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Behavioral Impediments to Valuing Annuities: Complexity and Choice Bracketing

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Abstract

This paper examines two behavioral factors that diminish people's ability to value a lifetime income stream or annuity, drawing on a survey of about 4,000 adults in a U.S. nationally representative sample. By experimentally varying the degree of complexity, we provide the first causal evidence that increasing the complexity of the annuity choice reduces respondents' ability to value the annuity, measured by the difference between the sell and buy values people assign to the annuity. We also find that people's ability to value an annuity increases when we experimentally induce them to think jointly about the annuitization decision as well as how quickly or slowly to spend down assets in retirement. Accordingly, we conclude that narrow choice bracketing is an impediment to annuitization, yet this impediment can be mitigated with a relatively straightforward intervention.

Keywords

pension, annuity, retirement income, Social Security, cognition, behavioral economics

Disciplines

Behavioral Economics

Comments

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Abstract

This paper examines two behavioral factors that diminish people's ability to value a lifetime income stream or annuity, drawing on a randomized experiment with about 4,000 adults in a U.S. nationally representative sample. We find that increasing the complexity of the annuity choice reduces respondents' ability to value the annuity, measured by the difference between the sell and buy values they assign to the annuity. When we limit narrow choice bracketing by inducing people to think first about how quickly or slowly to spend down assets in retirement, their ability to value an annuity increases.

Keywords: pension, annuity, retirement income, Social Security, cognition, behavioral economics

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1. Introduction

Annuities can be a valuable form of insurance against the possibility of exhausting financial resources or having to severely curtail retirement consumption. Nevertheless, there is relatively little demand for these insurance products (Mitchell, Piggott, and Takayama, 2011; Poterba, Venti, and Wise, 2011). A voluminous literature reviewed in Brown (2009) explores rational explanations for why observed levels of annuitization are much lower than predicted by standard optimizing models such as those by Yaari (1965) and Davidoff, Brown, and Diamond (2005). Recent contributions to this literature include several papers that combine multiple deviations from the standard optimizing framework. For instance, Ameriks, Caplin, Laufer, and Van Nieuwerburgh (2011), Ameriks, Briggs, Caplin, Shapiro, and Tonetti (2018), and Lockwood (2012, 2018) explain observed low annuity demand using structural models that combine a precautionary savings motive (for long-term care expenses when there is public care aversion) with a bequest motive; Reichling and Smetters (2015) do so as well by introducing stochastic mortality and correlated uninsured health care costs. Peijnenburg, Nijman, and Werker (2017) show that medical expenditure risk can rationalize low observed annuitization levels early in retirement, but not why many older people fail to buy annuities. Finally, Laitner, Silverman, and Stolyarov (2018) show analytically how the presence of implicit longevity insurance provided by Medicaid nursing home care can crowd out demand for annuities for the lower and middle classes.

A different strand of literature explores whether behavioral factors help explain low observed levels of annuitization. Several hypothetical choice experiments suggest that behavioral factors influence the demand for annuities, including studies showing that framing of the annuity choice affects the demand for annuities (Brown, Kling, Mullainathan, and Wrobel, 2008, 2013; Beshears, Choi, Laibson, Madrian, and Zeldes, 2014; Brown, Kapteyn, and Mitchell, 2016;

Merkle, Schreiber, and Weber, 2017; and Bockweg, Ponds, Steenbeek and Vonken, 2018). Similar findings emerge in incentivized laboratory settings (Agnew, Anderson, Gerlach, and Szykman, 2008; Gazzale and Walker, 2011). Another source of evidence is research demonstrating that individuals in a hypothetical choice setting provide widely divergent valuations for small increases versus small decreases in annuitization amounts (Brown, Kapteyn, Luttmer, and Mitchell, 2017). This latter result is consistent with people having trouble assessing the value of an annuity stream and therefore requiring a high selling price and offering a low buying price, as they are reluctant to trade what they do not understand. There is also suggestive evidence from non-hypothetical choices that points to behavioral mechanisms. For instance, in 10 Swiss firms, Bütler and Teppa (2007) show that annuitization rates are much higher on average in the firms that offer an annuity as the default payout option than in the one firm paying out a lump sum as the default. This finding suggests that annuitization rates are influenced by the default, implying a deviation from a standard rational model. Similarly, Hagen, Hallberg, and Lindquist (2018) show that a nudge affects annuitization decisions of Swedish pensioners. Other papers finding patterns in observed annuitization choices suggestive of deviations from rational choice models include Hurd and Panis (2006), Chalmers and Reuter (2012), Previtero (2014), and Fitzpatrick (2015). Shepard (2011) and Bronshtein, Scott, Shoven, and Slavov (2016) use arbitrage arguments to show that, for many people, the annuitization decision implicit in when to claim Social Security benefits cannot be fully explained by a standard rational model.

Although rational models can be constructed to match the low observed demand for annuities, our take from the literature on the annuity puzzle is that behavioral factors remain operative. In short, we share Brown's (2009, p. 185) assessment that while "it is possible to generate more limited annuitization by extending the rational model in several directions, such an approach does not seem to provide the complete answer to the puzzle" of low observed levels of annuitization. Similarly, Benartzi, Previtero, and Thaler (2011, p.161) conclude that the "tiny market share of individual annuities should not be viewed as an indicator of underlying preferences but rather as a consequence of institutional factors about the availability and framing of annuity options."

Many studies find that behavioral factors influence annuitization decisions, yet relatively little is known about the mechanisms driving this behavior. Brown et al. (2008, 2013) report that presenting annuities in terms of the consumption streams they generate leads to higher annuity demand than presenting annuities as investment products. Brown et al. (2008) suggest that the adoption of a narrow decision frame, also referred to as choice bracketing (Thaler, 1985; Read, Loewenstein, and Rabin, 1999), may drive this finding: that is, people evaluate annuities based on the return and variance of the payouts in isolation rather than by focusing on the level and variance of the consumption stream flowing from the annuity (which is what matters for utility). It remains a leap of faith, however, to infer that the choice is more rational simply because demand is higher. Brown et al. (2017) establish that the deviation from rational choice, measured by the gap between peoples' sell versus buy prices for annuities, is lower for individuals with better cognition scores. The authors take this as suggestive evidence that valuing annuities is cognitively challenging because it is a complex task. Nevertheless, they do not claim that this is *causal* evidence of a mechanism, as they lack exogenous variation in the complexity of the annuitization decision.

In the present paper, we produce stronger evidence on behavioral mechanisms that may affect the annuitization decision. Rather than asking for a respondent's own hypothetical annuitization decision, we first describe a vignette where a hypothetical person faces an annuity decision, and we then ask our respondents to advise that vignette person. This alternative way of eliciting hypothetical annuitization choices allows us to experimentally vary characteristics of the vignette person that affect the complexity of the annuitization decision while holding the characteristics of the annuity itself constant. The annuitization decision faced by the vignette person is a choice between a lump sum amount and a change in Social Security benefits. We use the stream of Social Security benefits as the annuity in our experiment for two reasons. First, most respondents are aware that Social Security payments last as long as they live (Greenwald, Kapteyn, Mitchell, and Schneider, 2010), which means they understand that Social Security provides an annuity even if they do not understand the term "annuity."[1] Second, because Social Security is a widely held annuity, it is natural to ask both about the value of decreases and increases in Social Security benefits, which allows us to measure the divergence between sell and buy valuations of the annuity. This divergence is our measure of deviations from rational decision-making because rational individuals should value a marginal increase in the Social Security annuity the same as a marginal decrease.

Specifically, we present respondents of the nationally representative Understanding America Study (UAS) with a vignette in which a hypothetical person faces a choice between receiving a $100 per month *increase* in Social Security benefits versus receiving a lump sum amount. We ask each respondent what the vignette person should choose and repeat the question for various values of the lump sums until we find the lump sum deemed equivalent in value to a $100 per month increase in the Social Security annuity. We call this lump sum amount the "sell" valuation because the respondent advises the vignette person to sell a $100 a month annuity for this lump sum. At a different point in the experiment, we ask each respondent to advise the same vignette person on a choice between a $100 per month *decrease* in Social Security benefits versus

[1] While policy risk reduces people's valuation of the stream of Social Security benefits (Luttmer and Samwick, 2018), this should reduce both the buy and sell valuation, leaving their differential unaffected.

paying a lump sum. The lump sum amount that is valued as much as the decrease in benefits is the "buy" valuation, as it represents the amount of money the respondent advises the vignette person to pay to avoid forfeiting a $100 per month annuity. We refer to the absolute difference between the log sell valuation and the log buy valuation as the "sell-buy spread," and we use this to measure deviations from rational decision-making.

We introduce two experimental interventions to test for two types of behavioral impediments to valuing annuities.[2] First, we vary the ease by which an annuity stream can be valued, which we refer to as the complexity of the annuitization choice.[3] Valuing an annuity stream is more difficult when there is greater uncertainty about longevity. We experimentally manipulate this uncertainty by telling the respondent what longevity information the vignette person received from a doctor. Valuing an annuity is also more difficult when the description of the annuity contains additional information that turns out to be irrelevant but nevertheless requires effort to process. This is an alternative means by which we vary complexity. Second, we independently randomize whether or not the respondent receives information about the benefits and drawbacks of spending down non-annuitized wealth during retirement more rapidly versus more slowly. This intervention occurs before the respondent advises the vignette person about annuitization. The purpose of the intervention is to induce people to think about the consumption consequences of holding an annuity during retirement. The "consequence message" intervention therefore has the potential to be a new instrument (besides framing) to reduce the narrow choice bracketing that Brown et al. (2008) identified as a behavioral mechanism.

[2] As described below, we have included additional experimental interventions to test for anchoring and to test whether results are robust. All these experimental interventions are orthogonal to the two main interventions designed to test for behavioral impediments to valuing annuities.
[3] Our reference to complexity differs from a common use of the term when describing smaller/larger choice sets, e.g., Carvalho and Silverman, 2019.

Our experiment yields two main findings. First, we show that greater complexity causes the sell-buy spread to increase, indicating that complexity associated with annuities reduces people's ability to assess the value of an annuity. This is the first causal evidence of complexity as a mechanism that impedes valuing annuities, and we consider this to be the first main contribution of our paper. This result supports the interpretation offered by Brown et al. (2017) that the cognitive challenge of assessing the value of an annuity makes people reluctant to either buy or sell an annuity, leading to a low buy price but a high sell price. Our finding is consistent with results from other contexts documenting that complexity reduces people's responsiveness to incentives or the quality of their decision-making, including in work decisions (Abeler and Jäger, 2015), portfolio choice (Carlin, Kogan, and Lowery, 2013; Carvalho and Silverman, 2019), benefit claiming (Bhargava and Manoli, 2015), and the selection of health insurance plans (Schram and Sonnemans, 2011; Besedeš, Deck, Sarangi, and Shor, 2012a, b). Different from most of this work, which manipulates complexity by providing a larger or smaller choice set, we manipulate complexity by making it more or less difficult to map the information offered about the annuity to the consequences or outcomes from buying or selling it.

Our second result is that the "consequence message" intervention reduces the sell-buy spread. In other words, people are better able to assess the value of an annuity if they think about the effect of the annuity on the distribution of their future consumption streams versus when they do not make this connection. This finding supports Brown et al. (2008, 2013) on the role of choice bracketing in annuity decisions. Yet unlike that study, here we measure a deviation from rational decision-making by the discrepancy between the buy and sell price of a small change in annuitized wealth, which is a more objective indicator of lack of rational decision-making than simply the level of annuitization. We consider this additional evidence on choice bracketing the second main contribution of this paper, and our finding adds to the growing empirical evidence on choice bracketing based on experimental variation in the breadth of the decision frame. For example, Bertrand and Morse (2011) report that people take out smaller payday loans when they are experimentally induced to think more broadly about the consequences of taking out such loans, and Enke (2017) shows that people develop more accurate beliefs when they are experimentally induced to adopt broader mental frames.[4]

Evidence that behavioral mechanisms affect annuitization decisions has the important implication that one cannot infer how much people value annuities by simply observing their annuitization decisions. Specifically, the fact that observed voluntary annuitization levels are low does not necessarily imply that utility-maximizing levels of annuitization are also low. In light of behavioral mechanisms affecting annuitization decisions, the fact that Social Security pays out benefits exclusively as an annuity is particularly valuable to people that would otherwise underannuitize.

Evidence that complexity impedes annuitization decisions has the important implication that reducing complexity can improve individuals' annuitization decisions. While it may be possible to make the decision less complex by presenting information about the annuity more clearly, we stress that much of the complexity is inherent in the annuitization decision itself: people need to jointly evaluate how much they will consume each future year with and without the annuity, how much they care about consumption fluctuations, and the probability that they will be alive in each future year. No matter how well the decision is presented, it remains a complex task.

[4] In addition, there is compelling empirical evidence that people do not treat money as fungible. Studies showing this include Kooreman (2000), Milkman and Beshears (2009), Feldman (2010), Hastings and Shapiro (2013), Beatty, Blow, Crossley, and O'Dea (2014), and Abeler and Marklein (2017). While these papers do not experimentally vary the breadth of the decision frame, a leading explanation of these findings is mental accounting, which is a form of choice bracketing.

We do find that inducing people to consider the consequences of annuitization decisions for their consumption streams enables them to better assess the value of an annuity. This is important because it provides clear guidance on how annuitization decisions should be presented. Still, while the consequence message limits the degree to which choice bracketing acts as an impediment to valuing an annuity, we emphasize that the sell-buy spread remains substantial even for those exposed to the consequences message.

The rest of the paper proceeds as follows. Section 2 describes our methodology and explains our experimental design. In Section 3, we present our empirical findings, and Section 4 concludes.

2. Methodology and Experimental Design

2.1 Understanding America Study

Our experiment uses the UAS, a probability-based Internet panel of about 6,000 adults[5] (age 18+) representative of the U.S. population. Panel members are recruited exclusively through address-based sampling, in which invitation letters are sent to randomly selected households using address lists obtained from the U.S. postal service. This provides a broadly representative sample, since individuals lacking prior access to the Internet are provided with a tablet and broadband Internet.[6] In addition, the UAS contains small oversamples (about 5% each) of Native Americans and residents of Los Angeles County. Our experimental module was fielded between June and October of 2016, and all UAS panel members at the time were invited to participate. Panel members received $10 for completing the survey, which took an average of 14 minutes, and they

[5] The description of the UAS refers to the situation at the time of the experiment. Current sample size is about 8,000 and is set to grow to 10,000.
[6] An extensive discussion of the UAS is provided in Alattar, Messer, and Rogofsky (2018).

could also receive additional earnings depending on their answers to quiz questions. Of the 5,521 invited panel members, 83.2% opened the link to the survey.[7] Of those who opened the link, 99.1% completed both annuity valuation questions for an overall response rate of 82.4% (4,549 respondents).

The UAS gathers information on demographic characteristics for all respondents as well as detailed measures of cognitive capabilities and financial literacy (the latter for about 90% of respondents). Given that cognitive ability and financial literacy are important predictors of responses to annuity questions, we limit our analysis sample to those observations with nonmissing measures of cognitive ability and financial literacy. In addition, we exclude 0.5% of observations with missing values for any demographic characteristics. The final analysis sample has 4,060 observations (89.2% of the total number of respondents who completed both the annuity sell and buy questions).

We recognize that a drawback of hypothetical choice data is that people may not put as much effort into making decisions as they might in real-life situations. As a result, their answers may contain more measurement error than would be true in the real world. Nevertheless, it seems unlikely that people can fully overcome cognitive biases simply by exerting more effort. Moreover, concerns about the reliability of willingness-to-pay responses in the UAS are allayed by Mas and Pallais (2017) who show that the distribution of willingness-to-pay for hypothetical flexible work arrangements obtained in the UAS closely matches the willingness-to-pay distribution from a similar field experiment. In our case, using hypothetical choice data has the important advantage that we can elicit *both* a willingness-to-pay and a willingness-to-accept for the same person,

[7] This response rate is typical in UAS surveys. The invitation reads "In the following survey we want you to play the role of financial advisor. We will show you some examples of persons who have to make a decision about money and we will ask you to help them make the decision."

permitting us to measure deviations from rational decision-making. We know of no field setting that allows for the simultaneous measurements of willingness-to-pay and a willingness-to-accept for an annuity for the same person. Moreover, in our setting, we observe the valuations of all respondents, in contrast to most revealed preference approaches where only the valuations of marginal individuals can be observed and the valuations of inframarginal persons can only be bounded, absent functional form assumptions.

Online Appendix Table A1 provides summary statistics for our baseline sample and compares it to the Current Population Survey (CPS) of the same year. Compared to the CPS, our sample overrepresents respondents between the ages of 35 and 65 by 11 percentage points, females by 6 percentage points, married respondents by 7 percentage points, non-Hispanic whites by 11 percentage points, individuals with more than a high school education by 16 percentage points, households with annual incomes above $75,000 by 3 percentage points, households with two or fewer members by 10 percentage points, and households with no children by 5 percentage points. While these differences are generally statistically significant, the two samples are reasonably similar in terms of economic magnitudes, with the absolute difference in the fraction of respondents in a category being 5 percentage points on average across the 25 demographic categories listed in the table. As such, we consider our sample to be broadly representative of the U.S. adult population.

2.2 Experimental Context

Rather than describing an unfamiliar hypothetical annuity product, we use Social Security benefits as the context for the analysis of payout annuities. Specifically, we asked respondents to make trade-offs between receiving higher or lower Social Security benefits (a change in a real annuity stream) and paying or receiving different one-time payments (lump sums). Our setting is policy relevant because past discussions of pension reforms around the world, including in the U.S., have included proposals to offer workers lump sum payments in exchange for a reduction in their annuitized pension benefits (Maurer, Mitchell, Rogalla and Tschimetschek, 2018). Several U.S. corporations have also recently offered to buy back defined benefit pension annuities from retirees in exchange for lump sums (Wayland, 2012).

2.3 Elicitation of the Valuation of an Annuity Stream

Throughout the experiment, we use vignettes to describe trade-offs and ask respondents to give the hypothetical "vignette person" advice about annuitization decisions. This approach has several attractive features. First, we can directly manipulate the complexity of the annuitization decision by using different experimental treatments. Second, we control for the respondent's own characteristics: unlike making a decision for one's own situation (as in Brown et al. 2017), we need not worry about factors such as liquidity constraints or private knowledge that the respondent may have about his or her own situation.

The vignette person in the control condition is described as follows:

> *Mr. Jones is a single, 60-year old man with no children. He will retire and claim his Social Security benefits at 65. When he retires, he will have $100,000 saved for his retirement, and he will receive $[SSB] in monthly Social Security benefits. Based on his current health and family history, doctors have told Mr. Jones that he will almost certainly be alive at age 75 but almost certainly will not live beyond age 85.*

The gender and name of the vignette person are experimentally varied between respondents. The variable *$[SSB]* represents the vignette person's monthly Social Security benefits, randomized with equal probability across respondents to $800, $1,200, $1,600, and $2,000.

Our main outcome of interest is the respondent's advice for how the hypothetical "vignette person” should trade off annuitized wealth and lump sum amounts at retirement. All respondents answer a series of questions that elicit either the equivalent variation (EV) of a $100 increase in monthly Social Security benefits or the EV of a $100 decrease in monthly Social Security benefits. Each respondent is asked both questions, and the order in which they are asked is randomized.

The valuation of a $100 increment in the annuity stream is elicited by asking a series of questions of the form:

What should Mr. Jones do?

(1) Receive a Social Security benefit of $[SSB+100] per month starting at age 65.

or

(2) Receive his expected Social Security benefit of $[SSB] per month <u>*and*</u> *receive a* <u>*one-time*</u> *payment of $[LS] from Social Security at age 65.*

The $100 increment in benefits of *$[SSB+100]* is displayed as a single number on the screen. The variable *LS* represents the lump sum amount that is traded off, randomized across respondents to start at $10,000, $20,000 or $30,000. The question is subsequently asked four more times for different values of *LS.* For example, if the person declines a $20,000 lump sum, we infer that that the valuation must exceed $20,000, so for the next question we use a higher value of *LS*, namely $60,000. If the person accepts the $20,000 lump sum, we would use a lower value of *LS*. Next, if the person accepts the $60,000 lump sum, we infer that the valuation must lie below $60,000, and we ask the question three more times to further reduce the difference between the lower and upper bound of the person’s valuation of the $100 increment in the annuity stream. The exact sequence of values for *LS* is shown in the survey instrument in the Online Appendix. We refer to this question as the “sell” version, because the person receives a payment in exchange for a smaller annuity stream.

The valuation of a \$100 decrease in the annuity stream is elicited by asking a series of questions of the form:

What should Mr. Jones do?

(1) Receive a Social Security benefit of \$[SSB-100] per month starting at age 65.

or

(2) Receive his expected Social Security benefit of \$[SSB] per month <u>and</u> make a <u>one-time</u> payment of \$[LS] to Social Security at age 65.

As before, the question is asked five times for different values of *LS* until we can place the respondent's valuation of the annuity into one of 32 bins. We refer to this question as the "buy" version, because the person is making a payment in exchange for a larger annuity stream.

Given that a \$100 change in the annuity stream is small relative to the average monthly benefit of \$1,400, a rational respondent should value this change approximately the same, whether it is an increase or a decrease. We therefore take the absolute difference of the sell and buy valuations to measure the deviation from rational decision-making.

2.4 Experimental Design

Our experiment consists of a 3x2 between-subjects design, summarized in Table 1. First, we experimentally vary what we refer to as the complexity of the vignette in one of two ways, either by increasing the uncertainty associated with length of life (*Complexity: Wide age range* treatment*)* or by adding extraneous information to the vignette that is not relevant to the decision (*Complexity: Added information* treatment). For example, control group respondents are told that the vignette person will "*almost certainly be alive at age 75 but almost certainly will not live beyond age 85.*" By contrast, respondents in the *Complexity: Wide age range* treatment are told that the vignette person "*has an 80% chance of being alive at age 70, a 50% chance of being alive* *at age 80, a 20% chance of being alive at age 90, and a 10% chance of being alive at age 95."* Determining the value of an annuity is a more complex task when the variation in possible ages of death is more dispersed, as is the case in this second vignette.[8] The extraneous information added to the *Complexity: Added information* treatment includes information about Social Security qualification rules and describes why the vignette person qualified. Here the increased complexity requires the respondent to think about the additional information and determine whether it is relevant.[9]

Second, prior to the advice decision, in half of the treatments we additionally provide a message about the consequences of spending down retirement savings *(Consequence message*). This message describes an interaction between a different vignette person and his or her financial advisor. In this interaction, the advisor describes the benefits and drawbacks of spending down savings relatively quickly (more likely to be able to use money in one's lifetime, but running a larger risk of running out of money while alive), versus relatively slowly (less likely to run out of money, but running a larger risk of not getting to enjoy one's money in one's lifetime). This message is framed as neutrally as possible and designed to encourage the respondent to avoid narrow choice bracketing: by inducing respondents to think about the problem of how to spend down wealth in retirement, we intended that respondents consider the annuitization decision and the asset decumulation decisions jointly, rather than as disjoint decisions. To ensure that respondents pay attention to the message, respondents are further told that, at the end of the message, they will be asked two questions about the facts in the story and will receive an additional

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[8] This manipulation affects the amount of longevity risk, which may affect buy and sell values. However, we would expect it to have the same effect on the buy and sell values, and therefore not affect the sell-buy spread.

[9] Respondents took on average about 25% longer to read and process the vignettes of the complexity treatment than the control vignette ("no added complexity"), and the text of vignettes of the complexity treatment required a reading comprehension 0.9 grade levels higher, according to the Flesch-Kincaid scale.

$1 for each question they answer correctly. These factual questions are two multiple choice questions about the financial advisor's explanation of the benefits and drawbacks under each scenario (spending down slowly or quickly). Of the respondents who are posed these two factual questions, 63% answer both correctly, 27% answer one correctly, and 10% answer neither correctly.

In summary, all respondents are asked to give advice to a primary vignette person about buying and selling a small fraction of that vignette person's Social Security benefit stream. Between respondents, we therefore have two main treatments: (1) the information about the vignette person, randomized between "*No added complexity", "Complexity: Wide age range"*, and *"Complexity: Added information*", and (2) whether narrow choice bracketing is discouraged, where we randomize between "*No consequence message"* and "*Consequence message."* In addition, we have the following six secondary randomizations. We perform two randomizations to test for anchoring, which is another indication of a lack of rational decision-making: (3) the starting value for the lump sum amount ($LS=$10,000, $20,000, $30,000); and (4) the order of the two annuity valuation questions. Finally, we randomize (5) the name and gender of the primary vignette person (*Mr. Jones, Mrs. Jones, Mr. Smith, Mrs. Smith)* and of the secondary vignette person;[10] (6) the Social Security benefit ($SSB=$800, $1,200, $1,600 or $2,000); (7) the order of the options shown (option with lump sum always shown first versus option with lump sum always shown last); and (8) whether the consequence message first discusses the consequences of

[10] The secondary vignette person (i.e., the vignette featured in the consequence message) was female if and only if the primary vignette person was male, and vice versa. Similarly, the secondary vignette person was named Jones if and only if the primary vignette person was named Smith, and vice versa. We did this to eliminate the possibility that the consequence message affected advice on annuity choices for the primary vignette person by respondents inferring the primary vignette person's preferences or circumstances from information provided in the consequence message. Because the consequence message used a different person, it can only have altered the advice by the respondent through the respondent thinking differently about annuitization decisions rather the respondent knowing more about the annuitant him- or herself.

spending wealth down quickly or slowly. The latter four manipulations are intended to verify that choices in the vignette that we assumed would be innocuous indeed do not matter for our results. All randomizations occur across subjects and are mutually orthogonal. The options within each randomization have equal probability of being selected.

2.5 Data on Cognition

To investigate how the ability to value annuities varies by cognitive ability, we merge the data from our survey with existing data in the UAS, including a financial literacy survey (Lusardi and Mitchell, 2014). We also include four subtests of the Woodcock-Johnson Test of Cognitive Ability, a nationally normed test, with sub-tests including numeracy, number series, verbal analogies, and picture vocabulary. The first two sub-tests measure numerical ability, and the second two measure lexical ability. We standardize the financial literacy measure and each of the four test scores: for the main analysis, we create a "cognition index" from these four tests and the financial literacy measure by taking their first principal component.[11] In the robustness section, we demonstrate the robustness of our main results to alternative measures of cognition.

3. Results

3.1 Baseline Sample and Randomization Check

As noted in Section 2.1, our baseline sample consists of respondents who answer both annuity valuation questions and who have nonmissing values for the cognition and demographic variables. We investigate whether the exclusion from the baseline sample due to missing data is balanced across the two key treatment conditions (see Online Appendix Table A3), and we find that neither the complexity treatment nor the consequence message treatment affects the likelihood

[11] The Online Appendix provides more detail on the construction of the cognition index and the questions used.

of a respondent failing to answer the annuity questions (p-values: 0.322 and 0.491, respectively). The fraction of observations with missing demographic data is marginally significantly higher in the complexity treatment than in the control condition, and the fraction with missing cognition data is significantly higher in the complexity treatment than in the control condition. Since both demographic and cognition data were collected prior to randomization, these findings cannot logically be a consequence of the treatment, and we conclude they were a fluke of the randomization. There are no significant differences in the fractions with missing demographics or cognition data between the consequence treatment and the control condition.

We also test for balance on the control variables in the baseline sample by the two main treatments (Panel B, Online Appendix Table A3). Of the four dozen tests of differences in means across treatments for individual control variables, four are significant at the 10-percent level and one at the 5-percent level. This is roughly what one would expect by chance. Jointly, the control variables do not significantly predict the complexity treatment (p-value: 0.107) or the consequence message treatment (p-value: 0.788).

3.2 Annuity Valuation Distributions and Summary Statistics

Figure 1 shows the distribution of buy valuations for the subsample in which the buy valuation is asked first, and the distribution of sell valuations for the subsample in which the sell valuation is asked first. By focusing on valuations when the question is asked first, we avoid any influence of anchoring on a previously asked valuation question. The figure clearly shows that the buy valuation is lower than the sell valuation throughout the distribution. Respondents advise our hypothetical vignette individuals to *buy* an annuity that pays \$100 per month for a median price of \$4,750 (s.e.: \$180) but advise them to *sell* this annuity for a median price of \$16,250 (s.e.: \$543). This represents a statistically significant difference (two-sample Wilcoxon-Mann-Whitney ranksum test z-statistic=25.8, *p*-value<0.001).[12] The actuarially fair value of this annuity is roughly $15,000 at a 3% real discount rate.[13]

Rational individuals should place a similar value on a marginal increase and a marginal decrease in the Social Security annuity. To examine the extent to which this holds in our data where we ask about a $100 change in the Social Security annuity, we calculate for each respondent the difference between the log sell price and the log buy price. Figure 2 shows the distribution of this log difference for our baseline sample and highlights two facts. First, there are large differences between buy and sell values at the individual level. Only about 10 percent of respondents have a buy value that is equal to their sell value, and only 40 percent have a buy and sell value that are within one log unit (i.e., within a factor of 2.72) of each other. In short, deviations from the predictions of the rational model for buy and sell valuations of marginal changes in Social Security benefits are substantial. Second, the distribution is not symmetric around zero: 63% have sell valuations that strictly exceed their buy valuations, whereas buy valuations strictly exceed sell valuations for about 27% of respondents. As Brown et al. (2017) explain, people may worry that they might be taken advantage of when they trade a good that they cannot value accurately. Accordingly, it can be a useful heuristic to be reluctant to trade such goods, and only to sell them at a very high price (or buy them at very low price). Such a heuristic predicts that sell prices exceed buy prices whenever it is difficult to accurately determine the value of a good, as is the case with an annuity.

Status-quo bias (or an endowment effect) in the level of Social Security benefits cannot

[12] Online Appendix Figure A1 shows the distributions of the buy and sell valuations in the entire baseline sample which, unlike Figure 1, includes responses to valuation questions that followed an earlier valuation question. The distributions are similar to those in Figure 1.

[13] The average of the median buy valuation and the median sell valuation is lower than the actuarially fair value. Why this is the case is not the focus of this paper's investigation.

explain why sell prices generally exceed buy prices. We elicit the sell price as the price for which people would be willing to sell \$100 of Social Security benefits that would be received on top of the expected benefits. Someone with status-quo bias would put a low price on this \$100 of benefits because this amount is in addition to the status-quo level of benefits. Conversely, we elicit the buy price as the price for which people would be willing to buy \$100 of Social Security benefits that would bring the total benefit level back to the expected level. Thus, someone with status-quo bias would place a high price on these benefits because they would return the benefit level to the status quo.

Any difference between the sell and buy price is a deviation from the prediction of the rational model for marginal changes in Social Security benefits, whether the sell price differs from the buy price due to the reluctance-to-trade heuristic offered by Brown et al. (2017), or for other reasons. Accordingly, our measure of the deviation from rational decision-making is the absolute value of the difference between the log buy price and the log sell price. We refer to this variable as the *spread* and use it as our main outcome variable. Table 2 presents summary statistics of the spread and Online Appendix Figure A2 plots its distribution. The spread is strictly positive for 90 percent of respondents, the median spread is 1.55, and the mean spread is 2.21. The table also shows the components of the spread, namely the log buy price and the log sell price. Anchoring mainly affects the buy price, which is significantly higher when asked after the (generally higher) sell price is elicited. The spread is slightly higher when the sell question is asked first (2.27 versus 2.16), but this difference is only marginally significant (p-value: 0.079). Because the spread is measured as an absolute log difference, an increase in the spread of 0.11 (from 2.16 to 2.27) can be interpreted as the difference between the higher valued annuity and the lower valued annuity increasing by 12 (= $e^{0.11}$-1) percentage points.

As we show in Online Appendix Table A4, demographic characteristics by themselves explain about 11% of the variation in the spread among individuals in the control group, i.e., those who see the "no added complexity" vignette and do not receive the consequence message. The spread is significantly higher for females, non-Hispanic blacks, and those with lower education levels. The most powerful predictor of the spread is the cognition index; those with higher levels of cognition have significantly lower spreads. By itself, the cognition index can explain 16% of the variation in the spread in the control group. If we regress the spread on both the cognition index and the demographics, the R^2 rises to 19%, and the cognition index is the strongest and most significant predictor of the spread. The only demographic characteristic that is significant at the 5% level in this regression is the indicator for being Hispanic, which implies that Hispanics have a lower spread than what would be predicted based on their cognition score and their other demographic characteristics.

Our findings on the discrepancy between buy and sell valuations are in line with the results of Brown et al. (2017), who asked respondents for how much they *themselves* would buy or sell an annuity that paid them \$100 per month. This similarity is reassuring, as it suggests that our elicitation of valuation advice to a vignette person (rather than asking about respondents' own valuations) does not meaningfully alter the responses. A further similarity is that we also find that the log buy and the log sell valuations are negatively correlated (correlation coefficient: -0.11, p-value<0.001).[14] Our use of vignettes allows us to vary the complexity of the annuity by experimentally altering the dispersion of ages of death, which would not be ethically feasible when asking about an annuity tied to the respondent's own life.

[14] The negative correlation and the discrepancy between buy and sell prices are also consistent with the results of Chapman, Dean, Ortoleva, Snowberg, and Camerer (2017), who elicit buy and sell prices for a monetary lottery in an incentivized way and show that these prices are persistent within person over time and that the discrepancy between buy and sell prices is not due to measurement error.

3.3 Treatment Effects

In Table 3, we investigate our two main research questions. The first asks whether complexity inhibits respondents' ability to value an annuity stream. The second asks whether narrow choice bracketing contributes to respondents' difficulty in valuing the annuity. We measure respondents' inability to value an annuity by the spread between their sell and buy valuations because the spread should be approximately zero for fully rational respondents. In all regressions, we control for the experimental manipulations,[15] the cognition index, and a common set of control variables (see Panel B, Online Appendix Table A3). In Table 3, we report only the coefficients of interest (the full set of coefficient estimates is provided in Online Appendix Table A5).

The estimate in the first row of Column 1 shows that the complexity treatment increases the sell-buy spread by 0.131, implying a 14 percent ($=e^{0.131}-1$) increase in the ratio of the higher-valued to the lower-valued annuity. To our knowledge, this is the first causal evidence that the complexity of an annuity choice affects individuals' reported annuity valuations. The fact that complexity increases the spread between the buy and sell price indicates that complexity reduces individuals' ability to value an annuity accurately.[16] The next two columns show the separate effects of the complexity treatment on the buy and sell price. While the estimates seem to indicate that the complexity treatment primarily operates on the buy price, and hence it reduces the average of the log sell and buy price, this is not a valid interpretation as we cannot reject that increase in the sell price and the decrease in the buy price are the same in absolute value (p-value 0.302). We

[15] We do not control for the order in which the two blocks of consequence message treatment were shown because this variable is available for only half the sample. Within the half of the sample for which this order was randomized, the order has no significant effect on the spread (p-value: 0.758).

[16] While the spread is a measure of people's inability to value an annuity accurately, it is not an overall measure of their decision-making quality. For example, if people reduce the buy price and increase the sell price when they recognize that they do not sufficiently understand how to value annuities, they will not only have a higher spread but also mechanically become less likely to make an arbitrage mistake such as buying an annuity for more than its market price.

also evaluate whether the two types of complexity treatments (*wide age range* vs. *added information*) have different effects on the spread. As reported in Online Appendix Table A6, this is not the case (*p*-value: 0.646), so we therefore pool the two complexity treatments.

The second row of Table 3 shows the treatment effects of the consequence message. The consequence message decreases the sell-buy spread by 0.141. This means that inducing respondents to think about how to spend down savings during retirement causes them to report an annuity sell price and a buy price that are closer together, which is consistent with being more able to value annuities rationally. Apparently, the consequence message reduces the degree to which respondents consider annuitization and the spending down of assets during retirement as two separate decisions, a form of narrow choice bracketing. The consequence message does move the buy and sell value closer by 15 percentage points, but this still leaves a substantial spread of 2.21 - 0.14 = 2.07 log units among respondents who received the consequence message. In short, decision-making among those who receive the consequence message is still far from rational, given that the spread remains well above zero. The next two columns show that the consequence message has virtually no effect on the sell price but significantly increases the buy price. In fact, it marginally significantly *increases* the average of the log buy and sell price (*p*-value 0.073), suggesting that the consequence message not only increases the rationality of the annuity valuations but also raises the levels. The latter finding is what one would expect when people jointly consider the asset decumulation decision and how to value the lifetime income stream. In particular, annuities remove uncertainty in consumption associated with asset decumulation in the face of uncertain life spans.

The third row shows that the cognition index is a very strong predictor of the sell-buy spread, such that a standard deviation increase in the cognition index narrows the sell-buy spread by 0.788. This underscores the conclusion that cognitive limitations play an important role in people's inability to value an annuity. This limitation had been previously established in a different setting by Brown et al. (2017), but we now have causal evidence on two mechanisms by which cognition affects people's ability to value annuities: narrow choice bracketing and the complexity of the annuity choice. The effect of cognition also allows us to put the magnitudes of the treatment effects in perspective. Each of our two treatments, which by coincidence have the same absolute magnitude of around 0.14, has the same effect on the spread as roughly a 17% (=0.14/0.79) of a standard deviation change in cognitive ability.

The remaining rows examine the effects of our secondary randomizations. Consistent with earlier findings in the literature, and indicative of less-than-fully rational decision-making, we find significant effects of anchoring. When we ask the sell valuation first (which typically has a higher valuation than the buy valuation), the respondent's buy valuation is significantly higher, consistent with the buy valuation being anchored on the sell valuation. We find no significant anchoring of the sell price on the buy price when the latter is asked first. The starting values ($10,000, $20,000, or $30,000) of the lump sum amount used in the annuity value elicitation procedure also have a strong effect on the valuation reported: in fact, we can reject at the 1-percent level that the starting value has no effect on the sell price or the buy price. The starting value has a similar effect on the sell and buy price, resulting in no significant net effect on the spread. The remaining randomizations cover the various choices we made in the design of the experiment (whether the lump sum amount is the first or second choice, the monthly Social Security benefit amount, and the name of the vignette person). We anticipated that these choices would be innocuous, but the randomizations allow us to test whether outcomes indeed are insensitive to them. The last three rows show that these choices have no significant effects on our main outcome variable, the sell-buy spread. With the exceptions of the effects of the vignette name and the benefit amount on the buy price, these choices also do not affect the sell or buy price.[17]

To alleviate concerns about multiple hypotheses testing, we also test whether our two key experimental manipulations, the consequence message and the complexity treatment, are jointly zero: we reject this hypothesis with a p-value of 0.0106. The p-value becomes 0.0256 if we do not pool the complexity treatment, i.e., when we test that the consequence message, the wide-age-range complexity treatment, and the extra-information complexity treatment are jointly zero. If we include all the secondary experimental manipulations in the joint test, we can reject that all treatment effects are jointly zero with a p-value of 0.0098 when the complexity treatments are pooled and with a p-value of 0.0148 when the complexity treatments are separated out.

What would annuity valuations be if we had an intervention sufficiently powerful to cause the mean log sell price and the mean log buy price to be equal (so no deviation from rationality at the mean)? We can get a rough answer to this question by extrapolating the effects of each of our two main experimental interventions. The mean log difference between sell and buy price is 1.01 (see Figure 2), and the consequence message moves log sell and buy price closer by 0.122 (=0.133-0.011, see columns 2 and 3 of Table 3). Thus, a treatment about $8 \approx 1.01/0.122$ times more powerful than our current consequence message would close the gap between the mean log sell and buy price. At that level of treatment, the median sell and buy price would be predicted to be about $17,000. Similarly, we can extrapolate the complexity treatment, in the direction of making the problem less complex, such that the sell and buy price coincide. This would require reducing

[17] One might expect that people with an initially higher Social Security benefit place a lower value on a $100 change in Social Security benefits, since they are already more highly annuitized. To test this, we run an alternative specification in which the baseline Social Security benefit amount is included as a linear control instead of as a set of dummy variables. Both the buy and sell value decline in the baseline amount of Social Security benefits. The effect is not significant for the sell value (*p*-value 0.145), but there is a significant 2.5% decline in the buy value for each additional $100 in baseline Social Security benefits.

complexity by about 5 times the amount of complexity added by our complexity treatment. The resulting sell and buy price would then be predicted to be about \$12,000. These point estimates obviously rely on a substantial extrapolation, and therefore they should be taken as only suggestive. Nevertheless, it is noteworthy that a simple average of these two predicted valuations at treatments sufficiently powerful to eliminate the discrepancy between the buy and sell price is quite close to the actuarially fair value (of about \$15,000).

3.4 Heterogeneous Treatment Effects

In Table 4, we explore whether the impact of our two main treatments varies across respondent subgroups. The first column examines heterogeneity in the effect of the complexity treatment, and the second column investigates whether the consequence message has different effects across subgroups. For each specification, we create two subgroups that are as close as possible in size to each other in order to maximize statistical power.

The first two specifications examine interaction effects between our treatments. One might expect that the complexity treatment has a greater impact on the spread when people engage in narrow choice bracketing because they do not recognize how annuities help in the asset drawdown process. In line with this prediction, the point estimate of the complexity treatment is larger for respondents who receive no consequence message than for those who do; nevertheless, this difference is not statistically significant (*p*-value: 0.408). The second specification is the flipside of the first, asking whether the consequence message has a greater impact on persons exposed to the complexity treatment. While the point estimates do go in this direction, this effect is again not significant (and the *p*-value is the same as in the first specification by construction).

The third specification shows that that we do not detect significant heterogeneity in either treatment effect by level of cognition.[18] The last specification splits the estimates by the randomly assigned level of Social Security benefits. A $100 change in Social Security benefits is closer to a marginal change for someone with monthly benefits of $2000 than for someone with monthly benefits of $800. The stability of treatment effects by level of benefits helps alleviate concerns that the estimates are affected by the fact that the $100 change is not literally a marginal change. Another way to address this concern is to not count small spreads as deviations from rational behavior, which could arise when a $100 change is insufficiently marginal. In Online Appendix Table A8, we do this by setting any spreads less than 0.50 log units equal to zero, and we find that the estimated treatment effects are essentially unaffected.

3.5 Robustness

Online Appendix Table A8 examines the robustness of the two primary treatments to different measures of cognition, to different ways of selecting the sample, to different sets of controls, and to transformations of the outcome variable. We find that the results on the complexity treatment are reasonably stable in magnitude but somewhat sensitive in terms of statistical significance, which falls to marginal in 7 of the 18 specification checks and disappears in 2 of them. This sensitivity can be traced largely to the fact that the cognition control, a very strong predictor of the spread, was not balanced across the complexity treatment and control conditions. Hence, having good controls for cognition is important for the results of the complexity treatment. By contrast, the consequence message treatment is extremely robust and remains significant at the 5% level everywhere, except for one specification where it is significant at the 10% level.

[18] Online Appendix Table A7 examines heterogeneity by gender, education, age, and income. In none of these specifications do we find a difference in the treatment effect by demographic characteristic significant at the 5-percent level or better, but we recognize that we have limited statistical power to detect even reasonably large interaction effects.

4. Conclusion

Annuities allow people to smooth consumption in retirement when facing an uncertain age of death, yet annuity holdings are relatively low and only about 3 percent of individuals maximize their annual Social Security annuity payouts by delaying claiming benefits until age 70 (Social Security Administration, 2017). Although these decisions may be rational for some people, this paper investigates whether behavioral factors impede people's annuitization choices. We do so in the context of a hypothetical choice experiment on a broadly representative sample of about 4,000 adults in the U.S. Such a setting confers two important advantages for our purposes. First, we can measure deviations from rational decision-making by observing for each respondent both his willingness to pay to forgo a small decrease in annuitization and his willingness to accept to forgo a small increase in annuitization. Second, we can experimentally vary the complexity of the annuitization decision. We also experimentally vary whether respondents are encouraged to jointly consider the annuitization decision and the asset decumulation decision during retirement (thus discouraging narrow choice bracketing), though this treatment could in principle also be applied in non-hypothetical choice settings.

Our first main finding is that increasing the complexity of the annuity decision reduces people's ability to value the annuity. This decreased ability manifests itself as an increase in the divergence of people's sell and buy prices for a marginal change in annuitization. When the annuity decision becomes more complex, people tend to become more reluctant to buy or sell annuities, meaning they need greater inducements (lower buy or higher sell prices) to do so. Brown et al. (2017) document that a reluctance to trade annuities, as measured by the sell-buy price spread, is strongly negatively associated with cognitive ability, but of course, cognitive ability is not randomly assigned. In our setting, we experimentally vary the complexity of the annuitization decision to obtain the first causal evidence that more complex annuitization decisions reduce people's ability to place a value on an annuity, as measured by the sell-buy spread. Hence, the observed low level of annuity holdings can be traced, at least in part, to the cognitive challenges of the complex task of valuing an annuity.

The second finding is that inducing people to think jointly about annuitization and how to draw down assets during retirement increases their ability to place a value on an annuity. We experimentally induce respondents to think about these decisions jointly by exposing them to a "consequence message" which explains the result of spending down assets more slowly or more rapidly during retirement. Respondents who think about this asset decumulation decision have a smaller sell-buy spread for annuities than do respondents not exposed to the consequence message. This finding suggests that narrow choice bracketing, which the consequence message counteracts, is one behavioral mechanism impeding people from placing a rational value on annuities.

Our results on the roles of complexity and cognitive ability offer relatively little scope for interventions to improve the quality of people's annuitization decisions. Cognitive ability for any given person is relatively immutable, as is the complexity of the annuitization decision. While this complexity can be somewhat diminished by presenting the annuity information more transparently, most of the complexity stems from having to consider how the annuity would alter consumption streams in different states of the world, which is an inherently complex task. In contrast, our finding on the role of narrow choice bracketing does offer scope for interventions to improve people's decision-making about annuities. In particular, people provide more rational annuity valuations if they first consider the question of how to spend down non-annuitized wealth during retirement. We therefore conclude that annuitization decisions can be improved by inducing people to jointly consider annuitization and spending down non-annuitized wealth.

Although our experimental setting is that of a hypothetical person facing an annuity decision, we believe our results inform understanding of an important set of nearly universal decisions. It is comforting that the distribution of buy-sell spreads found using these vignettes is similar to the distribution found in earlier research in which individuals were making hypothetical decisions for themselves (Brown et al., 2017). By using Social Security as our context, we are confident that the lifelong income feature of Social Security is widely understood. We therefore believe that these results potentially generalize to any situation in which an individual must place an implicit value on a stream of annuity income, including whether to claim Social Security benefits immediately upon retirement or to delay claiming, whether to accept a lump sum payment in lieu of an annuity from an employer's defined benefit pension plan, or whether to annuitize assets in a defined contribution plan. We think it is plausible that the behavioral mechanisms that drive the results in our setting would also operate in other markets, such as those for stocks, options, and insurance, but whether this is indeed the case should be based on research in those markets rather than on the extrapolation of our results.

Our results do not explain why average valuations are below actuarially fair levels, and thus our results should not be interpreted as fully explaining the annuity puzzle. Indeed, we do not believe that complexity and narrow choice bracketing are the only reasons that individuals are reluctant to annuitize. Nevertheless, our paper adds to the evidence that behavioral factors influence annuitization decisions, and it also provides causal evidence on two specific mechanisms: narrow choice bracketing and cognitive limitations to dealing with complex decisions. Naturally, our evidence on these two behavioral impediments to valuing annuities does not preclude other mechanisms (c.f., Brown 2009). One avenue for future investigation will be to quantify the welfare effects of behavioral deviations from rational decision-making in the context of annuitization decisions.

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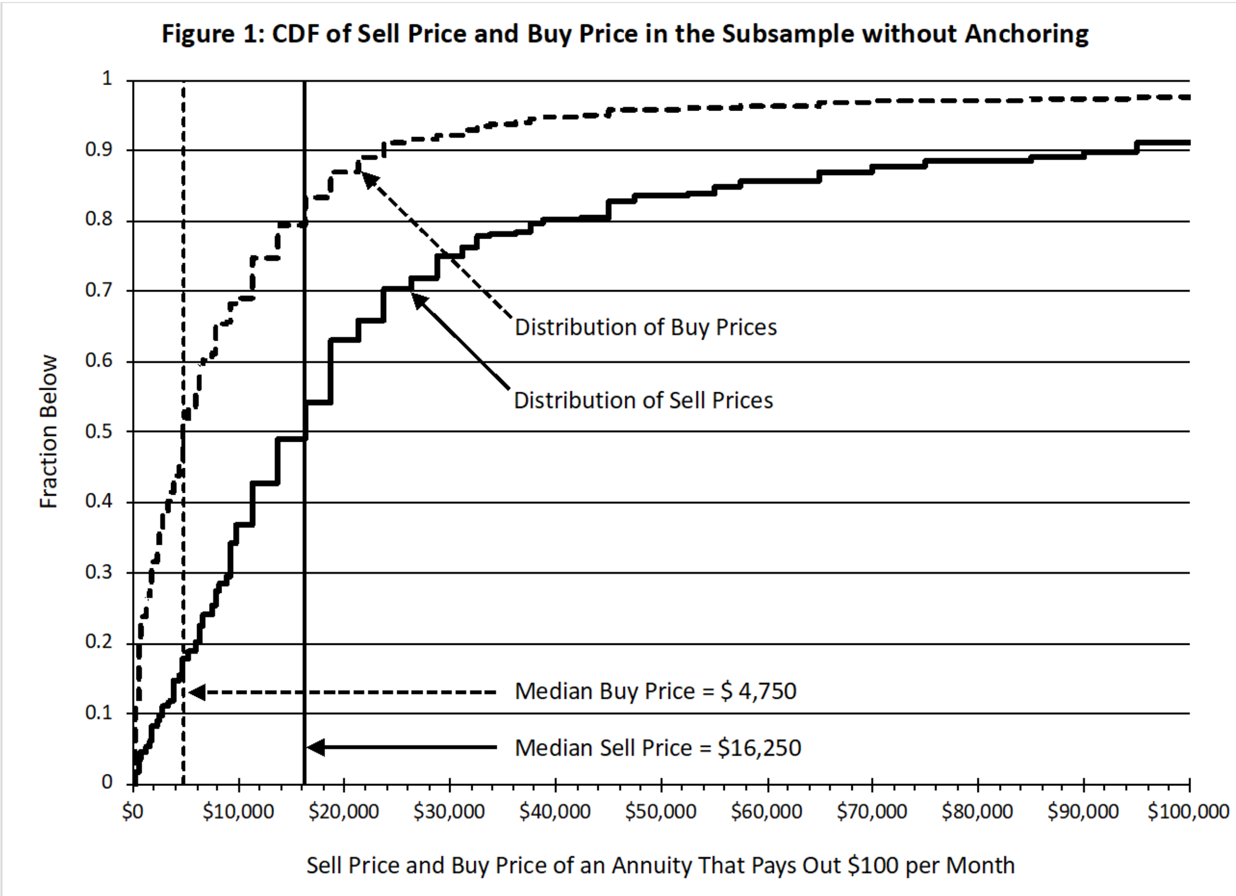
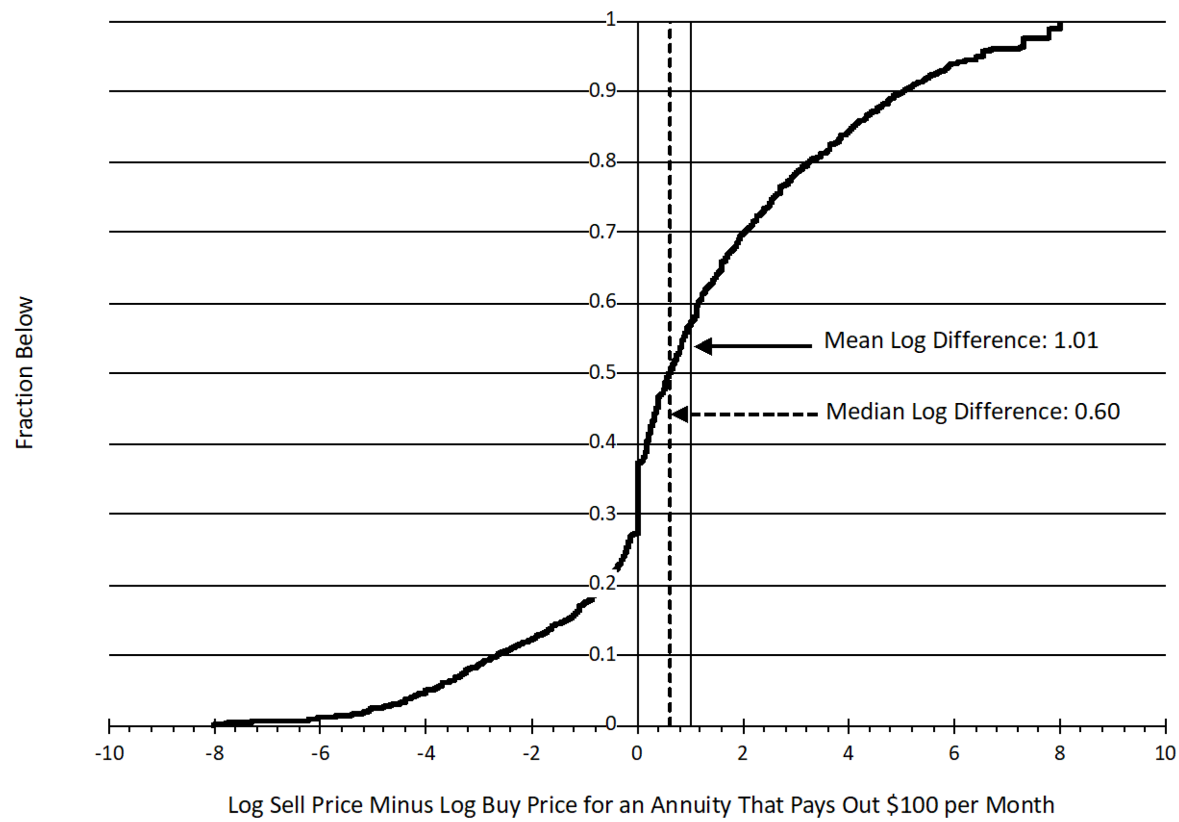
Figures and Tables



Note: This figure plots the cumulative distribution function (CDF) of the sell and the buy price for a real annuity that pays out $100 a month. The sell prices are plotted for the 2,009 observations in the baseline sample for which the sell question was asked first. The buy prices are plotted for the remaining 2,015 observations in the baseline sample, i.e., those for which the buy question was asked first. This avoids the influence of anchoring on a previously asked valuation question.

Figure 2: CDF of Log Sell Price Minus Log Buy Price



Note: This figure plots the cumulative distribution function (CDF) of the difference for each respondent between the log sell price and the log buy price for a real annuity that pays out $100 per month. This difference is plotted for all 4,060 respondents in the baseline sample.

Table 1: Experimental Design

	Consequence Message Treatment	
Complexity Treatment	*No consequence message*	*Consequence message*
No added complexity	Vignette 1	Consequence message + Vignette 1
Complexity: Wide age range	Vignette 2	Consequence message + Vignette 2
Complexity: Added information	Vignette 3	Consequence message + Vignette 3

Note: This table describes the 3x2 (vignette times consequence message) design of the experiment. Online Appendix Table A2 reproduces the exact text of the three vignettes and of the consequence message.

Online Appendix for:

Behavioral Impediments to Valuing Annuities: Complexity and Choice Bracketing

Jeffrey R. Brown, Arie Kapteyn, Erzo F.P. Luttmer,
Olivia S. Mitchell, and Anya Samek

Discussion of Robustness

Online Appendix Table A8 examines the robustness of the two primary treatments to different measures of cognition, to different ways of selecting the sample, to different sets of controls, and to transformations of the outcome variable. The first row reproduces our baseline specification from Column 1 of Table 3. Subsequent rows provide estimates on the two main treatments in specifications identical to the baseline specification except for the change noted in the row heading.

In Panel A, we examine robustness of our results using different measures of cognition because cognition is a very strong predictor of the spread, and also because we saw in Online Appendix Table A3 that the cognition index is marginally significantly higher for those who received the complexity treatment than for those who did not. Rows (2) and (3) show that the point estimates and standard errors are not at all sensitive to the details of the construction of the cognition index: it does not matter whether we control for cognition by using the first principal component of the five available cognition measures, taking a simple average of these five measures, or entering all five measures separately. However, it is important for the significance of complexity treatment that we exploit information from all the cognition tests. If we control only for financial literacy, the point estimate on the complexity treatment declines moderately (by about a fifth) but loses statistical significance. If we control only for the two numeracy measures or the two verbal measures, the point estimate on the complexity treatment declines somewhat (by less than a fifth) but becomes only marginally statistically significant. In contrast, the point estimate on the consequence message is very stable, retaining statistical significance in all three specifications that use a subset of the cognition measures. In the final row of Panel A, we add nine additional controls for three types of cognitive mistakes, self-rated and objective knowledge about Social Security, confidence in Social Security, experience with certain financial assets, and ability and knowledge in retirement planning. The additional controls do not meaningfully change the estimates of the two key experimental treatment effects.

Panel B examines robustness to different sample definitions. Row (8) includes observations with missing demographic information, Row (9) includes observations with missing cognition data, Row (10) includes observations with any missing information (demographic or cognition), and Row (11) excludes the oversamples of Native Americans and Los Angeles county residents. We include observations with missing values in the regression by dummying out missing values.

While the coefficient estimate of the complexity treatment is reasonably stable, it becomes only marginally significant once observations with missing cognition data are included or the oversample is excluded. The estimate of the treatment effect of the consequence message remains significant in all specifications of Panel B. Next, Panel C investigates robustness to excluding various controls. Given the earlier finding that cognition is not quite balanced across complexity treatments, it is not surprising that the complexity treatment is sensitive to having cognition controls included. Excluding the controls for the secondary experimental manipulations makes the complexity treatment only marginally significant. The four remaining estimates of Panel C are not sensitive in magnitude or significance to the exclusion of controls.

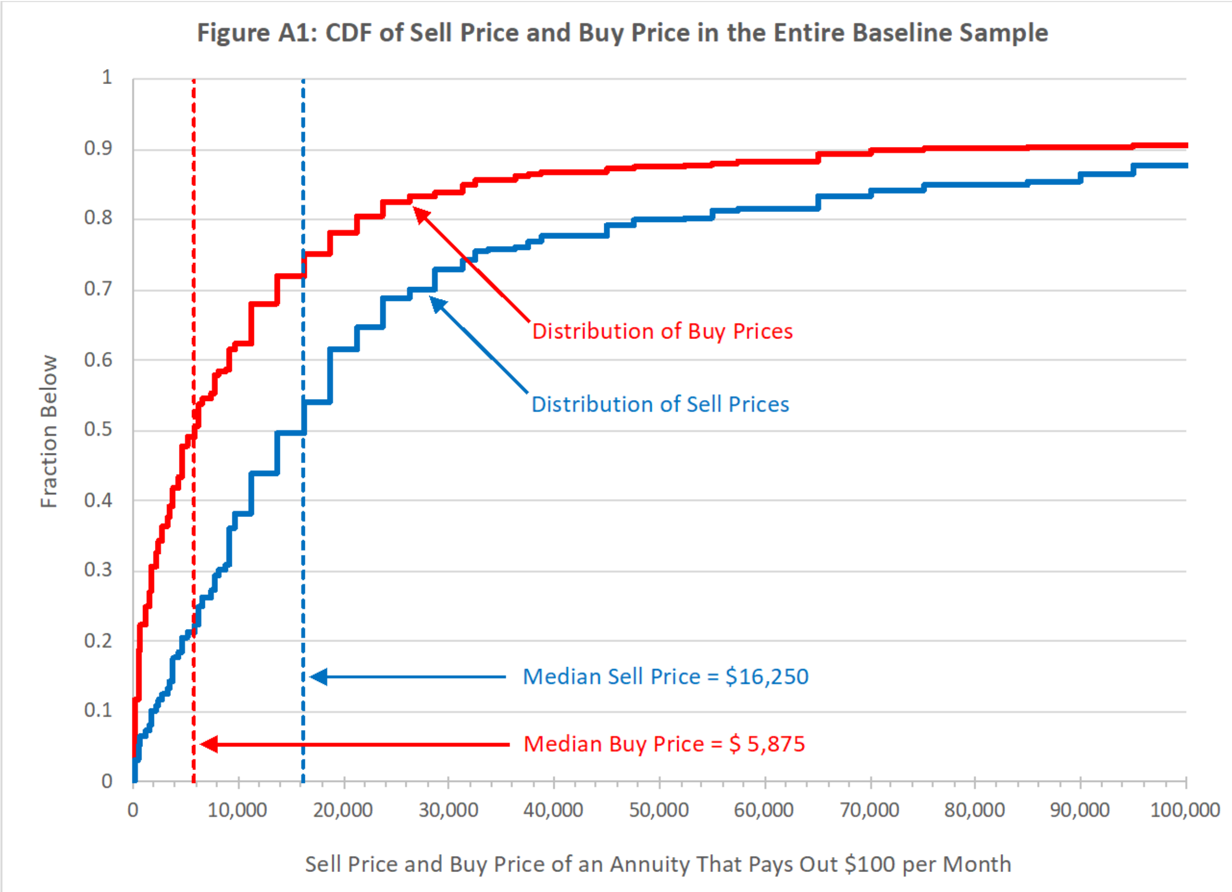
Our module tells the respondent that the vignette person will have saved \$100,000 for retirement when making the annuity decision. Hence, unless there are other sources of savings, the vignette person cannot logically pay more than \$100,000 for an annuity. This implies that there is an implicit topcode of \$100,000 on the buy valuations, though respondents are permitted to give a buy recommendation at a price in excess of \$100,000, and 9% of them do so. Nevertheless, we want to be sure that this implicit topcode does not drive key results. More generally, it is useful to know that the results do not hinge on a few respondents with very high buy or sell valuations. In the next specification check, therefore, we topcode all buy and all sell valuations at \$100,000. Row (15) of Panel D shows that the main results are not sensitive in terms of economic magnitude or statistical significance to such topcoding. Similarly, Row (16) shows that the results are not sensitive to topcoding the spread itself at the 90^{th} percentile, rather than topcoding the underlying sell or buy valuations. Row (17) shows that bottomcoding the buy and sell valuations at \$1000 each results in somewhat smaller estimates that are significant at the 10% level. Apparently, the low valuations given by some respondents do contribute to the significance of our treatment effects.

Our finding in Table 4 that the treatment effects do not meaningfully vary by the level of Social Security benefits may have already alleviated the concern that our estimates might be due to the fact that a \$100 change in monthly Social Security benefits is not literally a marginal change. Another way to address this concern is to not count small spreads as deviations from rational behavior, which could arise when a \$100 change is insufficiently marginal. In Row 18, we do this by setting any spreads less than 0.50 log units equal to zero, and we find that the estimated treatment effects are essentially unaffected.

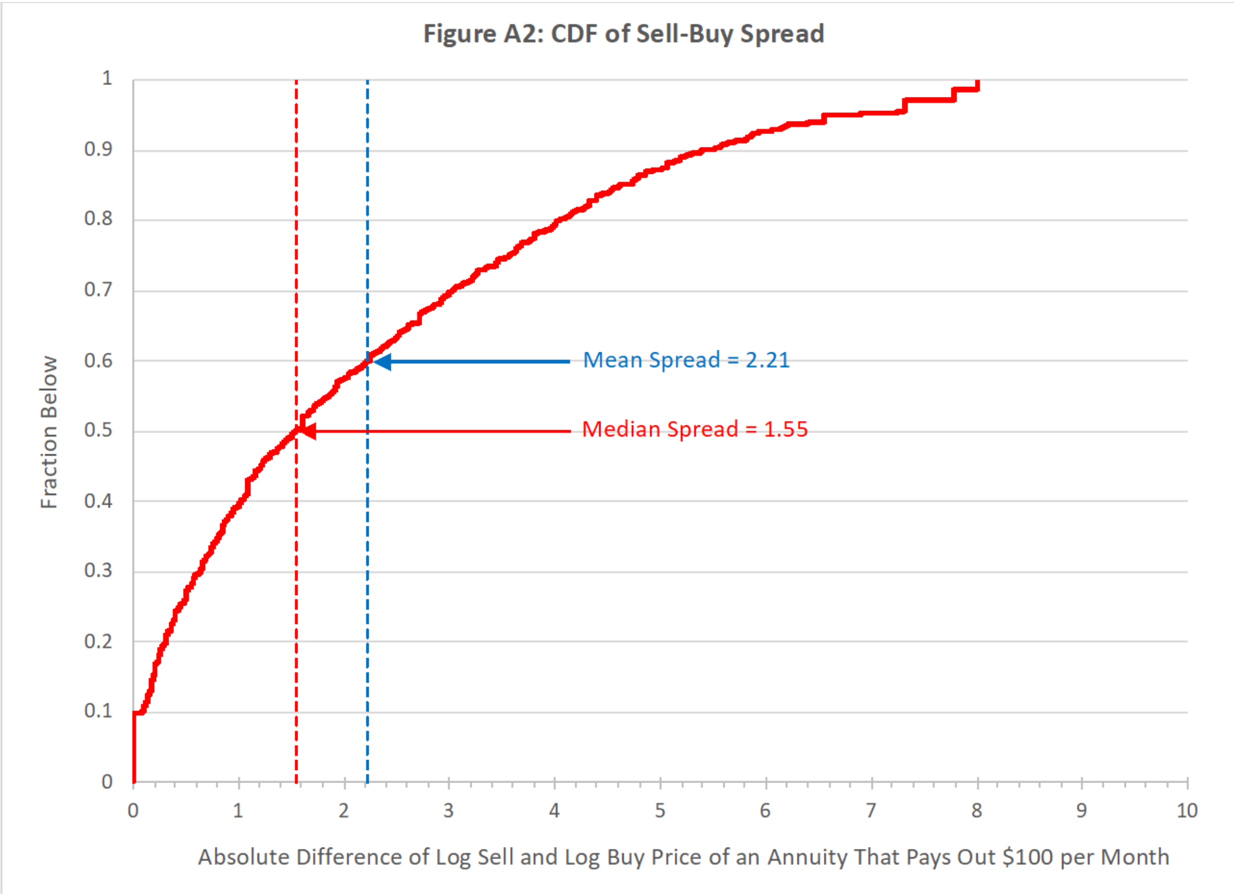
We defined the spread as strictly positive both when the sell price is larger than the buy price and vice versa. We do this because any difference is a deviation from rationality for a marginal change in Social Security benefits. However, if our treatment effects operate by reducing individuals' reluctance to trade when their understanding increases (due to the consequence message) or decreases (due to increased complexity), then they should operate predominantly on people who are reluctant to trade, i.e., whose sell price exceeds their buy price. We test this prediction in Row (19) by having a positive spread only for those who are reluctant to trade and setting the spread to zero for everyone else. Row (19) confirms that the treatment effects operate entirely on those who had sell prices exceeding buy prices, which is consistent with people's reluctance to trade being affected by the degree of their understanding. Reluctance to trade (so having a sell price exceeding the buy price) is a sensible heuristic in response to difficulty in valuing a product because it protects one from being taken advantage of by a better-informed party. In contrast, having a buy price exceeding the sell price could cause one to lose money in trading if the product is tradable (unlike the Social Security annuity). Thus, we would expect this latter group to be more disadvantaged and to score lower on measures of cognition or financial ability/experience. Online Appendix Table A10 indicates this is indeed the case.

Overall, Online Appendix Table A8 shows that the results on the complexity treatment are reasonably stable in magnitude but somewhat sensitive in terms of statistical significance, which falls to marginal in 7 of the 18 specification checks and disappears in 2 of them. This sensitivity can be traced largely to the fact that the cognition control, a very strong predictor of the spread, was not balanced across the complexity treatment and control conditions. Hence, having good controls for cognition is important for the results of the complexity treatment. By contrast, the consequence message treatment is extremely robust and remains significant at the 5% level everywhere, except for one specification where it is significant at the 10% level.

Online Appendix Figures and Tables



Note: This figure plots the cumulative distribution function (CDF) of the sell and the buy price for a real annuity that pays out $100 a month. The sell prices are plotted for all 4,060 observations in the baseline sample, unlike Figure 1, where it was plotted only for those observations where the sell question was asked first. Similarly, the buy prices are plotted all 4,060 observations in the baseline sample. Unlike Figure 1, some of the buy and sell prices may be influenced by anchoring on a previously asked sell or buy valuation.



Note: This figure plots the cumulative distribution function (CDF) of the sell-buy spread, which is the absolute value of the difference for each respondent between the log sell price and the log buy price for a real annuity that pays out $100 per month. This absolute difference is plotted for all 4,060 respondents in the baseline sample.

Appendix Table A2: Text of the Vignettes and the Consequence Message

Panel A: Vignette Text

Complexity	**Vignettes**
No added complexity (Vignette 1)	"Mr. Jones is a single, 60-year old man with no children. He will retire and claim his Social Security benefits at 65. When he retires, he will have $100,000 saved for his retirement, and he will receive $[*SSB*] in monthly Social Security benefits. <u>Based on his current health and family history, doctors have told Mr. Jones that he will almost certainly be alive at age 75 but almost certainly will not live beyond age 85."</u>
Complexity: Wide age range (Vignette 2)	"Mr. Jones is a single, 60-year old man with no children. He will retire and claim his Social Security benefits at 65. When he retires, he expects to have $100,000 saved for his retirement, and expects to receive $[*SSB*] in monthly Social Security benefits. <u>Based on his current health and family history, doctors have told Mr. Jones that he has an 80% chance of being alive at age 70, a 50% chance of being alive at age 80, a 20% chance of being alive at age 90, and a 10% chance of being alive at age 95."</u>
Complexity: Added information (Vignette 3)	"Mr. Jones is a single, 60-year old man with no children. <u>Social Security rules state that you need at least 40 credits, or 10 years of work, to qualify for Social Security – and Mr. Jones qualifies since he has worked for 30 years. Since Mr. Jones was born in 1956, his full retirement age is 66 years and 4 months, but he is eligible to start claiming starting at 62.</u> He will retire and claim his Social Security benefits at 65. When he retires, he will have $100,000 saved for his retirement, and he will receive $[*SSB*] in monthly Social Security benefits. <u>Based on his current health and family history, doctors have told Mr. Jones that he will almost certainly be alive at age 75 but almost certainly will not live beyond age 85.</u>"

Panel B: Text of the Consequence Message

Consequence Message Preceding Vignette
"First, we will show you a story about Mrs. Smith. Please pay close attention to the story, because at the end we will ask you two questions about the story. You will receive an additional \$1 for each question you answer correctly. Mrs. Smith is a single, 65-year old woman with no children, and she is as healthy as the typical 65-year old woman. She just retired and receives her monthly Social Security check. She is talking with her financial adviser on how to spend her substantial savings in retirement. Her advisor explains that she could decide to spend down her savings relatively quickly. In this case, she will be more likely to be able to enjoy her money during her lifetime. But she also runs a risk of running out of money while alive and having to cut back on her spending as a result. Her advisor explains that she could also decide to spend down her savings relatively slowly. In this case, she will be less likely to run out of money. But now she runs a risk of not getting to enjoy all her money during her lifetime." *This story is followed by two 4-option multiple-choice questions to induce the respondent to pay attention to the story. One question asks about the benefits and drawbacks of spending down wealth quickly while the other asks about the benefits and drawbacks of spending down wealth slowly. See the Survey Instrument in the Online Appendix for the exact wording of these questions.* *The screen with the two test questions is followed by an advice question where the respondent is asked to advise the vignette person how quickly to spend down her wealth. This question is asked to induce the respondent to think about the problem of how to spend down wealth during retirement. See the Survey Instrument in the Online Appendix for the exact wording of this question.*

Note: Panel A provides the text of each of the 3 vignettes, with underlining added to emphasize the differences between the vignettes. Panel B provides the text of the consequence message. Additionally, we include experimental variation in the name and gender of the vignette person: Mr./Mrs., Smith/Jones, and the order of the last two paragraphs of the consequence message (spending quickly first versus spending slowly first) are independently randomized across respondents. A different name and gender was used in the consequence message from that in the vignette. Finally, there is experimental variation in the monthly Social Security benefit value (*SSB* = \$800, \$1,200, \$1,600, or \$2,000).

Survey Instrument

Notes on the Survey Instrument

- Everyone sees both EV-Sell and EV-Buy questions in the same survey
- Randomizations are all orthogonal and across subjects. All options within each randomization are selected with equal probability.
  - The main manipulations consist of a 3x2 design: three vignettes that vary the complexity, and whether or not the consequence message (see Table 1) is shown.
  - The secondary manipulations consist of a 4x3x4x2x2 design that is orthogonal to the main manipulations.
    - There are four different versions for name and gender of the vignette person to be advised on annuity decisions. This name and gender is randomized to one of the following: Mr. Jones, Mrs. Jones, Mr. Smith, or Mrs. Smith. The person featured in the consequence message has the opposite name and gender from the vignette person in the annuity valuation questions.
    - The starting value for lump-sum amounts is randomized at $10,000, $20,000, or $30,000. For any given respondent, the same starting value is used for the EV-Sell and EV-Buy questions.
    - The baseline monthly Social Security Benefit, $*SSB*, is randomized to $800, $1200, $1600, or $2000.
    - Whether the choice option with the lump-sum amount ($*LS*) is shown first or second is randomized. For each respondent, this is randomized once and the same order is used for EV-Buy and EV-Sell.
    - Whether EV-Buy is asked before or after EV-Sell is randomized.
    - For the consequence message, it is randomized whether the paragraph on the benefits and drawbacks of spending down retirement wealth quickly is shown before or after the paragraph on the benefits and drawbacks of spending down retirement slowly.
- Text in Arial are instructions to the programmers while text in Times New Roman is shown to respondents. Text in *italicized Arial* denote variables and the respondents see the value contained by that variable.
- Text between square brackets is replaced based on the randomization.
- Page breaks are shown by horizontal lines.

Survey Instrument Text and Instructions for Understanding America Study #49

Invitation to the survey. When panelists logged on to their UAS account, they saw the following message. If they clicked on the link in this message, they entered into UAS49.

This survey asks you to make decisions as if you were giving someone financial advice. You will then play an insurance game. You will earn $10 for completion, and have a chance to win more.

In the following survey we want you to play the role of financial advisor. We will show you some examples of persons who have to make a decision about money and we will ask you to help them make the decision.

Consequence message treatment: Advisor explanations. Only people in the consequence message treatment get this screen and the following two screens. Respondents are randomized to see one of four vignette person names: Mr. Jones, Mrs. Jones, Mr. Smith, or Mrs. Smith. The pronouns [he/she] and [his/her] should match the gender of the consequence-message vignette person. Similarly, the word [man/women] should match the gender of the vignette person.

First, we will show you a story about [Mr. Jones/Mrs. Jones/Mr. Smith/Mrs. Smith]. Please pay close attention to the story, because at the end we will ask you two questions about the story. You will receive an additional $1 for each question you answer correctly.

[Mr. Jones/Mrs. Jones/Mr. Smith/Mrs. Smith] is a single, 65-year old [man/woman] with no children, and [he/she] is as healthy as the typical 65-year old [man/woman]. [He/She] just retired and receives [his/her] monthly Social Security check. [He/She] is talking with [his/her] financial adviser on how to spend [his/her] substantial savings in retirement.

Randomize whether either block 1 or block 2 is shown.

Block 1:

[His/Her] advisor explains that [he/she] could decide to spend down [his/her] savings relatively quickly. In this case, [he/she] will be more likely to be able to enjoy [his/her] money during [his/her] lifetime. But [he/she] also runs a risk of running out of money while alive and having to cut back on [his/her] spending as a result.

[His/Her] advisor explains that [he/she] could also decide to spend down [his/her] savings relatively slowly. In this case, [he/she] will be less likely to run out of money. But now [he/she] runs a risk of not getting to enjoy all [his/her] money during [his/her] lifetime.

Block 2:

[His/Her] advisor explains that [he/she] could decide to spend down [his/her] savings relatively slowly. In this case, [he/she] will be less likely to run out of money. But now [he/she] runs a risk of not getting to enjoy all [his/her] money during [his/her] lifetime.

[His/Her] advisor explains that [he/she] could also decide to spend down [his/her] savings relatively quickly. In this case, [he/she] will be more likely to be able to enjoy [his/her] money during [his/her] lifetime. But [he/she] also runs a risk of running out of money while alive and having to cut back on [his/her] spending as a result.

Consequence message treatment: Test questions 1 and 2.

Remember, you will earn an extra $1 for each question you answer correctly on this page.

The financial advisor tells [Mr. Jones/Mrs. Jones/Mr. Smith/Mrs. Smith] that spending down [his/her] savings more quickly:

- ○ Increases the risk that [he/she] does not get to enjoy all of [his/her] money during [his/her] lifetime.
- ○ Decreases the risk that [he/she] runs out of money during [his/her] lifetime.
- ○ Increases the risk that [he/she] runs out of money during [his/her] lifetime.
- ○ None of the above.

The financial advisor tells [Mr. Jones/Mrs. Jones/Mr. Smith/Mrs. Smith] that spending down [his/her] savings more slowly:

- ○ Increases the risk that [he/she] runs out of money during [his/her] lifetime.
- ○ Decreases the risk that [he/she] does not get to enjoy all of [his/her] money during [his/her] lifetime.
- ○ Increases the risk that [he/she] does not get to enjoy all of [his/her] money during [his/her] lifetime.
- ○ None of the above.

If a question is not answered, prompt once to answer the question, but move to next screen if respondent still leaves the question blank.

Consequence message treatment: Question to induce respondent to think about how to draw down savings during retirement

Now we are going to switch to a different type of question. Instead of asking you about facts, we are going to ask your advice about what decisions [Mr. Jones/Mrs. Jones/Mr. Smith/Mrs. Smith] should make. Unlike the previous questions, there is no right or wrong answer; we just want to know what you think.

Recall [Mr. Jones/Mrs. Jones/Mr. Smith/Mrs. Smith], the retired, single, 65-year old [man/woman] with no children. [He/She] is as healthy as the typical 65-year old [man/woman].

How quickly should [he/she] spend [his/her] savings?

- ○ Spend [his/her] savings by age 70. [he/she] can spend a <u>large</u> amount each year, but [he/she] will have to cut back if [he/she] lives beyond 70. If [he/she] dies before 70, [he/she] will not have enjoyed all of [his/her] savings.
- ○ Spend [his/her] savings by age 80. [he/she] can spend a <u>moderate</u> amount each year, but [he/she] will have to cut back if [he/she] lives beyond 80. If [he/she] dies before 80, [he/she] will not have enjoyed all of [his/her] savings.
- ○ Spend [his/her] savings by age 90. [he/she] can spend a <u>modest</u> amount each year, but [he/she] will have to cut back if [he/she] lives beyond 90. If [he/she] dies before 90, [he/she] will not have enjoyed all of [his/her] savings.
- ○ Spend [his/her] savings by age 100. [he/she] can spend a <u>small</u> amount each year, and [he/she] will have to cut back if [he/she] lives beyond 100. If [he/she] dies before 100, [he/she] will not have enjoyed all of [his/her] savings.

This is the end of the screens shown for the consequence message.

Complexity Treatment. Respondents are randomized to one of the three vignettes shown below: Vignette 1 (corresponding to treatment "No added complexity"), Vignette 2 (corresponding to treatment "Complexity: Wide age range") or Vignette 3 (corresponding to treatment "Complexity: Added information"). The name in the complexity vignette below is different than the name shown in the consequence-message vignette above. Similarly, the gender of the person in the complexity vignette is different from the gender of the person in the consequence-message vignette. The scalar variable *SSB* is randomized to 800, 1200, 1600, or 2000.

In the next few questions, we are going to ask you to give some advice to [Mrs. Smith/Mr. Smith/Mrs. Jones/Ms. Jones] for when [she/he] retires. You will be happy to know that whatever advice you give [Mrs. Smith/Mr. Smith/Mrs. Jones/Ms. Jones], [she/he] will not owe any taxes on the amounts shown and [her/his] benefits will keep up with inflation. There is no right or wrong answer; we just want to know what you think.

Vignette 1 ("No added complexity"):
[Mrs. Smith/Mr. Smith/Mrs. Jones/Ms. Jones] is a single, 60-year old [woman/man] with no children. [She/He] will retire and claim [her/his] Social Security benefits at 65. When [she/he] retires, [she/he] will have $100,000 saved for [her/his] retirement, and [she/he] will receive $[*SSB*] in monthly Social Security benefits. Based on [her/his] current health and family history, doctors have told Mr. Smith that [she/he] will almost certainly be alive at age 75 but almost certainly will not live beyond age 85.

Vignette 2 ("Complexity: Wide age range"):
[Mrs. Smith/Mr. Smith/Mrs. Jones/Ms. Jones] is a single, 60-year old [woman/man] with no children. [She/He] will retire and claim [her/his] Social Security benefits at 65. When [she/he] retires, [she/he] expects to have $100,000 saved for [her/his] retirement, and expects to receive $[*SSB*] in monthly Social Security benefits. Based on [her/his] current health and family history, doctors have told Mrs. Jones that [she/he] has an 80% chance of being alive at age 70, a 50% chance of being alive at age 80, a 20% chance of being alive at age 90, and a 10% chance of being alive at age 95.

Vignette 3 ("Complexity: Added information"):
[Mrs. Smith/Mr. Smith/Mrs. Jones/Ms. Jones] is a single, 60-year old [woman/man] with no children. Social Security rules state that you need at least 40 credits, or 10 years of work, to qualify for Social Security – and [Mrs. Smith/Mr. Smith/Mrs. Jones/Ms. Jones] qualifies since [she/he] has worked for 30 years. Since [Mrs. Smith/Mr. Smith/Mrs. Jones/Ms. Jones] was born in 1956, [her/his] full retirement age is 66 years and 4 months, but [she/he] is eligible to start claiming starting at 62. [She/He] will retire and claim [her/his] Social Security benefits at 65. When [she/he] retires, [she/he] will have $100,000 saved for [her/his] retirement, and [she/he] will receive $[*SSB*] in monthly Social Security benefits. Based on [her/his] current health and family history, doctors have told [Mrs. Smith/Mr. Smith/ Mrs. Jones/Ms. Jones] that [she/he] will almost certainly be alive at age 75 but almost certainly will not live beyond age 85.

Initializations for EV-Sell and EV-Buy. Whether the EV-Buy questions or the EV-Sell questions are shown first is randomized.
The scalar variable *LS_STARTVALUE* is randomized to 1, 2, or 3.
The values in the matrices *LS_LOW*, *LS_MED*, and *LS_HIGH* are listed at the very end of this document.

Initialization of the matrix *LS_AMT*:

If *LS_STARTVALUE* ==1

Set the 16x5 matrix *LS_AMT=LS_LOW*

Elseif *LS_STARTVALUE* ==3

Set the 16x5 matrix *LS_AMT=LS_HIGH*

Else

Set the 16x5 matrix *LS_AMT=LS_MED*

Endif

EV-Sell Questions

Set the scalar *j*=1

Set the scalar *ROW*=1

For *j*=1 to 5

This is the start of the loop for EV-Sell questions.

The text for each iteration of the loop is shown on a new screen.

If *j* = 1, Display:

If EV-Sell is asked before EV-Buy:

Suppose that the Social Security Administration is considering a new policy that gives people more choice in how they want to receive their benefits. As part of this policy, [Mrs. Smith/Mr. Smith/Mrs. Jones/Ms. Jones] is asked to make a choice between two money amounts.

What should [Mrs. Smith/Mr. Smith/Mrs. Jones/Ms. Jones] do?

Else

Now consider a different way of giving people more choice in how they want to receive their benefits. As part of this policy, [Mrs. Smith/Mr. Smith/Mrs. Jones/Ms. Jones] is asked to make a choice between two money amounts.

Endif

Else, Display:

Now we ask you the same question but with a different amount for the one-time payment.

What should [Mrs. Smith/Mr. Smith/Mrs. Jones/Ms. Jones] do?

Endif

The order of the two options shown is randomized once for each respondent. The order remains the same for the EV-Sell and EV-Buy questions shown to a given respondent. The third appearance of the word "receive" (i.e., when it appears after the underlined word "and") in the text below is shown in bold if and only if EV-Sell is asked after EV-Buy.

- Receive a Social Security benefit of $[*SSB*+100] per month starting at age 65.
- Receive [her/his] expected Social Security benefit of $[*SSB*] per month and receive a one-time payment of $[*LS_AMT*[*ROW,j*]] from Social Security at age 65.

If the respondent does not select any option, the respondent is prompted once to answer this question. If the respondent still doesn't give an answer, the variable *j* is set to 5, so that we get skipped out of this loop.

If Respondent selects the option that does **not** contain the one-time payment:

Set *ROW*=*ROW*+2^(4-*j*)]

Note: this will increase the size of one-time payment in the next iteration, so it makes the option that does not contain the one-time payment less attractive.

Endif

Set *j*=*j*+1

This is the end of the loop for the EV-Buy questions.

Vignette reminder. The complexity vignette is shown again, but now preceded by the word "Remember, ".

Vignette 1 ("No added complexity"):
Remember, [Mrs. Smith/Mr. Smith/Mrs. Jones/Ms. Jones] is a single, 60-year old [woman/man] with no children. [She/He] will retire and claim [her/his] Social Security benefits at 65. When [she/he] retires, [she/he] will have $100,000 saved for [her/his] retirement, and [she/he] will receive $[*SSB*] in monthly Social Security benefits. Based on [her/his] current health and family history, doctors have told Mr. Smith that [she/he] will almost certainly be alive at age 75 but almost certainly will not live beyond age 85.

Vignette 2 ("Complexity: Wide age range"):
Remember, [Mrs. Smith/Mr. Smith/Mrs. Jones/Ms. Jones] is a single, 60-year old [woman/man] with no children. [She/He] will retire and claim [her/his] Social Security benefits at 65. When [she/he] retires, [she/he] expects to have $100,000 saved for [her/his] retirement, and expects to receive $[*SSB*] in monthly Social Security benefits. Based on [her/his] current health and family history, doctors have told Mrs. Jones that [she/he] has an 80% chance of being alive at age 70, a 50% chance of being alive at age 80, a 20% chance of being alive at age 90, and a 10% chance of being alive at age 95.

Vignette 3 ("Complexity: Added information"):
Remember, [Mrs. Smith/Mr. Smith/Mrs. Jones/Ms. Jones] is a single, 60-year old [woman/man] with no children. Social Security rules state that you need at least 40 credits, or 10 years of work, to qualify for Social Security – and [Mrs. Smith/Mr. Smith/Mrs. Jones/Ms. Jones] qualifies since [she/he] has worked for 30 years. Since [Mrs. Smith/Mr. Smith/Mrs. Jones/Ms. Jones] was born in 1956, [her/his] full retirement age is 66 years and 4 months, but [she/he] is eligible to start claiming starting at 62. [She/He] will retire and claim [her/his] Social Security benefits at 65. When [she/he] retires, [she/he] will have $100,000 saved for [her/his] retirement, and [she/he] will receive $[*SSB*] in monthly Social Security benefits. Based on [her/his] current health and family history, doctors have told [Mrs. Smith/Mr. Smith/ Mrs. Jones/Ms. Jones] that [she/he] will almost certainly be alive at age 75 but almost certainly will not live beyond age 85.

EV-Buy Questions

Set the scalar *j*=1

Set the scalar *ROW*=1

For *j*=1 to 5

This is the start of the loop for EV-Buy questions.

The text for each iteration of the loop is shown on a new screen.

If *j* = 1, Display:

If EV-Buy is asked before EV-Sell:

Suppose that the Social Security Administration is considering a new policy that gives people more choice in how they want to receive their benefits. As part of this policy, [Mrs. Smith/Mr. Smith/ Mrs. Jones/Ms. Jones] is asked to make a choice between two money amounts.

What should [Mrs. Smith/Mr. Smith/ Mrs. Jones/Ms. Jones] do?

Else

Now consider a different way of giving people more choice in how they want to receive their benefits. As part of this policy, [Mrs. Smith/Mr. Smith/ Mrs. Jones/Ms. Jones] is asked to make a choice between two money amounts.

Endif

Else, Display:

Now we ask you the same question but with a different amount for the one-time payment.

What should [Mrs. Smith/Mr. Smith/ Mrs. Jones/Ms. Jones] do?

Endif

The order of the two options shown is randomized once for each respondent. The order remains the same for the EV-Sell and EV-Buy questions shown to a given respondent. The word "payment" in the text below is shown bold if and only if EV-Buy is asked after EV-Sell.

- Receive a Social Security benefit of $[*SSB*-100] per month starting at age 65.
- Receive [her/his] expected Social Security benefit of $[*SSB*] per month <u>and</u> make a <u>one-time</u> payment of $$[*LS_AMT[ROW,j]*] to Social Security at age 65.

If the respondent does not select any option, the respondent is prompted once to answer this question. If the respondent still doesn't give an answer, the variable *j* is set to 5 so that we get skipped out of this loop.

If Respondent selects the option that **does** contain the one-time payment:

Set *ROW*=*ROW*+2^(4-*j*)]

Note: this will increase the size of one-time payment in the next iteration, so it makes this option with the payment less attractive.

Endif

Set *j*=*j*+1

This is the end of the loop for the EV-Buy questions

End of survey instrument for experiment on annuity valuations. The remainder of UAS49 consisted of approximately 24 screens with information and questions about insurance decisions that were collected for a different project.

The Values of the Matrices for the Lump-Sum Amounts

The following tables show lump-sum amounts for three different starting values: low, medium and high, which are randomized as mentioned above.

10,000	**4,000**	**2,000**	**1,000**	**500**	**Row 1**
				1,500	**Row 2**
			3,000	**2,500**	**Row 3**
				3,500	**Row 4**
		7,000	**5,500**	**4,750**	**Row 5**
				6,250	**Row 6**
			8,500	**7,750**	**Row 7**
				9,250	**Row 8**
	30,000	**20,000**	**15,000**	**12,500**	**Row 9**
				17,500	**Row 10**
			25,000	**22,500**	**Row 11**
				27,500	**Row 12**
		60,000	**40,000**	**35,000**	**Row 13**
				50,000	**Row 14**
			100,000	**80,000**	**Row 15**
				200,000	**Row 16**
Col. 1	**Col. 2**	**Col. 3**	**Col. 4**	**Col. 5**	

We put the values of this in the 16x5 matrix *LS_LOW*. The i^{th} row and j^{th} column of this matrix is denoted by *LS_LOW*[*i,j*]

20,000	4,000	2,000	1,000	500	Row 1
				1,500	Row 2
			3,000	2,500	Row 3
				3,500	Row 4
		10,000	7,000	5,500	Row 5
				8,500	Row 6
			15,000	12,500	Row 7
				17,500	Row 8
	60,000	30,000	25,000	22,500	Row 9
				27,500	Row 10
			40,000	35,000	Row 11
				50,000	Row 12
		100,000	80,000	70,000	Row 13
				90,000	Row 14
			200,000	150,000	Row 15
				500,000	Row 16
Col. 1	Col. 2	Col. 3	Col. 4	Col. 5	

We put the values of this in the 16x5 matrix *LS_MED*. The i^{th} row and j^{th} column of this matrix is denoted by *LS_MED*[*i,j*]

30,000	**10,000**	**4,000**	**2,000**	**1,000**	**Row 1**
				3,000	**Row 2**
			7,000	**5,500**	**Row 3**
				8,500	**Row 4**
		20,000	**15,000**	**12,500**	**Row 5**
				17,500	**Row 6**
			25,000	**22,500**	**Row 7**
				27,500	**Row 8**
	60,000	**40,000**	**35,000**	**32,500**	**Row 9**
				37,500	**Row 10**
			50,000	**45,000**	**Row 11**
				55,000	**Row 12**
		100,000	**80,000**	**70,000**	**Row 13**
				90,000	**Row 14**
			200,000	**150,000**	**Row 15**
				500,000	**Row 16**
Col. 1	**Col. 2**	**Col. 3**	**Col. 4**	**Col. 5**	

We put the values of this in the 16x5 matrix *LS_HIGH*. The i^{th} row and j^{th} column of this matrix is denoted by *LS_HIGH*[*i,j*]

Construction of the Cognition Index

The cognition index is the first principal component of the 5 scores of different tests administered at different times in the UAS: one score for financial literacy and four scores for four standard cognition tests.

Financial Literacy

The financial literacy score is calculated by standardizing the number of correct answers to the 14 financial literacy questions in UAS1. These questions are derived from Lusardi and Mitchell (2014). The 14 questions are:

1. Suppose you had $100 in a savings account and the interest rate was 2% per year. After 5 years, how much do you think you would have in the account if you left the money to grow: more than $102, exactly $102, less than $102?
   a. More than $102
   b. Exactly $102
   c. Less than $102
   d. I don't know

2. Suppose you had $100 in a savings account and the interest rate was 20% per year and you never withdraw money or interest payments. After 5 years, how much would you have on this account in total?
   a. More than $200
   b. Exactly $200
   c. Less than $200
   d. I don't know

3. Imagine that the interest rate on your savings account was 1% per year and inflation was 2% per year. After 1 year, would you be able to buy more than, exactly the same as, or less than today with the money in this account?
   a. More than today
   b. Exactly the same as today
   c. Less than today
   d. I don't know

4. Assume a friend inherits $10,000 today and his sibling inherits $10,000 but 3 years from now. Who is richer today because of the inheritance?
   a. My friend
   b. His sibling
   c. They are equally rich
   d. I don't know

5. Suppose that in the year 2020, your income has doubled and prices of all goods have doubled too. In 2020, will you be able to buy more, the same or less than today with your income?

   a. Buy more than today
   b. Buy the same as today
   c. Buy less than today
   d. I don't know

6. Which of the following statements describes the main function of the stock market?
   a. The stock market helps to predict stock earnings
   b. The stock market results in an increase in the price of stocks
   c. The stock market brings people who want to buy stocks together with those who want to sell stocks
   d. None of the above
   e. I don't know

7. Which of the following statements is correct?
   a. Once one invests in a mutual fund, one cannot withdraw money in the first year
   b. Mutual funds can invest in several assets, for example invest in both stocks and bonds
   c. Mutual funds pay a guaranteed rate of return which depends on their past performance
   d. None of the above
   e. I don't know

8. If the interest rates (rise/fall), what should happen to bond prices? **Respondents are randomly selected to be asked about rise or fall.*
   a. They should rise
   b. They should fall
   c. They should stay the same
   d. I don't know

9. Do you think the following statement is true? Buying a (single company stock/stock mutual fund) usually provides a safer return than a (single company/stock mutual fund). **Respondents are randomly selected to be asked about single company or stock market mutual fund.*
   a. True
   b. False
   c. Don't know

10. Do you think that the following statement is true or false? (Stocks/bonds) are normally riskier than (stocks/bonds). **Respondents are randomly selected to be asked about stocks or bonds.*
    a. True
    b. False
    c. Don't know

11. Considering a long period (for example 10 or 20 years), what normally gives the highest return?

    a. Savings accounts
    b. Bonds
    c. Stocks
    d. I don't know

12. Normally, which asset described below displays the highest fluctuations over time: savings accounts, bonds or stocks?
    a. Savings accounts
    b. Bonds
    c. Stocks
    d. I don't know

13. When an investor spreads his or her money among different assets, does the risk of losing a lot of money increase, decrease, or stay the same?
    a. Increase
    b. Decrease
    c. Stay the same
    d. I don't know

14. Is the following statement true? Housing prices in the US can never go down.
    a. True
    b. False
    c. I don't know

Numeracy

Numeracy consists of 8 items taken from Weller et al. (2013). The test scores for this sub-test were derived within the UAS using a two-parameter logistic Item Response Theory (IRT) model. The test was administered in UAS1. The resulting score is standardized.

1. Imagine that we roll a fair, six-sided die 1,000 times. Out of 1,000 rolls, how many times do you think the die would come up as an even number?

   [Slider from 0 to 1,000]

2. In the BIG BUCKS LOTTERY, the chances of winning a $10.00 prize are 1%. What is your best guess about how many people would win a $10.00 prize if 1,000 people each buy a single ticket from BIG BUCKS?

   [Slider from 0 to 1,000]

3. In the ACME PUBLISHING SWEEPSTAKES, the chance of winning a car is 1 in 1,000. What percent of tickets of ACME PUBLISHING SWEEPSTAKES win a car?

   [Slider from 0 to 100]

4. If the chance of getting a disease is 10%, how many people would be expected to get the disease out of 1,000?

   [Slider from 0 to 1,000]

5. If the chance of getting a disease if 20 out of 100, this would be the same as having how much of a percent chance of getting the disease?

   [Slider from 0 to 100]

6. Suppose you have a close friend who has a lump in her breast and must have a mammogram. Of 100 women like her, 10 of them actually have a malignant tumor and 90 of them do not. Of the 10 women who actually have a tumor, the mammogram indicates correctly that 9 of them have a tumor and indicates incorrectly that 1 of them does not have a tumor. OF the 90 women who do not have a tumor, the mammogram indicates correctly that 80 of them do not have a tumor and indicates incorrectly that 10 of them do have a tumor. The table below summarizes all of this information.

	Tested positive	Tested negative	Totals
Actually has a tumor	9	1	10
Does not have a tumor	10	80	90
Totals	19	81	100

   Imagine that your friend tests positive (as if she had a tumor), what is the likelihood that she actually has a tumor?

   [Randomized between: (i) Answer box accepting numerics with decimals and (ii) answer box accepting answers in the format “<number> out of < number>”]

7. A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball. How much does the ball cost?

   [Answer box accepting numerics with decimals]

8. In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half of the lake?

   [Answer box accepting numerics with decimals]

Number Series, Picture Vocabulary and Verbal Analogies

Each of the three sub-tests – number series, picture vocabulary and verbal analogies – were taken from the Woodcock-Johnson Tests of Cognitive Abilities (Mather and Jaffe, 2016). Each measure consisted of 15 items, which were scored as either correct or incorrect. The number-series test was administered in UAS42, the picture-vocabulary test in UAS43, and the verbal-analogies test in UAS44.

The test scores for each of these three sub-tests were derived within the UAS using a two-parameter logistic Item Response Theory (IRT) model. The resulting scores are standardized.

Due to copyright, we are unable to reprint the specific questions here.

References

Lusardi, Annamaria, and Olivia S. Mitchell. 2014. "The Economic Importance of Financial Literacy: Theory and Evidence." *Journal of Economic Literature* 52(1): 5–44.

Mather, N, Jaffe, L.E. (2016). Woodcock-Johnson IV: Reports, Recommendations, and Strategies. Jossey-Bass: Hoboken, NJ.

Weller, J. S., Dieckman, N. F., Tusler, M., Mertz, C. K., Burns, W. J., and E. Peters. (2013). "Development and Testing of an Abbreviated Numeracy Scale: A Rasch Analysis Approach." *Journal of Behavioral Decision-Making* 26: 198–212.