Consumer Preferences for Annuities: Beyond NPV

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Abstract

Although consumer financial decision making has attracted renewed attention from marketing researchers, issues of consumer decumulation of retirement wealth have remained relatively unexplored. Research on decumulation presents an interesting problem for both behavioral and quantitative marketing researchers; it is a choice problem with large stakes, multiple sources of uncertainty, and difficult tradeoffs. As a contribution to such research, we measure and model individual preferences for life annuities using a choice-based stated-preference survey of adults aged 45-65 from a nationwide internet panel. Each annuity is presented in terms of its consumer-relevant attributes such as monthly income, yearly inflation adjustments, period certain guarantees, and company rating, and includes a "no choice" option that allows consumers to self-manage their assets. Our model of preferences allows each attribute to influence utility beyond its influence on the actuarial present value of the annuity, i.e., the expected NPV of the payments. We find that some attributes directly influence preferences beyond their impact on NPV, and we discuss the implication of such preferences for marketers and policy makers interested in promoting annuitization.

Keywords

Financial decision making, annuities, conjoint analysis

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INTRODUCTION

Americans now spend more on financial services and insurance than they do on food or cars. Further, spending on financial products and services is growing faster than most other expenditure categories (U.S. Bureau of Economic Analysis, 2011). To address this growing importance of the financial services industry, research in marketing is turning increasing attention toward consumer financial decision making (Lynch 2011). The emphasis is often on the accumulation stage of wealth management, addressing issues such as retirement savings decisions (Soman and Cheema 2011, Hershfield et al. 2011) or investment choice (Strahilevitz, Odean, and Barber 2011; Morrin et al. 2012). Although these issues of how to accumulate wealth during the 30 years prior to retirement are crucially important for workers, the decumulation of wealth in the 30 years after retirement is also an important problem and thus far relatively unaddressed in marketing research.

With baby boomers now retiring at the rate of almost 10,000 per day, the issue of decumulation is becoming of greater interest to economists, public policy experts, and the financial services industry. It should also be of interest to researchers in marketing because the consumer marketplace for decumulation products involves a large number of product variations – a marketplace in which smart marketing approaches can have a big impact on both public policy and consumer welfare. As a research domain, it represents a choice problem with large financial stakes and limited learning opportunities, difficult consumption tradeoffs, multiple sources of uncertainty, issues of trust and branding, and long time periods. All of these attributes are topics on which marketing research can offer important insights.

The first goal of this paper is to describe why marketing researchers should be interested in decumulation as a research domain. In doing so, we provide background on the decumulation problem, an overview of products available in the decumulation marketplace, current research findings in the literature, and a list of marketing research opportunities related to this domain. Our second goal is to advance the understanding of consumer decumulation behavior by

adapting and applying a well-accepted marketing technique for uncovering consumer preferences—conjoint analysis. Financial products, such as annuities, provide a unique setting for conjoint analysis because most annuity attributes have calculable actuarial value that can be directly compared to consumers' revealed utilities. In our analysis, we find that consumers do not merely maximize the actuarial expected payout of annuities, but instead react to different annuity attributes in ways beyond their impact on the expected financial payout. For example, consumers overvalue specific levels of period-certain guarantees relative to their financial impact, but generally undervalue inflation protection via annual increases in payments. We also find significant individual differences in response to annuities and annuity attributes correlated with consumer characteristics such as gender, numeracy, loss aversion, and perceived fairness.

Our findings provide several insights regarding annuity choice and the way marketers can improve consumers' acceptance without paying out more money in expectation. For example, our attribute findings suggest a marketer can increase demand for an annuity of a fixed expected present value by reducing the amount of an annual increase and using the resulting savings to fund an increase in the duration of the period-certain guarantee. We find that such repackaging of the payout stream can have a large effect on demand, possibly even doubling the take-up rate of annuities in the population we study. In terms of targeting, our results suggest the marketers should target customers in their late 40s instead of customers who are about to retire. In addition, product design and targeting interact: we find that men differ from women in their most preferred product design. Hence, tailoring annuity products by gender should pay off for sellers.

IMPORTANCE OF THE DECUMULATION PROBLEM FOR MARKETING

The problem of decumulation for consumers typically begins at retirement, as the individual transitions from receiving steady work-related income toward tapping sources of retirement income such as social security, pensions, and income from savings. The decisions inherent in this transition are difficult, including questions of when to retire from work and when

to begin claiming social security benefits (Knoll 2011, Coile et al 2002). The most complex decision of all, however, is how to optimally spend down saved assets. The size of this problem is substantial, with approximately $9.2 trillion in retirement assets held in either defined contribution plans (e.g., a 401k) or IRAs (Benartzi et al. 2011). The consumer's risks in consuming saved assets include either spending too quickly, in which case she may run out of money quickly, or spending too slowly, in which case her consumption is severely constrained and she dies with unused funds. Also complicating this decision is the large uncertainty about life expectancy, a crucial piece of knowledge for determining the optimal intertemporal consumption path (Payne et al. 2013).

One tool for managing the problem of generating secure retirement income from a stock of accumulated retirement wealth is a life annuity. The simplest form of a life annuity is the immediate single-payer life annuity, in which a consumer exchanges a lump sum for a guaranteed stream of payments for as long as he or she lives. In a sense, life annuities offer the opportunity for the retiree to convert retirement assets saved via a defined contribution plan into an income stream more similar to a defined benefit (pension) plan. The implied insurance against outliving one's assets is the biggest advantage of life annuities. Another advantage is that life annuities tend to pay out a higher percentage return than is normally feasible with self-managed accounts. For example, a life-annuity might pay a 6.8% annual rate of return rather than the 4% to 5% that one would collect from a self-managed account. This higher return is due to benefits to survivorship, because the accounts of those who die early are used, in part, to pay income to annuity holders who continue to live. On the downside, however, a consumer's purchase of a life annuity carries several disadvantages. First, one's estate (heirs) receives no payment when one dies with a traditional type of life annuity; the money remains with the company that issued the annuity, implying a loss or negative return on the original purchase. Another disadvantage is a loss of control over the assets because the investment funds are given to the annuity company to manage. These companies can vary in financial strength ratings, which is clearly important

given the fact that the decision has implications for many years and because government backing for such products is dependent on state-level regulations. Finally, life annuities typically provide relatively poor liquidity (cash availability) in case of emergencies.

To address some of these disadvantages, companies offering life annuities have introduced a variety of options in an effort to make annuities more attractive. These options include attributes such as period-certain guarantees, deferred start dates, annual income increases to compensate for inflation, and joint annuities (e.g., for married couples). Period-certain options guarantee payments for a specified number of years, even if the annuitant passes away, with remaining payments going to designated heirs; after the specified number of years, a period-certain annuity becomes like a standard annuity with payments that continue until the individual dies. These annuities thus protect against total loss of the principal investment due to early death while still being able to offer income for life. Deferred start date annuities, also called longevity annuities, require a lower upfront payment in exchange for payouts that begin in the future if and only if the purchaser is still alive by a set age. Offering annuities with consumer-oriented options, such as period-certain guarantees, carries financial tradeoffs; the issue for the offering company is whether consumers are willing to accept higher prices in exchange for these benefits.

CURRENT AND FUTURE RESEARCH ON DECUMULATION

The economics literature has long recognized that annuities are the most compelling marketplace solution to the decumulation problem (for a review, see Benartzi et al. 2011). Yaari (1965) was one of the first to show that rational retirees with no bequest motive should use all of their retirement assets to buy annuities. Life annuities eliminate "longevity risk"—the risk of outliving one's assets—while they can also offer a mortality premium on returns, due to the fact that some people in the annuity pool will die early. More recently, Davidoff, Brown, and

Diamond (2005) provided a simple analysis of the attractiveness of annuitization.[1] However, retirees' purchase of annuities remains below their theoretical potential, leading to a so-called annuity puzzle (Davidoff, Brown, and Diamond 2005; Brown 2007). A recent *New York Times* article (Lieber, 1/29/2010) cites a 2009 study by Hewitt Associates reporting that just 1% of employees actually buy annuities as payout options. Inkmann, Lopes, and Michaelides (2011), using U.K. data, report that only about 6% of households participate in the voluntary annuity market. Brown (2007) provides a summary of the "economic" answers to the question of why a person might not buy some amount of a life annuity in today's marketplace, including price premiums due to adverse selection by individuals with longer life expectancies, but also argues that annuities are a rational choice for many consumers.

Possible reasons for limited market demand for annuities include rational heterogeneous preferences at the consumer level. For people with limited accumulated retirement wealth, pre-existing annuitization through Social Security could lead to less demand for additional annuitization. However, insufficient accummulation does not account for the still small demand for annuitization for individuals who are higher up the wealth distribution. Similarly, an individual's bequest motive might account for less than full annuitization, so that some funds are set aside for beneficiaries, but bequest motives cannot explain the pattern of nearly no annuitization even among people without heirs. Concerns about liquidity to insure against expenditure shocks such as medical expenses could also reduce demand for full annuitization. On the other hand, the demand for bundled contracts of annuity and long-term care that can address these concerns is relatively small (Webb, 2009). Risks of inflation might also be expected to worry consumers, but evidence from Social Security claims suggests that many consumers have a preference for lump-sum payments rather than inflation-protected payoffs over time that are similar to annuities (Brown, 2007). Finally, consumers may worry about default

[1] They compare a one-year certificate of deposit to a security that "pays a higher interest rate at the end of the year conditional on living, but pays nothing if you die before year-end," and they conclude that "if you attach no value to wealth after death, then the second, annuitized, alternative is a dominant asset" (p. 1573).

risk by the annuity issuer. Babble and Merrill (2006) show that even a little default risk can have a large economic impact on annuity purchasing. Again, however, perceived default risk does not account for the relative lack of even partial annuitization.

Thus, although rational economic explanations of the lack of annuitization are factors in the annuity puzzle, they do not sufficiently explain the problem, and more psychological factors need to be considered (Brown 2007). For instance, some studies have looked at the general framing of the annuity decision. Hu & Scott (2007) argue that people adopt a narrow framing of the problem as a gamble, rather than as an insurance decision, due to the complexity of the annuity purchase task. Loss aversion from cumulative prospect theory (Tversky & Kahneman, 1992) is also widely invoked as a reason why annuities are generally less attractive than EU theory would predict, especially when considering the loss of the annuity purchase price due to early death. The risk of losing the full value of the annuity due to an unexpected early death is highlighted by not just loss aversion and risk aversion, but also the tendency to overweight small probabilities. Brown, Kling, Mullainathan, & Wrobel (2008) offer a preliminary test of the effects of framing the problem in terms of an investment (using words such as invest and earnings) or in terms of consumption (using words such as spend and payment) and find that consumers like annuities more in the consumption frame. Agnew, Anderson, Gerlach, & Szykman, (2008) also find framing effects, mediated by gender, in a "Retirement Game" in which subjects choose between annuities and self-managed market investments. These behavioral approaches to the annuity puzzle provide important insights to aspects of the annuity decision, but much more remains to be investigated and tested.

Given the inability of traditional utility theory to fully explain the annuity puzzle, along with the possibility that behavioral factors are affecting consumer annuity choice, several promising areas exist for marketing research on decumulation. The research on framing effects described above offers insights about how consideration of consumption versus investment affects annuity choice; additional testing of framing effects could focus on how benefits may be

described as a loss versus a gain relative to a reference point or how assets can be described in terms of future monthly income versus total retirement wealth (Benartzi et al. 2011). Consistent with the theory that loss aversion may underlie resistance to annuities, findings from the endowment-effect literature may offer insights on how to moderate loss aversion for accumulated retirement wealth (Kahneman, Knetsch, & Thaler 1990).

Many other aspects of consumer behavior research apply to this problem. Both intertemporal choice and judgment under uncertainty are crucial elements of the decumulation decision, and research in those domains is highly relevant to this area. Aspects of intertemporal choice that address differential discounting of gains and losses, predictions of resource slack, myopia and hyperopia, construal, procrastination, and/or intertemporal consumption all relate to consumers' preference for annuities (e.g., Soman 1998, Zauberman and Lynch 2005, Shu 2008). Consumer uncertainty exists for both judgments of future health and economic outcomes (e.g., inflation) and judgments of life expectancy; research on biases in probability judgments can offer substantial insights on these issues. Work on consumer learning as well as social aspects of decisions may offer advice on how observations of other consumers' retirement outcomes influence an individual's annuity choices.

Beyond general population judgmental biases, individual differences in how consumers handle financial purchase decisions are important to consider. Research on trust and branding speaks to the relationship between the consumer and the firm providing the decumulation solution, and may be able to show how brand names, company ratings, and perceived fairness all affect consumer choices (Kahneman, Knetsch, and Thaler 1986; Seligman and Schwartz 1997, Roth 2007). Finally, recent findings regarding consumers' financial knowledge (both objective and subjective knowledge), financial literacy, numeracy, and overall cognitive ability also offer important predictions for how consumers who differ in individual ability may react to annuity offerings (Lynch 2012, Hadar and Fox 2012, Peters et al. 2006, Frederick 2005).

Supply-side problems of annuity product design should also be of interest for marketing researchers. If consumers value features beyond their impact on the expected payout, managers need to incorporate such behavioral influences. Systematic results about how to most profitably structure product features would contribute to the growing literature on the impact of behavioral phenomena on optimal product-line design (Orhun 2009; Kuksov and Villas-Boas 2010).

A CONJOINT STUDY OF CONSUMER PREFERENCES FOR ANNUITIES PRODUCTS

To show how marketing tools can bring insight to the decumulation problem, and especially to the annuity puzzle, the rest of this paper proposes and estimates a model of individual preferences for annuities using a choice-based conjoint analysis. Our project brings together both behavioral theories of decision making (including topics such as fairness, loss aversion, and consumer numeracy) and quantitative marketing tools such as Bayesian hierarchical modeling and heterogeneous consumer preferences. Our conjoint analysis is distinct in the sense that nearly all of the product attributes can be converted to an actuarial financial value and modeled accordingly; knowing the financial impact of each attribute allows us to see whether consumers value the attributes based on expected value or whether certain attributes provide a psychological value "beyond" NPV. We also apply the estimated model to the product-design problem, and characterize how marketers and policy makers can increase the consumer acceptance of annuities without necessarily increasing the expected payout.

The remaining sections on our conjoint survey proceed as follows. First, we provide some background on conjoint analysis and why it is especially useful for understanding annuity preferences. We then lay out our model, including how we chose attributes and how those attributes can be converted to an actuarial value that is central to our model specification. We then describe our methods and subject population. Our results are broken into five separate sections. First, we describe how a model that depends only on actuarial value is unable to fully capture respondents' preferences, thus providing justification for a model that uses attributes

"beyond NPV." Second, we analyze the characteristics of respondents who never choose annuities relative to those who are willing to consider some annuities. Third, we report the results from the estimation of our choice model, including findings for attributes and demographic (and psychographic) characteristics. We explore these findings in more detail in the counterfactual simulations of the fourth section. Finally, we suggest implications for the marketing of annuities, and suggest how specific attributes make annuities more appealing to particular demographic groups.

Conjoint Analysis Survey: Motivation

Conjoint analysis is a state-of-the-art survey technique widely used by both academics and market researchers to estimate individual-level preferences for products and services (Green and Srinivasan 1978, Green et al. 2001, Orme 2006). Our conjoint-analysis survey consists of 20 choice tasks. Each choice task asks the respondents to choose from several different annuity alternatives. In every task, the respondents can also choose to not buy any of the offered annuities. The multiple responses per individual allow us to estimate each individual's indirect utility of an annuity contract as a function of the contract's attributes, both directly and to the extent that they contribute to the expected payout (calculated using the Social Security Administration's life expectancy tables and controlling for gender).

Conjoint analysis is a particularly useful method for assessing demand for annuities because it presents respondents with difficult tradeoffs between multiple desirable annuity attributes. By expressing preferences for some annuity offers over others, respondents are more likely to reveal their true multi-attribute preferences. Academics from other disciplines have also concluded that conjoint analysis can yield less biased results than alternative survey methods (Shamir and Shamir 1995, Sassi et al. 2005, Caruso et al. 2009).

In studying annuity preferences, surveys have three major advantages over secondary data. First, the survey can collect multiple observations of each respondent, allowing individual-

level estimation of indirect utility. Second, surveys can present respondents with options not currently available in the real world, allowing counterfactuals to be based on data rather than extrapolation. For example, we can measure demand for annuities with combinations of income and period-certain terms not currently available in the market but potentially available in the future. Third, the survey designer exogenously manipulates the explanatory variables, avoiding various endogeneity and selection problems that usually plague the analysis of secondary data. And finally, a survey allows greater examination of a variety of individual characteristics, including behavioral measures such as loss aversion, numeracy, and risk aversion.

Study Design: Attribute selection, Model Specification, and Statistical Optimization

To design a conjoint survey, one needs to select attributes, specify how the attributes combine into a utility function, and then design the set of choice tasks that maximize the data's information about the parameters of the utility model. We discuss each step in turn.

Attribute selection. We chose attributes based on current market offerings, with special emphasis on attributes that have been theorized to partially explain the annuity puzzle. The attributes we use include starting income, insurance company financial strength ratings,[2] amount and type of annual income increases, and period-certain guarantees. Each attribute can take on several levels selected to span the levels commonly observed in the market today (see Table 1). The seven levels of annual income increases include three increases expressed additively (e.g., "every year, payments increase by $X"), three increases expressed multiplicatively (e.g., "every year, payments increase by Y%"), and one level for no increase.[3] Period-certain guarantees include periods of 0 years (no period certain), 5 years, 10 years, 20 years, and an extreme option of 30 years. For all choice tasks, we asked participants, "If you were 65 and considering putting

[2] We included insurance company financial strength ratings to test the theory by Babble and Merrill (2006) that even a small default risk can have a large economic impact on annuity purchasing.

[3] We chose levels of additive increases and multiplicative increases to roughly match each other in the initial years of the annuity; for example, a 7% annual increase is roughly equal to a $500 annual increase for an annuity with starting monthly payments of $600.

$100,000 of your retirement savings into an annuity, which of the following would you choose?" They then saw three annuity options and a fourth no-choice option.

Model specification: Each of the 20 choice sets in our study consists of K=3 alternatives (annuities), with the kth alternative in the nth choice set characterized by attributes presented in Table 1. Our baseline utility specification is based on the variables that should theoretically drive annuity choice, namely, the expected payout and the financial strength rating of the issuer. We denote the expected payout of the annuity to the buyer as $V_{n,k}^{self}$, and calculate it from the monthly income and the annual increase (if any) of the k-th annuity in the nth choice set as follows:

$$V_{n,k}^{self} = \sum_{age=65}^{120} \delta^{(age-65)} \Pr\left(\text{alive at } age\right)\left(12 \times income_{n,k,age}\right)$$

where the $\Pr\left(\text{alive at } age\right)$ is the probability of being alive at a given *age* past 65 (conditional on being alive at 65)[4] based on the gender-specific life expectancy Social Security tables (Social Security Administration 2006), δ is an annual discount factor set to 0.97 following 2011 OMB guidelines, and $income_{n,k,age}$ is the monthly income provided by the k-th annuity in the nth choice set when the buyer reaches the given *age.* The latter is in turn determined by the starting income and the annual increases (if any).

Annuities with a period-certain guarantee also generate payouts to buyer-determined beneficiaries after the buyer's death. We denote the expected payout to the beneficiaries by $V_{n,k}^{other}$ and calculate it as:

$$V_{n,k}^{other} = \sum_{age=65}^{65+period\_certain_{n,k}} \delta^{(age-65)} \left[1 - \Pr\left(\text{alive at } age\right)\right]\left(12 \times income_{n,k,age}\right)$$

In our baseline utility specification, we assume the buyer cares equally about the two payout streams and let the total payout of the annuity $V_{n,k} = V_{n,k}^{self} + V_{n,k}^{total}$ influence utility. It is also

[4] Note the study participants are asked to imagine they are already at age 65 when they are buying the annuity, and thus no adjustment should be made for actual current age or the chance of living until 65.

apparent that a rational buyer should care about the financial strength of the company as measured by the AAA versus AA ratings, so the model directly incorporates this attribute.

In addition to the total expected payout and the company's financial strength, we let several attributes enter utility directly to capture the "beyond NPV" idea. Specifically, we include the type and amount of annual increase and the level of the period-certain guarantee. All levels of these additional attributes are dummy coded and contained in a row attribute vector $X_{k,n}$. We exclude starting income from $X_{k,n}$ to avoid strong collinearity: we find that $V_{n,k}$ is too correlated with starting income for the model to separately identify the impact of starting income on utility beyond its impact on the expected payout.

Given the $V_{n,k}$, the dummy variable $AAA_{n,k}$, and the $X_{k,n}$ variables, we model the respondent j's utility of the k-th annuity in the nth choice set as a linear regression:

$$U_{n,k,j} = \alpha_j + \beta_j V_{n,k} + \gamma_j AAA_{n,k} + X_{n,k}\theta_j + \varepsilon_{n,k,j} \text{ where } \varepsilon_{n,k,j} \sim N(0,1)$$

and we normalize the utility of the outside ("none of the above") alternative k=0 to zero in order to identify the parameters[5]: $U_{n,0,j} = 0$. Together with a simplifying assumption that $\varepsilon_{n,k,j}$ are independent, our model becomes a constrained version[6] of the multinomial probit model (Hausman and Wise 1978). The A individual-level parameters to be estimated are $\{\alpha_j, \beta_j, \gamma_j, \theta_j\}_{j=1}^{J}$, where θ_j is a column vector of the same length as $X_{k,n}$, and the rest are scalars.

To pool data across respondents j=1,2,…J while allowing for heterogeneity of preferences, we follow the standard hierarchical approach following Lenk et al. (1996). Please see Rossi et al. (2005) for an overview of hierarchical linear models. A row vector of M characteristics Z_j characterizes each respondent, and respondents with similar characteristics tend to have similar preferences following a multivariate regression:

[5] See McCulloch and Rossi (1994) for a detailed discussion of parameter identification in a multinomial probit.
[6] The restriction of *one* of the scalar elements of the covariance of the $\varepsilon_{n,j}$ vector to unity is standard. The restriction of the entire covariance matrix to identity simplifies estimation and reflects our belief that the unobserved shocks associated with the individual annuity profiles are not heteroskedastic and not mutually correlated. The resulting model is sometimes called "independent probit" (Hausman and Wise 1978).

$$\left[\alpha_j, \beta_j, \gamma_j, \theta_j'\right]' = \Delta Z_j + \tau_j \quad \text{where} \quad \tau_j \sim N\left(0, \Sigma\right),$$

where Σ is an *AxA* matrix and Δ is an *M* x *A* matrix. The baseline parameter from which individuals deviate according to their characteristics *Z* is the first row of Δ in that we set the first element of each Z_j to unity. To complete the model, we use standard conjugate priors for Σ and Δ, namely,

$$\Sigma \sim \mathit{InverseWishart}\left(\kappa_0, S_0\right) \quad \text{and} \quad \text{vec}\left(\Delta\right)\left|\Sigma \sim N\left(\text{vec}\left(\Delta_0\right), \Sigma \otimes I\sigma_\Delta^2\right)\right..$$

Although these priors allow us to add a priori scale information in S_0 and effect information in Δ_0, we try to let the data speak, and use proper but diffuse priors. Our specific settings are $\kappa_0 = \#\mathit{UtilityParams} + 3, E\left(S_0\right) = I, \Delta_0 = 0,$ and $\sigma_\Delta^2 = 100$.

Statistical optimization. Given the attribute levels in Table 1 and the model described above, we used SAS software (an industry standard) to generate the optimal choice-based survey design. We created the 20 choice sets using the %ChoicEff macro in SAS (Kuhfeld 2005), which finds utility-balanced efficient designs for choice-based conjoint tasks (Kuhfeld et al. 1994, Huber and Zwerina 1996). Anticipated model parameters[7] are provided as input to the macro, and an iterative procedure identifies the 20 choice sets with the highest design efficiency. Similar to other studies (Rooderkerk 2011), we assume utility increases linearly in the attributes with equal attribute importance for most attributes and higher importance for monthly income.

Study Implementation: subject recruitment and detailed survey procedure

Participants. We recruited participants through a commercial online panel from Qualtrics. Qualtrics does hundreds of academic research projects and also serves clients such as the US Army and government agencies. Panel members opt-in to Qualtrics through various websites and are offered the opportunity to participate in surveys; Qualtrics does not actively

[7] A pretest similar in design to the attribute levels shown in Table 1 had provided us with initial estimates for our model and informed our choice of attribute levels for the current test. Relative to the pretest, we increased the number of annual increases and period-certain options to expand the range of annuity expected values available.

solicit for its panel. For this project, participation was limited to individuals between the ages of 40 and 65 because this target group is the most appropriate for annuity purchases. We placed no limit on household income or current retirement savings, but we collected data on these characteristics so that we could perform an analysis of how financial status affects preferences. We also included several demographic questions including gender, race, and marital status. To assess financial literacy, we included eight numeracy and cognitive reflection (CRT) questions. Finally, we also collected key individual difference measures suggested in the literature to affect liking for annuities, including bequest motives, life expectations, loss aversion, risk aversion, and annuity perceptions such as attitude, desire for control, and perceived fairness.

Because any survey attracts some respondents who either do not understand the instructions or do not pay attention to the task, we included an attention filter at the start of the survey and excluded participants who did not pass the filter. Our final sample consists of 404 respondents. Of the 404, we have eliminated 41 who took less than 15 minutes to complete the questionnaire—a time we consider unreasonably fast. This elimination results in 363 useable respondents. Table 2 summarizes the respondent characteristics. Although ours is clearly a convenience sample of respondents, many of the demographic measures such as household income, race, and gender align well with general population distributions, suggesting our sample is reasonably representative of American households.

Procedure. We first presented participants with short descriptions of the annuity attributes being investigated (monthly income level, annual income increases, period-certain guarantees, and company ratings) as well as the full range of levels for each of these attributes. They were told the annuities were otherwise identical and satisfactory on all omitted characteristics. They were also told all annuities were based on an initial purchase price of $100,000 at age 65. We then asked each participant to complete 20 choice tasks. To control for order effects, we presented the choice tasks to the participants in a random order.

In each choice task, participants were asked, "If you were 65 and considering putting $100,000 of your retirement savings into an annuity, which of the following would you choose?" They then saw three annuity options and a fourth option that read, "None: If these were my only options, I would defer my choice and continue to self-manage my retirement assets." Figure 1 provides a sample choice task.

After completing the conjoint choice tasks, participants were asked to fill out a number of additional demographic and psychographic measures. First we asked them how long they expected to rely on their retirement funds, by having them indicate the probability that they would live to ages 65, 75, 85, and 95 (Payne et al. 2013). We next collected demographic information including gender, race, marital status, number of children, household income, and retirement assets. To assess financial literacy, we included five numeracy questions and three CRT questions (Weller et al. 2012, Frederick 2005). We administered an additional set of questions to measure individual differences in key constructs thought to affect preference for annuities. First, we collected bequest motives by asking individuals who they would identify as beneficiaries, whether they had formally or informally designated any portion of their savings as inheritance to others, and if so, what proportion of their savings was so designated. We also asked them to agree or disagree (7-point Likert scale) with statements about the importance of providing inheritance for family members versus financing their own retirement (see Web Appendix for text of all questions). Research has suggested perceived fairness is an important consideration for consumers of financial products as well as a strong input into attitude measures for such products; such fairness judgments depend on not just how outcomes are shared between consumers and firms, but also on the transparency and procedural aspects of the system that determines the outcomes (Bies et al. 1993). We measured perceived fairness for annuities through both direct questions about fairness (Kahneman, Knetsch, and Thaler 1986) and questions about the process underlying annuities; the inter-item covariance for these factors is high ($\alpha = .91$) and factor analysis suggests the factor driven by the single-item direct fairness

question captures 78% of the overall variance. Thus, for the remainder of this analysis, we use the single-item direct fairness measure as our measure of perceived fairness for annuities. We measured risk aversion through a series of choices for uncertain annuity income streams adapted from Barsky et al. (1997) as used in the 1992 HRS; responses to these choices allow us to categorize individuals into one of six levels of risk aversion (also see Kapteyn and Teppa 2011). Finally, participants responded to a set of 10 questions that asked them to choose between mixed (gain and loss) gambles, thus providing us with individual-level loss-aversion measures.

Preliminary model-free evidence of attribute impact on utility "beyond NPV"

Before we turn to estimation results for the model discussed earlier, a model-free investigation of whether participants' choices are generally consistent with the actuarial expected value of the annuities in the choice tasks is worthwhile. To do so, we present the results for one of the choice tasks from the survey. The choice task, including the attribute levels for each of the three annuities considered, is provided in Figure 1. Table 3 presents the average (across genders) expected payouts to self and to others, as well as the total expected payouts, and the inside shares of the three alternatives, that is, the shares among all (59%) people who chose one of the three annuities. If consumers cared most about the expected payout, they should be approximately indifferent among the three alternatives because all three deliver approximately the same expected payout. However, our respondents strongly prefer the right-most alternative, not only to the left-most (which is "only" AA), but also to the middle one that starts higher and delivers an additional $8,400 overall payout. This skewed pattern of choice shares clearly indicates that participants are choosing based on attribute values in a way that is not related only to the expected payout arising from those attributes. The preference for annuities that do not deliver the highest expected payout provides initial evidence that a model based only on expected value, without direct consideration of the annuity design in terms of attributes, is likely to miss important aspects of consumers' preferences for annuities.

Also informative is the fact that 41% of respondents selected "none of the above" in this example choice task despite all three annuities offering expected payouts with a net present value over $160K for a purchase price of $100K. This strong dislike of annuities with a high benefit relative to upfront costs (more than would ever be offered in the market, in fact) suggests some individuals are unwilling to consider annuities regardless of the benefit offered. In the next section, we focus on separating out these respondents who uniformly dislike annuities a priori.

Model Estimation Methodology: two types of respondents

Although our conjoint task involved 20 single-stage choices between four options (three annuities and one outside option), we find that a substantial proportion of respondents do not like annuities at all. Specifically, of the 363 participants in our survey, 22% (n=80) did not choose any annuity at all among the 20 choice tasks they completed. Some of the annuities in our design provided well over $200K in expected payout, in exchange for the $100K price of the annuity (held constant throughout). Therefore, some people simply seem to dislike the idea of an annuity a priori, and are unwilling to consider these products. Rather than interpreting their behavior as 20 actual choices following our model, we decided to only focus the choice model on people who chose at least one annuity during the survey. In a preliminary analysis, we describe how these 283 remaining subjects differ from the 80 "annuity haters," using a simple logistic regression with the individual characteristics as our independent variables. This regression allows us to identify those consumers who are likely to choose at least one annuity. Table 4 summarizes the explanatory variables used in the regression.

Estimation results: Willingness to consider annuities

Table 5 shows results for the logistic regression of selecting at least one annuity on individual characteristics (vs. disliking annuities a priori). Most demographics are not significant, with the exception of gender (female respondents are more likely to dislike annuities a priori) and income ("middle class" households with incomes between $35K and $100K dislike annuities

relative to lower-income households). The expected inverse-U-shape effect of retirement savings[8] seems to hold directionally, but the coefficients are not significant. We also find that survey respondents who clearly identify a family member as a potential beneficiary are more likely to sometimes select annuities, a somewhat surprising result given theoretical predictions that individuals with family beneficiaries may like annuities less due to bequest motives or use of the family as a replacement for an annuity (Brown 2007, Kotlikoff and Spivak 1981).

The strongest survey measure that is correlated with selecting at least one annuity is perceived fairness (measured by a direct question following Kahneman, Knetsch, and Thaler 1986): individuals who perceive annuities to be fair are much more likely to select some in our study. When we investigated the correlation between perceived fairness and other demographics in this logistic regression, we found that younger respondents and male respondents are relatively more likely to perceive annuities as fair. This finding explains why gender becomes a significant explanatory variable once we remove the survey measures from the model. We included several other behavioral measures in our logistic regression that we expected to influence overall liking of annuities, such as risk aversion, loss aversion, numeracy, and life expectancy. None of these measures had a significant effect on willingness to consider annuities. We will return to these measures as predictors of specific annuity choice in the next section.

Estimation results: Choice model

To estimate the parameters of our choice model for the 283 respondents who selected at least one annuity within the study, we follow a standard Bayesian procedure to generate draws from the posterior distribution of all parameters using a Gibbs sampler. Please see Rossi et al. (2005) for a detailed description of setting up the Gibbs sampler for a hierarchical linear model. We ran the Gibbs sampler for 20,000 iterations, discarding the first 5,000 as burn-in iterations

[8] Theory suggests that retirees with about $100K are the best candidates fora $100K annuity

(the sampler takes a while to navigate to the area of the parameter space with enough posterior mass) and using the remaining 15,000 draws to conduct our counterfactual exercises.

Table 6 summarizes the first two population moments of the estimated utility parameters for the full model presented above, as well as for an alternative model based on attributes only. Because we estimate a choice model, the average coefficients can be interpreted as average marginal effects on utility. However, they are obviously not marginal effects on probability of choice. To get a sense of the marginal effects on probability of choice, one can only interpret the sign of a coefficient to infer the direction of the effect. The counterfactual simulations in the next section will offer a more meaningful interpretation. Nevertheless, several conclusions can be drawn from the parameters alone. We focus our discussion on the parameters of the full model.

As expected, the average coefficients on both the expected payout and the AAA rating are positive. The consumer preference for financially safe issuers is strong: because the expected payout is measured in \$100K throughout, the AAA coefficient means the average consumer is indifferent between an AAA annuity with an expected payout of \$100K and an AA annuity with expected payout of about \$128K ($0.35/1.23 \approx 0.28$). More surprisingly, the coefficients on the annual-increase and period-certain dummies are mostly significant and often large, indicating consumer behavior is not well captured by using only the expected payout and financial-strength variables. We discuss each of the "beyond NPV" influences in turn.

Annual increases: Recall that we selected the levels of annual increases as pairs matched across the type of increase (additive vs. percentage). Specifically, the \$500/year increase results in approximately[9] the same expected payout as the 7% increase, and the (\$300,5%) and (\$200, 3%) pairs are matched analogously. Therefore, we can conclude from Table 6 that the average consumer prefers additive increases to percentage increases, ceteris paribus.

The negative signs on all the percentage increment variables suggest consumers systematically undervalue the benefits of annual payment increases: for example, the negative

[9] The magnitude of the difference in expected payout depends on gender, starting income, and other attributes.

coefficient on the 7% annual increase dummy implies that a given level of expected payout arising from no annual increase and a high starting income is preferable to the same level of expected payout arising from a lower starting income and 7% annual increases. The magnitude of the average coefficient (-0.72) indicates that the difference in utility is large: consumers like an annuity "A" that delivers an expected payout of $100K without any annual increases about as much as an otherwise identical annuity "B" that delivers $160K payout via 7% annual increases (1.23*(1.6-1)-0.72≈0). Another way to interpret the magnitude of the average coefficients is in terms of the variance (fixed to 1 by assumption) of the random-utility error terms: the coefficient magnitude of 0.72 means the random unobserved utility in the error term for annuity "C," which delivers an expected payout of $100K via 7% annual increases, would have to be about three-quarters of a standard deviation higher than the random error for annuity A for the average consumer to be indifferent between C and A.

The additive increases exhibit a different pattern from the percentage increases: the average consumer seems to undervalue the benefits of large ($500/year) increases and overvalue the benefit of small ($200/year) increases. In the next section, we measure the magnitude of the effect of various increaseson total market demand using counter-factual experiments, and compare the demand for additive increases to demand for percentage increases that deliver similar expected payouts..

Period certain: The positive average coefficients on the "mid-length" (10 and 20 years) period-certain guarantees suggest consumers like these options beyond their financial impact on the expected payout. Conversely, the short (5-year) period-certain guarantee actually hurts demand, ceteris paribus. Therefore, consumers do not simply prefer any period-certain guarantee over none. In the next section, we measure the magnitude of the effect of the period-certain guarantee on total market demand using counter-factual experiments.

Having interpreted the average utility coefficients, we now focus on the population heterogeneity in preferences. Overall, we find a lot of heterogeneity, and some of it can be

explained by variance in demographics and psychographics. Table 7 contains the estimates (posterior means) of the population-level parameter Δ. The most easily interpreted are the effects of the demographics and psychographics (Z) on the intercept of utilty (α), that is, on the individual's baseline liking of annuities: echoing the results of Table 5, we find that perceived fairness of annuities is strongly correlated with their baseline liking. In addition, Table 7 indicates that older, more numerate, and higher-saving individuals choose fewer annuities and more "none of the above," ceteris paribus. The same is true of individuals who would identify a family member as a beneficiary of a period-certain annuity. Some of these changes in the intercept are sometimes compensated by an increase in the slope of expected payout (β): Table 7 suggests more numerate, older, and higher-saving people care more about the expected payout. For example, a 65-year-old's β is about 0.5 (≈20*0.026) higher than a 45-year-old's, but his intercept is lower by over about 1 (≈0.054*20). The overall effect of age on the preference of annuities is thus most likely negative: an annuity would have to pay out over $200K for the 65-year-old to get the same utility as a 45-year-old. Analogously, we conclude that the effect of higher savings, numeracy, and selecting a family beneficiary all have negative overall effects on annuity preference. In the next section, we measure the magnitude of these effects using counter-factual experiments, which allows us greater insight into how population heterogeneity interacts with preference for specific attributes.

The population-level parameters (Δ) also shed light on the underlying reasons why consumers prefer annuities with period-certain guarantees. An obvious candidate would be a bequest motive, but we do not find any significant positive relationships between having children or being married, and preferring a longer period certain. Having a family member designated as a beneficiary, which was a significant factor in our analysis of who is willing to consider annuities, is not significant here. Also, surprisingly, neither risk aversion nor loss aversion increase the preference for a longer period-certain guarantee. Instead, we find a positive relationship between preferring period-certain guarantees and having retirement savings between $75K and $150K,

indicating that people like the certainty only when they are about to annuitize a majority of their savings. On the flipside, people who consider annuities to be fair dislike the period-certain guarantees.

We also find a substantial amount of unexplained heterogeneity, measured by the scale of the population-level covariance Σ. Table 6 focuses on the square root of the diagonal of the posterior mean of Σ, that is, the population standard deviation of each scalar coefficient. For example, the population standard deviation of the coefficient on the expected payout is about as large as the population average. Therefore, all of the above computations for the "average consumer" may not be representative of many of the respondents. This amount of unexplained heterogeneity underscores the need for individual-level estimates and individual-level counterfactual simulations, to which we now turn.

Counterfactual simulations of market demand

Population averages of the utility coefficients contain only limited insight into the marginal effects of annuity attributes on demand. In this section, we conduct a series of counterfactual simulations to assess the magnitude of these effects directly. Each simulation we conduct starts with a definition of the alternatives available to the prospective retirees. For example, in all our simulations presented below, we consider a specific single annuity offering along with a no-choice option (i.e., the outside option). We then separately estimate the probability of buying the annuity for every individual in our sample, using the posterior distributions of individual-level utility parameters. Adding the probabilities together yields an estimate of demand within our subject sample. To account for estimation error, we compute the probability separately for each of the 15,000 post-burn-in posterior draws of β_j and then average the probabilities over the draws. To account for the random component of utility given a particular β_j draw, we average each probability over 100 draws of the random utility ε drawn iid from Normal (0,1). One way to think about our simulation strategy is to imagine each person

generating 1.5 million pseudo-people, each with his own (β_j ,ε_j) vector. Assume each of the million pseudo-people picks his utility-maximizing alternative, and the original "real-person" choice probability is the average choice across his alter egos. In the statistical literature, this kind of posterior predictive simulation is the standard approach (Rossi et al. 2005). We now turn to the specific simulations and the results.

Result 1: Annual increases boost demand more than equal-payout percentage increases: Table 8 shows the estimated demand for an annuity from an AAA-rated company with $400 starting monthly income, no period-certain guarantee, and different types and magnitudes of annual increases. The demand estimates are further broken down by three individual characteristics suggested as influential by Table 7: gender, numeracy, and household income. The average consumer's preference for additive increases discussed above is representative of the overall population behavior: regardless of gender, additive increases result in over a 5-percentage-point increase in demand from the baseline of about 35% of the respondents predicted to buy the annuity without an increase. By contrast, percentage increases (although clearly costly to the issuer) do not appear to boost demand more than about 1.5 percentage points (see Figure 2 for an illustration of these results). Surprisingly, neither gender seems to respond to larger increases of either type. For example, the $500 annual increases result in the same demand as $200 annual increases. In other words, demand seems to increase as long as the annuity includes some additive increase, but the magnitude of the increase does not matter (between $200 and $500). Figure 2 illustrates these results by exhibiting a plateau after the $200 level.

We can rule out poor number skills as an explanation for the insensitivity of demand to the magnitude of payment increase, because even highly numerate consumers are insensitive (see Table 8). Also, the demand boost from additive increases occurs at all levels of numeracy. If anything, the magnitude of the boost is higher among more numerate people. The numeracy section of Table 8 also shows a strong negative main effect of numeracy on demand for annuities, regardless of payment increases. For example, the demand for an annuity without any

increases is more than double among the bottom quintile as compared to the top quintile of numeracy. Finally, Table 8 shows that members of high-income households do not like annuities. On the other hand, high-income people are the only group we found that does respond positively to the magnitude of the payment increase, regardless of the increase type. Overall, our analysis of annual payment increases suggests consumers overvalue a $200 annual increase, making it a potentially profitable option for the issuer.

Result 2: Mid-length period-certain guarantees boost demand, whereas short-length ones decrease it: Table 9 shows the estimated demand for an annuity from a AAA-rated company with a $400 starting monthly income, $200 annual increases, and different numbers of years of period-certain guarantees. Again, the average consumer's preferences are consistent with the shape of market demand: the 20-year period-certain guarantee yields the highest demand (see Figure 3 for an illustration). By contrast, the market prefers a 5-year period-certain guarantee less than no guarantee at all. This finding is surprising in the sense that even a 5-year period-certain guarantee provides some protection from full loss should the buyer unexpectedly die soon after purchasing the annuity. Finally, the demand for 10-year and 30-year period-certain guarantees is about the same despite the much larger expected payout of the 30-year guarantee. These results suggest consumers will not respond positively to issuers' offers of very short or very long period-certain guarantees.

The inverse-U shape is more pronounced among more numerate respondents, whose demand increases over 20 percentage points when moving from a zero to a 20-year period-certain guarantee. However, even highly numerate people exhibit lower demand for the 30-year option than the 20-year option, so we conclude the inverse-U shape is not a result of some sort of mathematical miscalculation. The demand boost from a 20-year option is so strong that it overcomes the negative main effect of numeracy on the demand for annuities without period-certain guarantees, as discussed above. Middle-numeracy respondents exhibit the highest demand (0.638).

Another large main effect clearly shown in Table 9 is the positive effect of perceived fairness: for every length of the period-certain guarantee, people who perceive annuities as completely fair exhibit the highest demand. Moreover, their demand changes the least as a function of the period-certain length. Therefore, the inverse-U shape described above seems to be primarily driven by people who consider annuities to be at least somewhat unfair. Offering them a 20-year period-certain guarantee can make a big difference in their behavior: for example, the demand among people who consider annuities unfair more than triples from 0.127 to 0.398 when moving from no guarantee to a 20-year period certain.

The final panel in Table 9 examines the relationship between current age and demand by considering quintile age groups. We find a main effect of age for every length of period certain, with the youngest people (i.e., early 40's) liking annuities the most. The effect of age is not monotonic for annuities with longer periods certain: for example, the second highest demand for a 20-year period certain guarantee is from people in the middle age group. Unfortunately for marketers, people just before retirement tend to like annuities the least. This finding is consistent with other research that has also found stronger interest in annuities among pre-retiree populations than among retirees (DiCenzo, Shu, Hadar, and Rieth 2011).

IMPLICATIONS FOR MARKETING OF ANNUITIES

Because annuity attributes influence preferences beyond their impact on expected payout, the annuity issuer has an opportunity to increase demand without increasing the actuarial present value of the product by structuring the annuity using attribute levels that consumers prefer. To assess the size of this "free" demand boost and find the best combinations of attributes, we estimate market demand for all possible combinations of attributes in Table 1 that result in an expected payout between $90K and $110K, which keeps us within reasonable range of the $100K annuity price used in the survey questions. For every annuity in the set, we compute the market demand the annuity would receive if it were the only offering in the market. Such a

simple definition of a market facilitates straightforward comparisons between the individual annuities.

Table 10 lists the top 10 and bottom 10 annuities in terms of demand, by gender. The gender conditioning is necessary because women live longer than men, so the same annuity gives women a larger expected payoff. The most striking aspect of Table 10 is the large difference between the demand for the top and bottom: regardless of gender, the top products more than double demand without increasing cost to the issuer. Consistent with the results discussed above, the highest-demand annuities within the feasible payout range involve a AAA issuer. A more interesting question that Table 10 answers is whether the consumer preferences for period-certain guarantees are strong enough to justify the compensating starting-income reduction and/or small annual increase necessary to satisfy the feasibility constraint that the expected payout remains between $90K and $110K. Table 10 shows clearly that the answer is "yes," especially for males: the median of the top 10 annuities provides 20-year period-certain guarantees at the cost of starting incomes between $300 and $400. The female market also calls for mid-length period-certain, but the preference for 20 years over 10 years is less stark. Because women's longevity makes all annuities more expensive to provide, the cheap-to-offer 10-year period-certain guarantee is more likely to fit within the feasibility constraints. For analogous reasons, the highest-demand annuities for men offer more annual increases, concentrating on the desirable $200-per-year level suggested by counter-factual simulations in the previous section. An interesting side effect of these ideal product offerings is that they make men (with their higher chance of dying and longer period-certain options) seem a lot more generous to their beneficiaries than women: the top 10 annuities for males leave about 24% of the expected payout to beneficiaries as opposed to only 9% for the top annuities for females.

Although Table 10 clearly shows that men should be offered different annuities than women, the feasibility constraint rather than preferences drives this difference. Table 11 shows the top 15 products for females along with the demand estimates for the same products in the

male market. It is immediately noticeable that both genders rank the annuities in the same order. Figure 4 illustrates the similarity of preference-ordering between genders by joining the male and female demands for the same annuity with lines. The connecting lines are mostly horizontal, so males and females exhibit about the same demand for the same annuity. Figure 4 also illustrates the wide range of demand one can expect while keeping the expected payout fixed. Clearly "packaging" a fixed expected payout can more than double demand while only slightly changing the expected payout changes demand.[10]

DISCUSSION

This paper presents a case for marketing research about decumulation products, and reports the results of a conjoint analysis that measures preferences for annuities in a national panel. We find that consumers value increases in the expected net present value of the payouts, but some annuity attributes also influence consumer preferences beyond their impact on financial value. One attribute that influences preferences "beyond NPV" is inflation protection via annual payment increases. We find that consumers undervalue annual increases, and show a stronger preference for fixed annual increases relative to percentage increases, holding the expected payout constant. Our results suggest that the presence of an increase matters more than its actual size. Another attribute with a strong influence beyond NPV is the period-certain guarantee. We find that consumers significantly over-value "middle-length" (10-year and 20-year) period-certain guarantees, and under-value very-short and very long guarantees. Finally, company financial strength rating is also important to consumers, with AAA-rated companies leading to significantly higher preferences than those with only an AA rating. The preference for AAA-rated companies adds to prior evidence that that consumers consider insurance company financial strength during purchase (Babble and Merrill 2006).

[10] We also performed a log-log regression (not reported in detail) and found that the elasticity of demand in the expected payout is only about 0.5.

Demand for annuities is correlated with demographics, such as gender, income, and having an identifiable family beneficiary. In addition, these demographics also moderate consumer preferences for various annuity attributes. Although many respondents do not like life annuities, those with less retirement savings (less than $75K), who are of pre-retirement age (41 to 45), and who score lower on numeracy tests all report a higher likelihood of purchase. Some of our findings mirror those suggested elsewhere, such as our findings that pre-retirees like annuities more than retirees (DiCenzo et al. 2011). One explanation for why younger consumers prefer annuities that start at age 65 might be based on the time period between the annuity choice and the start of monthly payouts, suggesting that annuities that begin in the future will be more preferred; we return to this question in the discussion below. Interestingly, responsiveness to period-certain options is the same among individuals with and without children, as well as among participants reporting strong bequest motives and clearly identified beneficiaries versus those without, suggesting that bequest motives are not a strong driver of value for this attribute (Ameriks et al. 2011, Lockwood 2012).

In terms of psychographics, we find that individual measures of perceived fairness are also predictive of annuity preference and are especially predictive of preference for period-certain attributes, consistent with behavioral explanations for the annuity puzzle (Hu & Scott 2007, Benartzi, Previtero & Thaler 2011). Surprisingly, individual measures of loss aversion and risk aversion do not appear to have significant effects on annuity preference, although the effects of loss aversion do appear to be larger than risk aversion.

Numeracy is another psychographic we find to be related to annuity preferences: Highly numerate individuals have the strongest responses to annuity value as measured through expected value, but are not as responsive to an issuer's higher company rating. By contrast, lower numeracy individuals are more responsive to the addition of annual increases (beyond their effect on expected payout), as are individuals from households with lower annual income .

Our main managerial contribution is the design of products that maximize demand without increasing the expected payout, i.e. the cost of the product to the issuer. We find that careful "packaging" of a given net present value into the optimal mix of the attributes can more than double demand for the product. We hope that marketers and public-policy experts can use our methodology and results to begin overcoming the annuity puzzle.

Although our study provides several insights about how consumers respond to different annuity attributes, both individually and in aggregate, several open questions remain. The first major open question concerns what else we can understand about the decision process, and especially how consumers make tradeoffs between annuity attributes? The current study provides a major step forward in our understanding of consumer annuity preferences by employing a widely accepted marketing technique, conjoint analysis, to measure individual-level preferences for annuity attributes through their effects on both an annuity's discounted expected payout and value beyond financial measures. We are then able to see how individual-level characteristics such as demographics and psychological measures such as numeracy, fairness, and loss aversion interact with those attribute preferences. To get an even better understanding of the actual decision process, we can turn to methods such as eye tracking. Running similar conjoint tasks with an eye-tracking system will allow us to see exactly which attributes attract participants' attention, and for how long, prior to them making a final choice.

A second open question is how individuals value other annuity attributes that exist in the marketplace but are unaddressed in this particular study. One attribute of key importance is the start date of the annuity. All of the choice tasks presented in this study involve immediate life annuities, which begin payment at age 65. However, the marketplace also offers annuities with delayed start dates (often called deferred annuities, ALDAs, or longevity insurance). Our finding that younger respondents show stronger preference for annuities beginning at age 65 than do older respondents who are closer in age to the start date could be due to a preference for annuities that begin further in the future, suggesting that deferred annuities may be more

appealing than immediate ones. Recent government reports encouraging greater use of such deferred annuities also capture this idea. In an earlier conjoint study not reported here in detail, we considered this possibility and explicitly included several levels of deferred start ages as attributes in our model. Specifically, we ran a separate conjoint study similar to this study in both methodology and design with a separate group of participants (n=405) aged 40 to 65 drawn from the same population. We found similar results to those presented here for most attributes. Importantly, we also tested three levels of start date (age 65, 70, and 75) as one of our attributes, and found consumers strongly preferred the age-65 start date, which received the highest coefficient of any other attribute, even when monthly income was sufficiently increased to compensate for the delay.

A final question regards the options available to marketers and public-policy experts for increasing consumers' preference for annuities. Our findings provide some insight into these questions, as provided in our estimates of most preferred annuities within a pre-specified payout range for each. However, our results assume a particular presentation of the annuity attributes; given the extensive findings in the behavioral literature on how information presentation affects preferences, we expect that different ways of presenting the information (such as with a table with cumulative payment amounts) will result in different preferences, possibly reducing the impact of attributes "beyond NPV". For example, we expect participants' non-normative response to percentage versus fixed annual increases may not persist when payments are shown in cumulative rather than per-period formats, whereas sensitivity to period-certain guarantees may become stronger when explicit life expectancy probabilities are provided. Testing of these types of presentational styles for annuity attributes may provide useful insights for interventions that can address the annuity puzzle.

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Table 1: Attribute levels used in the conjoint analysis

Level	Starting monthly income	Company financial strength rating	Annual increases in payments	Period-certain guarantee
1	Monthly payments start at $300 ($3,600/year)	Company rated AA (very strong)	Fixed payments (no annual increase)	No period-certain option
2	Monthly payments start at $400 ($4,800/year)	Company rated AAA (extremely strong)	3% annual increase in payments	5-year period-certain
3	Monthly payments start at $500 ($6,000/year)		5% annual increase in payments	10-year period-certain
4	Monthly payments start at $600 ($7,200/year)		7% annual increase in payments	20-year period-certain
5			$200 annual increase in payments	30-year period-certain
6			$400 annual increase in payments	
7			$500 annual increase in payments	

Table 2: Respondent characteristics

Age	min 41, max 66, average 54
Gender	50% male, 50% female
Race	86% white/Caucasian 8% African American 6% other
Marital status	14% single, never married 15% married no kids 45% married with kids 15% divorced, 11% other
Numeracy and CRT	min 0, max 8, average 3.25
Children	35% no children 14% one child 51% two or more
Hhold income	4% < $10K 30% $10K - $35K 16% $35K - $50K 33% $50K - $100K 13% > $100K 3% no answer
Retirement assets	35% < $10K 21% $10K - $50K 15% $50K - $150K 13% $150K - $500K 6% > $500K 10% no answer

Table 3: Relative inside shares of the three alternatives for the sample choice task shown in Figure 1

Left alternative in Figure 1	Middle alternative in Figure 1	Right alternative in Figure 1
V_{self} = $142,400	V_{self} = $167,800	V_{self} = $134,400
V_{other} = $122,500	V_{other} = $6,300	V_{other} = $31,300
V = $164,900	V = $174,100	V = 165,700
17% share	35% share	48% share

Table 4: Demographic and psychographic variables in regressions (283 subjects)

	mean	median	std. dev.	min	max
Age (years)	53.997	55	6.722	41	66
Male	0.537	1	0.500	0	1
Married	0.580	1	0.495	0	1
Has Children	0.633	1	0.483	0	1
HH Income 35to100K	0.519	1	0.501	0	1
HH Income over100K	0.141	0	0.349	0	1
Retirement savings 75to150K	0.120	0	0.326	0	1
Retirement savings over 150K	0.187	0	0.391	0	1
Period certain beneficiary would be family	0.898	1	0.304	0	1
Perceived fairness of annuities	0.552	0.667	0.219	0	1
Risk aversion	0.680	0.6	0.312	0	1
Loss aversion	0.572	0.6	0.302	0	1
Numeracy	0.428	0.375	0.247	0	1
Life expectancy (age at death, years)	82.92	83.39	9.27	59.50	99.04

Note: Perceived fairness is measured using the four-point fairness scale of Kahneman, Knetsch, and Thaler (1986) and then rescaled between 0 and 1. Risk aversion is a classification into six ordered levels of risk aversion following Barsky et al. (1997) and used on the 1992 HRS, and then rescaled between 0 and 1. Loss aversion is measured using a set of 10 choices between mixed (gain and loss) gambles and then re-scaled between 0 and 1. Numeracy was measured through a set of eight questions: five questions test numeracy through questions of probability and likelihood following Peters et al. (2006), and the additional three questions are taken from the CRT (Frederick 2005). The total number of correct answers is rescaled between 0 and 1 to arrive at our numeracy measure. Life expectancy is based on the individual-level subjective assessment of the probability of surviving until 65, 75, 85, and 95. The subjective probabilities are used to estimate a Weibull survival model via maximum likelihood (see Payne et al 2013), and the individual life expectancy is then derived as a plug-in estimate of the expected value of the Weibull random variable at the maximum likelihood parameter estimates.

Table 5: Willingness to consider annuities: who selected at least one of the offered annuities
(Logistic regression, 1=at least one purchase, 0=all individual's choices are "none of the above")

Individual characteristic (dummy unless noted)	Coeff	*t-stat*	Coeff	*t-stat*	Coeff	*t-stat*
Constant	2.221	1.20	2.506	1.385	**3.263**	2.737
Demographics						
Age (years, std=6.74)	-0.018	-0.78	-0.017	-0.739	-0.028	-1.375
Male	***0.538***	1.76	0.539	1.764	**0.657**	2.414
Married	0.070	0.22	0.085	0.264	0.119	0.401
Has Children	-0.476	-1.41	-0.467	-1.378	-0.332	-1.095
HH Income 35to100K	**-0.863**	-2.29	**-0.860**	-2.284	***-0.661***	-1.891
HH Income over100K	-0.728	-1.47	-0.738	-1.487	-0.817	-1.795
Retirement savings 75to150K	0.497	0.96	0.477	0.926	0.447	0.923
Retirement savings over 150K	-0.583	-1.62	***-0.593***	-1.657	-0.523	-1.625
Psychographic measures						
Period-certain beneficiary annuity would be family	**0.956**	**2.21**	**0.945**	**2.187**		
Perceived fairness of annuities	**3.485**	**5.49**	**3.527**	**5.576**		
Risk aversion (0 to 1 scale)	0.036	0.08	0.064	0.138		
Loss aversion (0 to 1 scale)	-0.619	-1.28	-0.651	-1.349		
Numeracy (0 to 1 scale)	0.637	0.57	-0.041	-0.063		
Life Expectancy (years)	-0.017	-1.00	-0.020	-1.215		
Life E. X (numeracy>median)	-0.005	-0.75				

Note to Table: N=363 respondents who did not complete the survey too quickly (took at least 15 minutes). All variables are dummies unless noted otherwise. **Bold**=$p<0.05$, ***BoldItalic*=**$p<0.1$. See Table 2 for summary statistics of the explanatory variables in these regressions.

Table 6: Estimation results: posterior means of utility parameters for full-choice model and attribute-only model

	Proposed model: Beyond NPV		Attribute-only model	
	Population Mean of $(\alpha,\beta,\gamma,\theta)_j$	Population Std. dev. $\sqrt{diag(\Sigma)}$	Population Mean of of $(\alpha,\beta,\gamma,\theta)_j$	Population Std. dev. $\sqrt{diag(\Sigma)}$
Intercept	**-2.216**	2.290	**-2.529**	2.455
E (payout) in \$100K $(V_{n,k})$	**1.226**	1.072		
Start. income \$400/mo. (vs. \$300)			**0.473**	0.472
Start. income \$500/mo. (vs. \$300)			**1.036**	1.047
Start. income \$600/mo. (vs. \$300)			**1.406**	1.404
AAA rated issuer (vs. AA)	**0.347**	0.763	**0.413**	0.740
Annual increase 3% (vs. 0)	**-0.200**	0.551	**0.312**	0.461
Annual increase 5% (vs. 0)	**-0.327**	0.955	**0.683**	0.469
Annual increase 7% (vs. 0)	**-0.718**	1.568	**0.874**	0.636
Annual increase \$200 (vs. 0)	**0.191**	0.768	**0.599**	0.613
Annual increase \$400 (vs. 0)	-0.040	1.093	**0.826**	0.689
Annual increase \$500 (vs. 0)	**-0.298**	1.381	**0.935**	0.783
Period certain 5 years (vs. 0)	**-0.318**	1.239	**-0.312**	1.324
Period certain 10 years (vs. 0)	**0.285**	1.635	**0.457**	1.753
Period certain 20 years (vs. 0)	**0.603**	1.914	**1.152**	1.956
Period certain 30 years (vs. 0)	**-0.536**	2.560	**0.909**	1.956

Note: Posterior means of the parameters indicated. N=283 respondents who select an annuity in at least one of the K=20 choice tasks and take at least 15 minutes to complete the survey. The population mean captures the average marginal effect of a variable on utility. The population standard deviation captures the amount of population variation in each marginal effect not explained by demographics or psychographics. **Bold** indicates that 97.5% or more of the posterior mass has the same sign as the posterior mean—a Bayesian analogue of significance at the 5% level.

Table 7: Population-level regression: Marginal effects of the demographics and psychographics on the utility parameters

	intercept	E(payout) ($100K)	AAA rated issuer (vs. AA)	Annual increase 3% (vs. 0)	Annual increase 5% (vs. 0)	Annual increase 7% (vs. 0)	Annual increase $200 (vs. 0)	Annual increase $400 (vs. 0)	Annual increase $500 (vs. 0)	Period certain 5 years (vs. 0)	Period certain 10 years (vs. 0)	Period certain 20 years (vs. 0)	Period certain 30 years (vs. 0)
Population mean	**-2.216**	**1.226**	**0.347**	**-0.200**	**-0.327**	**-0.718**	**0.191**	-0.040	**-0.298**	**-0.318**	**0.285**	**0.603**	**-0.536**
Population std. deviation	**2.290**	**1.072**	**0.763**	**0.551**	**0.955**	**1.568**	**0.768**	**1.093**	**1.381**	**1.239**	**1.635**	**1.914**	**2.560**
Δ:													
constant	1.483	-0.149	0.466	0.367	-1.056	-1.096	-0.587	-0.161	0.228	1.266	0.862	-0.514	-1.565
Age (years)	**-0.054**	***0.026***	0.001	**-0.022**	-0.009	-0.029	-0.003	-0.013	-0.008	***-0.027***	-0.009	0.009	-0.007
Male	***0.657***	-0.229	-0.011	0.224	0.155	0.269	-0.025	0.034	0.179	-0.031	-0.097	-0.234	-0.324
Married	-0.325	0.081	-0.199	0.027	-0.054	-0.147	-0.006	-0.088	-0.125	0.116	0.070	-0.057	-0.147
Has Children	0.278	-0.175	-0.047	-0.137	-0.026	0.049	-0.014	-0.089	0.081	-0.089	-0.005	-0.025	0.104
HH Income 35to100K	0.160	-0.057	***0.250***	-0.085	-0.025	-0.060	-0.096	0.102	0.031	-0.014	-0.034	0.312	0.577
HH Income over100K	-0.665	-0.348	0.106	0.279	0.467	**0.911**	-0.039	0.469	***0.749***	0.183	0.080	0.634	0.912
Retirement savings 75to150K	**-1.865**	***0.574***	0.260	0.367	0.072	-0.144	0.178	0.008	0.000	***0.585***	**0.850**	***0.723***	0.466
Retirement savings over 150K	**-1.314**	***0.484***	0.151	-0.106	0.122	0.007	0.183	-0.118	-0.233	-0.040	0.213	0.040	-0.037
Period certain beneficiary family	**-1.296**	0.139	0.017	0.173	0.268	0.422	***0.459***	0.438	0.418	0.286	0.076	0.047	-0.265
Perceived fairness of annuities	**4.092**	-0.312	-0.126	0.046	0.031	-0.062	-0.283	0.141	0.108	0.053	-0.728	**-1.455**	***-1.424***
Risk aversion	0.575	-0.308	0.157	0.255	***0.567***	***0.805***	0.304	0.370	0.582	-0.366	-0.310	-0.201	-0.211
Loss aversion	-0.146	-0.109	-0.081	-0.073	-0.081	0.166	0.076	-0.316	***-0.680***	-0.030	0.071	0.246	0.366
Numeracy	**-2.558**	**0.905**	**-0.582**	-0.032	0.168	-0.585	0.308	0.083	-0.027	-0.017	**1.161**	**1.543**	0.705
Life Expectancy (age at death, yrs)	-0.011	0.000	0.000	0.003	0.005	0.013	0.004	0.003	-0.008	-0.003	-0.002	0.007	0.022

Note: Posterior means of Δ (the marginal effects of demographic and psychographic variables on the utility parameters). **Bold** indicates that 97.5% or more of the posterior mass has the same sign as the posterior mean—a Bayesian analogue of significance at the 5% level. ***Bold&Italic*** indicates that 95% or more of the posterior mass has the same sign as the posterior mean—a Bayesian analogue of significance at the 10% level. See Table 2 for summary statistics of the explanatory variables in this regression.

Table 8: Effects of payment increases on demand

			Additive increases			Percentage increases		
	annual increase	none	$ 200	$ 400	$ 500	3%	5%	7%
expected payout ($100K)	*male*	*0.630*	*0.857*	*1.085*	*1.199*	*0.832*	*1.024*	*1.283*
	female	*0.704*	*0.986*	*1.269*	*1.410*	*0.961*	*1.213*	*1.564*
gender	male	0.352	0.407	0.413	0.410	0.361	0.368	0.358
	female	0.347	0.414	0.430	0.409	0.339	0.361	0.367
numeracy	bottom quintile	0.498	0.542	0.534	0.516	0.489	0.487	0.502
	2nd quintile	0.417	0.473	0.487	0.465	0.421	0.426	0.426
	middle quintile	0.358	0.430	0.453	0.442	0.363	0.387	0.394
	4th quintile	0.305	0.395	0.406	0.403	0.302	0.341	0.354
	top quintile	0.244	0.299	0.311	0.306	0.248	0.262	0.236
household annual income	under $35K	0.403	0.472	0.465	0.454	0.400	0.407	0.406
	$35K to $100K	0.359	0.421	0.434	0.414	0.358	0.374	0.361
	over $100K	0.188	0.221	0.265	0.286	0.204	0.231	0.261

Note: All estimates involve a AAA annuity with a $400 starting income and no period-certain guarantee. The *italics* numbers show the expected payout of the annuity, by gender. The non-italics numbers show estimated demand for the annuity when it is the only annuity in the market. The demand estimates are further broken down by three individual characteristics: gender, numeracy, and household income. Darker (greener) shading indicates a higher level of demand relatively to other levels of the same characteristic and/or other levels of annual increase.

Table 9: Effects of period-certain guarantees on demand

	Period-certain guarantee	none	5 years	10 years	20 years	30 years
expected payout ($100K)	*male*	*0.857*	*0.866*	*0.904*	*1.097*	*1.455*
	female	*0.986*	*0.992*	*1.018*	*1.160*	*1.466*
gender	male	0.407	0.340	0.443	0.543	0.413
	female	0.414	0.356	0.453	0.569	0.472
numeracy	bottom quintile	0.542	0.475	0.510	0.552	0.459
	2nd quintile	0.473	0.433	0.517	0.582	0.451
	middle quintile	0.430	0.374	0.482	0.638	0.531
	4th quintile	0.395	0.307	0.418	0.544	0.414
	top quintile	0.299	0.233	0.367	0.505	0.391
How fair is a life annuity?	Very unfair	0.127	0.171	0.267	0.398	0.327
	Somewhat unfair	0.283	0.210	0.305	0.436	0.359
	Acceptable	0.472	0.406	0.513	0.611	0.470
	Completely fair	0.684	0.653	0.718	0.772	0.656
Current age (all imagine a purchase at 65)	41 to 47	0.517	0.516	0.591	0.634	0.521
	48 to 52	0.428	0.382	0.481	0.559	0.407
	53 to 55	0.389	0.298	0.429	0.585	0.480
	56 to 59	0.332	0.299	0.391	0.487	0.371
	60 to 66	0.393	0.261	0.363	0.523	0.429

Note: All estimates involve a AAA annuity with a $400 starting income and $200 annual increases. The *italics* numbers show the expected payout of the annuity, by gender. The non-italics numbers show estimated demand for the annuity when it is the only annuity in the market. The demand estimates are further broken down by four individual characteristics: gender, numeracy, age, and fairness perception. Darker (greener) shading indicates higher level of demand relatively to other levels of the same characteristic and/or other levels of annual increase.

Table 10: Top 10 and bottom 10 annuities in terms of demand

	Male market							Female market						
Top 10 products								*Top 10 products*						
rank	Predicted demand	E(payout) ($100K)	% E(payout) to self	issuer quality rating	starting income	annual increases	period certain	Predicted demand	E(payout) ($100K)	% E(payout) to self	issuer quality rating	starting income	annual increases	period certain
1	0.54	1.10	78%	AAA	400	200	20	0.51	0.96	85%	AAA	300	200	20
2	0.49	0.90	78%	AAA	300	200	20	0.49	1.02	86%	AAA	500	0	20
3	0.48	1.07	95%	AAA	500	200	10	0.46	1.02	97%	AAA	400	200	10
4	0.47	1.10	78%	AA	400	200	20	0.45	1.09	97%	AAA	600	0	10
5	0.47	0.98	80%	AAA	500	0	20	0.43	0.96	85%	AA	300	200	20
6	0.47	1.06	78%	AAA	400	3%	20	0.42	1.07	85%	AAA	300	5%	20
7	0.44	0.90	95%	AAA	400	200	10	0.41	0.99	100%	AAA	400	200	0
8	0.44	1.10	95%	AAA	500	3%	10	0.41	1.02	86%	AA	500	0	20
9	0.43	1.01	100%	AAA	500	200	0	0.41	1.06	100%	AAA	600	0	0
10	0.43	0.99	77%	AAA	300	5%	20	0.41	0.91	97%	AAA	500	0	10
median	**0.47**	**1.04**	**79%**	**AAA**	**400**	**200**	**20**	**0.42**	**1.02**	**91%**	**AAA**	**450**	**0**	**15**
Bottom 10 products								*Bottom 10 products*						
last -9	0.31	1.00	96%	AA	300	7%	10	0.30	1.10	100%	AA	300	400	5
last -8	0.31	0.96	65%	AAA	400	0	30	0.30	0.97	99%	AAA	400	3%	5
last -7	0.30	0.94	99%	AA	300	400	5	0.30	0.96	100%	AA	400	3%	0
last -6	0.30	1.05	99%	AA	300	500	5	0.30	0.93	97%	AA	300	5%	10
last -5	0.28	1.03	99%	AA	400	5%	5	0.28	0.97	73%	AA	400	0%	30
last -4	0.28	0.97	99%	AAA	300	7%	5	0.28	0.91	100%	AA	300	5%	0
last -3	0.28	0.96	100%	AA	300	7%	0	0.27	0.91	100%	AAA	300	5%	5
last -2	0.26	1.07	58%	AA	300	3%	30	0.26	0.97	99%	AA	400	3%	5
last -1	0.25	0.96	65%	AA	400	0%	30	0.26	1.08	67%	AA	300	3%	30
last	0.24	0.97	99%	AA	300	7%	5	0.23	0.91	100%	AA	300	5%	5
median	**0.28**	**0.97**	**99%**	**AA**	**300**	**7%**	**5**	**0.28**	**0.96**	**99%**	**AA**	**300**	**3%**	**5**

Note: The 10 best and worst (in terms of expected demand) annuities that can be constructed from attribute levels in Table 1 and yield an expected payout between $90K and $110K. The predicted demand is normalized to a population of unit mass and in a market that includes only the focal annuity and the outside alternative (self-management of retirement assets).

Table 11: Demand by male consumers for the top 15 annuities for the female market

Annuity characteristics				Female market			Male market		
issuer quality rating	starting income	annual increases	period certain	Predicted demand	E(payout) ($100K)	% E(payout) to self	Predicted demand	E(payout) ($100K)	% E(payout) to self
AAA	300	200	20	0.51	0.96	85%	0.49	0.9	78%
AAA	500	0	20	0.49	1.02	86%	0.47	0.98	80%
AAA	400	200	10	0.46	1.02	97%	0.44	0.9	95%
AAA	600	0	10	0.45	1.09	97%	0.43	1	95%
AA	300	200	20	0.43	0.96	85%	0.43	0.9	78%
AAA	300	5%	20	0.42	1.07	85%	0.43	0.99	77%
AAA	400	200	0	0.41	0.99	100%	n/a	<0.9	100%
AA	500	0	20	0.41	1.02	86%	0.42	0.98	80%
AAA	600	0	0	0.41	1.06	100%	0.4	0.94	100%
AAA	500	0	10	0.41	0.91	97%	n/a	<0.9	95%
AAA	300	400	0	0.4	1.09	100%	0.39	0.93	100%
AA	400	200	10	0.39	1.02	97%	0.39	0.9	95%
AA	600	0	10	0.38	1.09	97%	0.39	1	95%
AAA	400	3%	10	0.38	0.99	97%	n/a	<0.9	95%
AAA	600	0	5	0.36	1.06	99%	0.34	0.96	99%

Note: The 15 top annuities for the female market that can be constructed from attribute levels in Table 1 and yield an expected payout between $90K and $110K, listed in order starting with the highest-demand product. The predicted demand is normalized to a unit population size in a market that includes only the focal annuity and the outside alternative (self-management of retirement assets). The "Female market" section shows demand and payout data for the natural target market (females). The "Male market" section shows male demand and payout data involving the same annuities. Demand "n/a" means "not available" because the annuity does not satisfy the selection criteria for males (expected payout between $90K and $110K).

Figure 1: Sample conjoint choice task

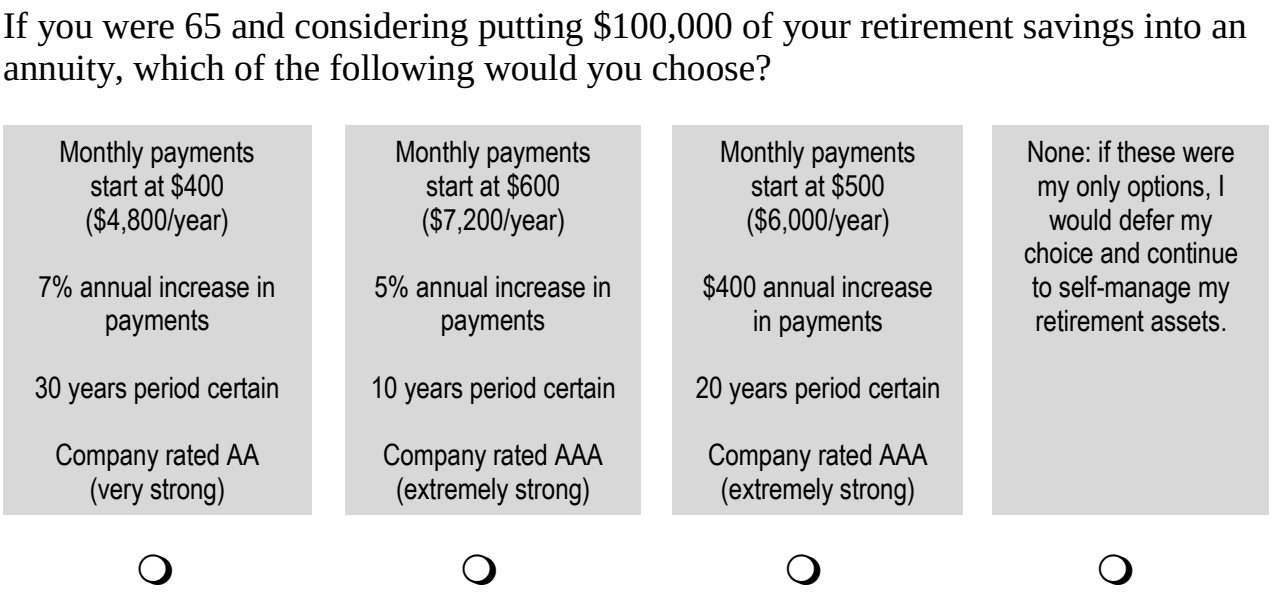
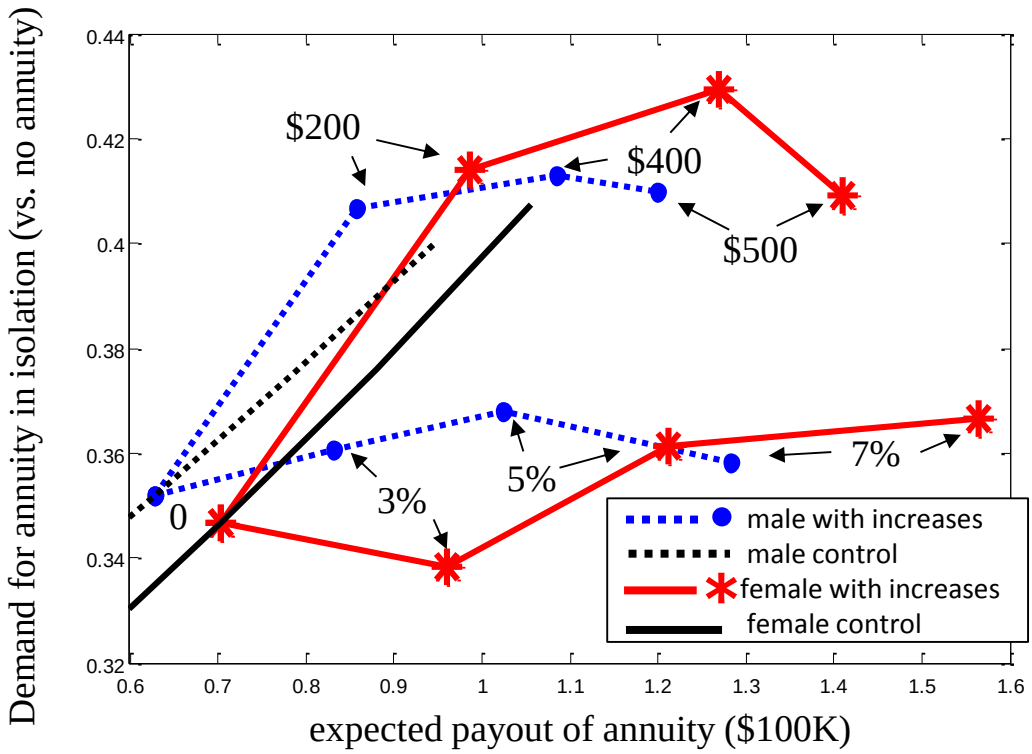


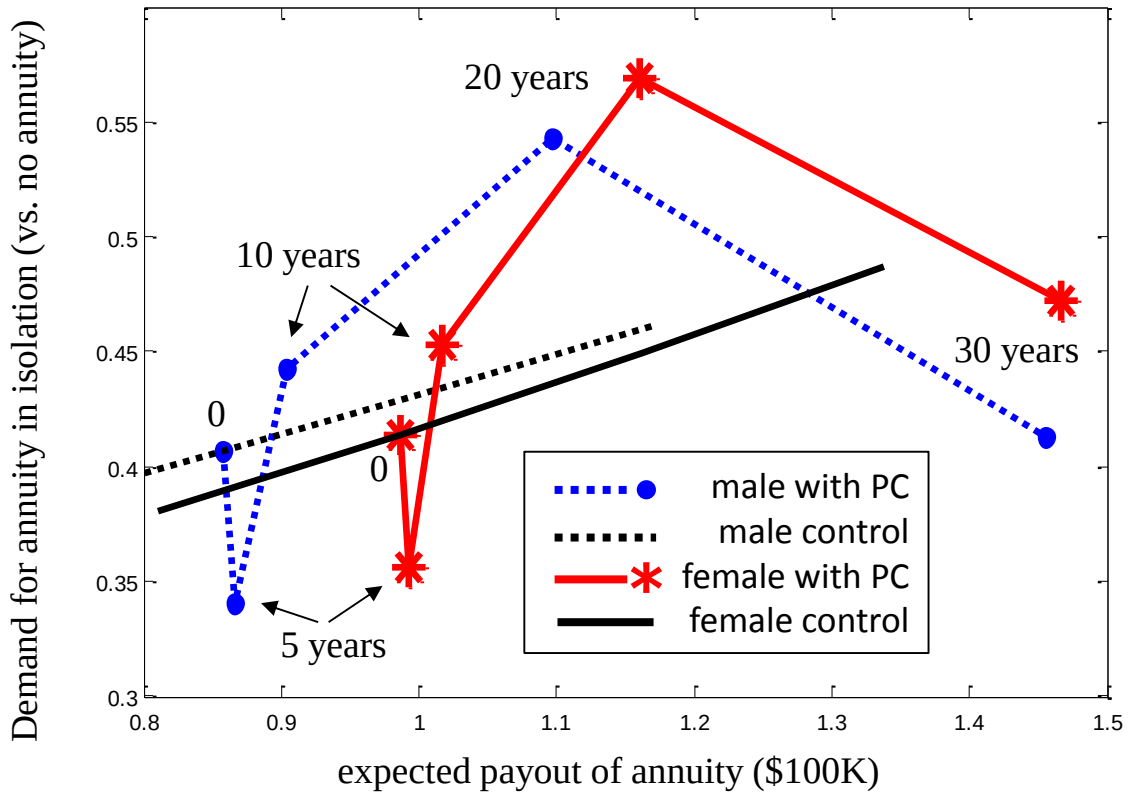
Figure 2: Demand for annuities with different amounts and types of annual increases



Note: Predicted demand for an annuity with no period-certain guarantee and starting at $400 monthly income, by gender and type of annual increase. The dashed (blue) lines with round makers indicate demand in the male market. The solid (red) lines with star markers indicate demand in the female market. The black dashed/solid lines without markets indicate demand in the male/female market for annuities with different starting incomes and no annual increases.

Takeaways: Controlling for expected payout, consumers prefer fixed annual increases rather than percentage increases. The percentage annual increases barely increase demand at all. The additive increases increase demand as a step function, so there are diminishing returns to higher levels of the additive annual increase. Consumers of both genders over-value $200 annual increases, and under-value all other increases as compared to demand for annuities with the same NPV but without annual increases.

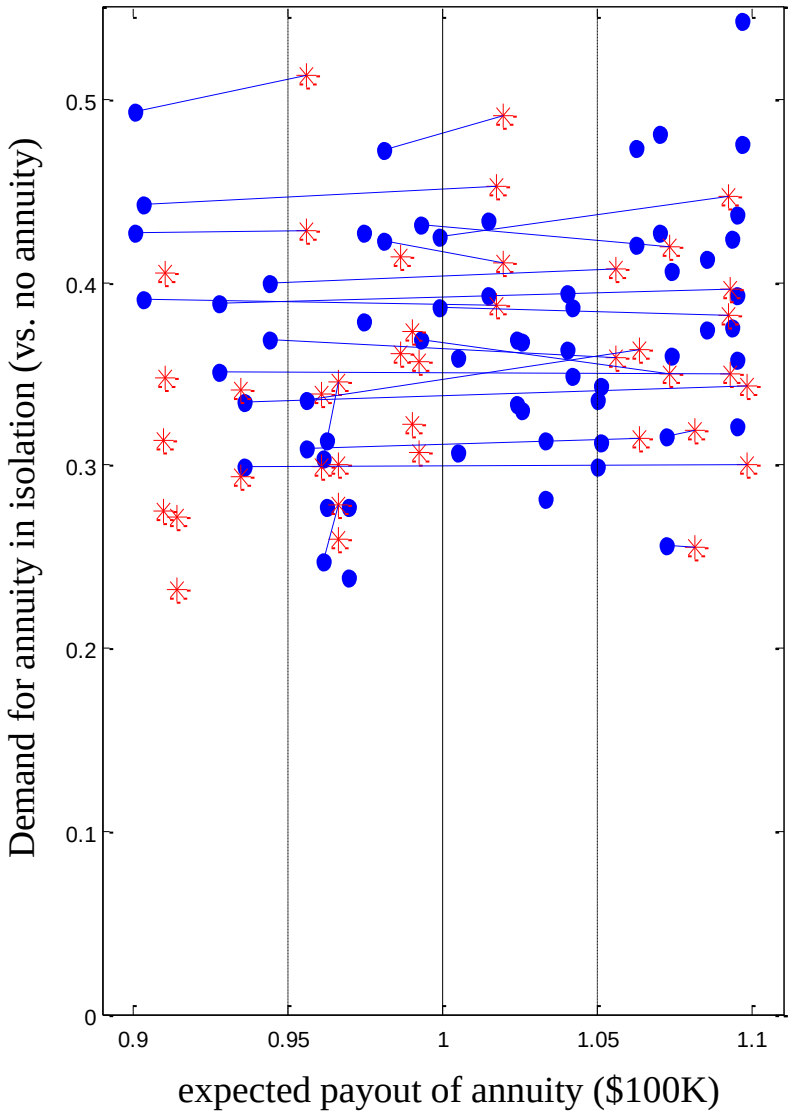
Figure 3: Demand for annuities with different lengths of period-certain guarantee



Note: Predicted demand for an annuity with monthly income starting at $400 and increasing by $200 per year, by gender and length of period-certain guarantee. The dashed (blue) lines indicate demand in the male market. The solid (red) lines indicate demand in the female market. The black dashed/solid lines without markets indicate demand in the male/female market for annuities with different starting incomes and no period-certain guarantees.

Takeaways: The 5-year PC is almost free in terms of issuer cost, but it hurts demand by more than 5 points and consumers under-value it. The 10-year PC is also not expensive to provide, but it barely boosts demand at all; consumers over-value it slightly. The 20-year PC boosts demand a lot, and consumers over-value it. Surprisingly, consumers demand the 30-year PC less than the 20-year PC, and they undervalue it substantially. Women like these annuities more than men, but that finding is probably driven by the $200 annual increase (see Figure 2).

Figure 4: Marketing of annuities



Note: Each (blue) dot is an annuity for males; each (red) star is an annuity for females. The horizontal axis shows the cost of the annuity to the issuer, and the vertical axis shows the estimated demand for the annuity when it is the only annuity in the market. The thin lines connect the same annuity marketed to males and females; lack of a thin line implies the annuity only appears once in the plot.

Takeaways: No appreciable slope to the dots occurs, so expected payout has little marginal impact on demand. The band of dots is wide (from about 0.25 to .055), suggesting that one can double demand by carefully selecting an annuity structure near the top of the band. The connecting lines are mostly horizontal, so males and females exhibit about the same demand for the same annuity.

Web Appendix: Wording of individual difference measures for psychographic variables

Bequest motives and desire for control of savings:

Please indicate how much you agree or disagree with each of the following statements:

- I am concerned about having enough money to last through my retirement
- It is important to me to leave behind inheritance money to family members
- It is important to me to leave behind inheritance money to organizations that I care about
- I think my family members have sufficient funds to take care of themselves without any inheritance from me
- Having enough money to care for myself in retirement is more important than leaving money to my heirs
- I like being able to control how quickly I spend my retirement money
- I like being able to decide how to invest my retirement savings
- I do not want to be dependent on my heirs to support me in my retirement

Perceived fairness:

Please rate how fair your think a life annuity product is.

Completely fair Acceptable Somewhat unfair Very unfair

How much do you agree with each of the following questions?

- I feel like I understand the life annuity market well.
- The system behind life annuities should be changed.
- I would avoid companies that sell life annuities if I could.
- It is clear where the money for this product comes from.
- It is fair that the company is allowed to keep the excess funds.
- I feel that I would have too little control over my retirement money if I bought an annuity.

Risk aversion:

Imagine that you are considering two annuity products which both cost $100,000. Both products are offered by the same company and are similar on all attributes, with the only difference being the certainty of the monthly income payments.

Annuity A provides a certain monthly income of $400 for as long as you live. Annuity B, however, is more variable, with payout determined by the performance of some underlying investments. For Annuity B, there is a 50% chance that you will permanently receive income that is twice as high as Annuity A: $800 per month for as long as you live. There is, however, an equally big chance (50%) that you will earn substantially less: $280 per month for as long as you live. Which annuity would you take?
1) Which annuity would you take? Choose one:

Annuity A: certain $400/month
Annuity B: 50% chance of $800/month and 50% chance of $280/month

If A on 1:
2a) Which annuity would you take? Choose one:
Annuity A: certain $400/month
Annuity B: 50% chance of $800/month and 50% chance of $320/month

If B on 1:
2b) Which annuity would you take? Choose one:
Annuity A: certain $400/month
Annuity B: 50% chance of $800/month and 50% chance of $200/month

If A on 2a:
3a) Which annuity would you take? Choose one:
Annuity A: certain $400/month
Annuity B: 50% chance of $800/month and 50% chance of $360/month

If B on 2b:
3b) Which annuity would you take? Choose one:
Annuity A: certain $400/month
Annuity B: 50% chance of $800/month and 50% chance of $100/month

Loss aversion:

Because retirement decisions often involve balancing risk and return, in this section we will ask for your preferences between a series of hypothetical gambles.

Although all choices made in this experiment are hypothetical, we ask that you respond as if you were going to play the gambles for real money to be gained or lost according to their associated probabilities. Please also treat each choice as if that was the only choice you have to make. That is, treat each decision as if it was the only decision you had to make.

You will be presented with two gamble options in each page. Each of the gambles has 3 distinct outcomes, each with a stated probability of occurrence.
Here's an example of the gamble options.

	33%	34%	33%
Gamble 1	-$100	$0	$500
Gamble 2	-$200	$0	$900

In the example above, Gamble1 has 33% chance of losing $100, 34% chance or neither winning or losing, and 33% chance of winning $500. Gamble 2 has 33% chance of losing $200, 34% chance or neither winning or losing, and 33% chance of winning $90.

Which gamble (Gamble 1 or Gamble 2) would you prefer to play?

You will now make choices for a series of ten pairs of gambles. Because we are interested in your preference for each option (gamble), we ask that you treat each one as if it was the only choice you had to make. Therefore, what you chose earlier should not affect what you choose next.

Although all choices made in this experiment are hypothetical, we ask that you respond as if you were going to play the gambles for real money. There is no right or wrong answer. We are only interested in your preference between each of the two gambles.

LA1:

	45%	10%	45%
Gamble 1	$400	$0	-$300
Gamble 2	$600	$0	-$600

LA2:

	45%	10%	45%
Gamble 1	-$450	$0	$650
Gamble 2	-$850	$0	$850

LA3:

	45%	10%	45%
Gamble 1	$600	$0	-$600
Gamble 2	$400	$0	-$400

LA4:

	45%	10%	45%
Gamble 1	-$550	$0	$550
Gamble 2	-$350	$0	$350

LA5:

	45%	10%	45%

Gamble 1	$400	$0	-$400
Gamble 2	$700	$0	-$600

LA6:

	45%	10%	45%
Gamble 1	-$650	$0	$650
Gamble 2	-$850	$0	$850

LA7:

	45%	10%	45%
Gamble 1	$400	$0	-$400
Gamble 2	$800	$0	-$600

LA8:

	45%	10%	45%
Gamble 1	-$400	$0	$400
Gamble 2	-$600	$0	$900

LA9:

	45%	10%	45%
Gamble 1	$350	$0	-$350
Gamble 2	$950	$0	-$950

LA10:

	45%	10%	45%
Gamble 1	-$350	$0	$350
Gamble 2	-$550	$0	$950