



TEXAS TECH UNIVERSITY  
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# Retirement Planning & Living Research Initiative

## **Framing Longevity Income**

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## **Abstract**

This paper analyzes the effect of framing on the stated demand for longevity annuities. We test whether longevity income framed as “insurance” is more attractive than longevity income framed as an “annuity,” since longevity income is consumption protection. In a sample of 1,425 respondents, we find that when the longevity insurance frame is shown before the longevity annuity frame, respondents are less likely to state a demand for a longevity annuity. In addition, we find that people with higher numeracy are less likely to succumb to longevity income framing effects.

## **Keywords**

Annuities; Retirement Income; Framing; Longevity Insurance; Longevity Income

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### Introduction

Retirees must make financial decisions in the face of two opposing risks. On the one hand, they face longevity risk, that is, the risk of living longer than expected. For example, although current life expectancy is 76.3 years for men and 81.2 years for women, there is a 20 percent chance that one of two 70-year-old spouses will live until age 95 (National Center for Health Statistics, 2017; Vanguard, 2017). On the other hand, rational individuals desire to maximize lifetime utility of consumption. Given an uncertain lifespan, those without a bequest motive risk consuming too little before death and falling short of realizing the maximum utility that they could have achieved.

Addressing the dual risks of an uncertain lifespan and suboptimal lifetime consumption can be difficult for retirees. Guaranteed income streams such as defined-benefit (DB) pensions, U.S. social security retirement benefits, and annuities were designed as means to address these risks. But, the reduction in the availability of DB plans and social security funding uncertainty lessens their potential benefits. In 2014, only 2 percent of private sector workers were enrolled in a DB-only plan, the consequence of a steady decline in the number of employers offering this type of retirement plan over the past decades (EBRI, 2017). The stability of social security's "pay-as-you-go" structure is currently threatened by the opposing demographic trends of a rising number of retirees versus a declining number of workers available to fund the obligations. Without policy changes, claims on social security benefits are projected to deplete the program's trust fund by 2034, potentially forcing a reduction in benefits to just 75 percent of what had been promised to retirees (SSA, 2017). Even without benefit reduction, benefits are modest. The average amount received is \$1,500 per month for men and \$1,182 per month for women. Benefits are capped at \$2,639 per month for those who retire at full retirement age (SSA, 2016).

The decline of DB plans and concerns over funding of the social security program has thrust more responsibility on individuals for making sure they can fund their post-retirement consumption over an uncertain lifespan. However, many individuals are unfamiliar with how to estimate life expectancies, manage assets, and effectively utilize asset withdrawal strategies. Consequently, they may underestimate the risks of either outliving their assets or failing to maximize their lifetime utility.

### Longevity Income

Longevity income products offer a way to help individuals align their retirement consumption needs with an uncertain lifespan. These products, also known as deferred annuities, pay out late in life (e.g. at age 80 or older) and are guaranteed to continue for life. Individuals who purchase longevity income products are protected against outliving their financial resources and, as an additional benefit, would then have a fixed time frame for projecting use of their other financial resources.

According to standard economic theory, a rational, self-interested individual strives to maintain consumption over time at a level that maximizes lifetime utility. Yaari (1965) was first to recognize that having an annuity in the portfolio of an older individual was a way to address the issue of a funding horizon of uncertain length. In a now classic paper, he demonstrated that given particular assumptions regarding both consumer and market characteristics, a risk-averse consumer would improve utility by exchanging all retirement wealth for an annuity rather than

investing in a bond. He argued that with an annuity, payments made by those that died early would subsidize payments made to survivors. As compared with a bond, this so-called “mortality premium,” would allow survivors to not only increase consumption but also to eliminate risk of funding shortfall.

Yaari’s (1965) analysis assumed that there was no desire for a bequest, a complete annuity market, actuarially fair prices, maximization of expected utility and utility functions with additive separability (Benartzi, Previtro, and Thaler, 2011). Subsequent work has evaluated the effects of relaxing some of these assumptions. Several researchers have found that the superior performance of annuities persists despite the fees and expenses associated with annuity purchase (Mitchell, Poterba, Warshawsky, and Brown, 1999), annuity prices (Fitzpatrick, 2012) or incomplete annuity markets (Davidoff, Brown, and Diamond, 2005). However, Brown et al. (2013) noted that the complex pricing structures of annuities could make it difficult for consumers to determine their fair value.

Many risk averse retirees would be better off if they hedged longevity risk by purchasing an annuity (Yaari, 1965; Brown and Diamond, 2005). Researchers have been puzzled by the fact that relatively few retirees actually do. A number of potential explanations for this under-annuitization puzzle have been proposed and evaluated, building a growing body of literature on the topic (see, for example, Beatrice, Drinkwater, and Sondergeld, 2004; Benartzi, Previtro, and Thaler, 2011; James and Song, 2001; Johnson, Burman, and Kobes, 2004). Initial investigations into reasons for under-annuitization that were related to the rational economic model of consumer behavior such as potential substitutes, anticipated healthcare expenditures and unfair pricing have provided some insight into reasons for non-purchase of annuities, but have not conclusively resolved the puzzle.

Some researchers have attributed low annuity purchase to use of substitutes, noting that many individuals already receive annuities in the form of social security retirement benefits or public and private sector pension plans (Bernheim, 1991; Dushi and Webb, 2004). Ability to pool and share resources among family members has also been suggested as another way to mitigate longevity risk instead of an annuity (Kotlikoff and Spivak, 1981; Brown and Poterba, 2000).

The uncertainty of future health expenditures would, in the absence of annuities, generally lead consumers to accumulate precautionary savings and shift away from risky assets toward bonds (Pang and Warshawsky, 2010). Replacing bonds with annuities offers the advantage of sustaining lifetime consumption while hedging against uncertain health care costs exceeding those covered by health insurance (Pang and Warshawsky, 2010). However, health shocks not only increase health expenses, they also can shorten life expectancy (Sinclair and Smetters, 2004). Using a dynamic programming model to estimate annuity demand, expectation of sizable health shocks made annuitization of wealth at retirement an unfavorable option for a risk-averse person, even without a desire to leave a bequest (Sinclair and Smetters, 2004).

The possibility of unfair pricing is another explanation for the under-annuitization puzzle that is consistent with the rational economic model. Analyzing data on the annuity market in the United Kingdom, Finkelstein and Poterba (2002, 2004), attribute low take-up of annuities to absence of actuarially fair policies. In the United States, the Supreme Court has mandated that unisex pricing be required for annuities purchased in employer-sponsored retirement plans, given that

participants are of the same age and have the same account balance (McCarthy, 2013). But, annuities purchased in the private U.S. market can be differentially priced based on sex.

Attention has recently turned to potential behavioral explanations related to how consumers respond to the presentation or framing of annuity purchase (Agnew et al., 2008; Brown, 2008; Brown et al., 2008). This research contributes to this line of inquiry, focusing specifically on the effects of framing on the stated willingness to purchase deferred longevity income.

### Review of Literature

Rational self-interest assumes an emotionless calculus of costs and benefits. Recently, researchers have begun to recognize that such things as perception, emotion, and cognitive function can color and influence evaluation of opportunities or transactions (Hu and Scott, 2007). These researchers have developed a new line of inquiry that examines behavioral factors that could influence annuity purchase and potentially resolve the puzzle of low demand – including the effect of framing in economic decision-making.

Brown et al. (2008) provide a framing model as an explanation for why people do not insure late life consumption. A retiree who maximizes the discounted sum of each period's utility of consumption can be modeled as:

$$\sum_{t=0}^T \delta u(c_t) \quad (1)$$

Where the retiree's utility of consumption at time  $t$ ,  $u(c_t)$ , is concave, the retiree's personal discount factor,  $\delta$ , is less than one and time of death,  $T$ , is a random variable. In this scenario, longevity income provides insurance by transferring money from a state where no utility is derived (death) to a state where money provides utility from consumption. In a two-period scenario, the retiree has a probability of dying,  $q$ , the retiree invests wealth,  $W$ , in a bond with a return,  $R$ . The retiree is able to consume  $W(1+R)$  from a bond. Longevity income provides for higher consumption due to the ability of retirees to pool their wealth today ( $t$ ) and share it with the survivors of the pool in the future ( $t+1$ ), creating a mortality premium. In the investment scenario, a bond has a return and is not dependent on mortality. Longevity income has a return  $\frac{(1+R)}{1-q}$  with probability  $1-q$  and return 0 with probability  $q$ . If we assume that longevity income is fairly priced and the retiree has full information regarding expected mortality, then the expected return is  $R$ .

The above model has an investment component and a consumption component. These two mechanisms can be linked to mental accounting and choice bracketing. Mental accounting is the tendency for people to separate money into different accounts based on criteria that may not be rational. Some underlying assumptions of mental accounting include changes in the marginal propensity to consume based on account type, which violates the economic principle of fungibility (Thaler, 1985). Mental accounting enhances our understanding of how consumers make complex decisions. In many instances, consumers make decisions in isolation (narrow bracketing) instead of assessing the consequences of all choices taken together (Read, Loewenstein and Rabin, 1999).

In this study, we imposed narrow bracketing on respondents by framing longevity income as a return on investment (investment frame) or as consumption protection (insurance frame) and compared the stated demand to longevity income framed as a traditional “annuity.” The contingent claim frame may be relatively attractive as it protects consumers from longer than expected mortality (i.e. outliving one’s retirement assets). Uncertainty surrounding mortality should make longevity income framed as an investment relatively unattractive.

Loss aversion<sup>1</sup> is not a required behavioral characteristic for a consumer to be averse to longevity income framed as an investment, but it may exacerbate the effect. An investment frame may appear even more unattractive to a loss averse investor because the return depends on  $T$ . Mortality may be negatively viewed within an investment frame because the loss averse annuitant could die earlier than expected and incur a “loss” of the upfront cost (UFC). On the other hand, if longevity income is framed as insurance, the UFC may be viewed as a premium that is paid to protect against a loss of consumption later in life.

This study contributes to the literature on the effect framing has on the stated demand for longevity income purchases by investigating:

1. Whether framing longevity income as “insurance” prior to an “annuity” alters the likelihood of purchasing a longevity “annuity.”
2. Whether framing longevity income as an “investment” prior to an “annuity” alters the likelihood of purchasing a longevity “annuity.”
3. The types of people who are more likely to succumb to framing effects within the domain of longevity income.

### Conceptual Model

Standard economic theory suggests that deferred annuity purchase is a rational consumer choice based on price, all else equal. Taking a different perspective, behavioral economics explicitly recognizes the influence that subjective perceptions and emotions may have on annuity purchase decisions. Research findings support both perspectives. Given this theory and prior research, the theoretical model used in this study was:

Likelihood of stated longevity income purchase =  $f(\text{framing structure, price structure, socio-demographic factors, financial resources and claims, retirement expectations, behavioral factors})$ .

A summary of the empirical measures used in this study and the hypothesized relations between these measures and likelihood of longevity annuity purchase is given in Table 1.

Objective and subjective life expectancy should be positively associated with likelihood of longevity income purchase, due to expecting to fund more years of consumption. Data collected in 2009 from the U.S. Centers for Disease Control and Prevention, National Center for Health Statistics indicate that life expectancy differs by race and ethnicity such that Asian-Americans

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<sup>1</sup> Loss aversion is the tendency for individuals to overweigh utility from losses relative to comparable gains from an arbitrary reference point (Kahneman and Tversky, 1979).

have the highest life expectancy at birth (86.50 years) followed by Hispanics (82.80 years), whites (78.90 years), and African-Americans (74.60 years), respectively (Lewis and Burd-Sharps, 2013). This difference should affect the stated demand for longevity annuity purchase. Prior research indicates that education level is positively associated with life expectancy (Meara et al., 2008) and annuity participation (Inkmann et al., 2011). Tobacco use shortens life expectancy, on average. Also, earlier empirical works have used smoking as a proxy for a higher personal discount rate (Scharff and Viscusi, 2011; Huston and Finke, 2003). Tobacco use is therefore negatively associated with annuity demand.

The effect of consumer psychological characteristics on annuity demand may vary. A strong negative relation has been found between past 12-month stock returns and annuity sales (Previtero, 2014), suggesting individuals may implicitly view an annuity purchase as a lost opportunity to experience stock market gains. Greater aversion to stock market losses should be associated with a higher likelihood of purchasing a fixed-rate longevity annuity, since the payoff is not dependent on equity returns. Individuals with weaker numerical abilities are less likely to accurately value annuities (Brown et al., 2017).

Family circumstances may affect perceived need for an annuity. Annuitization rates are lower among married couples; a result attributed to an ability to pool mortality risk (Brown, 2001). As the number of people who rely on a respondent's income increases, so should expenses, which could increase risk of retirement fund shortfall and generate demand for an annuity. Similarly, having a bequest motive should increase the demand for longevity income to avoid need to deplete a potential bequest to fund consumption needs.

Source and level of later life economic resources can influence annuity demand. According to the life-cycle hypothesis, risk averse consumers maximize lifetime utility by smoothing consumption over their lifespan (Modigliani and Brumberg, 1954). Consequently, those with high preretirement income levels would require large absolute replacement levels of income once employment income ends. Individuals with higher income levels also have lower social security wage replacement rates, which should force greater reliance on alternative income sources in retirement.

Having greater absolute levels of financial resources should decrease the benefit of a longevity annuity, as it is more likely that resources will be adequate to fund retirement goals. Consequently, individuals with greater assets, home equity or a defined benefit pension plan should be less likely to purchase longevity income. Similarly, individuals who are currently working should be less likely to incur a retirement shortfall. Having high liability levels, however, should increase shortfall risk and the demand for annuitization. An additional financial concern is the potential reduction in social security benefit payments beginning 2034 (SSA, 2017). Consumers expecting to be adversely affected by this potential reduction should be more likely to demand longevity income.

[Insert Table 1 about here]



## Methods

### *Study Design*

An online panel was used to recruit participants who were age 50 and older. Prior research has affirmed the appropriateness of this tool for survey research (Behrend et al., 2011; Paolacci and Chandler, 2014). Participants were paid \$0.50 to answer a series of longevity income questions along with various demographic and socioeconomic questions. To maintain data quality, in accordance with prior research, participants were asked multiple attention-check questions throughout the survey (Hauser and Schwarz, 2016). Participants who did not answer the attention check questions correctly were excluded from the sample, as were those who did not specify their gender or meet the age criteria. After these exclusions, 2,887 valid responses remained. For the current study, only longevity income questions that included a one-time UFC were analyzed for a final sample size of 1,425. The remaining sample included annuity questions that broke up the UFC of the annuity. Examples of longevity income questions that broke up the UFC are included in the appendix. All respondents observed both cost structures.

### *Sample Characteristics*

The mean age of the 1,425 respondents was 58 years comprised of 644 males (45.2%) and 781 females (54.8%). Seventy-six percent of the sample reported being white; 61.70% stated that they were married. Nearly half of the sample (49.7%) had an annual household income that was between \$41,187 and \$112,262 and slightly over half (50.5%) reported liability amounts of \$10,000 or lower. A majority of the respondents (55.9%) hold a four-year college degree; 72.9% stated they were currently still working.

### *The Frames*

Price quotes for deferred income annuities (DIAs) were obtained from Cannex<sup>2</sup>. The quotes were based on an assumed annuitant age 65 at the time of purchase with an UFC of either \$50,000 or \$100,000. The longevity income payout would begin at either age 80 or 85. Since pricing differs by sex in the private U.S. annuity market<sup>3</sup>, male and female participants were presented with sex-specific prices. The four DIA questions for female participants are displayed below. Pricing for male participants is provided in parentheses. Participants were shown a total of 12 longevity income questions. Order of presentation of the three different frame blocks (annuity, insurance, or investment) was random for each participant. Alternative frames are illustrated in brackets. Response options were yes or no:

1. Suppose you are offered an annuity [insurance] [investment] where you pay \$50,000 at age 65. In exchange, you receive \$871 per month for life beginning at age 80 (\$1,090 per month for males). If you do not live until age 80 there is no return of the amount you paid for the annuity [insurance] [investment]. If you

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<sup>2</sup> New York Life Insurance and Annuity Corporation prices were used for the analyses. Quotes were obtained on January 29, 2016.

<sup>3</sup> In the U.S., unitary pricing is required when annuities are purchased through employer-sponsored retirement plans.

reach your 80th birthday, the \$871 you receive per month continues as long as you live. Would you buy this annuity [insurance] [investment]?

2. Suppose you are offered an annuity [insurance] [investment] where you pay \$100,000 at age 65. In exchange, you receive \$1,763 per month for life beginning at age 80 (\$2,203 per month for males). If you do not live until age 80 there is no return of the amount you paid for the annuity [insurance] [investment]. If you reach your 80th birthday, the \$1,763 you receive per month continues as long as you live. Would you buy this annuity [insurance] [investment]?
3. Suppose you are offered an annuity [insurance] [investment] where you pay \$50,000 at age 65. In exchange, you receive \$1,699 per month for life beginning at age 85 (\$2,333 per month for males). If you do not live until age 85 there is no return of the amount you paid for the annuity [insurance] [investment]. If you reach your 85th birthday, the \$1,699 you receive per month continues as long as you live. Would you buy this annuity [insurance] [investment]?
4. Suppose you are offered an annuity [insurance] [investment] where you pay \$100,000 at age 65. In exchange, you receive \$3,439 per month for life beginning at age 85 (\$4,717 per month for males). If you do not live until age 85 there is no return of the amount you paid for the annuity [insurance] [investment]. If you reach your 85th birthday, the \$3,439 you receive per month continues as long as you live. Would you buy this annuity [insurance] [investment]?

Two multivariate probit analyses were conducted. First, to evaluate factors associated with the likelihood of deferred income annuity purchase, a dummy dependent variable was created and coded as one if participants chose to buy at least one of the four annuity options shown above; otherwise it was coded as zero. Second, in order to assess the correlates of inconsistent responses across the various longevity income frames, another dummy dependent variable was created and coded as one if a respondent had an inconsistent response among any of the three frames; otherwise it was coded as zero. The frame the respondent saw first was controlled for in both probit regression models.

#### *Additional Measurements*

Respondent socio-demographic factors included age, race/ethnicity, education level, and marital status. In the empirical analyses, age was treated as a continuous variable. Race and ethnicity were categorical variables with white as the comparison category. Education level was measured as a dichotomous variable and was coded one if the respondent had completed a baccalaureate or advanced degree, zero otherwise. Marital status was measured as a dichotomous variable with not married as the comparison category.

Income, non-mortgage assets and liabilities, and home equity were used as measures of the respondent's economic resources. All of these variables except home equity were measured as categorical variables, with the categories based on quartiles. Home equity was measured as a continuous variable. The number of persons depending on respondent income was continuous and included to proxy demands on economic resources.

Measures of respondents' current retirement expectations included current employment status (working vs. not working), percent of income expect to need to replace in retirement, having a DB plan, age at which expect social security benefits to begin and expectation regarding future reduction in social security retirement benefits. To capture planning horizon, respondents were asked to report a subjective remaining life expectancy.

Several psychological and behavioral factors were included in the analysis. Previous literature has suggested that differences in numeracy are associated with judgment and decision making such that those with lower numeracy have more difficulty evaluating risks, are worse at reading graphs, and display less consistency when measuring levels of utility (for reviews, see Estrada et al., 1999; Reyna et al., 2009; Weller et al., 2013). The present study utilized the three-question numeracy measure developed by Schwartz et al. (1997). Numeracy was scored on a 0-3 scale based on how many correct answers the participant provided for the three questions that evaluated respondent understanding of chance and ability to convert between percentages and proportions. No correct answers was deemed "low numeracy ability," and assigned a zero score. "Moderate numeracy ability" indicated one to two correct answers. "High numeracy ability" indicated all three questions were answered correctly. The text of the three questions developed by Schwartz et al. (1997) and utilized in this current study is available in the appendix.

Stock market loss aversion was assessed by respondent's report of how far the stock market would have to fall in percentage terms for them to sell all of their stocks (including stock mutual funds and exchange traded funds). Responses were categorized as: would not sell (reference category), do not own stocks, 5-10 percent market decline, 20 percent market decline, 30 percent or greater market decline.

## Results

### *Descriptive Statistics*

Table 2 displays the percentage of respondents who stated they would purchase at least one longevity annuity. Overall, 31 percent of respondents stated they would purchase at least one longevity annuity, regardless of the frame presentation order. Thirty-three percent of respondents stated they would purchase at least one longevity annuity when the annuity frame was shown first. Thirty-three percent of participants also indicated they would purchase at least one longevity annuity when the investment frame was shown first. However only 27 percent of respondents stated they would purchase at least one longevity annuity when the insurance frame was shown first.

[Insert Table 2 about here]

### *Framing Effects*

Table 3 presents the marginal effects of the independent variables when the binary dependent variable indicated respondent's stated intent to purchase at least one longevity annuity. Participants were approximately 9 percent less likely to state that they would buy at least one longevity annuity, all else equal, when the insurance frame was presented first. Table 5 (see appendix) shows that the framing effect persists when the full sample is used and the cost structure (UFC pricing structure shown first) is controlled for in the regression.

[Insert Table 3 about here]

### *Who Succumbs to Longevity Income Framing?*

Table 4 displays the marginal effects of the independent variables when the binary dependent variable indicated whether the respondent had an inconsistent response among any of the three longevity income frames. A monotonic relation was found between numeracy and inconsistent longevity income responses. Respondents with higher levels of numeracy were less likely to have inconsistent responses across the three frames. Table 6 (see appendix) shows that the numeracy effect persisted when the full sample was used and the cost structure was controlled for in the regression.

[Insert Table 4 about here]

## **Discussion**

Uncertain lifespans make it difficult for retirees to smooth consumption in advanced age. The decline in the availability of DB plans and uncertainty regarding the future level of social security retirement payments exacerbates this problem, making it increasingly likely that retirees will have to determine for themselves how to best maximize lifetime utility of consumption. Theory indicates that an annuity is an optimal way for a retiree to smooth consumption. However, consumers do not purchase annuities at the rate that theory would predict.

Insight into the ways that psychological biases could influence the annuity purchase decision may lead to advancements in resolving the annuity puzzle. A primary finding of this article was that people were less likely to state a demand for a longevity annuity when they observed longevity income framed as insurance first. This result may be because longevity income framed as an investment, such as a bond, would seemingly provide principal and interest to a retiree, but the uncertainty of longevity risk would persist. In contrast, longevity insurance would provide the retiree with principal, interest *and* mortality credits. Narrowly framing longevity income as insurance should help a retiree focus on the consumption protection aspect of the product, which should be especially attractive to both risk averse and loss averse retirees.

Attempts to resolve the puzzle of low annuity take-up will become increasingly important as future retirees bear greater individual responsibility for acquiring sufficient retirement income resources. Research indicates that retirees with lifetime income streams (a privately-purchased annuity or DB pension, but not social security) are more satisfied in retirement and report fewer depression symptoms (Panis, 2004). Currently, however, only 7% of workers who retired from a job with a defined contribution plan have converted their assets into an annuity (Hurd and Panis, 2006).

The availability of annuities is growing in defined contribution accounts and in investment options such as target-date funds. Results of this research indicate that the way that these products are framed to consumers will have important implications on the demand for the product, especially for consumers with lower numeracy. If these products are compared with other investment options in a defined contribution account, they should appear relatively unattractive. On the other hand, if these products are framed as insurance that protects against a decline in spending in advanced age, they may have greater appeal to consumers.

## Framing Longevity Income

Among consumers receiving financial planning advice, one additional factor that may influence demand for longevity income is the compensation model of the adviser. Advisers who are compensated through a percentage of assets under management (AUM) have interests that closely align with their clients during the asset accumulation phase of the lifecycle. However, post-retirement, advisers who receive a percentage of AUM have a financial incentive for their clients to limit spending, which may include avoiding a large UFC out of AUM to purchase longevity income. These advisers may rationalize a conservative decumulation strategy as reducing the likelihood that a retiree will outlive their portfolio assets. A satisfactory solution to this conflict may involve the purchase of longevity insurance as a client approaches retirement in order to increase spending earlier in retirement and protect against the tail risk of exhausting financial resources prior to death.

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**Table 1**  
**Hypothesized Direction of Effect on the Stated Demand for Longevity Annuities**

Independent Variable	Hypothesized Direction of Effect
<b>Socio-demographic</b>	
Age	+
African American (Reference: White)	-
Hispanic (Reference: White)	+
Asian (Reference: White)	+
No four-year college degree	-
Married	+
<b>Financial Resources and Claims</b>	
Annual gross income	+
Assets	-
Liabilities	+
Home equity	-
Number of people who rely on income	+
Bequest motive	-
<b>Retirement Expectations</b>	
Currently working	-
% of income needed in retirement	+
Has a defined benefit pension plan	-
Age begin taking social security	-
Believe social security reduced	+
Subjective remaining life expectancy	+
<b>Psychological/Behavioral Factors</b>	
Numeracy	+
Use of tobacco products	-
Stock market loss aversion	+

**Table 2**  
Descriptive Statistics

	% of respondents who state they would purchase at least one longevity annuity	N
Regardless of order	30.74%	1,425
Annuity frame shown first	33.12%	462
Insurance frame shown first	26.60%	485
Investment frame shown first	32.64%	478

*Note:* Statistical significance was not tested.

**Table 3**

Framing and the Stated Demand for at Least One Longevity Annuity

Variable	ME	P> z	95% Confidence Interval	
Initial frame				
Insurance	-0.091	0.003	-0.151	-0.031
Investment	-0.021	0.518	-0.082	0.042
Demographics				
Age	0.004	0.074	0.000	0.009
Male	0.087	0.002	0.031	0.143
White	-0.108	0.002	-0.178	-0.034
No 4-year college degree	-0.084	0.003	-0.139	-0.029
Married	-0.055	0.071	-0.115	0.005
Working	0.025	0.473	-0.043	0.093
Number of dependents	0.024	0.000	0.015	0.032
Income				
\$41,187 - \$112,262	-0.050	0.121	-0.112	0.013
\$112,263 or above	-0.126	0.002	-0.206	-0.045
Income replacement ratio	-0.003	0.000	-0.004	-0.002
Assets				
Home equity	0.000	0.107	-0.000	0.000
\$250,000 or above	0.040	0.215	-0.023	0.103
Liabilities				
\$10,001 - \$30,000	0.083	0.039	0.004	0.161
\$30,001 or above	0.981	0.003	0.033	0.163
Social security benefits				
Claiming age	0.013	0.019	0.002	0.024
Believe will be reduced	0.053	0.054	-0.001	0.108
Has defined benefit plan	0.001	0.960	-0.055	0.058
Remaining life expectancy	0.003	0.003	0.001	0.005
Bequest motive	0.026	0.365	-0.030	0.082
Never used tobacco	-0.046	0.143	-0.107	0.015
Stock market loss aversion				
Stock market declines 5-10%	0.261	0.000	0.155	0.366
Stock market declines 20%	0.233	0.000	0.134	0.331
Stock market declines 30% or more	0.142	0.002	0.051	0.233
Do not own stocks	-0.004	0.917	-0.079	0.071
Numeracy				
Moderate	-0.112	0.006	-0.191	-0.033
High	-0.189	0.000	-0.260	-0.119

Notes: The number of observations is 1,390. Marginal effects are reported in the ME column. The pseudo- $R^2$  is 0.2408. Only respondents who provided a response to all questions are included in this analysis.

**Table 4**  
Who Succumbs to Longevity Income Framing Effects?

Variable	ME	P> z	95% Confidence Interval	
Initial frame				
Insurance	-0.017	0.570	-0.077	0.042
Investment	0.038	0.218	-0.023	0.099
Demographics				
Age	0.001	0.668	-0.003	0.005
Male	0.050	0.062	-0.002	0.103
White	-0.082	0.013	-0.147	-0.017
No 4-year college degree	-0.031	0.251	-0.083	0.022
Married	-0.020	0.478	-0.076	0.036
Working	0.017	0.599	-0.046	0.080
Number of dependents	0.008	0.028	0.001	0.015
Income				
\$41,187 - \$112,262	-0.032	0.278	-0.091	0.026
\$112,263 or above	-0.099	0.013	-0.178	-0.021
Income replacement ratio	-0.003	0.000	-0.004	-0.002
Assets				
Home equity	-0.000	0.850	-0.000	0.000
\$250,000 or above	0.045	0.139	-0.015	0.105
Liabilities				
\$10,001 - \$30,000	0.052	0.164	-0.021	0.125
\$30,001 or above	0.096	0.002	0.035	0.157
Social security benefits				
Claiming age	0.003	0.549	-0.007	0.013
Believe will be reduced	0.061	0.019	0.010	0.111
Has defined benefit plan	-0.002	0.945	-0.055	0.051
Remaining life expectancy	0.002	0.050	-0.000	0.004
Bequest motive	-0.013	0.636	-0.066	0.041
Never tobacco user	-0.034	0.243	-0.090	0.023
Stock market loss aversion				
Stock market declines 5-10%	0.192	0.000	0.089	0.295
Stock market declines 20%	0.204	0.000	0.108	0.299
Stock market declines 30% or more	0.147	0.001	0.059	0.236
Do not own stocks	0.036	0.344	-0.038	0.109
Numeracy				
Moderate	-0.085	0.022	-0.158	-0.012
High	-0.184	0.000	-0.248	-0.120

*Notes:* The number of observations is 1,390. Marginal effects are reported in the ME column. The pseudo- $R^2$  is 0.177. Only respondents who provided a response to all questions are included in this analysis.

## Appendix

**Table 5**

Framing and the Stated Demand for at Least One Longevity Annuity (Both Cost Structures)

Variable	ME	P> z	95% Confidence Interval	
Initial frame				
Insurance	-0.087	0.000	-0.127	-0.048
Investment	-0.021	0.314	-0.062	0.020
Demographics				
Age	0.003	0.063	0.000	0.006
Male	0.056	0.004	0.018	0.093
White	-0.100	0.000	-0.146	-0.054
No 4-year degree	-0.056	0.003	-0.093	-0.019
Married	-0.020	0.316	-0.060	0.019
Working	0.003	0.884	-0.042	0.049
Number of dependents	0.018	0.000	0.012	0.023
Income				
\$41,187 - \$112,262	-0.050	0.019	-0.092	-0.008
\$112,263 or above	-0.103	0.000	-0.156	-0.049
Income replacement ratio	-0.003	0.000	-0.004	-0.002
Assets				
Home equity	0.000	0.169	0.000	0.000
\$250,000 or above	0.044	0.043	0.001	0.087
Liabilities				
\$10,001 - \$30,000	0.072	0.007	0.019	0.125
\$30,001 or above	0.097	0.000	0.053	0.141
Social security benefits				
Claiming age	0.011	0.002	0.004	0.018
Believe will be reduced	0.058	0.001	0.022	0.094
Has defined benefit plan	0.021	0.283	-0.017	0.058
Remaining life expectancy	0.003	0.000	0.001	0.004
Bequest motive	0.039	0.035	0.003	0.076
Never tobacco user	0.008	0.701	-0.031	0.047
Stock market loss aversion				
Stock market declines 5-10%	0.282	0.000	0.209	0.355
Stock market declines 20%	0.264	0.000	0.193	0.335
Stock market declines 30% or more	0.186	0.000	0.122	0.250
Do not own stocks	0.023	0.374	-0.028	0.075
Numeracy				
Moderate	-0.089	0.001	-0.141	-0.037
High	-0.162	0.000	-0.209	-0.115
Observed UFC first	0.038	0.030	0.004	0.073

Notes: The number of observations is 2,813. Marginal effects are reported in the ME column.

The pseudo- $R^2$  is 0.2275. Only respondents who provided a response to all questions are included in this analysis.

**Table 6**  
Who Succumbs to Longevity Income Framing Effects (Both Cost Structures)?

Variable	ME	P> z	95% Confidence Interval	
Initial frame				
Insurance	-0.042	0.032	-0.080	-0.003
Investment	0.016	0.443	-0.024	0.055
Demographics				
Age	0.001	0.737	-0.002	0.003
Male	0.037	0.041	0.002	0.072
White	-0.075	0.001	-0.118	-0.033
No 4-year college degree	-0.039	0.028	-0.073	-0.004
Married	-0.001	0.938	-0.038	0.035
Working	0.012	0.564	-0.029	0.054
Number of dependents	0.008	0.002	0.003	0.013
Income				
\$41,187 - \$112,262	-0.026	0.191	-0.065	0.013
\$112,263 or above	-0.062	0.024	-0.117	-0.008
Income replacement ratio	-0.003	0.000	-0.003	-0.002
Assets				
Home equity	0.000	0.968	0.000	0.000
\$250,000 or above	0.039	0.055	-0.001	0.079
Liabilities				
\$10,001 - \$30,000	0.072	0.004	0.022	0.122
\$30,001 or above	0.084	0.000	0.042	0.125
Social security benefits				
Claiming age	0.006	0.071	-0.001	0.013
Believe will be reduced	0.045	0.010	0.011	0.078
Has defined benefit plan	0.012	0.491	-0.023	0.047
Remaining life expectancy	0.001	0.383	-0.001	0.002
Bequest motive	0.023	0.191	-0.011	0.057
Never tobacco user	-0.004	0.813	-0.041	0.032
Stock market loss aversion				
Stock market declines 5-10%	0.195	0.000	0.125	0.265
Stock market declines 20%	0.208	0.000	0.140	0.276
Stock market declines 30% or more	0.135	0.000	0.074	0.196
Do not own stocks	0.045	0.076	-0.005	0.094
Numeracy				
Moderate	-0.076	0.002	-0.123	-0.028
High	-0.160	0.000	-0.202	-0.118
Observed UFC first	0.048	0.004	0.016	0.080

*Notes:* The number of observations is 2,813. Marginal effects are reported in the ME column. The pseudo- $R^2$  is 0.1673. Only respondents who provided a response to all questions are included in this analysis.

**Longevity income questions that broke up the UFC:**

1. Suppose you are offered an annuity [insurance] [investment] where you pay \$385 per month beginning at age 65 and stopping at age 80. In exchange, you receive \$871 per month for life beginning at age 80 (\$1,090 per month for males). If you do not live until age 80 there is no return of the amount you paid for the annuity [insurance] [investment]. If you reach your 80th birthday, the \$871 you receive per month continues as long as you live. Would you buy this annuity [insurance] [investment]?
2. Suppose you are offered an annuity [insurance] [investment] where you pay \$769 per month beginning at age 65 and stopping at age 80. In exchange, you receive \$1,763 per month for life beginning at age 80 (\$2,203 per month for males). If you do not live until age 80 there is no return of the amount you paid for the annuity [insurance] [investment]. If you reach your 80th birthday, the \$1,763 you receive per month continues as long as you live. Would you buy this annuity [insurance] [investment]?
3. Suppose you are offered an annuity [insurance] [investment] where you pay \$333 per month beginning at age 65 and stopping at age 85. In exchange, you receive \$1,699 per month for life beginning at age 85 (\$2,333 per month for males). If you do not live until age 85 there is no return of the amount you paid for the annuity [insurance] [investment]. If you reach your 85th birthday, the \$1,699 you receive per month continues as long as you live. Would you buy this annuity [insurance] [investment]?
4. Suppose you are offered an annuity [insurance] [investment] where you pay \$666 per month beginning at age 65 and stopping at age 85. In exchange, you receive \$3,439 per month for life beginning at age 85 (\$4,717 per month for males). If you do not live until age 85 there is no return of the amount you paid for the annuity [insurance] [investment]. If you reach your 85th birthday, the \$3,439 you receive per month continues as long as you live. Would you buy this annuity [insurance] [investment]?

**Numeracy questions as developed by Schwartz et al. (1997):**

“Imagine that we rolled a fair, six-sided die 1,000 times. Out of 1,000 rolls, how many times do you think the die would come up even.” Correct answer: 500

“In the BIG BUCKS LOTTERY, the chances of winning a \$10.00 prize is 1%. What is your best guess about how many people would win a \$10.00 prize if 1,000 people each buy a single ticket to BIG BUCKS?” Correct answer: 10

“In the ACME PUBLISHING SWEEPSTAKES, the chance of winning a car is 1 in 1,000. What percent of tickets to ACME PUBLISHING SWEEPSTAKES win a car?” Correct answer: 0.001