CENTER for RETIREMENT RESEARCH at BOSTON COLLEGE

WHAT MATTERS FOR ANNUITY DEMAND: OBJECTIVE LIFE EXPECTANCY OR SUBJECTIVE SURVIVAL PESSIMISM?

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Abstract

Objective life expectancy and *subjective* survival pessimism (defined as the difference between objective and subjective life expectancy) may both affect the demand for annuities. The question this project answers is: how do these two explanations contribute to annuitization decisions in practice? To explore this question, the analysis estimates regression models that include objective life expectancy, subjective survival pessimism, and other characteristics that are linked to annuitization decisions. The results show that, as one would expect, individuals with higher objective life expectancy are more likely to buy an annuity. Similarly, less pessimistic individuals are also more likely to buy an annuity. A one-year rise in objective life expectancy increases the probability of buying an annuity product by 0.20 percentage points, which is nearly nine times larger than a one-year decline in pessimism.

Introduction

Since 1965, academics have argued that, under a broad set of assumptions, individuals should annuitize a large part of their assets (Yaari 1965). For nearly as long, it has also been documented that annuitization rates fall short of what seem to be optimal levels, a fact known as the "annuity puzzle."[1]

One proposed explanation is adverse selection: annuity prices are set to compensate insurers for the higher average life expectancy of those who voluntarily purchase annuities, thereby making annuities less attractive to potential consumers (Mitchell et al. 1999). An implication of this explanation is that objective life expectancy should predict annuity purchases. Another proposed explanation is subjective survival pessimism: evidence from multiple studies suggests that individuals in their 50s and 60s underestimate their life expectancies. Such pessimism makes them underestimate the years they have to live and therefore their lifetime payouts from an annuity.[2] An implication of this explanation is that subjective survival pessimism (defined as the difference between objective and subjective life expectancy) should predict annuity purchases. The question this paper addresses is: how do these two (non-contradictory) explanations contribute to annuitization decisions in practice?

The analysis explores this question using the *Health and Retirement Study* (HRS) to estimate regression models that control for objective life expectancy, subjective survival pessimism, and other characteristics that are linked to annuitization decisions. By conducting a horse race between the objective and subjective measures, the contribution of objective life expectancy to annuity demand can be controlled for and, holding objective life expectancy constant, the incremental effect of pessimism can be estimated.

One impediment to this type of estimation is that, in practice, objective life expectancy is heterogeneous across individuals and correlated with pessimism.[3] A key innovation in the current project is that it captures objective life expectancy heterogeneity by using mortality tables that account for race, gender, cohort, age, and education. The analysis also uses detailed controls for diagnosed health conditions that might impact individuals'

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[1] For examples of recent work exploring this puzzle, see Laitner, Silverman, and Stolyarov (2018), Lockwood (2018), and Brown et al. (2021). In the *2018 Health and Retirement Study*, around 5% of respondents reported receiving annuity income.

[2] For an early discussion of the impact of subjective mortality on annuitization decisions, see Hamermesh (1985).

[3] Hurd and McGarry (1995) show that subjective mortality correlates with SES and responds to new diagnoses of disease. Elder (2013) shows that subjective mortality expectations are predictive of realized future mortality for the same individual.

objective life expectancy.[4] By incorporating the reasonable drivers that make objective life expectancy deviate from the population-level life expectancy, the analysis arbitrates between low objective life expectancy and pessimism as impediments to the purchase of annuities.

The rest of the paper is structured as follows. The next section provides background on this question. The second section describes the data used in this study. The third section shows how subjective life expectancies are constructed and discusses how they compare to their objective counterparts. The fourth section discusses the methodology used to assess the correlation between annuitization measures and objective life expectancy and pessimism. The fifth section presents the results. The final section concludes that annuity purchases are correlated with both objective life expectancy and pessimism, but the objective measure is substantially more predictive of annuitization decisions.

Background

Of the many possible explanations for the annuity puzzle, irrational pessimism on the part of potential consumers regarding future life expectancy is appealing. Naturally, no one can learn about their own life expectancy from personal experience. Further, the decision to buy an annuity is itself usually made once and for all, a situation in which individuals never get the chance to learn from their own mistakes – and so mistakes can persist.

Furthermore, assessing to what extent *objective* life expectancy, versus *subjective* survival pessimism, drives demand for annuities is important for annuity providers and policymakers. If demand for annuities is depressed largely because of irrational pessimism, perhaps such pessimism can be reduced through interventions that simply inform the public regarding mortality rates. Conversely, if adverse selection based on objective life expectancy is the main reason for low annuitization rates, other policies, such as a more public role in annuity provision, could be considered to reduce the price of annuity products.[5]

Theoretical work has shown that annuitization rates can be substantially depressed in a lifecycle model due to pessimistic survival expectations (O'Dea and Sturrock 2021).[6]

[4] Chetty et al. (2016) provide evidence of income gradients in mortality. Leive and Ruhm (2021) and Wettstein et al. (2021) find large race and education mortality differentials.

[5] The literature suggests that effective private annuity mandates may be hard to devise; see Einav, Finkelstein, and Schrimpf (2010) and Hurwitz, Sade, and Winter (2020). However, mandated publicly provided annuities, such as Social Security in the United States, are common.

[6] Prior research has also shown that subjective mortality expectations are relevant to decision making in several other related contexts, such as timing of retirement and Social Security claiming (Hurd, Smith, and Zissimopoulos 2004; Bloom et al. 2006) and savings (Post and Hanewald 2013; Heimer, Myrseth, and Schoenle 2019).

However, the impact of such survival pessimism on annuitization in practice has not been empirically demonstrated.

Studying the topic is complicated since, in reality, individual objective mortality expectations may vary from full-population life tables that differ only by gender and birth year for perfectly rational reasons: information on race, socioeconomic status (SES), and health conditions may reasonably influence individuals' assessments of their life expectancy above and beyond irrational pessimism. Both low objective life expectancy expectations and pessimism may reduce demand for annuities priced for annuitants with high life expectancies. The next sections describe how the current analysis distinguishes the objective life expectancy and subjective pessimism of potential annuity consumers.

Data

The analysis draws on data from the HRS, which is a nationally representative, biennial longitudinal survey of adults in the United States. The survey started in 1992 and is based on a steady-state sampling design, with a new cohort ages 51-56 entering every six years. The HRS asks questions about a wide range of topics broadly used in retirement research, including education, income, wealth, health, cognition, expectations, and demographics.

The expectations module of the survey asks participants about their self-reported probability of living to older ages.[7] These questions take the form: *"What is the percent chance that you will live to be age [X] or more?"* Participants answer this question with a number between 0 and 100, where 0 means that they think that there is no chance that the event will happen, and 100 means that they think that the event is certain. We use these answers to estimate the individual *subjective* survival curves and *subjective* life expectancies (see the next section).

Similar to previous research, we find that people are pessimistic regarding life expectancy between ages 55-70 and optimistic between ages 70-85. Figures 1 and 2 display the mean subjective and objective probabilities of survival to future ages as a function of the respondent's age, for men and women, respectively. We find that, on average, females are more pessimistic than males at all ages, but the overall patterns are similar between the two

[7] Our analysis uses waves 5-13 of the HRS. Individuals ages 65 and under are asked two subjective mortality questions. For waves 5-7, they are asked about ages 75 and 80, and for waves 8-13 they are asked about ages 75 and 85. Individuals over 65 are asked one question about an age which is 11 to 15 years ahead of their current age and is a multiple of 5.

groups. These patterns are also similar when we condition on education and race (see Figures A1 to A8 in the Appendix).

To calculate *objective* life expectancies, the analysis uses the life tables estimated by Wettstein et al. (2021). The tables include mortality rates by gender, cohort, race, age, and education, combining data from the *2020 Social Security Trustees Report*, the *National Vital Statistics System*, and the *American Community Survey*.

Subjective life expectancies are calculated for individuals 65 or younger, who are asked two subjective mortality questions. Objective life expectancies are calculated starting in the calendar year 2000 for individuals ages 55 or older. Our objective life expectancy calculations are limited to those classified as Black, White, or Hispanic and those for whom education data are available. We drop individuals for whom we do not have the objective or subjective life expectancy. Also, we drop individuals who report having an annuity but the annuity payments stop while they are alive.[8]

The result of all these exclusions is a 32,179 person-year observation sample, where individuals are ages 55-65. The dataset covers the years 2000 to 2016. Results are weighted using the HRS cross-sectional individual weights. See Table 1 for the sample's summary statistics.

When calculating life expectancies, both objective and subjective survival probabilities are discounted using a 3% discount rate. They are discounted because time-preference makes annuity income in an additional year of life far in the future less valuable than income in the near future. Simply using life expectancy as a measure (without first discounting future years of life) misses this fact.[9]

Subjective and Objective Mortalities

This section describes how the information provided by the subjective mortality expectation questions is used to construct individual-specific subjective survival curves and life expectancies. Then, the estimated subjective life expectancies are compared with their objective counterparts.

[8] Such annuities are likely period certain and are not insurance in a meaningful sense.

[9] For example, consider two 65-year-olds with a life expectancy of 80. The first individual will live to 80 with certainty, while the second will either die tomorrow with a 50% chance or will live to 95 with a 50% chance. The present discounted value of an annuity will be higher for the first individual than for the second, even though their life expectancies and time preference discount rates are identical. Of course, an annuity would be more valuable to the second individual if they were sufficiently risk averse because the first faces no longevity risk.

The analysis follows O'Dea and Sturrock (2021). The assumption is that individuals believe that they are almost certain not to live beyond age 110; thus, the subjective probabilities of surviving to age 110 are equal to the relevant life table survival probabilities. By imposing this assumption, we obtain three reports of subjective survival probabilities for each person-year observation. The set of the three reports is denoted by $A_i = \{\alpha_1, \alpha_2, \alpha_3\}$, where α_j is the age that individuals are asked to provide the subjective probability of surviving to. Also, $R_i(\alpha, z)$ denotes the subjective probability of surviving to age α for an individual i with age z (e.g., $R_i(110{,}65)$ denotes the subjective probability of surviving to age 110 of a 65-year-old individual).

To ensure the computational feasibility of the problem, the functional form of the individual's subjective survival curves is assumed. Specifically, the function is a two-parameter Weibull distribution. The Weibull distribution is widely used in the epidemiological literature.

$$S(a, \lambda_i, \kappa_i) = exp[-(\frac{a - z_i}{\lambda_i})^{\kappa_i}]\lambda_i, \kappa_i > 0$$

The two parameters (λ_i, κ_i) are estimated by fitting the Weibull distribution via nonlinear least squares for each person-year observation i in our sample.

$$(\hat{\lambda}_i, \hat{\kappa}_i) = \underset{\lambda_i, \kappa_i}{argmin} \sum_{a \in A_i} (R_i(a, z_i) - S(a, \lambda_i, \kappa_i))^2$$

In total, 32,179 coefficient vectors $\left\{\hat{\lambda}_i, \hat{\kappa}_i\right\}$ are estimated, one for each person-year observation. Finally, using the function $S(a, \hat{\lambda}_i, \hat{\kappa}_i)$, individual subjective life expectancies are calculated.

Table 2 compares average subjective and objective life expectancies for various subgroups of the population. On average, subjective life expectancy is lower than objective life expectancy by 1.6 years for the 55-59 age group, and 1.2 years for the 60-65 age group. For the 55-59 age group, males are less pessimistic than females, understating their life

expectancies by 0.9 years versus 2.5 years. For the 60-65 age group, the difference between men and women holds steady at 0.5 years versus 2 years.

Methodology

To assess the relative importance of objective life expectancy and subjective survival pessimism, a regression model that controls for objective life expectancy, pessimism, and the information that insurers use to price annuities is estimated. This regression model takes the form:

$$A_{i,t} = \beta_0 + \beta_1 * LE_{i,t}^{obj} + \beta_2 * (LE_{i,t}^{obj} - LE_{i,t}^{subj}) + \boldsymbol{\beta}_3 * \boldsymbol{X_{i,t}} + \varepsilon_{i,t},$$

where $A_{i,t}$ indicates that individual *i* had a commercial annuity at time *t*, $LE_{i,t}^{obj}$ and $LE_{i,t}^{subj}$ are *i*'s discounted objective and subjective life expectancy, subjective survival pessimism is measured as the difference between $LE_{i,t}^{obj}$ and $LE_{i,t}^{subj}$, and $\boldsymbol{X_{i,t}}$ is a vector that contains the insurers' information (age and gender controls). In this model, a statistically significant coefficient for β_1 means that objective life expectancy matters for annuity purchases, and a statistically significant coefficient for β_2 means that pessimism is affecting the annuity market above and beyond objective life expectancy.[10] Since the same individual appears multiple times in the sample at different periods and often shares wealth with other household members, standard errors are clustered at the household level.

This estimation is repeated adding controls for various diagnosed health conditions that could affect objective life expectancy and other forms of income and assets that might substitute for annuitized wealth, such as whether someone has a defined benefit (DB) pension plan, how much Social Security wealth the household has, or whether they own a home.[11] In addition, controls for marital status and children are included, as these demographic variables

[10] Note that although our measure of objective life expectancy contains information that is not available to the insurers, it is not ex-post. Hence, the results should not be interpreted as a positive correlation test (Chiappori and Salanie 2001).

[11] The Social Security wealth variable is calculated based on the respondent's projected earnings history, assuming claiming at the Full Retirement Age. For details, see the HRS documentation. We impute this measure for the waves in which it is not available and account for spousal benefits to arrive at a household measure.

have been shown to be related to both the theoretical value of annuities and their take-up empirically.[12]

Finally, the analysis is repeated by replacing the dependent variable with the share of financial wealth held in an annuity. The share of financial wealth held in an annuity is defined by dividing the present discounted value of all annuities by current net financial wealth (including this annuitized wealth).

Results

This section presents results of the analysis. Column 1 of Table 3 shows results for the regression that controls for objective life expectancies, pessimism, and the information that insurers use to price annuities. Both coefficients β_1 and β_2 are statistically significant (at the 1% and 10% levels, respectively). This finding implies that both objective life expectancy and pessimism affect the choice of whether to purchase an annuity. The estimates indicate that a one-year rise in objective life expectancy increases the probability of holding an annuity by 0.20 percentage points (a 2% change relative to the share who ever buy an annuity, 8.8%), while a one-year decline in pessimism increases the probability of holding an annuity by 0.023 percentage points (a 0.2% change).[13]

The impact of adding additional controls is shown in Columns 2 and 3 of Table 3. Column 2 adds objective physician-diagnosed health conditions, which makes the measure of objective life expectancy conditional on these real factors. Column 3 adds economic factors that may influence annuity demand on the individual's part beyond life expectancy, such as marital status, whether the individual has children, and the presence of a DB pension plan. In both specifications, we find that both coefficients β_1 and β_2 are at least marginally statistically significant, although the magnitude and significance of objective life expectancy declines as more controls are added. With the most complete set of controls, both coefficients are marginally significant at the 10% level.

Taken at face value, the results are consistent with objective life expectancy having a much stronger effect on the decision of whether to buy an annuity than pessimism. The

[12] Fixed effects regressions are also estimated, controlling for time-invariant individual characteristics. However, because observed health diagnoses are limited, these within-individual estimates may be particularly sensitive to unobserved health developments. Therefore, the fixed effects results are shown in the Appendix.

[13] Because the regression includes both the objective life expectancy and the difference between objective and subjective, an increase in the objective life expectancy has the effect of adding $\beta_1 + \beta_2$ to the probability of holding an annuity.

coefficient on objective life expectancy is an order of magnitude larger than that on pessimism.

These results are directionally similar to those in O'Dea and Sturrock (2021). However, in contrast to the prior work, we find that selection (in this case, the correlation of objective life expectancy and annuity coverage) plays a meaningfully larger role than pessimism. Meanwhile, O'Dea and Sturrock suggest the two factors could be similarly important.

Table 4 shows results of regressions with the share of wealth from annuities as the left-hand side variable.[14] In these regressions, we do not find that objective life expectancy is statistically significant once controlling for health conditions.[15] However, in the specifications controlling for health, pessimism is still marginally significant.[16] These results are more in line with past research, as pessimism seems to remain important in the extensive margin decision of *how much* to annuitize, even as controls for objective factors such as health and demographics render objective life expectancy moot.

Two possible explanations for the divergence of results on the extensive margin of annuitization here and in past work stem from the different methodological approaches in the two studies. First, the analysis in O'Dea and Sturrock (2021) is theoretical; the analysis here is empirical and thus is affected by more variables that may affect the annuitization decision (e.g., specific health shocks). Second, the current analysis goes to greater effort to approximate the "real" objective life expectancy of individuals, by accounting for their demographic and health characteristics, rather than relying on a general population life table. A more accurate measure of objective life expectancy would be expected to lead to more predictive power of the variable.[17]

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[14] Regressions with the share of income deriving from annuities show no effect of life expectancy on annuities, possibly due to measurement error in the dependent variable. These results are available upon request.

[15] Finding selection in one contract dimension but not in another is not unusual. Finkelstein and Poterba (2004) also find evidence of selection on some contract dimensions, and no evidence on others.

[16] See the Appendix for regressions that control for the respondent's planning horizon and financial literacy. The planning horizon variable categorizes respondents on five groups, based on how many years ahead they self-report to be planning ahead. The financial literacy variable is binary and assumes the value one for respondents who answered a question about interest rates and inflation correctly. Specifically, it asks "Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy more than, exactly the same as, or less than today with the money in this account?" Neither of these regressions yield significant results on either objective life expectancy or pessimism; however, the former controls, to a large extent, for life expectancy and pessimism and so may be absorbing their impact, and the latter includes only a very small sample size.

[17] Many other smaller differences in sample and design could affect the discrepancy in findings between the current study and O'Dea and Sturrock (2021). For example, the U.K. annuity market is different than the U.S. market; the English Longitudinal Study of Ageing and the HRS use somewhat different sampling methods; etc.

Conclusion

This paper assessed the relative importance of objective life expectancy and subjective survival pessimism in annuitization decisions. Regression models were estimated that control for objective life expectancy, subjective survival pessimism, and other characteristics that are linked to annuitization decisions. Results suggest that both objective life expectancy and subjective pessimism are correlated with having a commercial annuity.

However, the estimates indicate that objective life expectancies are more important than pessimism in the decision of whether to annuitize. One more year of objective life expectancy increases the chance of buying a commercial annuity by 0.20 percentage points. Meanwhile, one less year of pessimism is associated with an increase of 0.023 percentage points in the probability of having an annuity, nearly nine times smaller than the coefficient on objective life expectancy.

One limitation of our methods is that, although objective life expectancy and pessimism can predict whether an individual has a commercial annuity, the relationship does not have to be causal. Pessimism about life expectancy may be correlated with pessimism about other variables that affect annuity purchases. These variables include pessimism about medical expenditures and pessimism about market risk. Hence, our results on the importance of subjective life expectancies may capture an overall measure of pessimism rather than a causal effect.

A final caveat to the straightforward interpretation of the results here is that subjective beliefs are inherently more difficult to measure than observable objective characteristics. Measurement error may lead to attenuation of the correlation of subjective pessimism and annuitization, which could in turn give an advantage to the objective measure in the horse race regressions. This analysis represents a best effort at measuring beliefs, but future work may improve on these methods.

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Table 1. *Summary Statistics of HRS Sample*

	Mean	SD	Min	Max
Subjective LE	22.031	8.695	1	43.988
Objective LE	23.525	3.866	13.742	34.658
Discounted subjective LE	15.072	4.939	1	24.602
Discounted objective LE	16.087	1.960	10.521	20.784
Age	59.803	3.032	55	65
Married	.64	0.480	0	1
Male	.499	0.500	0	1
Kids	.906	0.292	0	1
High blood pressure	.493	0.500	0	1
Diabetes	.177	0.382	0	1
Cancer	.086	0.280	0	1
Lung disease	.067	0.250	0	1
Heart disease	.143	0.350	0	1
Stroke	.036	0.185	0	1
Psychiatric problems	.156	0.363	0	1
Arthritis	.463	0.499	0	1
Net housing wealth	1.638	3.327	-38.38	146.606
Social Security income	1,878.576	4,904.475	0	101,161.07
DB plan	.184	0.387	0	1

Source: Authors' estimates from the University of Michigan, *Health and Retirement Study* (HRS) (2000-2016).

Table 2. *Objective and Subjective Life Expectancies in the HRS*

		Male		Female		Everyone	
		Objective	Subjective	Objective	Subjective	Objective	Subjective
Ages 55-59	Total	24.4	23.5	27.8	25.3	26.0	24.4
	High education	27.2	25.4	29.1	27.1	28.2	26.3
	Low education	22.2	21.3	26.3	23.0	24.1	22.1
	White	24.4	23.5	27.7	25.7	25.9	24.5
	Black	21.7	25.2	26.1	26.5	24.0	25.9
Ages 60-65	Total	19.7	19.2	22.6	20.6	21.1	19.9
	High education	21.9	20.5	23.8	22.3	22.9	21.5
	Low education	17.9	17.2	21.4	18.8	19.7	18.1
	White	19.6	19.2	22.5	20.9	20.9	20.0
	Black	17.7	20.9	21.6	21.6	19.7	21.3

Source: Authors' estimates from the HRS (2000-2016).

Table 3. *Regression Results for the Effect of Life Expectancy and Pessimism on Owning a Commercial Annuity*

Variables	(1) Demographics only	(2) Demographics + health	(3) Demographics + health + SES
Objective LE	0.00204***	0.00193**	0.00128*
	(0.000760)	(0.000784)	(0.000725)
Pessimism	-0.000233*	-0.000259*	-0.000224*
	(0.000130)	(0.000133)	(0.000129)
Age	0.164	0.162	0.180
	(0.285)	(0.285)	(0.282)
Age squared	-0.00278	-0.00276	-0.00307
	(0.00479)	(0.00480)	(0.00474)
Age cubed	1.59e-05	1.58e-05	1.75e-05
	(2.69e-05)	(2.69e-05)	(2.66e-05)
Male	0.000951	0.00109	-0.00230
	(0.00211)	(0.00201)	(0.00287)
High blood pressure		-0.00255	-0.00207
		(0.00172)	(0.00171)
Diabetes		-0.00207	-0.00155
		(0.00191)	(0.00191)
Cancer		0.00397	0.00310
		(0.00378)	(0.00381)
Lung disease		0.000450	0.000646
		(0.00394)	(0.00390)
Heart disease		0.00486	0.00503
		(0.00342)	(0.00335)
Stroke		-0.00417 *	-0.00387
		(0.00249)	(0.00250)
Psychiatric problems		0.00360	0.00316
		(0.00272)	(0.00269)

-continued-

Table 3. *Regression Results for the Effect of Life Expectancy and Pessimism on Owning a Commercial Annuity (continued)*

	(1)	(2)	(3)
Variables	Demographics only	Demographics + health	Demographics + health + SES
Arthritis		-0.000817	-0.000497
		(0.00149)	(0.00148)
Net housing wealth			0.00183*
			(0.00103)
Social Security wealth			-4.51e-09
			(6.21e-09)
DB plan			-0.00270*
			(0.00159)
Married			-0.00742**
			(0.00297)
Male x Married			0.00458
			(0.00342)
Kids			-0.000331
			(0.00272)
Constant	-3.275	-3.232	-3.566
	(5.619)	(5.629)	(5.567)
Observations	32,109	32,018	32,018
R-squared	0.003	0.004	0.010

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' estimates from the HRS (2000-2016).

Table 4. *Regression Results for the Effect of Life Expectancy and Pessimism on Share of Wealth from Annuities*

	(1)	(2)	(3)
Variables	Demographics only	Demographics + health	Demographics + health + SES
Objective LE	0.000986 *	0.000916	0.000470
	(0.000544)	(0.000566)	(0.000523)
Pessimism	-0.000174	-0.000217 *	-0.000197 *
	(0.000111)	(0.000116)	(0.000112)
Age	0.0438	0.0445	0.0516
	(0.217)	(0.217)	(0.215)
Age squared	-0.000762	-0.000778	-0.000897
	(0.00366)	(0.00367)	(0.00363)
Age cubed	4.52e-06	4.63e-06	5.27e-06
	(2.06e-05)	(2.06e-05)	(2.04e-05)
Male	-0.000711	-0.000612	-0.00315
	(0.00148)	(0.00139)	(0.00226)
High blood pressure		-0.00165	-0.00133
		(0.00121)	(0.00120)
Diabetes		-0.00124	-0.000929
		(0.00141)	(0.00141)
Cancer		0.00311	0.00254
		(0.00270)	(0.00274)
Lung disease		-0.000172	-8.32e-05
		(0.00283)	(0.00279)
Heart disease		0.00434	0.00446*
		(0.00267)	(0.00263)
Stroke		-0.00326	-0.00306
		(0.00205)	(0.00206)
Psychiatric problems		0.00367 *	0.00336
		(0.00209)	(0.00206)

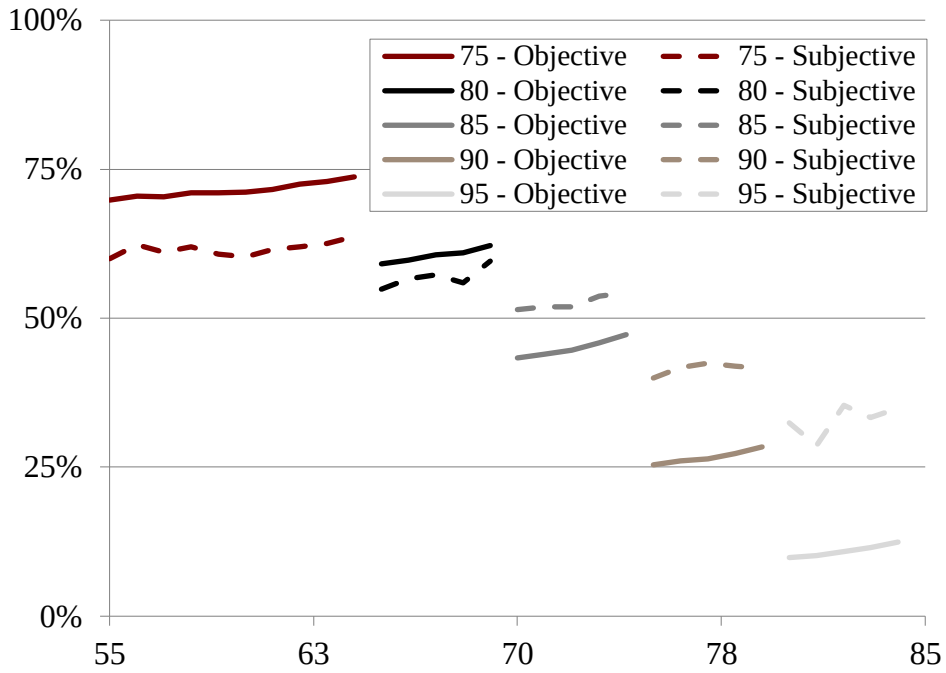
-continued-

Table 4. *Regression Results for the Effect of Life Expectancy and Pessimism on Share of Wealth from Annuities (continued)*

	(1)	(2)	(3)
Variables	Demographics only	Demographics + health	Demographics + health + SES
Arthritis		-0.000959	-0.000751
		(0.00113)	(0.00111)
Net housing wealth			0.00117
			(0.000809)
Social Security wealth			-4.48e-09
			(4.88e-09)
DB plan			-0.00191*
			(0.00108)
Married			-0.00479**
			(0.00207)
Male x Married			0.00341
			(0.00256)
Kids			-0.000324
			(0.00228)
Constant	-0.872	-0.880	-1.004
	(4.267)	(4.275)	(4.240)
Observations	28,667	28,590	28,590
R-squared	0.003	0.005	0.010

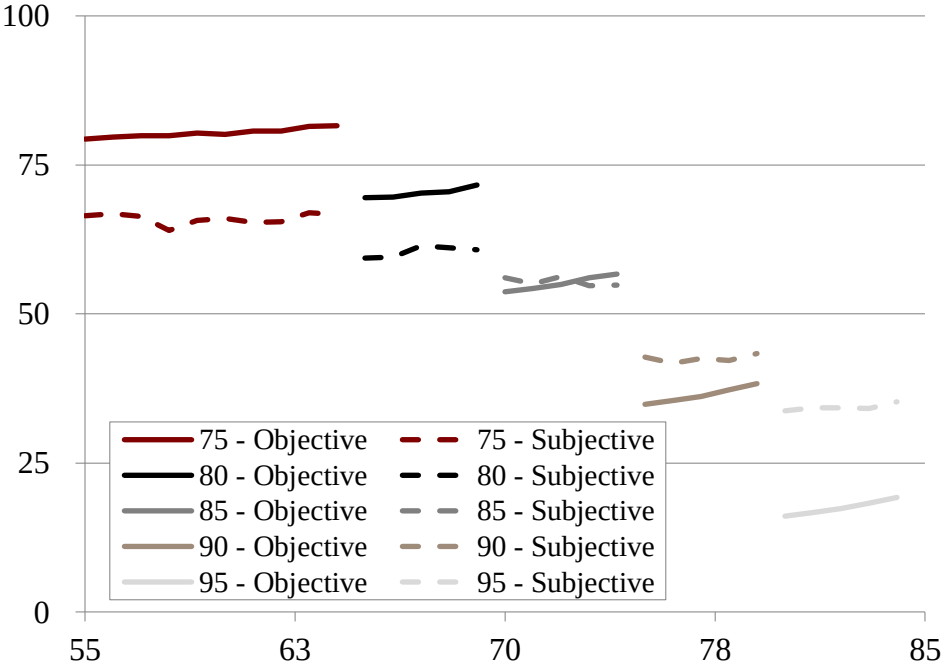
Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' estimates from the HRS (2000-2016).

Figure 1. *Objective and Subjective Probabilities of Living to Ages 75, 80, 85, and 95 for Individuals of Each Age, Males*



Source: Authors' calculations based on the HRS (2000-2016).

Figure 2. *Objective and Subjective Probabilities of Living to Ages 75, 80, 85, and 95 for Individuals of Each Age, Females*



Source: Authors' calculations based on the HRS (2000-2016).

Appendix

Table A1. *Fixed-Effects Regression Results for the Effect of Life Expectancy and Pessimism on Annuity Outcomes*

	(1)	(2)	(3)
Variables	Annuity presence	Wealth share	Income share
Objective LE	0.00140	0.00287	-0.000130
	(0.00334)	(0.00271)	(0.00122)
Pessimism	-6.58e-06	-3.36e-05	-1.11e-05
	(0.000167)	(0.000143)	(6.19e-05)
Age	0.556**	0.335*	0.0776
	(0.245)	(0.197)	(0.0899)
Age squared	-0.00951**	-0.00575*	-0.00132
	(0.00411)	(0.00332)	(0.00151)
Age cubed	5.43e-05**	3.30e-05*	7.43e-06
	(2.30e-05)	(1.86e-05)	(8.46e-06)
High blood pressure	-0.00275	-0.00242	-0.00153*
	(0.00238)	(0.00193)	(0.000874)
Diabetes	0.00219	0.00142	-0.000202
	(0.00301)	(0.00246)	(0.00111)
Cancer	-0.00159	-0.00167	-0.00128
	(0.00392)	(0.00313)	(0.00144)
Lung disease	0.00135	-0.00745**	0.00269*
	(0.00420)	(0.00342)	(0.00154)
Heart disease	-0.00532*	-0.00208	-0.00102
	(0.00317)	(0.00258)	(0.00116)
Stroke	-0.00447	-0.00360	-0.00145
	(0.00565)	(0.00458)	(0.00207)
Psychiatric problems	-0.00357	-0.00124	0.000187
	(0.00322)	(0.00259)	(0.00119)

-continued-

Table A1. *Fixed-Effects Regression Results for the Effect of Life Expectancy and Pessimism on Annuity Outcomes (continued)*

	(1)	(2)	(3)
Variables	Annuity presence	Wealth share	Income share
Arthritis	0.00233	0.00204	-0.000979
	(0.00228)	(0.00184)	(0.000837)
Net housing wealth	-0.000533**	-0.000441**	-0.000188**
	(0.000232)	(0.000180)	(8.53e-05)
Social Security wealth	1.34e-08*	1.12e-08*	-1.76e-10
	(7.44e-09)	(5.99e-09)	(2.73e-09)
DB plan	-0.00390**	-0.00232*	-0.00110*
	(0.00170)	(0.00135)	(0.000624)
Married	-0.0137***	-0.00824**	-0.00186
	(0.00452)	(0.00364)	(0.00166)
Male x Married	0.00654	-0.00250	0.000296
	(0.00617)	(0.00502)	(0.00227)
Kids	-0.00596	-0.00550	-0.00290
	(0.00588)	(0.00492)	(0.00216)
Constant	-10.87**	-6.589*	-1.511
	(4.844)	(3.908)	(1.781)
Observations	32,018	28,590	31,603
R-squared	0.007	0.008	0.003
Number of HHIDPN	12,150	11,342	12,102

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' estimates from the HRS (2000-2016).

Table A2. *Regression Results for the Effect of Financial Planning Horizons on Annuity Outcomes*

	(1)	(2)	(3)
Variables	Annuity presence	Wealth share	Income share
Objective LE	0.000826	-6.05e-05	7.85e-05
	(0.000791)	(0.000566)	(0.000238)
Pessimism	-5.47e-05	-5.82e-05	-7.15e-06
	(0.000151)	(0.000126)	(5.29e-05)
Age	0.272	0.173	-0.102
	(0.347)	(0.245)	(0.104)
Age squared	-0.00464	-0.00298	0.00175
	(0.00585)	(0.00414)	(0.00177)
Age cubed	2.65e-05	1.71e-05	-9.98e-06
	(3.28e-05)	(2.33e-05)	(9.98e-06)
Male	-0.00368	-0.00481 *	-0.00166
	(0.00353)	(0.00275)	(0.00141)
High blood pressure	-0.00159	-0.000734	-0.000327
	(0.00183)	(0.00133)	(0.000674)
Diabetes	-0.00367 **	-0.00262 **	-0.000467
	(0.00146)	(0.00114)	(0.000528)
Cancer	0.00454	0.00343	0.00246
	(0.00476)	(0.00344)	(0.00211)
Lung disease	-0.000411	-0.000209	-0.000811
	(0.00318)	(0.00249)	(0.000765)
Heart disease	0.00310	0.00433	0.00181
	(0.00349)	(0.00283)	(0.00159)
Stroke	0.000338	-0.00101	-0.00154 ***
	(0.00412)	(0.00352)	(0.000571)
Psychiatric problems	0.00456	0.00420	0.00120
	(0.00314)	(0.00270)	(0.000992)

-continued-

Table A2. *Regression Results for the Effect of Financial Planning Horizons on Annuity Outcomes (continued)*

	(1)	(2)	(3)
	Annuity presence	Wealth share	Income share
Arthritis	-0.00116	-0.000856	-0.000337
	(0.00174)	(0.00136)	(0.000554)
Net housing wealth	0.00259 **	0.00162	0.000459 *
	(0.00131)	(0.00103)	(0.000241)
Social Security wealth	-1.06e-08 *	-6.27e-09	-3.24e-09 **
	(6.42e-09)	(5.07e-09)	(1.54e-09)
DB plan	-0.00466 ***	-0.00312 ***	-0.00106 ***
	(0.00135)	(0.000843)	(0.000361)
Married	-0.0103 ***	-0.00709 ***	-0.00304 ***
	(0.00316)	(0.00249)	(0.00113)
Male x Married	0.00771 **	0.00562 *	0.00268 **
	(0.00387)	(0.00306)	(0.00135)
Kids	-0.00170	-0.000856	-0.000806
	(0.00363)	(0.00308)	(0.00131)
Financial planning horizon = Next year	0.00249	0.00305 *	0.00140
	(0.00233)	(0.00179)	(0.00103)
Financial planning horizon = Next few years	0.00376 **	0.00342 ***	0.000839 **
	(0.00169)	(0.00130)	(0.000364)
Financial planning horizon = Next 5-10 years	0.00543 ***	0.00403 ***	0.00166 ***
	(0.00193)	(0.00146)	(0.000624)
Financial planning horizon = > 10 years	0.00648 **	0.00479 **	0.00260 **
	(0.00325)	(0.00212)	(0.00105)
Constant	-5.323	-3.342	1.976
	(6.863)	(4.835)	(2.039)
Observations	17,861	15,998	17,647
R-squared	0.019	0.016	0.009

Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' estimates from the HRS (2000-2016).

Table A3. *Regression Results for the Effect of Financial Literacy on Annuity Outcomes*

	(1)	(2)	(3)
Variables	Annuity presence	Wealth share	Income share
Objective LE	0.00107	0.000746	0.00110
	(0.00265)	(0.00247)	(0.00124)
Pessimism	-0.000825	-0.000821	-5.17e-05
	(0.000688)	(0.000678)	(0.000108)
Age	4.097*	2.092	-0.00796
	(2.293)	(1.787)	(0.520)
Age squared	-0.0688*	-0.0350	0.000401
	(0.0389)	(0.0304)	(0.00897)
Age cubed	0.000385*	0.000195	-3.66e-06
	(0.000220)	(0.000172)	(5.14e-05)
Male	-0.0163	-0.0136	-0.00724*
	(0.0126)	(0.00966)	(0.00403)
High blood pressure	-0.0123	-0.00908	-0.00331
	(0.00802)	(0.00750)	(0.00379)
Diabetes	-0.00345	-0.00430	-0.000880
	(0.00891)	(0.00767)	(0.00143)
Cancer	0.0266	0.0277	0.0153
	(0.0283)	(0.0260)	(0.0159)
Lung disease	0.0208	0.0235	-4.50e-05
	(0.0278)	(0.0287)	(0.00649)
Heart disease	-0.00608	-0.00588	-0.00233
	(0.00971)	(0.00856)	(0.00312)
Stroke	-0.0126	-0.00932	-0.00121
	(0.00900)	(0.0107)	(0.00245)
Psychiatric problems	-0.000137	0.00455	0.00553
	(0.00970)	(0.0100)	(0.00686)

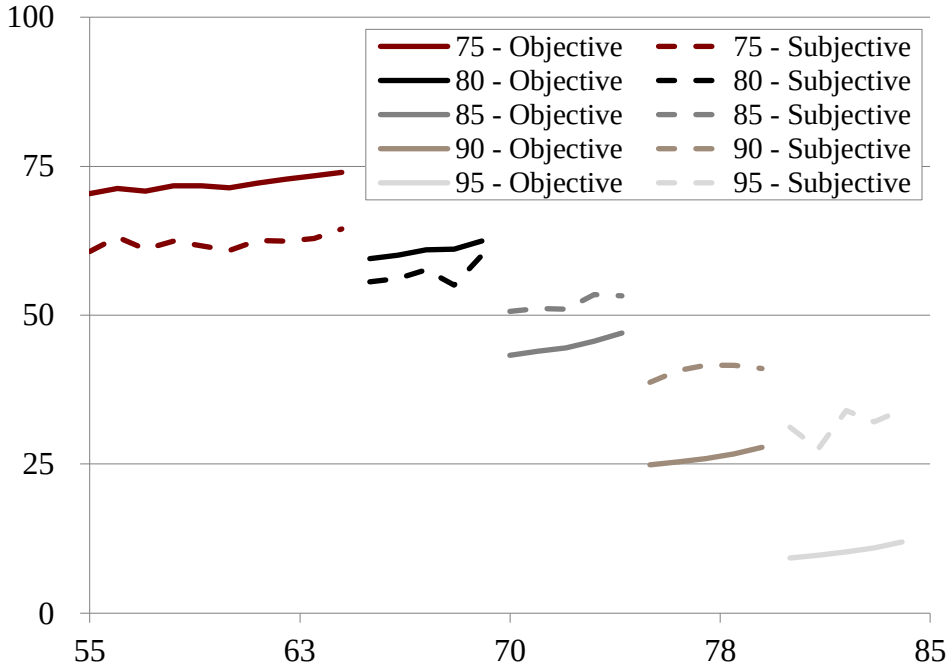
-continued-

Table A3. *Regression Results for the Effect of Financial Literacy on Annuity Outcomes (continued)*

	(1)	(2)	(3)
	Annuity presence	Wealth share	Income share
Arthritis	0.0107	0.0109	0.00201
	(0.0103)	(0.00935)	(0.00284)
Net housing wealth	-0.00159**	-0.00121*	-0.000378
	(0.000788)	(0.000661)	(0.000335)
Social Security wealth	-6.48e-09	-1.93e-08	-3.75e-09
	(5.55e-08)	(5.21e-08)	(9.99e-09)
DB plan	-0.00755	-0.0103**	-0.00252
	(0.00772)	(0.00464)	(0.00221)
Married	-0.0226	-0.0151	-0.0118
	(0.0161)	(0.0146)	(0.00775)
Male x Married	0.0319**	0.0255**	0.0108*
	(0.0145)	(0.0122)	(0.00627)
Kids	0.00726	0.00743	0.00478
	(0.0119)	(0.0115)	(0.00571)
Financially literate	0.0142**	0.0126*	0.00296
	(0.00625)	(0.00662)	(0.00305)
Constant	-81.29*	-41.72	-0.188
	(44.97)	(34.98)	(10.02)
Observations	935	806	923
R-squared	0.034	0.040	0.035

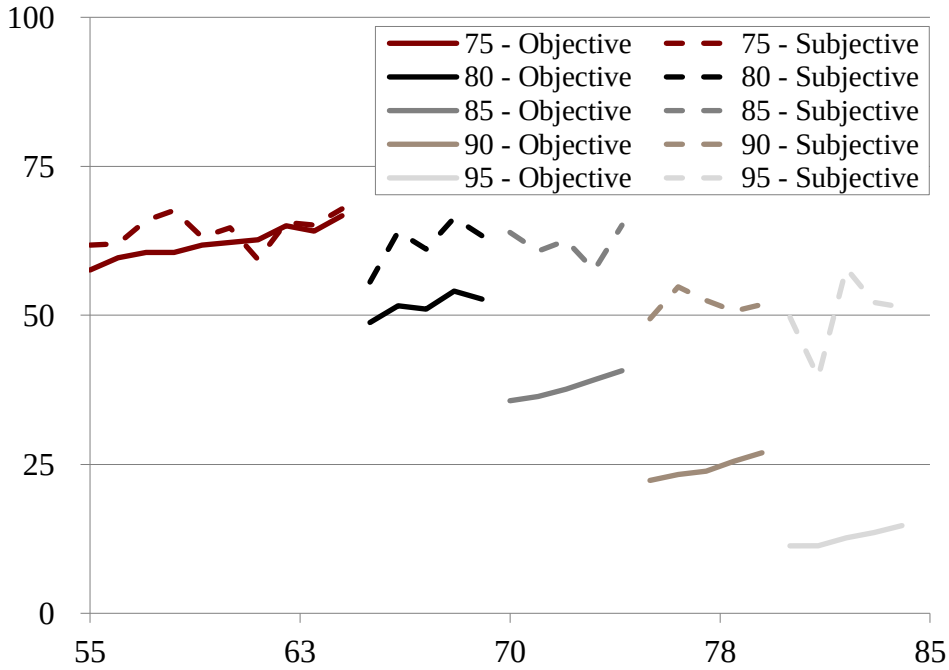
Notes: Standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' estimates from the HRS (2000-2016).

Figure A1. *Objective and Subjective Probabilities of Living to Ages 75, 80, 85, and 95 for Individuals of Each Age, White Males*



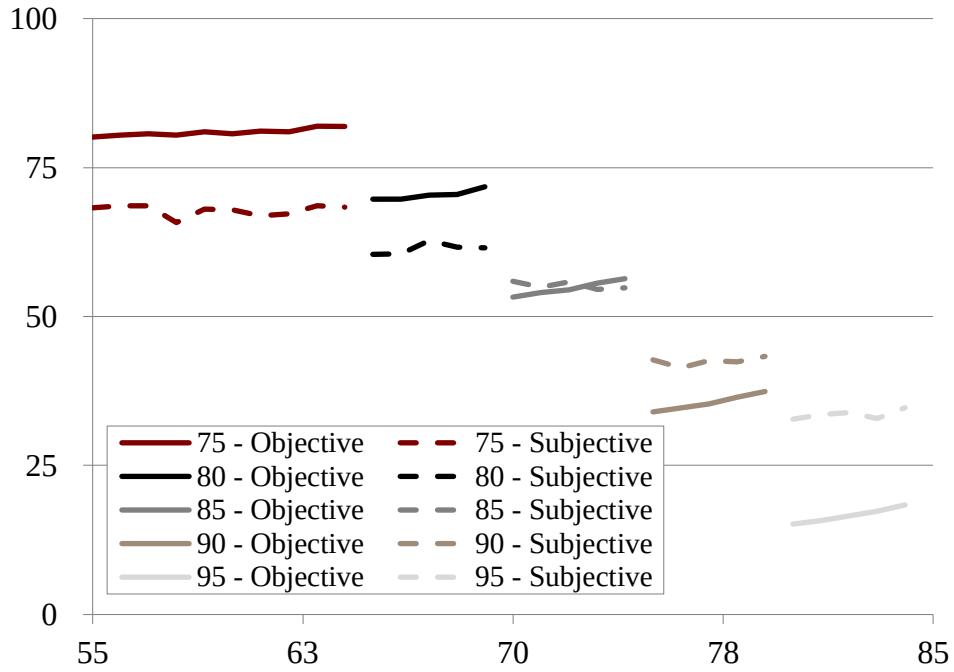
Source: Authors' estimates from the HRS (2000-2016).

Figure A2. *Objective and Subjective Probabilities of Living to Ages 75, 80, 85, and 95 for Individuals of Each Age, Black Males*



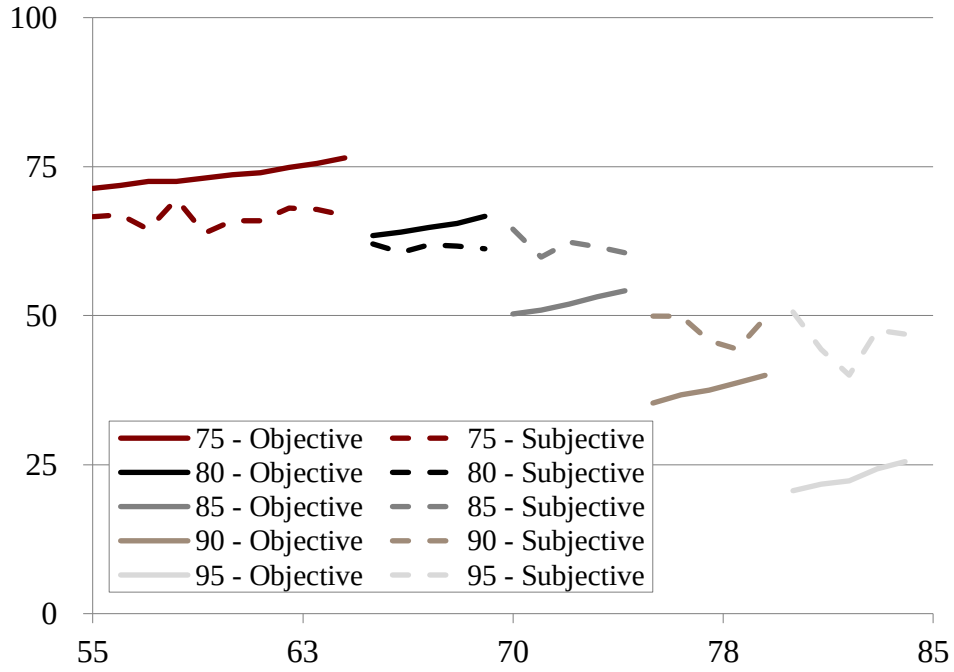
Source: Authors' estimates from the HRS (2000-2016).

Figure A3. *Objective and Subjective Probabilities of Living to Ages 75, 80, 85, and 95 for Individuals of Each Age, White Females*



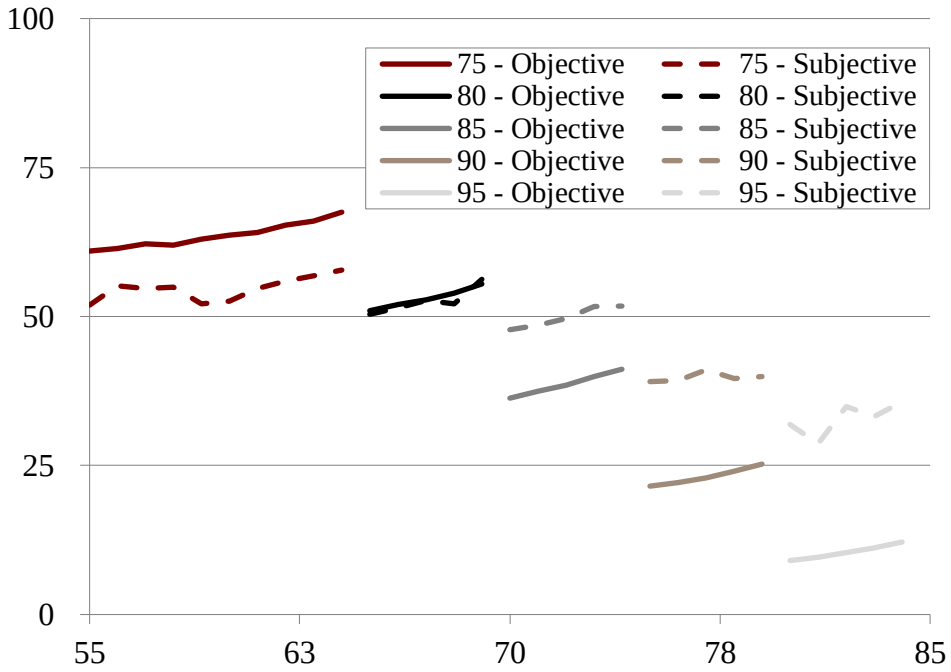
Source: Authors' estimates from the HRS (2000-2016).

Figure A4. *Objective and Subjective Probabilities of Living to Ages 75, 80, 85, and 95 for Individuals of Each Age, Black Females*



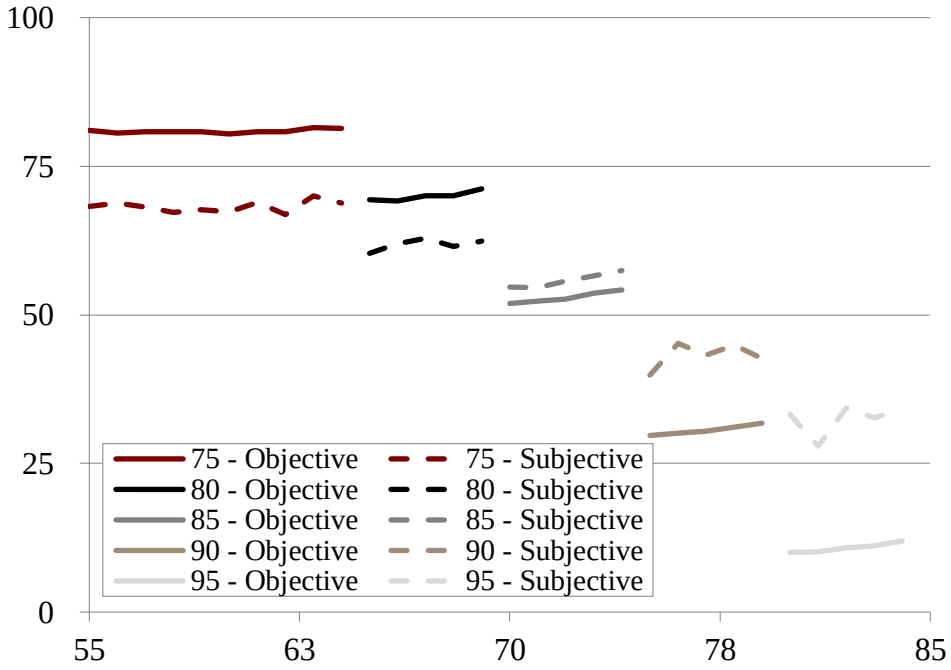
Source: Authors' estimates from the HRS (2000-2016).

Figure A5. *Objective and Subjective Probabilities of Living to Ages 75, 80, 85, and 95 for Individuals of Each Age, Low Education Males*



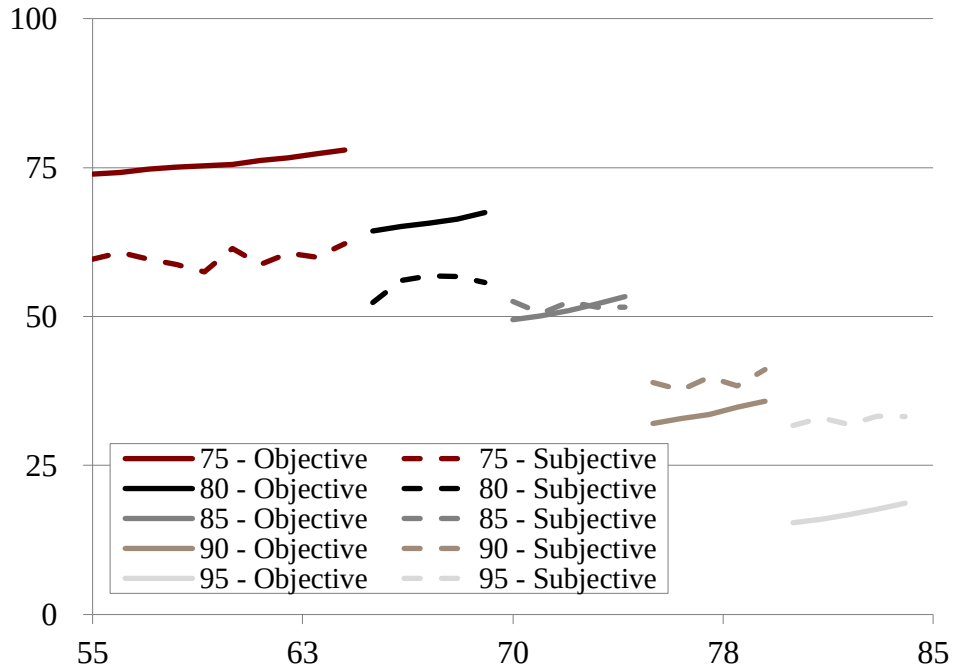
Source: Authors' estimates from the HRS (2000-2016).

Figure A6. *Objective and Subjective Probabilities of Living to Ages 75, 80, 85, and 95 for Individuals of Each Age, High Education Males*



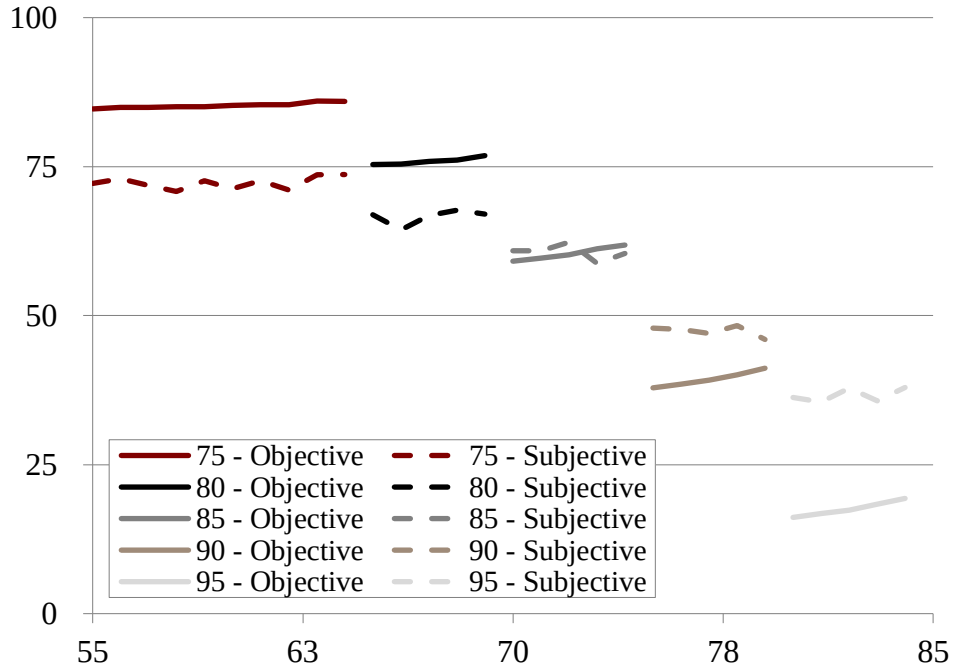
Source: Authors' estimates from the HRS (2000-2016).

Figure A7. *Objective and Subjective Probabilities of Living to Ages 75, 80, 85, and 95 for Individuals of Each Age, Low Education Females*



Source: Authors' estimates from the HRS (2000-2016).

Figure A8. *Objective and Subjective Probabilities of Living to Ages 75, 80, 85, and 95 for Individuals of Each Age, High Education Females*



Source: Authors' estimates from the HRS (2000-2016).

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