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 expected 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 that valuation of those attributes depends on how information is displayed. We end by discussing 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 complex options – a marketplace in which smart marketing approaches based on a solid understanding of consumer decision making can have a big impact on both public policy and consumer welfare. The consumers in the market for decumulation products face 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 aspects of the problem 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 closely examine consumer demand for a particular class of decumulation products - immediate life annuities – from a behavioral perspective. We employ a discrete choice experiment (conjoint analysis) to test whether consumers' attribute valuations reflect only financial value or include nonfinancial concerns that have been suggested in the psychology and behavioral economics literature. Financial products, such as annuities, provide a unique setting for conjoint analysis because most annuity attributes have calculable expected present value that can be directly compared to consumers' revealed utilities. In our analysis, we find that a typical consumer does not merely maximize the expected payout of annuities, but instead reacts to different annuity attributes in ways beyond their impact on the expected financial payout. For example, most 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. Finally, we test different ways of presenting annuities and find that consumers' demand is highly sensitive to changes in how annuity information is presented to them.

Our findings provide several insights regarding consumer 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, 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, as long as the owner is alive, 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 possible 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 as long as 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 various possible economic rationalizations of the annuity puzzle, 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.

One way to explain the annuity puzzle is the low rate of retirement savings in the United States, where over 45 percent of working-age households have no retirement savings at all (National Institute of Retirement Security, 2013). 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

[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).

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 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 (Babble and Merrill 2006).

Thus, rational economic arguments explain only a part of the annuity puzzle, and more psychological factors need to be considered (Brown 2007). Several recent papers have answered this call, and it is to this literature that we contribute. For instance, Hu & Scott (2007) have looked at the general framing of the annuity decision. They 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. Brown, Kling, Mullainathan, & Wrobel (2008) test 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 expected 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. One fruitful research direction is to explore concepts from cumulative prospect theory (Tversky & Kahneman, 1992)

as potential explanations of the annuity puzzle. For example, loss-aversion may make annuities unattractive when consumers perceive the forfeiture of the annuity purchase price due to early death as a loss either to themselves or their family and heirs (Hu and Scott 2007). Furthermore, prospect theory suggests that the risk of losing the full value of the annuity due to an unexpected early death may be highlighted by not just loss aversion, but also the tendency to overweight small probabilities. If loss aversion indeed underlies the consumer resistance to annuities, then findings from the endowment-effect literature may offer insights on how to moderate loss aversion for accumulated retirement wealth (Kahneman, Knetsch, & Thaler 1990).

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). 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).

A STUDY OF CONSUMER PREFERENCES FOR ANNUITY ATTRIBUTES: DESIGN AND IMPLEMENTATION

To examine more deeply the question of how consumers value and make tradeoffs between annuity attributes, the remainder of this paper proposes and estimates a model of individual preferences for annuities using a discrete choice experiment. 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 to capture heterogeneous consumer preferences. Our analysis is distinct from other applications of conjoint in the sense that nearly all of the product attributes can be converted to an expected present financial value; knowing the financial impact of each attribute allows us to see whether consumers value the attributes based on the implied expected present 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 proceed as follows. First, we lay out our model, including how we chose attributes and how those attributes can be converted to an expected present value that is central to our model specification. We then describe our subject population and our methods, including an enriched information-presentation treatment hypothesized to affect participants'

value for particular attributes. Our results are broken into five separate sections. First, we describe how a model that depends only on expected present value is unable to fully capture respondents' preferences, thus providing justification for a model that uses attributes "beyond NPV." Second, we report the results from the estimation of our choice model, including findings for attributes and demographic (and psychographic) characteristics. Third, we test how our information manipulation affects these findings. 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.

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

Our conjoint-analysis survey consists of 20 choice tasks. In every choice task, we asked participants, "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 no-choice option that read, "None: If these were my only options, I would defer my choice and continue to self-manage my retirement assets." We discuss the attributes of the annuities next.

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, 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). Beyond starting income, which is clearly one of the most important financial attributes for an annuity, the attributes selected have theoretical importance for understanding decumulation tradeoffs. First, insurance company financial strength ratings are included to test the theory by Babble and Merrill (2006) that even a small default risk can have a large economic impact on

annuity purchasing. They may also serve as a proxy for trust concerns, such that individuals will be more likely to enter into economic transactions with highly rated firms (Seligman and Schwartz 1997).

Including annual increases as one of our primary attributes allows us to test the importance of inflation protection in annuity purchases, building on work by previous researchers who have shown that consumers show preference for lump sums over inflation protected payoffs in Social Security choices (Brown 2007). The seven levels of annual income increases we use in the study 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. We chose levels of additive increases and multiplicative increases that 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. Inclusion of both percentage and fixed increases of similar amounts tests the possibility that individuals underestimate savings growth for rates expressed in percentages (Wagenaar and Sagaria 1975, McKenzie and Liersch 2011). This misunderstanding of exponential growth may be especially important for individuals with low skills in financial literacy and numeracy (Lusardi and Mitchell 2007).

The third attribute we focus on is the period-certain guarantee. Period-certain guarantees include periods of 0 years (no period certain), 5 years, 10 years, 20 years, and an extreme option of 30 years. As documented by Scott, Watson and Hu (2011) and Benartzi et al (2011), the purchase of a period certain guarantee on a life annuity is economically dominated by buying a combination of a bond and a deferred start annuity, making the popularity of this attribute in the marketplace a puzzle for standard economic theory. If annuities are truly intended to be an insurance policy for a long life, then adding a guaranteed payment component is a contradiction to this goal. Thus, their popularity in the market suggests that consumers may be interested in them for more psychological reasons such as aversion to the potential loss of the principal. Note

that our design includes annuities with combinations of income and period-certain terms not currently available in the market but potentially available in the future, which allows counterfactuals to be based on data rather than extrapolation.

Individual Differences: 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 gender-specific life expectancy tables). To explain some of the population heterogeneity we observe, we collect several key demographic and psychographic measures from each participant. Because life expectancy is a key life cycle input for decumulation choices, we ask each individual how long they expect 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 also collect demographic information including gender, race, and retirement assets. To assess financial literacy, we include five numeracy questions and three CRT questions for a subset of our total survey population[2] (Weller et al. 2012, Frederick 2005).

We also administered an additional set of questions to measure individual differences in key behavioral constructs thought to affect preference for annuities, including perceived fairness of annuities and loss aversion (Benartzi et al 2011, Hu and Scott 2007). (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 measure perceived fairness for annuities through a single item direct question based on Kahneman, Knetsch, and Thaler (1986). Finally,

[2] Numeracy measures were limited to a subset (about 65 percent) of the total population due to concerns about survey length that emerged while the study was running. For participants who did not complete the numeracy scale, median numeracy is substituted during the analysis. This creates an error-in-variable problem, making all of our inference about the effects of numeracy conservative.

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.

Information Presentation Treatment: To test how presentation of information about annuity choices affects attribute valuation, our study tests two versions of the annuity choice task; each participant was assigned to only one of the two conditions. In the basic condition, each annuity is described based only on its primary attributes of starting monthly (and annual) payments, annual increases, period certain options, and company rating. The presentation is modeled on typical presentations of annuity attributes by issuers in the market today. Our second "information enriched" condition provides the same information but also includes a table of cumulative payout per annuity for the ages of 70, 75, 80, 85, 90, and 95. These cumulative tables do not provide any additional information beyond what the participant could calculate directly using the provided attributes. However, we predict that by "doing the math" for them, participants will be able to more clearly see the cumulative impact of both high monthly payments and annual increases, and will therefore be more likely to value these attributes closer to their expected present value relative to the basic condition. Finding that cumulative payout amounts change attribute valuations, especially for annual increase attributes, would be consistent with prior work on how individuals underestimate savings growth and misunderstand interest rates (McKenzie and Liersch 2011, Lusardi and Mitchell 2007) Sample presentations for each condition are shown in Figures 1a and 1b. From a marketing and regulatory perspective, it is interesting to ask whether the enriched treatment increases the demand for annuities (vs. the basic treatment modeled on today's industry practice), and whether it more strongly leads consumers to choose annuities with higher expected present value payouts.

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 $V_{n,k}$, and calculate it from the monthly income, period certain, and the annual increase (if any) of the *k*-th annuity in the *n*th choice set as follows:

$$V_{n,k} = \underbrace{\sum_{age=65}^{65+pc_{n,k}} \delta^{(age-65)} \left(12 \times income_{n,k,age}\right)}_{\text{guaranteed income during the period certain } pc_{n,k}} + \underbrace{\sum_{age=66+pc_{n,k}}^{120} \delta^{(age-65)} \Pr\left(\text{alive at } age\right)\left(12 \times income_{n,k,age}\right)}_{\text{uncertain income conditional on living until a given age}} \quad (1)$$

where $pc_{n,k}$ is the length of the period-certain guarantee (if any), $\Pr\left(\text{alive at } age\right)$ is the probability of being alive at a given *age* past 65 (conditional on being alive at 65)[3] 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 *n*th 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). Note that for annuities with the period-certain guarantee, we implicitly assume that the annuity buyer cares equally about payout to himself/herself, and the payout to beneficiaries in the case of an early death.

In addition to the expected present value of the payout, it is also apparent that a rational buyer should care about the financial strength of the company as measured by the AAA versus AA ratings. We incorporate the strength rating as a main effect in our main model, and consider interactions with the payout variable in extensions.

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

[3] 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.

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 *n*th choice set as a linear regression:

$$U_{n,k,j} = \alpha_j + \beta_j V_{n,k} + \gamma_j AAA_{n,k} + X_{n,k}\theta_j + \varepsilon_{n,k,j} \text{ where } \varepsilon_{n,k,j} \sim N(0,1) \qquad (2)$$

and we normalize the utility of the outside ("none of the above") alternative *k*=0 to zero in order to identify the parameters[4]: $U_{n,0,j} = 0$. Together with a simplifying assumption that $\varepsilon_{n,k,j}$ are independent, our model becomes a constrained version[5] 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:

$$\left[\alpha_j, \beta_j, \gamma_j, \theta_j'\right] = Z_j\Delta + \tau_j \quad \text{where} \quad \tau_j \sim N(0,\Sigma) \qquad (3)$$

where […] indicates a concatenation of all parameters into a row vector, 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,

$$\Sigma \sim InverseWishart(\kappa_0, S_0) \quad \text{and} \quad \text{vec}(\Delta)|\Sigma \sim N(\text{vec}(\Delta_0), \Sigma \otimes I\sigma_\Delta^2). \qquad (4)$$

[4] See McCulloch and Rossi (1994) for a detailed discussion of parameter identification in a multinomial probit.
[5] 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).

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 $\kappa_0 = \#UtilityParams + 3, E(\Sigma) = I, \Delta_0 = 0,$ 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). The macro requires anticipated model parameters a as input because the optimal choice-experiment design depends on the parameters. Following Rooderkerk (2011), we assume utility increases linearly in the attributes with equal attribute importance for most attributes and higher importance for monthly income. Since the design of the choice tasks is not intended to be the main contribution of our study, we merely strive to follow current practice and arrive at a reasonable design.

Estimation methodology. To estimate the parameters of our choice model f, 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 (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. As in the case of the experiment design, the estimation method is standard in the field.

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

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 current retirement savings, but we collected data on savings as part of our demographic measures so that we could perform an analysis of how financial status affects preferences.

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 estimation sample consists of 334 respondents in the basic treatment, and 323 in the enriched information treatment. Table 2 summarizes the respondent demographic and psychographic characteristics exactly as they are coded in the *Z* variables in equation 3 of the model.

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 from one of the two conditions. To control for order effects, we presented the choice tasks in a random order. For the design of the tasks and the details of the questionnaire, please see the previous section. Figure 1 provides a sample choice task and illustrates the enriched information treatment. After completing all twenty choice tasks in their assigned condition, participants were asked to fill out the additional demographic and psychographic measures.

A STUDY OF CONSUMER PREFERENCES FOR ANNUITY ATTRIBUTES: RESULTS

Preliminary model-free evidence of attribute impact on utility "beyond NPV" and the importance of the information-presentation treatments

Before we turn to estimation results for the model discussed earlier, we present model-free evidence that attributes matter beyond their impact on the expected present value. Consider the aggregate results for the choice task provided in Figure 1. Table 3 presents the average (across genders) expected payouts, as well as the total expected payouts, and the choice shares of the three alternatives in the two treatments.

If consumers cared most about the expected payout, they should prefer annuity Option A in Figure 1 because it delivers substantially more income than the other two options. However, respondents in both information presentation treatments seem to dislike annuity A, perhaps because its issuer is "only" AA rated, or because they undervalue the period certain guarantee that is responsible for about half of the expected present value of the payout. Even ignoring the additional expected payout to beneficiaries arising from the period certain guarantee, they should be approximately indifferent among the three alternatives because all three deliver approximately the same expected payout to the buyer (note that this payout is actually rather high relative to the annuity's purchase price). Instead, the annuity Option B is clearly preferred, especially in the enriched information treatment. Annuity Option C is chosen regularly in the basic treatment, but much less in the enriched treatment. One explanation for this drop in preference for Option C is that without doing the math and calculating the expected payout, respondents prefer annuities with additive increases rather than percentage increases. Clearly, different annuity attributes have an impact on preferences beyond their effect on value, and this impact depends on how information about the annuity is delivered to the individual. Our model of demand is designed to measure the extent to which preferences respond to attributes beyond NPV.

Before discussing our estimation results, we also note that that in the basic treatment, 36 percent of respondents selected "none" 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, a hint of an explanation of the annuity puzzle. Some but not all of this general unwillingness can be explained by an inability to "do the math": in the enriched information treatment, the proportion of respondents selecting "none" drops to 24 percent, but still does not drop to zero.

Estimation results: population average parameters and their interpretation

Before discussing the results, we note that although our experiment involved 20 single-stage choices between four options (three annuities and one outside option), a substantial proportion of respondents did not like any of the annuities on offer. Specifically, 67 (20%) and 51 (16%) respondents selected "none" in all 20 tasks in the basic and enriched treatment, respectively. Some of the annuities in our design provided well over $200K in expected payout, in exchange for the $100K price of the annuity (held constant throughout). Therefore, some people simply seem to dislike the idea of an annuity a priori, and are unwilling to consider these products (see Table 3 for an example). To be conservative in our analysis, these "annuity haters" are retained in the full estimation.[6] A simple logistic regression to distinguish the annuity haters from participants who select at least one annuity, with the individual characteristics as our independent variables, suggests that individuals who are willing to consider annuities are those who perceive annuities as a fair product. Additional information on these analyses is provided in the Supplementary Online Materials. Table 4 summarizes the first two population moments of the estimated utility parameters ($\alpha,\beta,\gamma,\theta,\Sigma$), by treatment. The population mean of each coefficient can be interpreted as the average marginal effects on utility of the associated attribute. Note that other than the E(payout) attribute, all other attributes enter utility as dummy variables, and so they measure the *change* in utility relative to the baseline level set to {AA, no annual increase, no period certain}. For example, the 0.27 coefficient on the "AAA" attribute in the

[6] Analyzed in isolation, these respondents do not provide information about the parameters of interest. However, the Bayesian hierarchical prior partially pools their responses with responses of demographically and psychographically similar people, allowing inference. Analyses done both with and without these individuals excluded yield consistent results, please see Web Supplement for details.

basic information treatment means that, on average, annuities by AAA-rated issuers are valued 0.27 utiles more than annuities by AA-rated issuers, ceteris paribus.

Note that the population mean of each coefficient is not the marginal effect of the associated attribute 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 precise measurement of the marginal effects on the probability of choice (aka "demand").

Because we are estimating a choice model, the parameters cannot be directly compared across treatments because of the well-known scaling problem (Swait and Louviere 1993). One transformation of the parameters that can be meaningfully compared is their ratio, and the most interesting ratio to consider is the ratio of "beyond NPV" parameters (γ,θ) to the expected payout parameter (β). We call this ratio a "willingness to pay" (hereafter "WTP") because it measures the amount of expected present value that would compensate for the presence of an attribute relative to the baseline attribute. For example, the $18,226 standardized coefficient on the "AAA" attribute means that on average, our respondents are indifferent between annuities by AAA-rated issuers and otherwise equivalent annuities by AA-rated issuers whenever the AAA-rated annuities offer $18,226 less expected present value than the AA-rated ones.

Estimation results: average preferences in the basic information treatment

We first consider the results for the basic information treatment, provided on the left side of Table 4. Several conclusions can be drawn from the parameters and their associated WTPs. 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, as can be seen from the WTP numbers for AAA. 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 from these different attributes in turn.

Annual increases: The negative signs on all of the annual increase variables suggest that consumers systematically undervalue the benefits of annual payment increases. From the WTP standardized parameters, we can see that the magnitude of the undervaluation can be large, especially for the percentage increases. For example, the WTP of -$77,051 on the 7% annual increase means that our respondents are indifferent between an annuity that generates an expected present value of $100,000 with a constant monthly income, and another annuity that generates $177,051 expected present value by starting at a lower monthly income level and adding 7 percent per year.

The additive increases exhibit a different pattern from the percentage increases that are all significantly undervalued: the average consumer seems to undervalue the benefits of large ($400 and $500/year) increases and exactly values the benefit of small ($200/year) 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[7] the same expected payout as the 7% increase, and the ($300, 5%) and ($200, 3%) pairs are matched analogously. Therefore, we can compare the WTP numbers within these matched pairs, and conclude that the average consumer actually prefers additive increases to percentage increases, ceteris paribus. In a later section, we measure the magnitude of the effect of various increases on 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 coefficient on the 20-year period-certain guarantee suggests consumers like this option beyond its financial impact on the expected payout. Conversely, the short (5-year) and very long (30-year) period-certain guarantees actually hurt demand, ceteris paribus. Therefore, consumers do not simply prefer any period-certain guarantee over none. The dislike of a 5-year guarantee suggests that our respondents are not as concerned with insuring against death in the immediate short-term, but are instead interested in period

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

certain guarantees that are more aligned with their predicted life expectancy. In a later 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; some of it can be explained by variance in demographics and psychographics, but much of it remains unexplained. The population standard deviation for each attribute estimate (the square root of the posterior mean of Σ) is shown in Table 4. It is clear from the magnitude of the population standard deviation that particular individuals can exhibit very different preferences than the average ones discussed above. However, before describing the demographic and psychographic effects on preferences, we consider how the average preference shifts due to the enriched information treatment.

Effect of the enriched information treatment on average preferences

Recall that only the standardized coefficients (WTP) can be meaningfully compared across treatments in Table 4. The results for the enriched information treatment are provided in columns 4-6 of this table, and the difference between the standardized coefficients is provided in column 7. We offer three observations: First, echoing the conclusion from the model-free analysis of the example task, the WTP of the intercept is lower in the enriched treatment, indicating that an increased overall preference for annuities In other words, individuals generally dislike annuities in both treatments, but they dislike them less when seeing the cumulative payouts for each annuity as provided in the enriched information treatment.

Second, compared to the basic treatment, the annual increase coefficients in the enriched information treatment are mostly insignificant and their associated WTPs much smaller in magnitude. This indicates that the apparent disliking of percentage increases in the basic treatment may be due to the subjects' inability to "do the math" on compounding, and not to a more fundamental aversion. This finding agrees with prior work in the literature on individuals'

difficulty with compounding in financial decisions (e.g. Wagenaar and Sagaria 1975, McKenzie and Liersch 2011). By offering a table of cumulative payouts, individuals can better appreciate the impact of the percentage increases over time. Third, respondents in the enriched treatment dislike longer (20- and 30-year) period-certain guarantees, both in an absolute sense and relative to the basic treatment. While we do not have a strong hypothesis for why this is the case, it may be that the cumulative payout information in the enriched condition has shifted attention away from these attributes and toward overall payout, thus lessening their influence on annuity preferences.

Estimation results: population heterogeneity of preferences per treatment

Table 5a contains the estimates (posterior means) of the population-level parameter Δ in the basic information treatment. Recall that Δ captures the heterogeneity of preferences explained by demographics and psychographics (see equation 3). The most easily interpreted are the effects of the demographics and psychographics (Z) on the intercept of utility (α), that is, on the individual's baseline liking of annuities.

First, we find that older individuals choose fewer annuities and more "none of the above," ceteris paribus. In addition, Table 5a indicates that perceived fairness of annuities is strongly correlated with their baseline liking. Additionally, perceived fairness also increases the liking of annual increases beyond NPV, compensating for their apparent disliking by the average respondent. We observe that numerate people, on the other hand, undervalue annual increases but also care more about the expected payout. The population-level parameters (Δ) also shed some light on the underlying reasons why consumers prefer annuities with period-certain guarantees. Surprisingly, neither lower life expectancy nor loss aversion significantly increase the preference for a longer period-certain guarantee in this condition. Instead, we find a positive relationship between preferring short (5-year) period-certain guarantees and having retirement savings above $75K, indicating that people like the certainty when they have substantial savings

to put into an annuity. We also detect a gender effect: males do not like period certain guarantees (beyond NPV) as much as women do.

Table 5b contains the estimates (posterior means) of the population-level parameter Δ in the enriched information treatment. Recalling that we cannot compare the coefficients directly (Swait and Louviere 1993), we confine ourselves to broad qualitative observations of the effect of the enriched information on our estimates. Several patterns from 5a replicate in 5b: perceived fairness continues to increase general liking of annuities, numeracy decreases it, and numeracy increases the weight put on expected payout. However, two clear differences emerge: First, as a rational model would predict, higher life expectancy increases the liking of annual increases in this treatment condition. Second, people with a high level of retirement savings (over $75K) begin to strongly dislike annuities once they see the contingent cumulative payout tables. Whether these individuals are confident that they can self-manage their assets better without annuities, or are evaluating the payback on an annuity in an investment frame (Brown et al 2008), it seems clear that providing them with cumulative payout information is not increasing overall liking for annuities as much as for other respondents.

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 estimated 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: Fixed annual increases boost demand more than equal-payout percentage increases in the basic, but not the cumulative, treatment condition: Figure 2 displays the estimated demand from both men and women 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 top plot shows the demand based on the basic treatment, and the bottom plot shows it for the enriched information treatment. The gender-specific black straight "control" lines indicate predicted demand for annuities that do not include annual increases, but deliver higher expected present value through higher starting incomes. Thus, we interpret demand above the control line as an over-valuation of the particular annual increase level, and demand below the control line as an under-valuation.

Consider the basic treatment first: It is obvious that all increases other than $200/year are undervalued (in the sense described in previous paragraphs). The average consumer's preference for additive increases discussed above is representative of the overall population behavior: regardless of gender, additive increases result in a substantial boost in demand relative to payoff-equivalent percentage increases, and the boost tends to be higher among women. While larger additive increases correspond to greater demand for the annuity, larger percentage increases do not. The demand curves look completely different in the enriched information

treatment: there is no more under-valuation, and no longer a relative preference for additive increases over percentage increases. In other words, annual increases are valued at almost exactly their financial value in the enriched information condition, since lines for both genders closely match the gender-specific control lines. The only increase likely not valued at its full impact is the 7% increase. Thus, as suggested by the estimation results described above, providing a table with cumulative payouts explicitly calculated for the participants appears to bring their attribute valuations more in line with expected present value.

Result 2: Mid-length period-certain guarantees boost demand, whereas short-length ones decrease it: Figure 3 displays the estimated demand for each gender 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. The top plot shows the demand based on the basic treatment, and the bottom plot shows it for the enriched information treatment. The gender-specific black straight "control" lines are analogous to the ones in Figure 2.

Consider the basic treatment first: Again, the average consumer's preferences are consistent with the shape of overall market demand: the 20-year period-certain guarantee yields the highest demand and is overvalued relative to control (especially by women). By contrast, individuals of both genders prefer 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 30-year period-certain guarantees is slightly below that for 10-year guarantees 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 of the basic treatment is also visible for annuities presented in the cumulative information treatment, but the differences in demand among annuities with shorter period certain guarantees are not as extreme. A dislike for 5-year guarantees is still evident,

while dislike for 20-year and 30-year guarantees is very pronounced. Further details on demand for period certain attributes by gender, numeracy, perceived fairness, and current age are provided in the Supplemental materials. Generally, we find that the inverse U-shape is more pronounced among highly numerate individuals; that people who perceive annuities as fair are least interested in period certain guarantees; and that there is a main effect of age for every length of period certain with the youngest people (i.e., early 40's) liking annuities the most. 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). The persistence of the inverse-U shape across both treatments, as well as its persistence among individuals with high numeracy, suggests that it is not a result of some sort of mathematical miscalculation but instead reflects real preferences for certain levels of period certain guarantees over others.

DISCUSSION

This paper presents a case for marketing research about decumulation products, and reports the results of a discrete choice experiment 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, and its influence on preferences depends on the way product information is presented. We find that consumers who see only basic attribute information undervalue annual increases, and show a stronger preference for fixed annual increases relative to percentage increases, holding the expected payout constant. However, consumers who also see a table with contingent cumulative payoffs implied by the attributes do not exhibit either of these effects:

they value increases approximately correctly, and do not care whether the increases are expressed in the form of percentages or dollars. These findings are consistent with prior behavioral research on consumers' biases in understanding compounding interest (Wagenaar and Sagaria 1975, McKenzie and Liersch 2011).

Another attribute with a strong influence beyond NPV is the period-certain guarantee. We find that regardless of the information presentation, consumers overvalue "middle-length" (10-year and 20-year) period-certain guarantees, and undervalue very short and very long guarantees. Interestingly, having no period certain guarantee is consistently preferred to short (5-year) guarantees. Since mean life expectancy for our participants was in the mid-80's, it may that death within the first 5 years of the annuity is not a significant enough concern to justify the choice of that option, whereas the 10 and 20 year guarantees are perceived as more likely to be useful. 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 consumers consider insurance company financial strength during purchase (Babble and Merrill 2006).

Demand for annuities is correlated with demographics, and these demographics also moderate consumer preferences for various annuity attributes. Although many respondents do not like life annuities, those who are of pre-retirement age (41 to 45) report a higher likelihood of purchase. In the enriched information treatment, individuals with demographic measures of low retirement savings and low numeracy also report 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.

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). Individual measures of loss aversion affect annuity preference through their effect on valuation of payout, with more loss averse individuals placing less value on increased expected value in the enriched information condition. Life expectations are an important predictor of valuation for annual increases, with those expecting to live longer valuing such increases more highly, especially when they are provided with tables of cumulative payout information. 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; in contrast, lower numeracy individuals are more responsive to the addition of annual increases (beyond their effect on expected payout).

One of the main managerial contributions of this type of analysis is the design of products that maximize demand without increasing the expected payout. Because annuity attributes can influence preferences beyond their impact on expected payout, the annuity issuer has an opportunity to increase demand without increasing the expected 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 (using the basic condition model) 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, allowing straightforward comparisons between the individual annuities.

Table 6 lists the top 5 and bottom 5 annuities in terms of demand, by gender and information treatment[8]. The most striking aspect of Table 6 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. Table 6 also clearly shows that men should be offered different annuities than women, and which annuities should be offered depends on how their attribute information is presented. It is important to note that part of the gender difference is due to feasibility constraints from the issuer, due to women's increased longevity making annuities more expensive and thus, for example, constraining the ability to offer long period certain guarantees to women within this price band. In sum, we find that careful "packaging" of a given net present value into the optimal mix of the attributes can more than double demand for annuity products. 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 discrete choice experiment 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

[8] The gender conditioning is necessary because women live longer than men, so the same annuity gives women a larger expected payoff.

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, through our testing of how annuity attribute values change as cumulative payout information is provided. However, our results from both treatment conditions assume particular presentations 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 will result in further differences in preferences. For example, our participants' response to percentage versus fixed annual increases was significantly affected when payments were shown in cumulative rather than per-period formats, but the pattern of sensitivity to period-certain guarantees was generally unchanged. Other information presentation formats that might highlight probability of death at certain ages could potentially reverse this finding. Testing of these types of presentational styles for annuity attributes may provide additional 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 demographic and psychographic characteristics

Demographic or psychographic characteristic	Baseline treatment (334 respondents)			Enriched info treatment (323 respondents)			Same for both treatments	
	mean	median	std. dev	mean	median	std. dev	min	max
Age (years)	52.87	53	6.83	52.80	53	7.02	40	65
Male	0.41	0	0.49	0.40	0	0.49	0	1
Retirement savings 75to150K	0.13	0	0.34	0.17	0	0.38	0	1
Retirement savings over 150K	0.18	0	0.38	0.21	0	0.41	0	1
Perceived fairness of annuities	0.59	0.67	0.22	0.57	0.67	0.22	0	1
Loss aversion	0.66	0.7	0.29	0.68	0.7	0.29	0	1
Numeracy	0.50	0.5	0.16	0.50	0.5	0.15	0.125	1
Life expectancy (age at death)	85.77	87	8.03	84.80	86	9.01	59	99

Note: Perceived fairness is measured using the four-point fairness scale of Kahneman, Knetsch, and Thaler (1986) 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. Note that 38 percent of the respondents did not complete the numeracy questions; we substituted the population median and the table reflects the statistics after this substitution. 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 4: Estimation results: posterior means of utility parameters and standardized willingness-to-pay parameters, by treatment

	Basic information treatment			Enriched information treatment			Difference in Standardized parameters (enriched-basic)
	Population Mean of $(\alpha,\beta,\gamma,\theta)_j$	Population Std. dev. ($\sqrt{}$diagonal(Σ)	Standardized parameters (willingness to pay)	Population Mean of $(\alpha,\beta,\gamma,\theta)_j$	Population Std. dev. ($\sqrt{}$diagonal(Σ)	Standardized parameters (willingness to pay)	
Intercept	**-2.75**	**2.55**	-$183,552	**-2.97**	**3.59**	-$136,984	$46,568
E(payout) in $100K ($V_{n,k}$)	**1.50**	**0.98**	$100,000	**2.17**	**1.72**	$100,000	$0
AAA rated issuer (vs. AA)	**0.27**	**0.71**	$18,226	**0.34**	**0.86**	$15,579	-$2,646
Annual increase 3% (vs. 0)	**-0.41**	**0.56**	-$27,719	-0.02	**0.55**	-$695	$27,024
Annual increase 5% (vs. 0)	**-0.64**	**0.85**	-$42,738	-0.10	**0.93**	-$4,587	$38,151
Annual increase 7% (vs. 0)	**-1.15**	**1.26**	-$77,051	-0.72	**1.76**	-$32,927	$44,124
Annual increase $200 (vs. 0)	-0.05	**0.58**	-$3,340	0.01	**0.54**	$649	$3,990
Annual increase $400 (vs. 0)	**-0.47**	**0.78**	-$31,474	**-0.20**	**0.80**	-$9,256	$22,218
Annual increase $500 (vs. 0)	**-0.50**	**1.06**	-$33,338	-0.15	**0.97**	-$6,733	$26,605
Period certain 5 years (vs. 0)	**-0.57**	**0.96**	-$37,761	-0.09	**0.66**	-$4,002	$33,759
Period certain 10 years (vs. 0)	0.16	**1.30**	$10,569	**0.17**	**1.00**	$7,921	-$2,648
Period certain 20 years (vs. 0)	**0.61**	**1.63**	$40,640	**-0.21**	**1.67**	-$9,440	-$50,081
Period certain 30 years (vs. 0)	**-1.04**	**2.49**	-$69,161	**-2.47**	**3.26**	-$113,723	-$44,562

Note: Posterior means of the parameters indicated. 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. Standardized parameters are derived from the posterior means by dividing through by the coefficient on the expected payout. Only the standardized parameters can be meaningfully compared across the treatments.

Table 5a: Population-level regression: Marginal effects of the demographics and psychographics on the utility parameters, basic condition only

	intercept	expected_payout	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	**-2.75**	**1.50**	**0.27**	**-0.41**	**-0.64**	**-1.15**	-0.05	**-0.47**	**-0.50**	**-0.57**	***0.16***	**0.61**	**-1.04**
Population std. deviation	**2.55**	**0.98**	**0.71**	**0.56**	**0.85**	**1.26**	**0.58**	**0.78**	**1.06**	**0.96**	**1.30**	**1.63**	**2.49**
Δ:													
Constant	-2.50	0.85	0.67	-0.45	-1.57	-1.87	-0.32	-1.05	-1.33	0.81	0.82	-0.01	-2.39
Age (years)	**-0.06**	0.02	-0.01	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.01	0.02	0.01
Male	0.25	0.19	-0.13	0.15	**0.40**	0.27	0.05	0.22	0.16	-0.13	-0.31	**-0.65**	**-0.90**
Retirement savings 75to150K	-0.45	0.29	-0.02	-0.30	-0.21	-0.28	-0.21	***-0.43***	-0.43	**0.55**	0.34	0.15	-0.06
Retirement savings over 150K	-0.32	0.21	***0.29***	0.07	0.12	0.05	-0.16	-0.13	0.17	**0.58**	0.29	0.10	0.08
Perceived fairness of annuities	**4.62**	-0.83	-0.04	**0.90**	**1.28**	**1.52**	**0.63**	**1.32**	**1.40**	-0.12	0.02	0.06	1.16
Loss aversion	-0.61	-0.21	0.02	-0.19	-0.26	-0.07	-0.05	-0.18	-0.23	-0.37	-0.19	-0.01	0.14
Numeracy	-0.87	**1.40**	-0.26	-0.62	-0.84	***-1.32***	**-1.16**	**-0.95**	**-1.50**	0.27	0.01	0.14	-1.31
Life expectancy (age at death, yrs)	0.01	-0.01	0.00	0.00	0.01	0.00	0.00	0.01	0.01	-0.01	-0.01	0.00	0.01

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 5b: Population-level regression: Marginal effects of the demographics and psychographics on the utility parameters, cumulative information treatment only

	intercept	expected_payout	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	**-2.97**	**2.17**	**0.34**	-0.02	-0.10	**-0.72**	0.01	***-0.20***	-0.15	-0.09	**0.17**	**-0.21**	**-2.47**
Population std. deviation	**3.59**	**1.72**	**0.86**	**0.55**	**0.93**	**1.76**	**0.54**	**0.80**	**0.97**	**0.66**	**1.00**	**1.67**	**3.26**
Δ:													
Constant	-1.52	-0.83	0.70	***-1.27***	**-3.04**	**-4.59**	**-1.88**	**-2.90**	**-3.54**	***1.20***	0.61	0.39	0.25
Age (years)	0.00	0.02	-0.01	-0.01	-0.02	-0.02	0.00	-0.01	-0.02	***-0.02***	-0.02	-0.03	-0.06
Male	-0.07	0.20	**-0.30**	0.10	0.22	0.42	-0.15	0.23	0.24	0.00	-0.09	-0.29	-0.68
Retirement savings 75to150K	**-1.47**	0.32	**0.43**	0.27	0.10	0.24	0.22	0.22	0.21	0.23	0.18	0.57	0.68
Retirement savings over 150K	**-1.97**	**0.98**	0.17	0.35	**0.66**	0.35	***0.40***	0.26	0.31	0.04	-0.03	-0.22	**-1.19**
Perceived fairness of annuities	**4.81**	0.78	-0.30	-0.06	0.07	-0.53	-0.40	-0.24	-0.13	0.09	-0.16	-0.57	-1.39
Loss aversion	0.13	***-0.78***	0.24	0.39	0.42	0.55	0.10	0.25	0.45	0.30	0.30	0.52	1.12
Numeracy	**-5.13**	**2.31**	**1.03**	***-0.81***	-0.30	-1.24	0.36	-0.67	-0.88	0.69	0.51	-0.19	***-2.50***
Life expectancy (age at death, yrs)	-0.02	0.01	0.00	**0.02**	**0.04**	**0.06**	**0.02**	**0.04**	**0.05**	***-0.01***	0.00	0.01	0.02

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 6: Top 5 and bottom 5 annuities in terms of demand

	Male market							Female market						
	Demand	Expected payout ($100K)	% payout to self	issuer rating	start income	annual increase	period certain	Demand	Expected payout ($100K)	% self	issuer rating	start income	annual increase	period certain
Basic information treatment	*Top 5 products*							*Top 5 products*						
	0.54	1.10	85%	AAA	$400	$200	20	0.47	1.02	86%	AAA	$500	0	20
	0.49	1.10	85%	AA	$400	$200	20	0.45	0.96	85%	AAA	$300	$200	20
	0.48	0.98	86%	AAA	$500	0	20	0.41	1.02	86%	AA	$500	0	20
	0.47	1.07	97%	AAA	$500	$200	10	0.40	0.96	85%	AA	$300	$200	20
	0.47	0.90	85%	AAA	$300	$200	20	0.38	1.09	97%	AAA	$600	0	10
	Bottom 5 products							*Bottom 5 products*						
	0.24	0.97	100%	AAA	$300	7%	5	0.20	0.91	100%	AA	$300	5%	0
	0.24	0.96	73%	AAA	$400	0	30	0.20	0.91	100%	AAA	$300	5%	5
	0.23	1.07	67%	AA	$300	3%	30	0.19	1.10	100%	AA	$300	$400	5
	0.22	0.96	73%	AA	$400	0	30	0.18	0.97	99%	AA	$400	3%	5
	0.21	0.97	100%	AA	$300	7%	5	0.16	0.91	100%	AA	$300	5%	5
Enriched information treatment	*Top 5 products*							*Top 5 products*						
	0.50	1.10	97%	AAA	$500	0	10	0.50	1.09	97%	AAA	$600	0	10
	0.49	1.07	97%	AAA	$400	5%	10	0.49	1.02	97%	AAA	$400	$200	10
	0.48	1.09	97%	AAA	$300	$500	10	0.47	0.99	97%	AAA	$400	3%	10
	0.48	1.10	97%	AA	$500	0	10	0.46	0.99	100%	AAA	$400	$200	0
	0.47	1.07	97%	AA	$400	5%	10	0.46	1.06	100%	AAA	$600	0	0
	Bottom 5 products							*Bottom 5 products*						
	0.33	0.90	85%	AA	$300	$200	20	0.37	0.91	100%	AA	$300	5%	5
	0.23	1.07	67%	AAA	$300	0	30	0.28	1.08	67%	AAA	$300	3%	30
	0.21	1.07	67%	AA	$300	0	30	0.25	1.08	67%	AA	$300	3%	30
	0.20	0.96	73%	AAA	$400	0	30	0.25	0.97	73%	AAA	$400	0	30
	0.18	0.96	73%	AA	$400	0	30	0.22	0.97	73%	AA	$400	0	30

Note: The 5 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, by gender and information treatment. 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).

Figure 1: Sample conjoint choice task

If you were 65 and considering putting $100,000 of your retirement savings into an annuity, which of the following would you choose?

Monthly payments start at $400 ($4,800/year) 7% annual increase in payments 30 years period certain Company rated AA (very strong)	Monthly payments start at $600 ($7,200/year) 5% annual increase in payments 10 years period certain Company rated AAA (extremely strong)	Monthly payments start at $500 ($6,000/year) $400 annual increase in payments 20 years period certain Company rated AAA (extremely strong)	None: if these were my only options, I would defer my choice and continue to self-manage my retirement assets.
❍ A	❍ B	❍ C	❍ none

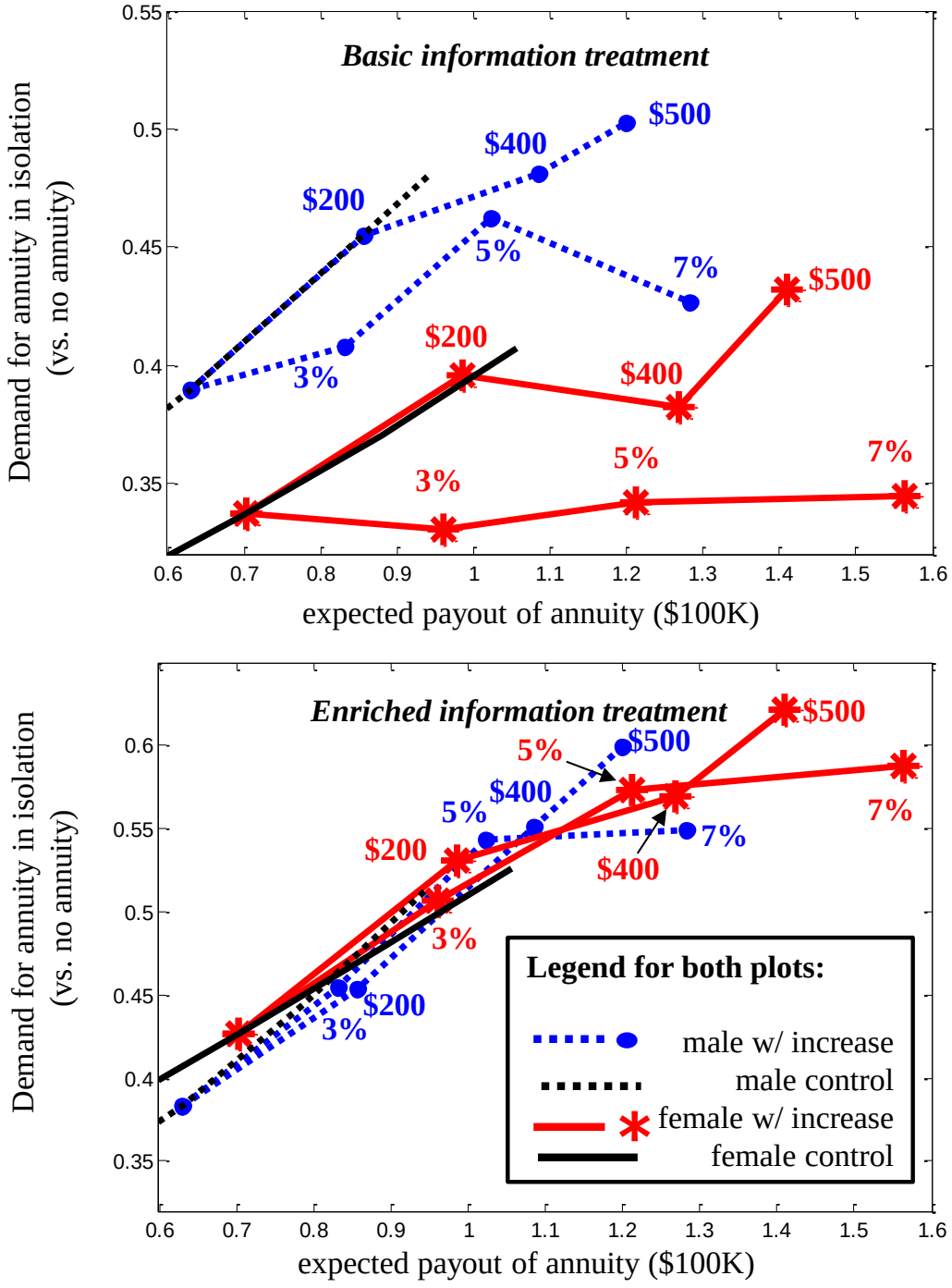
In the enriched information treatment, the following table was shown directly under the task:

	Cumulative amount paid to you by different ages if you live to that age					
Age	70	75	80	85	90	95
Option A	$27,600	$66,300	$120,600	$196,800	$303,600	$453,400
Option B	$39,800	$90,600	$155,400	$238,100	$343,600	$478,400
Option C	$34,000	$78,000	$132,000	$196,000	$270,000	$354,000

Table 3: Choice shares of the three alternatives for the sample choice task in Figure 1

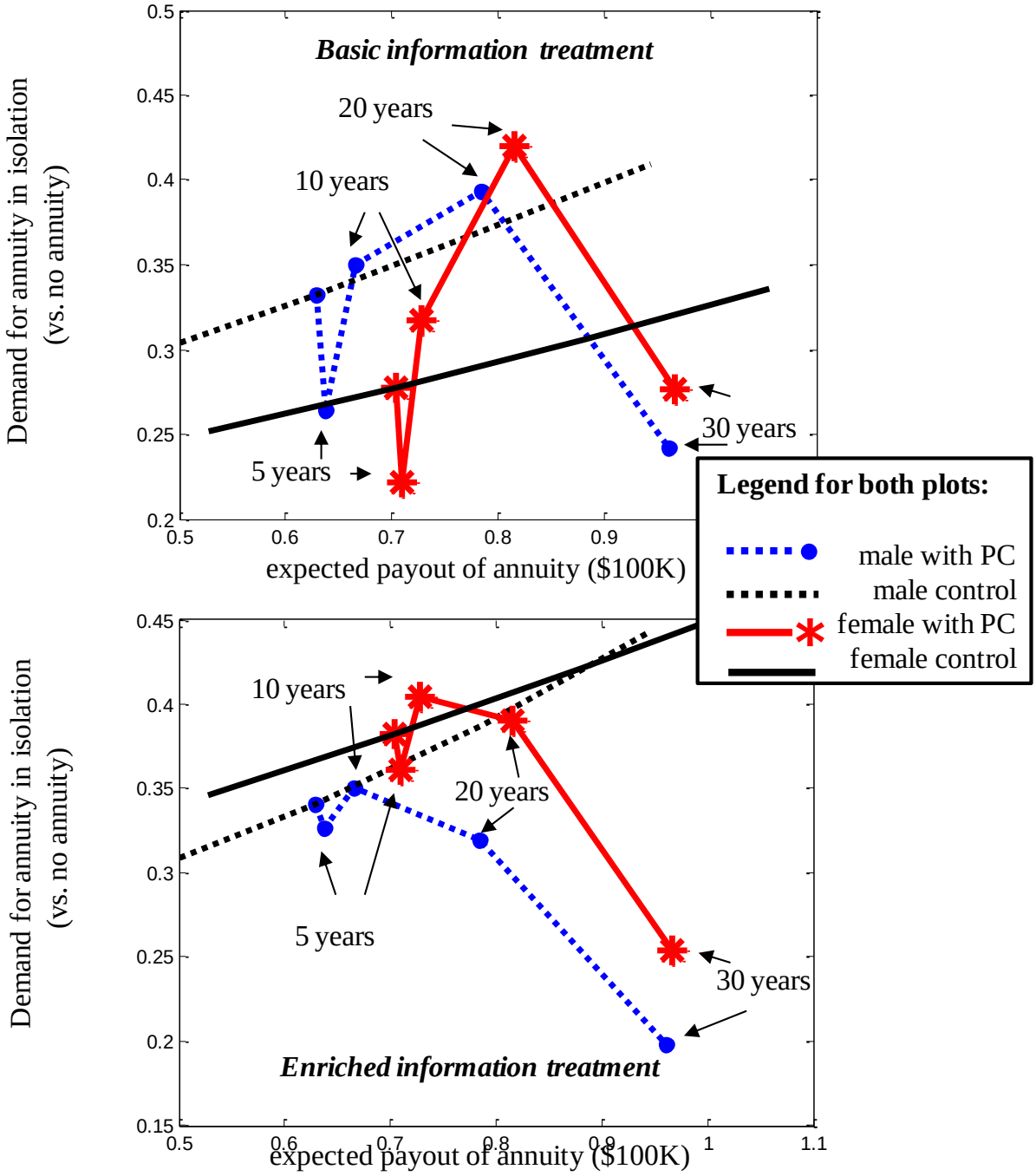
		Option A	Option B	Option C	None
Expected present value (*V*)	***V***	**$264,900**	**$174,100**	**165,700**	?
	V without period certain guarantee	$142,400	$167,800	$134,400	?
Observed choice shares	Basic treatment	15%	28%	20%	36%
	Enriched treatment	14%	50%	12%	24%

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



Note to Figure: 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.

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



Note to Figure: Predicted demand for an annuity with monthly income starting at $400 and not increasing at all, 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.