1.98	0.221	0.000
Marital Status *(Married)*						
Married, spouse absent	0.59	0.233	0.182	0.59	0.234	0.184
Partnered	0.71	0.121	0.042	0.71	0.121	0.045
Separated	0.70	0.206	0.223	0.70	0.207	0.223
Divorced	0.77	0.081	0.012	0.77	0.080	0.011
Widowed	0.91	0.082	0.317	0.91	0.082	0.307
Never married	0.78	0.117	0.097	0.78	0.116	0.089
Physical Health *(Poor)*						
Excellent	12.25	2.568	0.000	12.10	2.539	0.000
Very good	6.80	0.943	0.000	6.77	0.940	0.000
Good	4.21	0.557	0.000	4.20	0.556	0.000
Fair	2.37	0.324	0.000	2.35	0.322	0.000
Homeowner *(No)*						
Yes	1.30	0.12	0.01	1.29	0.118	0.005
HI Netwealth - NH Wealth	1.28	0.10	0.00	1.28	0.099	0.002
Log Income	1.34	0.06	0.00	1.33	0.060	0.000

Source: RAND HRS Wave 15

Overall, the findings emphasize the significant role of investing in equities for retirement satisfaction. A stock allocation greater than 50% in Model 1, along with stock allocations of

25.01% to 50%, 50.01% to 75%, and 75.01% to 100%, showed strong positive associations with retirement satisfaction. The control variables also demonstrated similar trends across the two models, with education level, age, physical health, homeownership, net worth, and income significantly impacting retirement satisfaction. In Model 1, a high stock allocation, defined as having more than 50% of assets invested in equities, was significantly associated with greater retirement satisfaction. Retirees with high stock allocations had 41% higher odds of reporting increased satisfaction compared to those with lower stock allocations (OR = 1.41, p = 0.000). This finding provides strong support for Hypothesis 1, which posits that allocating a majority of assets to equities is positively related to retirement satisfaction. Model 2 supports Hypothesis 1, indicating that allocating more than 50% of assets to equities is associated with higher retirement satisfaction, but it also suggests that even moderate stock allocations (25.01% to 50%) are linked to greater satisfaction compared to very low stock holdings (<25%). These results were also consistent in a robustness check using robust standard errors and bootstrapping to address potential heteroscedasticity.

To assess the validity of the proportional odds assumption underlying both ordered probit models, a Brant test was conducted after each ordered logistic regression. The overall Brant test was significant ($p < .001$), indicating a violation of the parallel lines assumption. Specifically, violations were observed for health status, age group two, and "other" race categories. However, the stock allocation the primary independent variable of interest in both models satisfied the assumption, suggesting that the key relationships were unlikely to be biased. As a robustness check, we re-estimated the model using a generalized ordered logit model (gologit2) with the autofit option, which relaxes the proportional odds assumption only for variables that violate it. The results of the gologit2 model were substantively consistent with those of the original

ordered probit model. Higher stock allocations remained significantly associated with greater retirement satisfaction, and the direction and magnitude of the effects were stable. Moreover, a Wald test of the final generalized ordered model indicated no overall violation of the proportional odds assumption ($p = 0.689$), confirming the robustness of the findings. Taken together, these results suggest that while minor violations of the proportional odds assumption exist among some control variables, the primary conclusions regarding stock allocation and retirement satisfaction are robust.

Marginal Effect Analysis

While odds ratios indicated the direction and relative strength of associations (greater than 1 for positive, less than 1 for negative) in Models 1 and 2, the average marginal effects were calculated to measure the change in the probability of retirement satisfaction for a one-unit change in stock allocation, holding other variables constant. Table 6 summarizes the average marginal effects from the two models examining the relationship between stock allocation and retirement satisfaction, with robust standard errors.

Table 5:

Average Marginal Effects of Stock Allocation on Retirement Satisfaction

	Model 1: >50% Stock Allocation Retirement Satisfaction			**Model 2: Stock Allocation Categories Retirement Satisfaction**		
Stock Allocation Category	**dy/dx**	**RSE**	**p**	**dy/dx**	**RSE**	**p**
Predict - Not at all satisfied						
>50% Stock Allocation	-0.020	0.006	0.000			
25.01% - 50% Stock				-0.023	0.008	0.002
50.01% -75% Stock				-0.019	0.008	0.013
75.01% - 100% Stock				-0.020	0.005	0.000
Predict - Moderately satisfied						

	Model 1: >50% Stock Allocation Retirement Satisfaction			Model 2: Stock Allocation Categories Retirement Satisfaction		
Stock Allocation Category	**dy/dx**	**RSE**	**p**	**dy/dx**	**RSE**	**p**
>50% Stock Allocation	-0.051	0.014	0.000			
25.01% - 50% Stock				-0.072	0.028	0.011
50.01% -75% Stock				-0.055	0.025	0.031
75.01% - 100% Stock				-0.059	0.018	0.001
Predict- Very Satisfied						
>50% Stock Allocation	0.071	0.019	0.000			
25.01% - 50% Stock				0.095	0.036	0.008
50.01% -75% Stock				0.073	0.033	0.026
75.01% - 100% Stock				0.079	0.023	0.000

Source: RAND HRS Wave 15

In Table 5, the first three columns illustrate that Model 1 respondents with more than 50% of their non-housing wealth allocated to stocks were significantly less likely to report low or moderate satisfaction with retirement and significantly more likely to report high satisfaction. Specifically, having over 50% in stocks was associated with a 2.0% decrease in the probability of being “Not at all satisfied,” a 5.1 decrease in being “Moderately satisfied,” and a 7.1% increase in being “Very satisfied” with retirement, all else being equal.

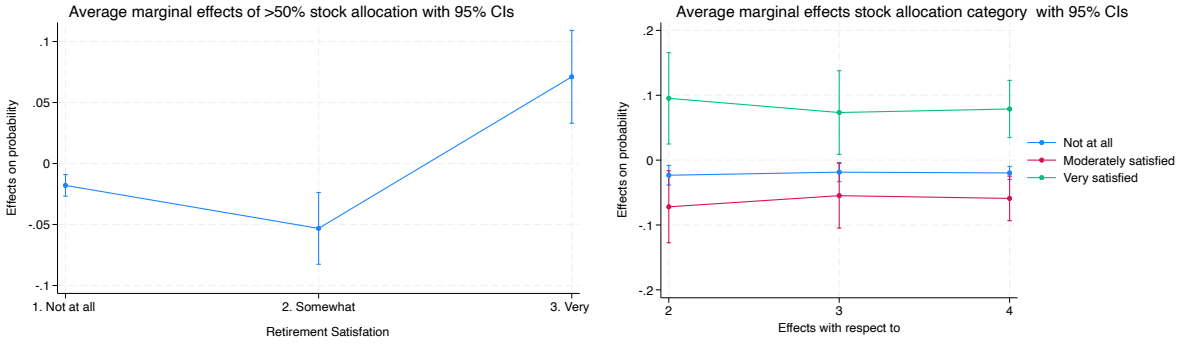
Similarly, in Model 2, for the "Not at all satisfied" category, the probability decreased by 2.3% for the 25.01% - 50% Stock group, 1.9% for the 50.01% - 75% Stock group, and 2.0% for the 75.01% - 100% Stock group, all statistically significant. In the "Moderately satisfied" category, probabilities decreased by 7.2%, 5.5%, and 5.9% for the same respective groups, which were also statistically significant. Conversely, the probability of "Very satisfied" increased by 9.5% for the 25.01% - 50% Stock group, 7.3% for the 50.01% - 75% Stock group, and 7.9% for the 75.01% - 100% Stock group. These results suggest a nonlinear relationship, with the strongest marginal gains in satisfaction occurring at stock categories two and four.

The average marginal effect analysis is visualized in Figure 1. Model 1 presents average marginal effects of having over 50% non-housing wealth invested in equities on retirement satisfaction. The results show that individuals with high stock allocation are significantly more likely to report "very satisfied" (AME = +7.1 percentage points) and less likely to report "not at all satisfied" (–1.8 points) or "somewhat satisfied" (–5.3 points) satisfaction. These effects are statistically significant ($p < .001$), suggesting that a greater proportion of retirement wealth held in stocks is positively associated with retirement satisfaction. Model 2 also represents average marginal effects, focusing on stock allocation categories regarding retirement satisfaction. The graph uses the 0 – 25% stock allocation category as the reference group. All higher stock categories are associated with significantly lower probabilities of low and medium satisfaction, and significantly higher probabilities of high satisfaction. The strongest effect appears in the 25.01 – 50% range, which increases the probability of high satisfaction by 9.5 percentage points. These results support the conclusion that moderate equity exposure, especially between 25.01 – 50%, is most strongly associated with improved retirement satisfaction, while higher allocations yield diminishing marginal gains.

Figure 1:

Average Marginal Effects Stock Allocation on Retirement Satisfaction

Model 1: Stock >50%/Retirement Satisfaction ***Model 2: Stock Cat/Retirement Satisfaction***



Source: RAND HRS Wave 15

Generalized Ordered Logit Analysis

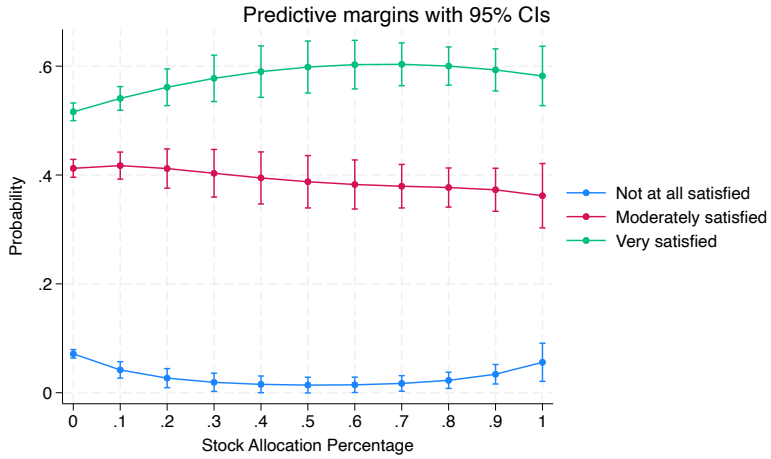
To examine the relationship between stock allocation as a continuous variable and retirement satisfaction, Model 3 estimated a generalized ordered logit model (gologit2) was estimated using stock allocation as a continuous variable (h15astck_perc), which included a quadratic term to capture potential nonlinearity. This model was chosen to determine the stock allocation associated with the greatest likelihood of high retirement satisfaction. A Brant test indicated that the continuous stock allocation variable violated the proportional odds assumption when using an ordered logit model that had been applied in previous models of this research. Therefore, a generalized ordered logit model was used for Model 3 because it relaxes the proportional odds assumption, improving flexibility without sacrificing interpretability. This model was run with the autofit option, confirming that the proportional odds assumption was not violated, thus validating the application of a generalized ordered logit model with parallel coefficients across retirement satisfaction thresholds. Model 3 controlled for the same demographic and financial variables used in Models 1 and 2. Results from Model 3 indicated a statistically significant, nonlinear association between stock allocation and retirement satisfaction. The first threshold evaluated not at all versus moderately and very satisfied; here, the linear term for stock percentage was positive and significant ($\beta = 7.\ 11$, $p =.\ .003$), while the squared term was negative and significant ($\beta = –6.\ 81$, $p =.\ .003$), suggesting a concave relationship. This first threshold showed that increases in stock allocation improve satisfaction up to a point, beyond which the effect diminishes or reverses. The second threshold in Model 3 compared not at all and moderately versus very satisfied, where the linear term for stock percentage was positive and significant ($\beta = 1.\ 23$, $p =.\ .021$), while the squared term was

negative but not significant (β = –. .923, p =. .122). Although the second threshold lacked significance, this model suggests that the nonlinearity is strongest when avoiding dissatisfaction, while the marginal benefits of stock allocation on transitioning from medium to high satisfaction are more linear.

Figure 2 visualizes the predicted probabilities of changes in each level of retirement satisfaction as the percentage of household non-housing wealth held in stocks increases from 0% to 100%, based on Model 3. The line for those not at all satisfied decreases steadily as stock allocation increases. At 0% stock allocation, the predicted probability of reporting low satisfaction is 7.2%, but this drops to 5.6% at 100% allocation. This suggests that higher stock exposure is linked to a lower likelihood of low retirement satisfaction. The line for moderately satisfied individuals also declines, from 41.2% at 0% stock allocation to 36.2% at full stock allocation, indicating a modest decline in moderate satisfaction as stock allocation increases. In contrast, the line for high satisfaction rises significantly from 51.6% at 0% stock to 58.2% at full stock allocation. This pattern indicates that greater stock allocation is positively associated with higher retirement satisfaction, particularly between 60% and 80% stock allocation.

Predictive Margins Stock Allocation Percentage on Retirement Satisfaction

Model 3: Stock Allocation %/Retirement Satisfaction



Source: RAND HRS Wave 15

Post Estimation Analysis

To assess the model fit for the ordered logit regression (Model 1), which explored associations between retirement satisfaction and an allocation of over 50% of non-housing wealth, several tests were utilized in the research. Table 6 presents the fit statistics, showing that the model with predictors had a higher log-likelihood (-3329.619) compared to the null model (-3743.703), indicating a better fit. The AIC and BIC values were 6707.239 and 6859.74, respectively, with lower values suggesting a good balance between model complexity and fit. The Chi-square statistics ($p < 0.05$) confirmed the model's overall significance. Various R-squared measures (McFadden = 0.111, McKelvey & Zavoina = 0.222, Cox-Snell/ML = 177) demonstrated moderate explanatory power, with the McKelvey & Zavoina indicating that the model explains about 22% of the variance in retirement satisfaction.

Table 6:

Model Fit Statistics for Model 1 Ordered Logistic Regression

Statistic	Value
Log-likelihood	
Model	-3329.619

Statistic	Value
Intercept-only	-3743.703
Chi-square	
Deviance (df = 3923)	6659.239
Wald (df = 26)	828.167
p-value	0
R-squared	
McFadden	0.111
McFadden (adjusted)	0.104
McKelvey & Zavoina	0.222
Cox-Snell/ML	0.177
Cragg-Uhler/Nagelkerke	0.214
Count	0.608
Count (adjusted)	0.16
Information Criteria	
AIC	6707.239
AIC divided by N	1.579
BIC (df = 29)	6859.74
Variance of	
E	3.29
y-star	4.228

Source: RAND HRS Wave 15

Model 2 explored associations between retirement satisfaction and various stock allocation categories of non-housing wealth. Table 7 presents the fit statistics, indicating that the model with predictors had a higher log-likelihood (-3326.229) compared to the null model (-3743.703), also reflecting a better fit. The AIC and BIC values were 6704.458 and 6869.667, respectively, similar to Model 1 and suggesting a good balance between model complexity and fit. The Chi-square statistics ($p < 0.05$) confirmed the model's overall significance. Various R-squared measures (McFadden = 0.112, McKelvey & Zavoina = 0.224, Cox-Snell/ML = 178) demonstrated moderate explanatory power. Most of the fit statistics favored Model 2, except that the BIC favored the fewer parameters in Model 1.

Table 7:

Model Fit Statistics for Model 2 Ordered Logistic Regression

Statistic	Value
Log-likelihood	
Model	-3326.229
Intercept-only	-3743.703
Chi-square	
Deviance (df = 3923)	6652.458
Wald (df = 26)	834.948
p-value	0
R-squared	
McFadden	0.112
McFadden (adjusted)	0.105
McKelvey & Zavoina	0.224
Cox-Snell/ML	0.178
Cragg-Uhler/Nagelkerke	0.215
Count	0.609
Count (adjusted)	0.161
Information Criteria	
AIC	6704.458
AIC divided by N	1.578
BIC (df = 29)	6869.667
Variance of	
E	3.29
y-star	4.239

Source: RAND HRS Wave 15

Model 3 explored the associations between retirement satisfaction and the stock allocation of non-housing wealth as a continuous variable. Table 8 presents the fit statistics, indicating that the model with predictors has a higher log-likelihood (-3294.45) compared to the null model (-3743.703), which also suggests a better fit. The AIC and BIC values were 6654.900 and 6864.588, respectively, and were similar to Model 1 and Model 2, indicating low values that suggest a good balance between model complexity and fit. The Chi-square statistics ($p < 0.05$) confirmed the overall significance of the model. Various R-squared measures (McFadden =

0.120, Cox-Snell/ML = 0.191) demonstrated moderate explanatory power. All three models have very similar fit statistics, showing statistically significant improvement, moderate explanatory power, and acceptable classification accuracy for ordinal logistic modeling.

Table 8:

Model Fit Statistics for Model 3 Generalized Ordered Logistic Regression

Statistic	Value
Log-likelihood	
Model	-3294.45
Intercept-only	-3743.703
Chi-square	
Deviance (df = 3923)	6588.9
Wald (df = 26)	898.506
p-value	0
R-squared	
McFadden	0.120
McFadden (adjusted)	0.111
Cox-Snell/ML	0.191
Cragg-Uhler/Nagelkerke	0.23
Count	0.612
Count (adjusted)	0.167
Information Criteria	
AIC	6654.900
AIC divided by N	1.567
BIC (df = 33)	6864.588

Source: RAND HRS Wave 15

Discussion and Implications

This study explores the relationship between stock and stock fund asset allocation as a percentage of non-housing wealth and retirement satisfaction among U.S. adults over the age of 50 and their spouses, using data from Wave Fifteen of the Health and Retirement Study (HRS), collected in 2020. Modern Portfolio Theory served as the theoretical framework for this research (Markowitz, 1952). The findings indicate that equity allocations greater than 50% are

significantly associated with retirement satisfaction. These findings add to the existing literature that highlights how financial security, financial situations, and increased financial resources can impact retirement satisfaction, with a focus on the role of asset allocation (Amorim & França, 2019; Hershey et al., 2010; Lim et al., 2025).

This research found that stock and stock fund asset allocation of non-housing wealth greater than 50%, 25.01 – 50%, 50.01% – 75%, and 75.01 – 100% demonstrated significant positive impacts on retirement satisfaction, with the highest average marginal effect of 9.5% observed in the 25.01 – 50% group. The first two models suggested a non-linear relationship between stock allocation and retirement satisfaction among older U.S. adults, but Model 3 formally captured and statistically tested this non-linear relationship, which was statistically significant. The generalized ordered logit model in Model 3 revealed that moderate levels of stock holdings, particularly in the range of 50–60% of non-housing wealth, are associated with the highest predicted levels of retirement satisfaction.

The research findings support Modern Portfolio Theory (MPT), which posits that the "optimal" portfolio is located on the efficient frontier, where expected returns are maximized for a specified level of risk (Markowitz, 1952). The observed non-linear relationship between stock allocation and retirement satisfaction corresponds to the efficient frontier's concave shape. The results indicate that while increasing stock exposure enhances utility or retirement satisfaction up to a certain threshold, it eventually leads to diminishing marginal returns, or as suggested by the data, a decline possibly stemming from perceived or actual risks risk.

These results are significant because the average respondent in the study had $216,674 in non-housing wealth, with only 16.3% invested in stocks and stock funds, and 70.4% in checking and savings accounts. The average income was $56,922. While I do have data on their average

monthly expenses, they maintain over 32 months' worth of income in checking and savings accounts, which considerably exceeds the typical emergency fund recommendation of three to six months in liquid investments. The lower levels of stock ownership may cause retirees to miss out on long-term growth and inflation protection. The data from this research also suggest that extremely high levels of equities with increased market volatility may undermine financial peace of mind and retirement satisfaction. Overall, the results indicate that neither extreme conservatism nor excessive risk-taking maximizes retirement satisfaction.

A key implication from this study for financial planners is to ensure their clients truly understand the risks and rewards associated with their investment options and how this choice could impact their retirement satisfaction. The average retiree in this study had very conservative investments that would not support Bengen's 4% withdrawal rate, which modeled a portfolio with equity allocations between 50% and 75%. (Bengen, 1996).

From the standpoint of policy and planning, the findings emphasize the significance of personalized financial advice. Financial advisors and retirement planners need to take into account not only historical return trends but also the psychological comfort levels of their clients when suggesting asset allocations. Furthermore, public policies designed to enhance retirement outcomes could benefit from encouraging financial education programs that support households in making informed long-term investment decisions. Specifically, tools for assessing retirement readiness and guidelines for portfolios could include satisfaction-based benchmarks aligned with risk tolerance, in addition to the conventional financial metrics.

Limitations and Future Research

Despite its contributions, this study has several limitations. First, the analysis relies on self-reported retirement satisfaction from the Health and Retirement Study (HRS), which is

inherently subject to biases and inaccuracies. Second, the data were collected during 2020 at the peak of Covid, which may cause the responses to be influenced by transient emotional or contextual factors. Third, the HRS data did not provide the asset allocation for the IRA and Keough accounts of the respondents. Non-housing wealth accounted for the majority of their investable assets at 60.73%; however, IRA accounts represented 39.27%, and this could be where participants were keeping their stock and stock fund investments. Finally, the use of cross-sectional data limits the ability to draw definitive causal conclusions. Future research could address these limitations by utilizing longitudinal data to better capture the dynamic relationship between asset allocation and retirement satisfaction over time.

Conclusion

In conclusion, this research provides valuable insights into the impact of asset allocation on retirement satisfaction. By analyzing data from 4,248 participants in the Health and Retirement Survey (HRS) dataset and using various statistical models, the study highlights the statistically significant associations between stock allocation and retirement satisfaction. Model 1 reveals that participants with non-housing wealth stock allocations greater than 50% (OR = 1.41, $p < 0.00$) had statistically significant odds of reporting higher retirement satisfaction compared to the reference group (non-housing wealth stock allocations less than or equal to 50). These results support Hypothesis 1, suggesting a positive relationship between stock allocation and retirement satisfaction.

Model 2 demonstrates a strong relationship between higher stock allocation categories and retirement satisfaction. Participants in the 25.01% - 50% Stock category had the highest odds of reporting greater retirement satisfaction (OR = 1.58, $p < 0.011$), followed by those in the 75.01% - 100% Stock category (OR = 1.46, $p < 0.001$), and those in the 50.01% - 75% Stock category

(OR = 1.42, p = 0.027), compared to individuals in the 0% - 25% Stock category. Model 2 also supports Hypothesis 1; however, even moderate stock allocations (25.01% - 50%) are linked to greater satisfaction compared to very low stock holdings (<25%).

Model 3, the final model, used a generalized ordered logistic regression. This model confirmed the non-linear association between the proportion of non-housing wealth held in stocks and retirement satisfaction. Specifically, moderate levels of stock investment are associated with the highest predicted satisfaction, while both very low and very high allocations are linked to lower satisfaction outcomes. These results remain robust across three different model specifications and are consistent with the core tenets of Modern Portfolio Theory, which emphasizes risk-return trade-offs and optimal asset allocation. The results highlight that maximizing retirement satisfaction may not require extreme portfolio positions, but rather a balanced approach that aligns risk exposure with household preferences, income levels, and demographic characteristics.

Demographic and other relevant factors associated with retirement satisfaction were consistent across all three models. Education level, age, physical health, homeownership, net worth, and income positively and significantly impacted retirement satisfaction. All these findings are in alignment with prior studies.

These findings add to the expanding literature on financial well-being in later life and present practical implications for policymakers and financial planners who seek to enhance the quality of life for retirees. Although the study has several limitations, it offers a solid foundation for future research that investigates the behavioral drivers of portfolio choice and long-term well-being in retirement.

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