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# Cognitive Constraints on Valuing Annuities

Jeffrey R. Brown
*University of Illinois*

Arie Kapteyn
*University of Southern California*

Erzo F.P. Luttmer
*Dartmouth College*

Olivia S. Mitchell
*The Wharton School, University of Pennsylvania and NBER*

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## Abstract

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## Keywords

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## Disciplines

Behavioral Economics


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Pension Research Council
The Wharton School, University of Pennsylvania
3620 Locust Walk, 3000 SH-DH
Philadelphia, PA 19104-6302
Email: prc@wharton.upenn.edu
http://www.pensionresearchcouncil.org

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**Jeffrey R. Brown**
Department of Finance
University of Illinois
260 Wohlers Hall
Champaign, IL 61820
and NBER
brownjr@illinois.edu

**Arie Kapteyn**
Center for Economic and Social Research
University of Southern California
635 Downey Way
Los Angeles, CA 90089
kapteyn@usc.edu

**Erzo F.P. Luttmer**
Department of Economics
6106 Rockefeller Center
Dartmouth College
Hanover, NH 03755
and NBER
Erzo.FP.Luttmer@dartmouth.edu

**Olivia S. Mitchell**
The Wharton School
University of Pennsylvania
3620 Locust Walk, 3000 SH-DH
Philadelphia, PA 19104
and NBER
mitchelo@wharton.upenn.edu

# Cognitive Constraints on Valuing Annuities

It is difficult for the average person contemplating retirement to determine how to draw down his wealth. While formal economic models typically feature consumers willing to, and fully capable of, engaging in complex intertemporal optimization in the face of multiple sources of uncertainty, this approach is often adopted because of its analytical tractability rather than due to its realism as a portrayal of actual consumer behavior. Moreover, individuals can differ with regard to how they solve the complex problem of selecting wealth decumulation and consumption strategies to maximize lifetime utility. Economists have begun to document such differences in individual decision-making abilities. A key implication of this research is that there can be a gap between people's actual decisions and the decisions that a normative model would prescribe (c.f., Choi, Kariv, Müller, and Silverman 2014). The size of such gaps may vary across individuals and across decision contexts (Campbell 2006; Guiso and Sodini 2013). The gap could reflect people's inability to costlessly optimize, but, as suggested by Calvet, Campbell, and Sodini (2007) in the context of understanding household portfolio allocations, it could also arise when households take their limited abilities into account and effectively optimize subject to constraints on their cognitive abilities or knowledge.

The present paper explores this idea in the important context of retirement income security, focusing on how cognitive abilities influence the valuations that individuals place on an annuitized income stream. We focus on whether people are internally consistent in their annuity valuations across a variety of different elicitation methods. Specifically, we present individuals with scenarios in which they are offered an opportunity to decrease their annuity holdings for a lump sum (what we call annuity "selling"), as well as scenarios in which the same individuals are offered an opportunity to exchange a lump sum for additional annuitized wealth (called annuity "buying"). Our central hypothesis is that people differ in their ability to meaningfully value a stream of life annuity income relative to a lump sum, and that this ability is associated with measures of cognitive ability including education, financial literacy, and numeracy.

We study the lump-sum versus annuity choice, rather than other financial or economic decisions, for four reasons. First, the annuitization decision is important in its own right as an academic research topic. Indeed, there is a vast academic literature dating back a half-century on

the role that annuities should and do play in people's portfolios in later life.[1] Second, as we discuss below, it is also an important retirement policy concern in many developed nations. Third, the annuitization decision is a natural place to look for variation in consumers' decision-making abilities. Valuing an annuity versus a lump sum is cognitively challenging because it requires that one wrestle with multiple sources of uncertainty (e.g., mortality, returns, inflation), and it also requires that one make a near-term choice with far-distant consequences, which are characteristics known to render decision-making difficult (Beshears, Choi, Laibson, and Madrian 2008). Fourth, because individuals are typically faced with annuitization decisions only once or twice in their lifetimes, these are not transactions that people learn about through repeated market interaction (Bernheim 2002). In such settings, behavior is known to be less likely to follow the predictions of costless optimization (Kling, Phaneuf, and Zhao 2012), which can drive a wedge between true versus revealed preferences (Beshears, Choi, Laibson, and Madrian 2008).

We provide six pieces of evidence consistent with the hypothesis that individuals have difficulty valuing annuities, and that the degree of difficulty is correlated with cognitive abilities. First, we show that a non-trivial fraction of the population has implied annuity values that are difficult to reconcile with costless optimization under any plausible set of parameters. Second, we uncover a large divergence between the price at which individuals are willing to buy versus sell an annuity, a result that cannot be explained by liquidity constraints or endowment effects. Third, and even more striking, we find that people's buy and sell valuations are negatively correlated. In other words, those who demand higher sell prices are also more likely to offer very low buy prices. Fourth, we show that the size of the sell-buy valuation discrepancy is strongly negatively correlated with cognitive ability as measured by education, financial literacy, and numeracy. This is consistent with less cognitively capable individuals having much greater difficulty valuing a stream of annuity payments. Fifth, we use additional experimental variation to show that the elicited valuations are sensitive to anchoring effects. Finally, we argue that it is difficult to explain observed cross-sectional variation in the measured annuity valuation amounts with theoretically attractive measures. In other words, the pattern of significant marginal valuation predictors is more consistent with individuals using relatively simple heuristics, rather than engaging in costless optimization to value the trade-offs.

[1] Two useful reviews include Benartzi, Previtero, and Thaler (2011) and Poterba, Venti, and Wise (2011).

Our evidence is drawn from a randomized experiment we conducted in the American Life Panel (ALP), where we present respondents with hypothetical scenarios involving choices with different lump sum amounts and levels of the Social Security annuity. By varying whether the questions elicited a compensating variation (CV) or an equivalent variation (EV) value, whether the individual was buying or selling the annuity, the size of the increments or decrement of the Social Security annuity, and the order of the questions, we directly examine the internal consistency of subjective valuations placed by respondents on their Social Security annuities. We collected a number of additional variables to control for potentially confounding factors such as heterogeneity in liquidity constraints and beliefs about political risk.

Like most economists, we usually find evidence based on actual choices in natural settings more compelling than evidence based on hypothetical choices. We acknowledge important drawbacks of using hypothetical choices, such as the possibility that lower stakes could lead respondents to exert less effort and seek out fewer resources to assist them with their decisions. However, although these considerations may make hypothetical choice behavior noisy, it would be surprising if they led to systematic patterns in hypothetical choice behavior that would be completely absent in actual choices.

Counterbalancing these drawbacks are three important benefits of using a hypothetical choice setting. First, it allows us to observe an individual's annuitization choices for a wide range of annuity prices, from which we obtain individual-specific annuity valuations without having to rely on functional form assumptions. By contrast, in real-world settings, annuitization decisions are typically made at a single price (and if there is price variation, it is generally not exogenous). Second, in a hypothetical setting it is feasible to elicit both the price at which an individual is willing to buy and the price at which he is willing to sell the annuity. Such within-person variation turns out to be extremely valuable in exploring cognitive constraints on consumers' abilities to value annuities. Third, the hypothetical setting allows us to elicit annuitization choices for a broadly representative sample of the U.S. population. As discussed in the literature overview below, actual annuitization decisions in natural settings are typically only observed for rather select populations.

In addition to advancing the academic understanding of consumer behavior in this area, our results also have considerable practical policy relevance. In March 2014, for example, the UK Chancellor announced the end of a requirement that savers annuitize a portion of their assets

upon retirement (PricewaterhouseCoopers 2014), a significant policy change that led to an immediate and substantial decline in annuity sales (Gray 2014). In contrast, the U.S. has been moving in the direction of encouraging annuities in defined contribution plans (US DOL 2010), with some analysts going so far as to suggest that people be automatically annuitized upon retirement (Gale, Iwry, John, and Walker 2008; Steverman 2012). Numerous other countries are also debating these issues.[2] These discussions, in part, revolve around whether people can make optimal payout decisions using their accumulated retirement assets. Moreover, many countries are grappling with fiscally unsustainable pay-as-you-go public pension systems. The extent to which households are poorly equipped to value the annuities offered by their public pensions has implications for the political feasibility of reforms changing the benefit structure, particularly if retirees were to be offered a choice between a lump sum and future annuity payments. The same point applies to state and local public defined benefit plans (DB) in the U.S., which also face substantial underfunding problems (Novy-Marx and Rauh 2011). Indeed, some reformers have called for a reduction in DB annuities in exchange for lump-sum contributions to defined contribution (DC) accounts (e.g., Kilgour 2006).

In what follows, we first summarize key prior studies on the demand for annuities from both the neoclassical and the behavioral economics literatures. Next, we describe the American Life Panel (ALP) Internet survey, a broadly representative sample of the U.S. population, and we outline how we elicited lump-sum versus annuity preferences in this survey. We then present our key empirical results, followed by a number of robustness checks and further analyses for subgroups that vary according to financial capabilities. We conclude with a discussion of possible policy implications and future research questions.

## I. Related Literature

### *A. Annuity Demand*

There is a very large economics literature focused on modeling the optimal level of annuitization for life-cycle consumers under various assumptions.[3] That literature began with

[2] Similar debates about the role of lifetime income in retirement plans are occurring in Europe, including the Netherlands (Brown and Nijman 2012), Italy (Guazzarotti and Tommasino 2008), and elsewhere (Fornero and Luciano 2004).

[3] Rather than providing a comprehensive review here, we instead highlight those studies most germane to the research that follows. Readers interested in the broader literature on life annuities may consult

Yaari's (1965) paper in which he noted a set of conditions under which it would be optimal for an individual to annuitize all of his wealth.[4] Extensions to the theory went on to show that full annuitization would be optimal under more general conditions,[5] a puzzling prediction in light of very low annuitization rates in the real world (Mitchell, Piggott, and Takayama 2011). Extended life-cycle models have been constructed to measure consumer valuations of life annuities and to compute how optimal annuitization will vary with numerous other factors.[6] Although these model extensions affect the level at which individuals value annuities, most models still imply that individuals have an internally consistent valuation of an annuity versus a lump sum.

Our paper focuses on how an individual's annuity valuation varies depending on whether the transaction is structured as buying or selling the annuity. Unlike a "bid-ask spread" in financial markets, which is a wedge between the highest price a buyer is willing to pay for an asset and the lowest price for which a different seller is willing to sell it (e.g., due to counterparty risk), we document what amounts to a bid-ask spread *for the same individual*. There are two extensions of the standard model with costless optimization in which a within-individual bid-ask spread could arise: liquidity constraints and transaction costs. For liquidity-constrained individuals, the buying price is capped by their limited liquidity, but no such cap exists for their selling price. In our empirical work below, we show that liquidity constraints are not the primary

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Benartzi, Previtero, and Thaler (2011); Poterba, Venti, and Wise (2011); Brown (2008); Horneff, Maurer, Mitchell, and Dus (2008); and Mitchell, Poterba, Warshawsky, and Brown (1999). Note that we use the term "life annuity" because we are interested in products that guarantee income for life, as opposed to financial products such as "equity indexed annuities" that are mainly used as tax-advantaged wealth accumulation devices (and hence they are rarely converted into life-contingent income).

[4] The conditions include no bequest motives, time-separable utility, exponential discounting, and actuarially fair annuities (among others).

[5] Davidoff, Brown, and Diamond (2005) showed that full annuitization is optimal under complete markets with no bequest motives. Peijnenburg, Nijman, and Werker (2010; forthcoming) found that if agents saved optimally out of annuity income, full annuitization can be optimal even in the presence of liquidity needs and precautionary motives. They further found that full annuitization is suboptimal only if agents risk substantial liquidity shocks early after annuitization and do not have liquid wealth to cover these expenses. This result was robust to the presence of significant loads.

[6] Among the many factors modeled in research are pricing (Mitchell, Poterba, Warshawsky, and Brown 1999); pre-existing annuitization (Brown 2001; Dushi and Webb 2006); risk-sharing within families (Kotlikoff and Spivak 1981; Brown and Poterba 2000); uncertain health expenses (Turra and Mitchell 2008; Peijnenburg, Nijman, and Werker 2010, forthcoming); bequests (Brown 2001; Lockwood 2011); inflation (Brown, Mitchell, and Poterba 2001, 2002); the option value of learning about mortality (Milevsky and Young 2007); stochastic mortality processes (Reichling and Smetters 2015; Maurer, Mitchell, Rogalla, and Kartashov 2013); and broader portfolio issues including labor income and the types of assets on offer (Inkmann, Lopes, and Michaelides 2011; Koijen, Nijman, and Werker 2011; Chai, Horneff, Maurer, and Mitchell 2011; Horneff, Maurer, Mitchell, and Stamos 2009, 2010).

explanation of our findings. Although there may be transaction costs that could lead to a spread in a market setting, these transaction costs are not relevant in our experimental setup.

Much of the annuity literature has focused on theory or simulation, largely owing to the small size of the voluntary life annuity market in most countries making empirical work difficult. The empirical literature that does exist often points to behavior suggestive of heterogeneity in decision-making abilities. For example, Brown (2001) used the 1992 wave of the U.S. Health and Retirement Study (HRS) to show that expected annuitization from DC plans was correlated with the annuity valuations predicted by a life-cycle model based on demographic characteristics, but only for persons with sufficiently long (1+ year) planning horizons. Hurd and Panis (2006) explored payouts from DB plans in the HRS and found that many people exhibited behavior consistent with *status quo* bias. Bütler and Teppa (2007) used Swiss administrative data to track choices made by employees in ten different pension plans and concluded that annuitization was higher in plans where an annuity was the default payout option. Chalmers and Reuter (2012) exploited exogenous variation in the price of annuities using Oregon public-sector workers; they (unexpectedly) found that worker demand for partial lump-sum payouts rose rather than fell as the value of the forgone life-annuity payments increased, leading them to conclude that the decisions were being made by unsophisticated individuals. Fitzpatrick (2015) examined a policy in which Illinois Public School employees could purchase additional annuitized pension benefits. Using the observed take up of this policy and how the take up varies with the annuity's price, she estimated that the average employee is willing to pay only 20 percent of the actuarial value of the annuity. Previtero (2014) showed that annuity demand was negatively correlated with the prior year's stock returns, consistent with consumers engaging in naïve trend-chasing. Shepard (2011) examined the implicit purchase of marginal annuities through the delay of claiming Social Security. Using perturbation arguments, he argued that standard explanations (such as lack of liquidity, risk of medical expenditure shocks, bequest motives, actuarially unfair pricing, and political risk) cannot explain the puzzle of why so few people delay claiming. He concluded that understanding the annuity puzzle likely rests on a behavioral explanation.

Several experimental papers have also suggested that annuitization decisions are not well described by models of optimizing agents facing no cognitive constraints or decision-making costs. Agnew, Anderson, Gerlach, and Szykman (2008) showed that people can be steered toward or away from life annuities in an experimental setting, depending on whether the

products were described using positive or negative frames. Brown, Kling, Mullainathan, and Wrobel (2008) used an internet survey to show that perceptions of annuity value relative to alternative financial products were heavily influenced by whether the products were described using "consumption" or "investment" frames. Beshears, Choi, Laibson, Madrian, and Zeldes (2014) also found evidence that framing affects annuity demand. Brown, Kapteyn, and Mitchell (2013) showed that Social Security claiming behavior (which is akin to making an annuitization decision) was influenced by framing changes. Accordingly, this small literature suggests that individuals behave at odds with models based on costless optimization.

The two studies closest to ours in spirit are Cappelletti, Guazzarotti, and Tommasino (2013) and Liebman and Luttmer (2014), although both were more limited in focus. The first of these used a 2008 survey of Italian households to investigate whether people would give up half their monthly pension income (assumed to be €1000) in exchange for an immediate lump sum of €60,000. The study reported that the better educated and more financially literate were more likely to annuitize. The second paper conducted a 2008 survey on the perceived labor supply incentives in Social Security, which included a question asking for the equivalent variation of a $100/month increase in Social Security benefits. Because each of those papers used only a single elicitation method, neither addressed the hypotheses we test here across elicitation measures based on within-person differences in valuation.

*B. Variation in Decision-making Abilities*

Lusardi and Mitchell (2014) provide a comprehensive review of the large and growing literature relating financial literacy to behavior, including the robust finding that many households lack basic financial knowledge. Indeed, many households make a range of financial mistakes when managing their financial affairs (e.g., Calvet, Campbell, and Sodini 2007, 2009; Agarwal, Driscoll, Gabaix, and Laibson 2009), and households making such mistakes often lack day-to-day financial skills (Hilgert, Hogarth, and Beverly 2003). Relatedly, findings by Agarwal, Chomsisengphet, and Zhang (2015) indicate that financial literacy plays an important part in mortgage default behavior. The literature has also established that financial literacy is correlated with the propensity to participate in financial markets (Kimball and Shumway 2006; Christelis, Jappelli, and Padula 2010; van Rooij, Lusardi, and Alessie 2011; Almenberg and Dreber 2015; and Arrondel, Debbich, and Savignac 2013), and in pensions (Fornero and Monticone 2011).

Moreover, Lusardi and Mitchell (2007, 2011) demonstrated that more financially knowledgeable individuals are more likely to engage in retirement planning and accumulate retirement wealth.

A related literature has focused on the links between cognitive abilities and financial decision-making. Fang, Keane, and Silverman (2008) showed that cognitive functioning was a stronger predictor of Medigap purchase patterns than risk preferences. Agarwal and Mazumder (2013) reported that performance on cognitive tests helped explain the quality of financial decisions related to the use of credit. A subset of this literature has also focused more specifically on retirement preparedness among older individuals. For example, McArdle, Smith, and Willis (2011) and Banks, O'Dea, and Oldfield (2010) found that people with greater cognitive ability had accumulated more retirement wealth.

Taken together, these and other studies suggest that people differ in their financial decision-making abilities, and these differences are important correlates of financial well-being later in life. Taking this literature a step further in establishing causality, Choi, Kariv, Müller, and Silverman (2014) conducted a large-scale experiment designed to directly test the extent to which individual decisions were consistent with the Generalized Axiom of Revealed Preference (GARP). They detected substantial heterogeneity and found that their measure of decision-making quality was higher among younger and better-educated individuals. Additionally, they showed that individuals having better decision-making skills accumulated more wealth. Behrman, Mitchell, Soo, and Bravo (2012) also reported that the more financially literate saved more in their pensions, controlling for the possible endogeneity of financial knowledge.

Our work below contributes to this literature in two ways. First, we focus on a decision important in its own right – annuitization – but we concentrate on an area where heterogeneity in decision-making quality has not yet been studied, namely Social Security annuities. Second, we explore an outcome novel to the study of decision-making ability by investigating a measure of low decision-making quality, namely the spread of individual responses across different approaches to eliciting stated valuations for life annuities. We show that this spread is strongly inversely related to various measures of cognition and financial literacy.

## II. Methodology and Data

### *A. The Experimental Context*

Rather than describing an unfamiliar hypothetical annuity product, our experiments use

Social Security benefits as the context. This approach has several advantages. First, most workers understand that Social Security pays benefits to retirees that last for as long as they live (Greenwald, Kapteyn, Mitchell, and Schneider 2010), which means that respondents are likely to understand the nature of our "offer" to trade off annuities and lump sums. Second, our context provides a simple way to control for possible concerns about the private annuity market that might otherwise influence results, such as the lack of inflation protection (our question makes it clear that Social Security is adjusted for inflation), or concerns about counterparty risk of the insurer providing the annuity.[7] Third, our setting is highly policy relevant. For example, past discussions of possible pension reforms around the world, as well as at the U.S. state and local levels, have included proposals to partially "buy out" benefits by issuing government bonds to workers in exchange for a reduction in their annuitized benefits. Several U.S. corporations have also recently offered to buy back defined benefit pension annuities from retirees in exchange for lump sums (c.f., Wayland 2012).

*B. Our Experiments in the American Life Panel*

To test how people value their Social Security annuity streams, we fielded a survey between June and August of 2011 using the RAND American Life Panel, a panel of U.S. households that regularly take surveys over the Internet. RAND provided Internet access to household lacking such access.[8] By not requiring Internet access at the recruiting stage, the ALP has an advantage over most other Internet panels when it comes to generating a representative sample.[9] At the time of our survey, the American Life Panel included about 4,000 active panel members. The survey was conducted over two waves of the ALP. For the first wave, we selected 2,954 respondents age 18 or older, of whom 2,478 completed the survey for a response rate of 83.9%. Those who completed the first wave were invited to participate in a second survey at least two weeks later; of these, 2,355 respondents completed the second wave for a response rate of 95%. About 4% of participants indicated that they thought they would not be eligible to receive Social Security benefits (either on their own earnings records or on those of a current,

[7] Below we examine whether concerns about the fiscal sustainability of Social Security influences people's valuation of the Social Security annuity. See Luttmer and Samwick (2015) for a detailed analysis of the effects of policy uncertainty on valuations of future Social Security benefits.

[8] Initially these households received a WebTV allowing them to access the Internet. Since 2008, households lacking Internet access have received a laptop and broadband Internet access.

[9] A more detailed explanation of the ALP is provided in Online Appendix A. Our survey instrument is included in Online Appendix B.

late, or former spouse). We showed these respondents the level of Social Security benefits equal to the average received by people with their age/education/sex characteristics, and asked them to assume for the purposes of the survey that they would receive this level of benefits. Our full sample included 2,112 complete responses for both waves 1 and 2.[10]

Table 1 compares our sample characteristics with those of the same age group in the Current Population Survey (CPS).[11] Our sample is, on average, five years older, more female, more non-Hispanic white, better educated, slightly better-paid, and has a somewhat smaller household size than the CPS; the regional distribution is close to that of the CPS. The fact that our sample is more highly educated means that, if anything, our respondents should be in a better position to provide meaningful responses to complex annuity valuation questions, compared to a national sample. Despite the differences between the ALP and the CPS, our ALP sample does include respondents from a wide variety of backgrounds, so in this sense, we think of the ALP as broadly representative of the U.S. population.

*[Table 1 here]*

*C. Eliciting Lump-Sum versus Annuity Preferences*

To elicit preferences regarding annuitization, respondents were posed several questions of the following sort:

> In this question, we are going to ask you to make a choice between two money amounts. Please click on the option that you would prefer. Suppose Social Security gave you a choice between:
> (1) Receiving your expected Social Security benefit of *$SSB* per month.
> *or*
> (2) Receiving a Social Security benefit of *$(SSB-X)* per month and receiving a one-time payment of *$LS* at age *Z*.

The variable *SSB* is an estimate of each respondent's estimated monthly Social Security benefit; the variable *LS* refers to the lump-sum amount; and *Z* is an age that depends on whether the respondent currently receives Social Security benefits. For those not currently receiving benefits, the trade-off was posed as a reduction in future monthly Social Security benefits in exchange for

[10] Of the 2,355 respondents who completed the second wave, we dropped 69 observations from the pilot version of wave 2 (where the questionnaire was slightly different). We further dropped 168 observations where the survey instrument was incorrectly administered due to a technical glitch and we dropped 6 observations with missing information on basic demographics (age, education, or marital status).

[11] Summary statistics of other key variables from our survey such as annuity valuations (discussed below) are provided in Online Appendix Table A.1.

a lump sum to be received at that person's expected claiming age. For those currently receiving Social Security benefits, the questions were modified to compare a change in monthly benefits to the receipt of a lump sum in one year. In both cases, the receipt of the lump sum was to take place in the future in order to avoid having present bias possibly confound our results.

Before asking the annuity trade-off question, we explained that the question referred to real after-tax amounts (i.e., "you don't owe any tax on any of the amounts we will show you;" and "please think of any dollar amount mentioned in this survey in terms of what a dollar buys you today because Social Security will adjust future dollar amounts for inflation"). In the trade-off question, we told married respondents: "benefits paid to your spouse will stay the same for either choice." Thus, individuals were asked to value a single-life inflation-indexed annuity.

To probe the reliability of the valuations provided by respondents, we also varied the question in a systematic way along two dimensions. First, we elicited how large a lump sum would be required to induce an individual to accept a reduction of (i.e., to *sell*) a portion of his Social Security income; below we refer to this version of the question with the shorthand "sell." We also elicited how large a lump sum the individual would be willing to *pay* in order to increase his Social Security annuity (the "buy" condition).

Second, we varied our questions depending on whether we elicited a compensating variation (CV) – the annuity/lump-sum trade that would keep a respondent at his existing utility level – or an equivalent variation (EV) –the lump-sum amount that would be equivalent in utility terms to a given change in the monthly annuity amount. As we discuss in more detail below, an analysis of the CV versus EV distinction should allow us to distinguish our findings from a simple *status quo* bias or endowment effect because the *status quo* was not included in the EV choice set. All choices in the EV scenario either involved a change in Social Security benefits or the payment or receipt of a lump sum. Even though there is no *status quo* in the EV version, we continue to use "sell" to describe the version that includes the respondent receiving a lump sum as a choice and to use "buy" for the version that has the respondent paying a lump sum as a choice. We believe this description fits with the common notion of the meaning of buying and selling, but we acknowledge that this description implicitly assumes that selling and buying is perceived as relative to the choice where the respondent receives only Social Security income.

In total, we elicited four measures and designate them for discussion purposes as **CV-Sell** (as in the example above), **CV-Buy**, **EV-Sell,** and **EV-Buy**. The chart below describes these four

scenarios. We define *SSB* as the monthly Social Security benefit the individual was currently receiving (if the individual was a current recipient), or was expected to receive in the future (if the individual was not a recipient); *X* is the increment (or decrement, if subtracted) to that monthly Social Security benefit. Finally, we set *LS* as the lump-sum amount offered in exchange for the change in monthly benefits. In essence, this paper is about how individuals trade off a monthly benefit of $*X* for a lump sum of $*LS*.

**Four Variants of the Annuity Valuation Tradeoff Question**

| | "Sell" Version | | "Buy" Version | |
|---|---|---|---|---|
| | Choice A | Choice B | Choice A | Choice B |
| Compensating Variation (CV) | [*SSB*-*X*] + *LS* | [*SSB*] | [*SSB*+*X*] – *LS* | [*SSB*] |
| Equivalent Variation (EV) | [*SSB*] + *LS* | [*SSB*+*X*] | [*SSB*] – *LS* | [*SSB*-*X*] |

Note: *SSB* stands for current/expected monthly Social Security benefits, *X* is the amount by which monthly Social Security benefits would change and *LS* is a one-time, lump-sum amount. Positive amounts are received by the individual while negative amounts indicate a payment by the individuals. Amounts between square brackets are paid monthly for as long as the individual lives, whereas *LS* is a one-time payment or receipt. The individual is asked to elect Choice A or Choice B.

The CV-Sell scenario presented respondents with a choice between their current (or expected) Social Security benefits (*SSB*) and an outcome in which their benefits are reduced by $*X* per month in exchange for receiving a lump sum of $*LS*. The EV-Sell scenario provided a choice between receiving a higher monthly benefit (*SSB*+*X*) or receiving $*SSB* plus a lump sum of $*LS*. Note that within the Sell scenario, one can obtain EV simply by adding $*X* to each side of the CV trade-off. Given that *X*=$100 per month in the baseline versions, the change in benefits is modest relative to total monthly income for most individuals. We would therefore expect CV and EV to be comparable, barring strong endowment effects that might be present in the CV formulation but not in the EV formulation (where the *status quo* was not an option).

Switching to the Buy scenarios, the CV-Buy question provided a choice between *SSB* and a benefit increased by $*X* in exchange for paying $*LS* to Social Security. EV-Buy provided a choice between receiving a lower monthly benefit (*SSB*-*X*) and paying a lump sum to maintain the existing benefit. In these Buy scenarios, the respondent could obtain CV simply by adding $*X* to each of the EV scenarios. Again, no *status quo* option was available in the EV case.

In order to elicit the subjective valuation resulting from any given measure above, the survey used a "branching" approach. For example, we started with a $100 increment to the

monthly annuity versus a $20,000 lump sum. If the individual rejected the lump sum, then $20,000 is the upper bound of the individual's valuation of the annuity. Conversely, if the lump sum was chosen, $20,000 is a lower bound. Next, based on each individual's response, we either increased or decreased the amount of the lump-sum payment offered. Each subsequent response tightens the range of lump-sum values between the upper and lower bound. By going through four or five rounds of this branching process, we identify a narrow range of lump-sum values that contains each respondent's implied subjective valuation of the change in the annuity stream.

We chose one of our four approaches as a benchmark on which to do additional sensitivity tests along other dimensions. While there is no theoretical basis for suggesting that one treatment would be preferred to the other three, we selected the CV-Sell option as the benchmark condition because it is most relevant to policy discussions. For example, offering retirees an opportunity to sell their annuities for a lump sum is a transaction observed in recent years (e.g., GM has offered retirees lump sums in lieu of their life annuities). The Sell measure is also less likely than the Buy measure to be bounded by people's access to liquidity. Accordingly, all respondents were asked the CV-Sell question in one of the two waves, whereas the other three versions (CV-Buy, EV-Sell, and EV-Buy) were asked in a randomized order in the other wave. Placement of the CV-Sell question in the first or second wave was randomized across respondents. The two waves were administered approximately two weeks apart. Below, we test whether responses to CV-Sell differ across the first and second wave.

*D. Other Sources of Experimental Variation*

We also randomized along a number of other dimensions. The order of the options within a question was randomized to test whether respondents took the survey seriously (as opposed to, say, always choosing option A). We also tested for anchoring effects in our benchmark question (CV-Sell) as well as whether responses varied with the magnitude of the change in the benefit, to provide an additional assessment of the role of cognitive limitations. Finally we asked a version of the questions designed to control for political risk, to ensure that our results were not driven by concern over the system's pending insolvency. Each of these factors is discussed in detail below, after we present our main results.

## III. Evaluating Heterogeneity in Annuity Valuations

Figure 1 reports the cumulative distribution function (CDF) of the responses to the CV-

Sell and CV-Buy questions, while Figure 2 provides a similar plot for EV-Sell and EV-Buy. Given our branching approach in eliciting valuations (described in Section II.C), the two Figures plot both the upper and lower bounds for each respondent's annuity valuation.[12] In Figure 1, the midpoint of the upper and lower bounds for the CV-Sell question indicates a valuation of $13,750 for a $100-per-month change in Social Security benefits. The CV-Buy question midpoint valuation is only $3,000. In Figure 2, the comparable valuations are $12,500 for EV-Sell and $3,000 for EV-Buy. By comparison, the median *actuarial value* of this annuity for respondents in our sample is $16,855 (computed using Social Security Trustees' Report intermediate assumptions of a three percent interest rate and intermediate mortality).

*Figures 1 and 2 here*

Four patterns are evident in these two figures. First, median valuations are all substantially below the actuarial value of $16,855. Second, substantial dispersion of valuations is generated by all four valuation approaches. Third, the distributions of EV and CV valuations appear similar, holding constant whether the Buy or Sell valuation was offered, although we will see below that the correlation is far from perfect. Fourth, there is a very large difference between the Sell and Buy valuations, regardless of whether this was elicited in a CV or an EV setting. After briefly discussing each of these issues, we will then delve more deeply by analyzing differences in valuations within and across individuals.

*A. Median Valuations*

When we simply pool responses to our four valuation questions – CV-Sell, CV-Buy, EV-Sell and EV-Buy – we find that 70% of the responses have an upper bound below the actuarially fair level and 64% of the responses have an upper bound at least $5,000 below the actuarially fair level.[13] This finding is interesting, given the ongoing discussion in the literature about the "annuity puzzle" which notes that life-cycle optimizers should recognize annuities' high utility value, while real-world consumers avoid purchasing them. Nevertheless, there are several reasons for why people might value an annuity below its actuarially fair level, including bequest

[12] The CV-Sell figure plots valuations only for individuals who saw the $100 increment first (the other three annuity valuation questions are asked only for $100 increments). Other respondents saw higher annuity amounts first which, as discussed below, led to an anchoring effect that increased their valuation.

[13] As in the figure, we limit the sample for the CV-Sell response to individuals who saw the $100 increment first to avoid anchoring effects. If we double the weight on the remaining half of the CV-Sell responses (to compensate for the fact we dropped CV-Sell responses affected by anchoring), the percentages become 68% and 61%, respectively.

motives and a desire for liquidity. Indeed, the current paper does not attempt to explain the annuity puzzle; rather, our goal is to test whether people's valuations are internally consistent. The remainder of our results should be viewed in light of this important distinction.

*B. Valuation Dispersion*

The cumulative distributions presented in Figures 1 and 2 reveal substantial heterogeneity in respondent valuations. For example, five percent of the sample reported upper-bound CV-Buy valuations of $1,500 or less. Such low amounts are difficult to explain if the respondent can optimize costlessly since the $100 monthly annuity payments would yield more than this in only 16 months. The exception would be if some individual were virtually certain that he would die in that time span, but these outliers persist even after we control for respondents' self-reported health status and expected survival probabilities. At the other extreme, 16 percent of the respondents gave lower-bound CV-Sell annuity values of $60,000 or higher – nearly four times the actuarial value of the annuity. Moreover, more than six percent of the respondents in the CV-Sell approach said they would not accept a lump sum of less than $200,000. This is unexpected, since even if someone earned only a 60 basis-point (0.60%) annual return on the $200,000 lump sum, he could replace the $100 per month he was giving up with this return and still keep the lump sum of $200,000. As noted below, these findings are not explained by subjective life expectancy, concerns about political risk, or many other plausible explanations.[14] In other words, many respondents appear to have difficulty providing economically meaningful values for the Social Security annuity, at least in the tails of the CDF.[15]

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[14] We control for political risk in two ways in this study. First, we asked individuals about their confidence that the Social Security system will be able to provide them with the level of future benefits they are supposed to get under current law. Including responses to this question as a control variable in various analyses does not substantially affect our findings. Second, we asked a version of our CV-Sell annuity valuation question in which we explicitly instructed individuals not to consider political risk by stating: "From now on, please assume that you are absolutely certain that Social Security will make payments as promised, and that there is no chance at all of any benefit changes in the future other than the trade-offs discussed in the question below." Comparing the response to the no-political-risk question to the baseline CV-Sell question for those for whom the two questions were asked in different waves of the survey, we find that the response to the no-political-risk question is a statistically insignificant 10 percent *lower* than the response to the baseline CV-Sell question. Taken literally, this implies a negative risk premium, but we believe the more likely explanation is that our question may have had the unintended effect of making political risk more salient. Overall, our analysis suggests that the incorporation of political risk does not alter our main findings.

[15] Individuals in the tails of the annuity valuation distributions tend to be worse off economically and score lower on indicators of cognition. We return to the relation between cognition and annuity valuations in Section III.F below. However, these differences are not dramatic and there is substantial overlap in the

*C. Comparing CV and EV*

The EV-Sell options are obtained by adding $100 to both of the options in the CV-Sell questions. Given the small magnitude of the shift (relative to mean estimated monthly benefits of $1,395), we anticipated that a costlessly optimizing decision-maker would provide quite similar assessments across these two ways of eliciting value. Although the distributions of CV-Sell and EV-Sell look similar in Figures 1 and 2 (as do the distributions of CV-Buy and EV-Buy), individual responses are only moderately correlated. Table 2 reports the correlations across the four different measures.[16] Column 1 shows that CV-Sell and EV-Sell are significantly positively correlated, but the correlation coefficient of +0.31 is far from one. Given that we asked the CV-Sell and the EV-Sell questions in survey waves separated by at least two weeks, it is unlikely that the correlation was driven by anchoring or memory effects that could arise if the questions had been asked within the same questionnaire. The correlation of +0.72 between CV-Buy and EV-Buy is substantially higher, but we cannot rule out that anchoring effects contributed to this higher correlation since CV-Buy and EV-Buy were asked in the same wave.

*Table 2 here*

*D. Sell Prices Exceed Buy Prices*

A key and very striking pattern emerging from Figures 1 and 2 is that the distributions of annuity valuations from the Buy solicitations are substantially below those of the Sell solicitations. Recall that the Sell question asked how much a person would have to be compensated to give up part of his Social Security annuity, whereas the Buy question asked how much he would be willing to pay to increase his Social Security annuity. In Figure 1, the median midpoint response drops from $13,750 for CV-Sell to only $3,000 for CV-Buy.

If we observed this result only in the CV case, one might argue that this could result from *status quo* bias (Samuelson and Zeckhauser 1988) or an endowment effect (Kahneman, Knetsch, and Thaler 1991). Yet Figure 2 shows that an almost identical shift occurs when we use the EV-Sell and EV-Buy responses, where the *status quo* is not an option because both the annuity and the lump sum are represented as deviations away from the initial endowment. Online Appendix

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characteristics of those in the tails and those who are not. Online Appendix Table A.2 presents the mean characteristics of respondents in the tails of the annuity valuation distributions.

[16] To control for correlations induced by common experimental manipulations, we regress the log midpoint valuation on controls for the relevant manipulations and then correlate the residuals, which are reported in Table 2. Uncorrected correlations are similar and shown in Online Appendix Table A.3.

C shows that a kinked utility function, such as is typically used to explain endowment or *status quo* effects, cannot simultaneously explain our findings for EV choices and CV choices.[17]

To examine the possibility that answers might be driven by liquidity constraints, we asked respondents about their ability to come up with the money needed for the lump sum. The vast majority (91 percent) indicated that their choice was not due to liquidity constraints,[18] and the clear divergence in valuations persists in the non-liquidity constrained sub-sample. Another possibility is that the difference between sell and buy prices arises because respondents had a differential understanding of these two questions. Although we have no way to empirically rule out this possibility, we note that we took great care to make the wording of the two questions as similar as possible and to balance the design in terms of when the questions were asked.

Rather than *status quo* bias, endowment effects, differential question understanding, or liquidity constraints, we conjecture that this wedge is the outcome of valuation difficulties on the part of respondents. This conjecture has two testable implications. First, individuals who have difficulty valuing annuities may seek to protect themselves by agreeing to an annuity transaction only if the annuity is priced very attractively, which would lead them to demand a high price to sell, but offer a low price to buy. We refer to this as a "reluctance to exchange," which would imply that buy valuations will be negatively correlated with sell valuations if there is heterogeneity across people in their degree of reluctance. Second, it implies that the size of the

[17] While our results cannot be explained by endowment or *status quo* effects if respondents take the Social Security benefit amount they report to us as the reference point, we cannot rule out that respondents may have had a "fuzzy" reference point that shifted based on the version of the question asked. In particular, if they shifted their reference point up by $100 in the EV-Buy version (i.e., $100 above their actual or expected Social Security benefits) and down by $100 in the EV-Sell version (i.e., $100 below their actual or expected Social Security benefits), then the EV answers could be explained by endowment or *status quo* effects. To explore this explanation, we compared sell and buy valuations of individuals who are least likely to have a fuzzy reference point, namely those who are currently receiving Social Security benefits and were able to report their benefit amount to us. The difference between EV-Sell and EV-Buy prices is as large for this group as for the rest of the sample.

[18] Specifically, we asked whether each respondent could come up with $5,000 "if you had to" and, separately, whether he could come up with the lump sum needed to purchase the higher annuity. The time frame for accessing the money was the same time frame as in the annuity valuation question, namely one year from now or the respondent's expected claim date, whichever was later. About two-thirds of the respondents answered that they were certain they could come up with $5,000, and over 90 percent responded that they could come up with the amount probably or certainly. About 82 percent of respondents indicated that they could come up with the lowest lump-sum amount that they declined to pay. Of the 18 percent that indicated they could not come up with this amount, half said that even if they had the money, they would decline to pay the lump sum. Thus, for 91 percent of the respondents, liquidity constraints were not the reason for the low reported annuity valuation in the CV-Buy trade-off question.

wedge between buy and sell valuations will be decreasing with cognitive abilities.

*E. Negative Buy-Sell Correlations*

Although Figures 1 and 2 reveal large differences in the distributions of responses between Sell and Buy valuations, they do not indicate whether *within-person* responses to these alternative valuation measures are correlated. Hence we cannot yet conclude that the entire distribution is shifted to the left, or whether the same individuals change their positions in the distribution depending on whether they see a Sell or Buy question. This is addressed in Table 2, which reports a negative correlation between Buy and Sell valuations. Specifically, the correlation between CV-Sell and CV-Buy is -0.11, whereas the correlation between EV-Sell and EV-Buy is -0.15; both are highly statistically significant. These negative correlations suggest that individuals who place above-average values on a $100/month annuity when asked to sell it tend to be willing to pay less than average to purchase a $100/month benefit. The negative correlation also implies substantial movement within the distributions, rather than a uniform downward shift when we move from a Sell to a Buy elicitation method. This pattern is consistent with individuals who have difficulty valuing annuities being reluctant to exchange annuities because they wish to ensure that they are not losers in a transaction they have difficulty evaluating.

*F. The Role of Cognition and the Sell-Buy Spread*

If the Sell-Buy differential is due to low-ability decision-makers being reluctant to engage in annuity transactions, then the size of this differential should be correlated with measures of cognition. To explore this, we construct a measure of the "Spread" that equals the absolute value of the difference between the log CV-Sell and the log CV-Buy valuation of a $100 change in monthly Social Security benefits. The spread is defined as an absolute value because a discrepancy between Sell and Buy valuations in either direction is indicative of a lack of internal consistency. In practice, the spread is dominated by the 80 percent of the sample who place a higher value on CV-Sell than CV-Buy. Because the spread is measured as the difference in log points, this variable reflects the relative value of Sell and Buy valuations. The mean of the Spread variable is 2.58 and its median is 2.30, indicating that the median individual reports Sell and Buy valuations that differ by a factor of 10. In the large majority that places a higher value on the Sell than the Buy valuation, the mean and median of the Spread variable are 2.63 and 2.35 respectively. This implies that the median person in this sample demands a price to sell a $100/month annuity 10.5 times higher than the price he is willing to pay to buy the same annuity.

Figure 3 shows the bivariate relation between the CV Sell-Buy Spread and various measures of cognition. Panel A groups respondents according to an index of financial literacy, measured as the sum of correct answers to the three questions devised for the Health and Retirement Study to rate respondents' financial literacy levels.[19] We find that that the Sell-Buy Spread falls sharply with measured increases in financial literacy. In Panel B, we make use of a number scoring test, where respondents are shown six incomplete sequences of numbers and are asked to complete each sequence (e.g.: 7, 8, …, 10). Scores are assigned using a Rasch scoring algorithm (Linacre 1999). We find a sharp and monotonic decline in the Sell-Buy Spread across quintiles of this numeracy measure. In Panel C, we split the Spread measure by level of education and, once again, we find a sharply declining pattern. Panel D uses an overall cognition index, which is the first principal component of the three measures of cognition.[20] Given the fact that the weight on each of the three factors is roughly equal, it is not surprising that we also find a strong, monotonic, negative relation between the Sell-Buy Spread and our cognition index.[21] Our conjecture that the Sell-Buy Spread stems from a reluctance to exchange when individuals have difficulty valuing annuities has the testable implication that the Sell-Buy Spread falls with cognitive ability. The findings from Figure 3 support this testable implication.

*Figure 3 here*

We repeat this analysis in a regression framework in Table 3, along with controls for other factors. Column 1 regresses the Spread on age dummies and controls for experimental variations (to be discussed in the next section). The coefficient on age 65+ is positive and significant: on average, older individuals have a 0.44 log point larger absolute difference between their Sell and Buy valuations than the reference age category (age 34 or younger). The difference remains economically large and statistically significant if we compare them to the age 50-64 category. This finding is important for two reasons. First, it addresses the concern that our

[19] The three questions test for an understanding of inflation, compound interest, and risk diversification (for a complete listing of the questions see Online Appendix B).

[20] Although we use principal components analysis to construct the weights in the cognition index, the contributions of each of the three components turn out to be very close to equal. We therefore obtain very similar results if we construct an index in which we give each of the three components equal weight.

[21] Online Appendix Figure A.1 shows that findings of Figure 3 (monotonically declining spreads in each of the three measures of cognition as well as in the index) also hold when the Sell-Buy spread is based on EV valuations rather than CV valuations. Online Appendix Figure A.2 shows that we obtain declining spreads (but not always monotonically so) when we use the spread between CV and EV valuations (both using the Sell condition).

findings could be driven by younger individuals who might lack interest in decisions related to retirement or be less familiar with Social Security. Yet we find the opposite: younger individuals have a smaller Sell-Buy Spread than do older individuals. Second, the increase in the Spread with age fits with results of Agarwal, Driscoll, Gabaix, and Laibson (2009), who showed that cognitive functioning declines at older ages and may contribute to a decline in the quality of financial decision-making. As we will see below, this relation persists after adding direct controls for cognition. To the extent that the increase in the Spread with age is due to a decline in cognitive functioning, this implies that it is driven by dimensions of cognitive functioning not captured by our measures of cognition.[22]

*Table 3 here*

In column 2, we add our three direct measures of cognition. All three– financial literacy, education, and numeracy – are significantly negatively correlated with the Sell-Buy Spread. Each additional correct answer on the financial literacy questions reduces the spread by 0.32 log points. Moving up one education category reduces the spread by 0.24 log points. A one standard deviation increase in the score on the number series questions reduces the spread by 0.31 log points. In column 3, we combine these measures into our cognition index, and here again, we find a strongly significant relation. A one standard deviation increase in cognition corresponds to a 0.59 log point reduction in the Sell-Buy Spread. Column 4 adds additional controls for demographics and preferences including sex, marital status, race and ethnicity, family income, home ownership, self-reported health, having children, risk aversion, return expectations, and political risk, among others.[23] Even with this rich set of additional controls, the coefficient of -0.41 on the cognition index remains highly significant. The results of Table 3 are similar if we use the Sell-Buy Spread based on EV valuations rather than on CV valuations (see Online Appendix Table A.5). If we take the spread between CV-Sell and EV-Sell, which have similar values on average because they are both Sell measures, we continue to find significant negative effects of the cognition index on the spread, though the magnitude of the coefficient drops by

[22] Our questions ask respondents to consider the choice between a change in Social Security and a lump sum paid/received at the Social Security claim age (or one year from now for those already claiming). Hence, for younger respondents the consequences occur further in the future. As a result, it is possible that younger respondents think of the choice as less consequential and hence exhibit less reluctance to exchange. This is an alternative explanation for the age gradient in the Sell-Buy Spread.

[23] Definitions and summary statistics of control variables are given in Online Appendix Table A.1. The coefficients on the control variables can be found in Column 1 of Online Appendix Table A.4.

half (see Online Appendix Table A.6). This indicates that individuals with higher values of the cognition index give more internally consistent answers even in settings where the "reluctance-to-exchange" motive should not be prominent.[24]

Thus far, we have shown that many people have implied annuity values that are difficult to reconcile with costless optimizing behavior under any plausible set of parameters. We have also documented a large divergence between the price at which individuals are willing to buy an annuity and the price at which they are willing to sell an annuity, and we showed that this cannot be explained by liquidity constraints or endowment effects. Moreover, buy and sell valuations are negatively correlated, and the size of the sell-buy disparity is highly correlated with cognitive ability, as measured by education, financial literacy, and numeracy. The next section extends our analysis in several additional directions.

## IV. Robustness and Further Results

### *A. Are the Responses Meaningful?*

In view of the implausible values in the tails of the distributions, the negative correlation across Sell and Buy valuations, and the large Sell-Buy Spread, one might surmise that a subset of respondents may not have taken the survey seriously (or perhaps did not understand it). Nevertheless, we have already shown that there is information contained in the elicited valuations: respondents provide reasonably consistent responses to similarly constructed offers (e.g., CV-Sell and EV-Sell) despite being asked in different waves two weeks apart. Additionally, our survey contained two sources of variation designed to test whether responses were meaningful. First, we randomized the order of the scenarios to which people were exposed.[25] Second, we also randomized the order of the options *within* a question (i.e., whether the lump-sum amount was the first or the second option). If the order of the questions or the order of the options within the questions mattered, this would suggest that individuals had difficulty with the survey itself. We test for sensitivity to "asked in wave 1" and "lump-sum

[24] In Online Appendix Figure A.3 and Table A.7, we show that the negative correlation between Sell and Buy valuations decreases in absolute value for those with higher levels of cognition. In addition, the positive correlation between CV and EV valuations tends to increase with cognition. Hence, cognition also has effects in the expected direction on our correlations. However, because correlations cannot be measured at the individual level (but only for subsamples), these results have less statistical precision.

[25] We first randomized at the individual level whether CV-Sell was asked in the first or second wave of our survey. Then CV-Buy, EV-Sell, and EV-Buy were asked in the other survey wave and their order was randomized at the individual level over each of the six possible orderings.

option shown first" in the sub-section below, when we also test for sensitivity to anchoring and starting values. As we shall see, our evidence is consistent with respondents reading and understanding the questions.

*B. Sensitivity to Anchoring and Starting Values*

We also incorporated two sources of experimental variation designed to further test for the consistency of valuations with costless optimization. First, we varied the starting values of the size of the lump sum, randomizing across $10,000, $20,000 and $30,000; below, we refer to this as "log of starting value." Second, in the CV-Sell case, we varied the order of size of the increment of the monthly benefit. Specifically, we presented the CV-Sell version multiple times to each respondent for $X$=$100, $X$=$500, $X$=$$SSB$ (i.e., the entire amount of the respondent's Social Security benefits), and for a random $X$ that was a multiple of $100 (less than min($$SSB$-100, 2000), and not equal to 100 or 500). We also randomized whether we asked CV-Sell with the $X$ amounts arranged in increasing or decreasing order. We control for this randomization in the regressions (i.e., whether people were shown values from small-to-large or large-to-small). We refer to this in our tables as "asked after larger version." These four randomizations (two used to test for meaningfulness of responses and two to test for consistency with costless optimization) were conducted independently.

*C. Results of these Extensions*

If individuals have difficulty valuing annuities, then we would expect to find that people would be sensitive to irrelevant cues such as starting values and whether questions were asked after a larger version. Conversely, the order of the scenarios or the options would not matter for valuation decisions as long as the respondent tried to answer the questions. Our findings on these points are provided in the first column of Table 4, where we regress the log midpoint of our baseline CV-Sell variable (using a $100 variation in Social Security benefits) against the four variables capturing all sources of randomization.[26]

*Table 4 here*

Several findings stand out. First, there is no evidence that respondents simply elected the first option shown (i.e., there is no effect of "Lump sum shown last"), giving some comfort that the respondents took care in answering the survey questions. Relatedly, it does not matter

[26] We do this analysis on the CV-Sell version because only the CV-Sell version asks for different increment sizes of the Social Security amount. This means that we can randomize the order in which the increment sizes are shown only for the CV-Sell version.

whether the question was asked in the first or second wave (i.e., "Asked in wave 1" has a small and insignificant coefficient estimate). Second, there is bias with respect to both of the other measures, as would be expected if individuals had difficulty valuing annuities. Specifically, the starting value has a statistically significant coefficient of 0.37. Because both the annuity valuation and the starting value are measured in logs, this means that increasing the first lump-sum amount shown by 10% raised respondents' valuations by an average of 3.7%. Furthermore, when the CV-Sell question was shown after a CV-Sell question with a larger change in Social Security benefits (so the order was large-to-small), respondents reported a 0.7 log-point higher average valuation of the annuity than if the baseline CV-Sell question was seen first.

Next we re-run this regression on two respondent sub-samples: those in the top quintile of the cognition index (col. 2) and those in the bottom quintile (col. 3). We find the effect of the log of the starting value is insignificant for individuals with higher cognitive abilities, whereas it is substantially more important (the coefficient is 0.92) for those in the bottom quintile of cognition. This suggests that less cognitively capable people are more sensitive to anchoring effects. Interestingly, however, the effect of "asked after larger version" is significant and similar in magnitude across the cognition quintiles. Moreover, the "asked after larger version" effect is extremely persistent across any cut of the data by measures of cognition. Whether the lump-sum option was shown as the first or second option continues to be insignificant for all quintiles, although we do now find that whether the question was asked in wave 1 or wave 2 is significant in the lowest cognition quintile. That is, respondents in the bottom quintile appeared to provide a significantly higher valuation in the second wave, though why this is so is not evident.

In column 4, we return to the full sample and include interactions between the cognition index and each of the four survey manipulations. Results tell a similar story: people are sensitive to starting values and even more so if they have lower cognitive abilities. "Asked after larger version" is highly significant but not mitigated by cognition. "Asked in wave 1" and "lump-sum option shown last" continue to be statistically insignificant.

*D. Explaining Annuity Valuations*

A key reason that life annuities play such an important role in life-cycle economic models is that they provide a cost-effective way to smooth consumption by insuring against longevity risk. Although numerous authors have calculated the welfare gains associated with annuitization, there is conflicting evidence on the extent to which real-world individuals actually value the

insurance. Brown (2001) showed that a utility-based measure of annuity valuation was correlated with a binary measure of intended annuitization of asset balances. Bütler and Teppa (2007) documented similar findings in the Swiss system. Nevertheless, such measures explain only a very small fraction of the variation in the annuitization decision. Brown, Kling, Mullainathan, and Wrobel (2008) suggested that the ubiquitous framing of retirement planning in terms of wealth accumulation has conditioned individuals to ignore the insurance aspects of annuities and view them through an investment lens, consistent with individuals resorting to simplified decision-making heuristics in the face of complexity (Benartzi, Previtero, and Thaler 2011).

To further explore the determinants of annuity valuations, we regress annuity valuations against various determinants of annuity demand in our data. Column 1 of Table 5 regresses the average of CV-Sell and CV-Buy valuations against the actuarial value of the annuity offer presented (which varied by cohort, age at annuitization, and sex; it also assumed a real interest rate of three percent).[27] The actuarial value term has a coefficient of 1.02, suggesting that there is approximately a one-for-one correspondence between the annuity's actuarial value and individuals' subjective valuations of the annuity. Column 2 replaces the actuarial value with a theoretical utility-based measure. Following Brown (2001), this is derived from a parameterized life-cycle model with variation coming from age at annuitization, mortality differences by cohort and sex, marital status (which determines whether it is a single or joint optimization), risk aversion, current levels of non-annuitized wealth, current annuitized wealth, and interactions of these variables through the utility-maximizing model. We find that the coefficient on this theoretical, utility-based annuity value in column 2 is not significantly different from zero, though it is significantly different from one.[28] In columns 3 and 4, we repeat this analysis using even more control variables, and we obtain very similar results.[29]

[27] We use the CV versions because, unlike the EV versions, these were asked in different waves of the survey. We take the average of CV-Sell and CV-Buy because there is no a priori reason to consider one more credible than the other.

[28] In results not detailed here, when we include both the actuarial value and the utility-based measure, we continue to find that the coefficient on the actuarial value is approximately one and that the utility-based measure is insignificant.

[29] In Online Appendix Table A.8, we repeat the regressions in columns 1 and 3 of Table 5, but now we use each of our four separate valuation measures (CV-Sell, CV-Buy, EV-Sell and EV-Buy). In seven of the eight additional specifications, we cannot reject the hypothesis that the coefficient on the actuarial value is equal to one, but we can reject at the 10% level or better that it is equal to zero. In unreported results, we also find that the utility-based measure is not significant using these alternative dependent

*Table 5 here*

Overall, we view these results as casting some doubt on the notion that individuals take consumption-smoothing and insurance considerations into account when valuing annuities, although we acknowledge that the lack of predictive power of the theoretical utility-based measure could be related to possible misspecification of the underlying model. One possible interpretation of our findings in Table 5 is that individuals use a simple financial decision rule (e.g., "How long will it take me to break even?") to obtain a first guess of the annuity value, and then they adjust this value to reflect their reluctance to trade an asset that they have trouble valuing. The adjustment would be upwards for CV-Sell and downwards for CV-Buy. Because these adjustments go in opposite directions, we obtain valuations that on average appear to be following a simple decision rule. We note that R-squared values are very low, at around 0.05 to 0.06. The low explanatory power is consistent with prior studies (e.g., Brown 2008), which also found it difficult to account for observed variation in annuitization decisions.

Table 6 reports coefficient estimates on the actuarial value separately by cognition index quintile. Though the coefficients differ non-monotonically across the cognition quintiles, they are never significantly different from 1.[30] We do, however, find that the root MSE is monotonically declining with the level of cognition. Recalling that our dependent variable is in logs, these differences are economically meaningful. For example, the root mean squared distance from the regression line declines by 0.24 log-points when one moves from the bottom to the second cognition quintile, and by 0.60 log-points when one moves from the bottom to the top cognition quintile. In other words, decisions made by less cognitively capable individuals are substantially noisier than those made by the more cognitively able.

*Table 6 here*

*E. Robustness to Outliers and to Age of the Sample*

To verify that possible outliers have no important major effects on the results, we have replicated Figure 3 and Tables 2-6 using only annuity valuation measures winsorized at the 10$^{th}$ and 90$^{th}$ percentiles. Results are very similar (see Online Appendix Figure A.4 and Tables A.11-

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variables. Moreover, in Appendix Tables A.9 and A.10, we show that the results of Table 5 are robust to using either the CV-Sell or CV-Buy value (rather than their average) as the dependent variable.

[30] We also ran a single regression in which the cognition index was interacted with the actuarial value (including the same controls as in Table 6, the direct effect of the cognition index and the direct effect of actuarial value). The interaction term has a coefficient estimate of 0.001 (s.e.: 0.146), which confirms that the effect of the actuarial value on the annuity valuation does not differ significantly by cognition.

15). We also examined the possibility that our results might be driven by a lack of interest in our questions by younger respondents, who may not have given retirement planning much thought. Accordingly, we replicated Figure 3 and Tables 2-6 using only respondents age 50+, and our results for this sample are similar (see Online Appendix Figure A.5 and Tables A.16-20).

## V. Discussion and Conclusions

The goal of this study has been to investigate what drives cross-sectional variation in individuals' abilities to value a stream of life annuity payments. We find that, on average, consumers tend to value annuities less when given the opportunity to buy more, but they value them more when given the opportunity to sell annuities in exchange for a lump sum. Because this finding holds even when no *status quo* option is available, this finding is not driven by standard *status quo* or endowment effects. Additionally, we show that liquidity constraints cannot explain this finding. Furthermore, there is considerable heterogeneity across individuals in the difference between the sell and buy valuations.

We conjecture that the discrepancy between sell and buy valuations arises because people are reluctant to enter into an annuity transaction if they have difficulty ascertaining its value. Such reluctance regarding difficult-to-value transactions will generally serve people well, because such transactions can come with a risk of being taken advantage of by a more sophisticated counterparty. One testable implication of our conjecture is that people who are less cognitively able and therefore have more difficulty valuing the annuity, will be more reluctant to trade, resulting in higher selling and lower buying prices. We show that the spread between sell and buy prices indeed falls with our index of cognition, which relies on measures of education, financial literacy, and numeracy. A second testable implication is that heterogeneity in cognition will lead to a negative correlation between selling and buying prices. We indeed observe this negative correlation. A further indication that people have trouble valuing annuities comes from our finding that people are sensitive to framing and starting values and that the sensitivity to starting values decreases in the cognition index. Moreover, the cross-sectional variation in subjective annuity valuations is correlated with the relatively simple-to-calculate actuarial value, but not with a more cognitively challenging utility-based value. Finally, decisions made by less cognitively adept individuals are substantially noisier than those of the more cognitively able. Our conjectured mechanism – heterogeneity in cognitive abilities combined with a reluctance to

exchange when one has trouble valuing an annuity – is consistent with all of our findings, and we have shown that many alternative explanations, such as transactions cost, endowment or *status quo* effects, or liquidity constraints, cannot explain all of our findings. Of course, we cannot rule out the existence of yet some other mechanism that might be consistent with the results.

Our findings raise questions about the extent to which consumers are able to make utility-maximizing choices when confronted with a decision about whether to buy longevity protection. While our results do not speak directly to why average annuity values are so low (and thus do not illuminate the "annuity puzzle"), they do indicate that one should not necessarily infer from low annuity demand that individuals' experienced utility is maximized at low levels of annuitization. For example, the fact that so few people annuitize their defined contribution pension balances when given the opportunity to do so should not be interpreted as conclusive revealed preference evidence that they do not value longevity protection. Of course, even if an individual places similar values on an annuity when buying and selling, this does not imply that he correctly assesses the value of the annuity to him; consistency in valuation across buying and selling is a necessary but not a sufficient condition for the correct valuation of annuities.

In addition to advancing our intellectual understanding, our results have considerable policy relevance. For example, in 2014 the UK eliminated its mandatory annuitization requirement, thus leaving the decision of whether or not to annuitize retirement account balances in the hands of individual retirees (Donaldson and Hutton 2014). By contrast, the Singaporean government now requires retirees to purchase life annuities sufficient to cover subsistence needs (Fong, Mitchell, and Koh 2011). U.S. policymakers have expressed interest in encouraging annuitization in 401(k) and other defined contribution plans. There is also an emerging debate in the U.S. about whether to encourage or discourage a particular form of "de-risking" of corporate defined benefit pension plans, where retirees are offered a lump sum in lieu of lifelong pension benefits. In these and other instances, our results suggest that many individuals face cognitive constraints in making appropriate judgments about annuitization. Accordingly, policymakers would do well to recognize the substantial heterogeneity in people's capabilities to make important financial decisions that are in their best interest.

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**Figure 1: Cumulative Distribution Functions of CV-Sell and CV-Buy Annuity Valuations**

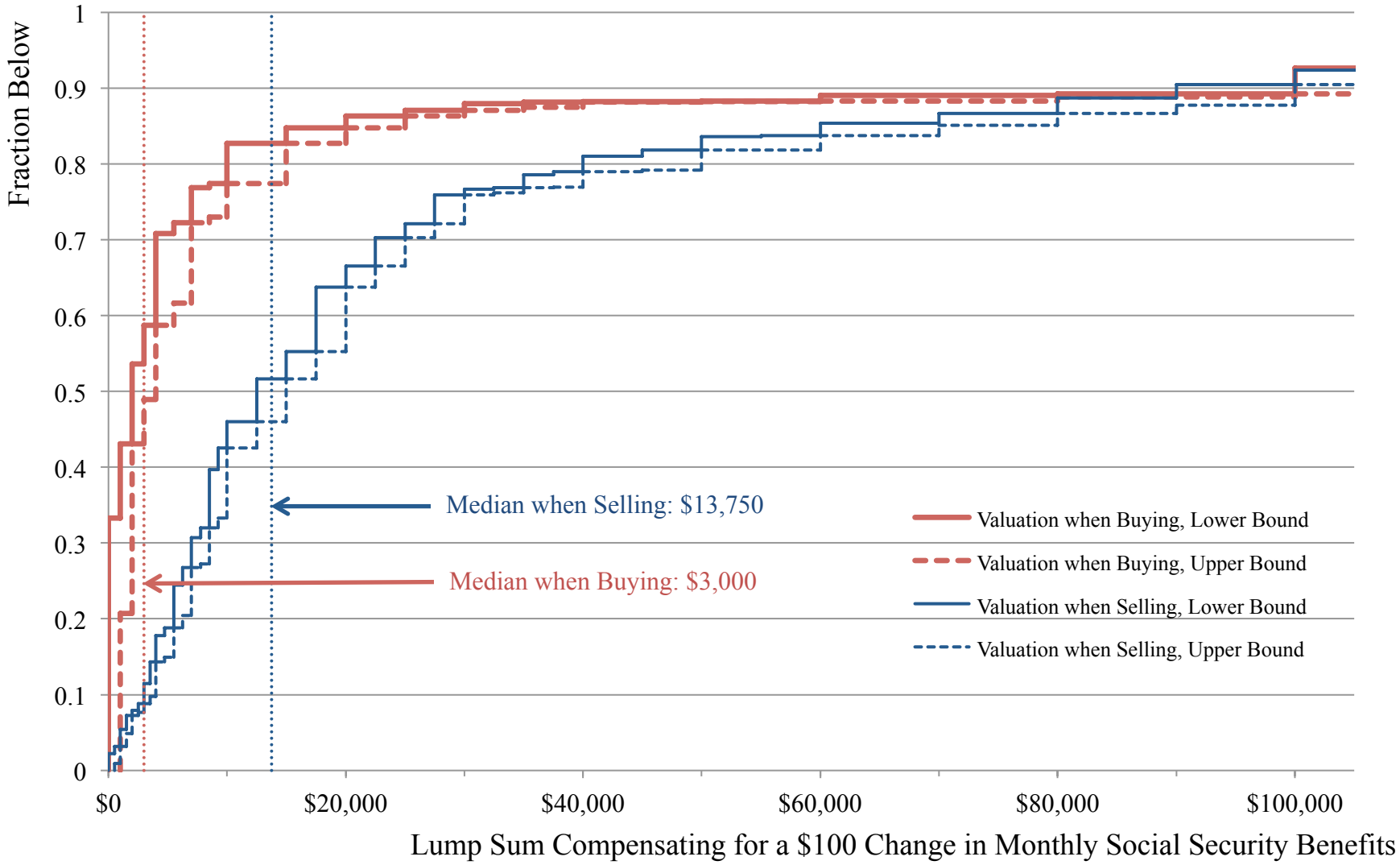


**Figure 2: Cumulative Distribution Functions of EV-Sell and EV-Buy Annuity Valuations**

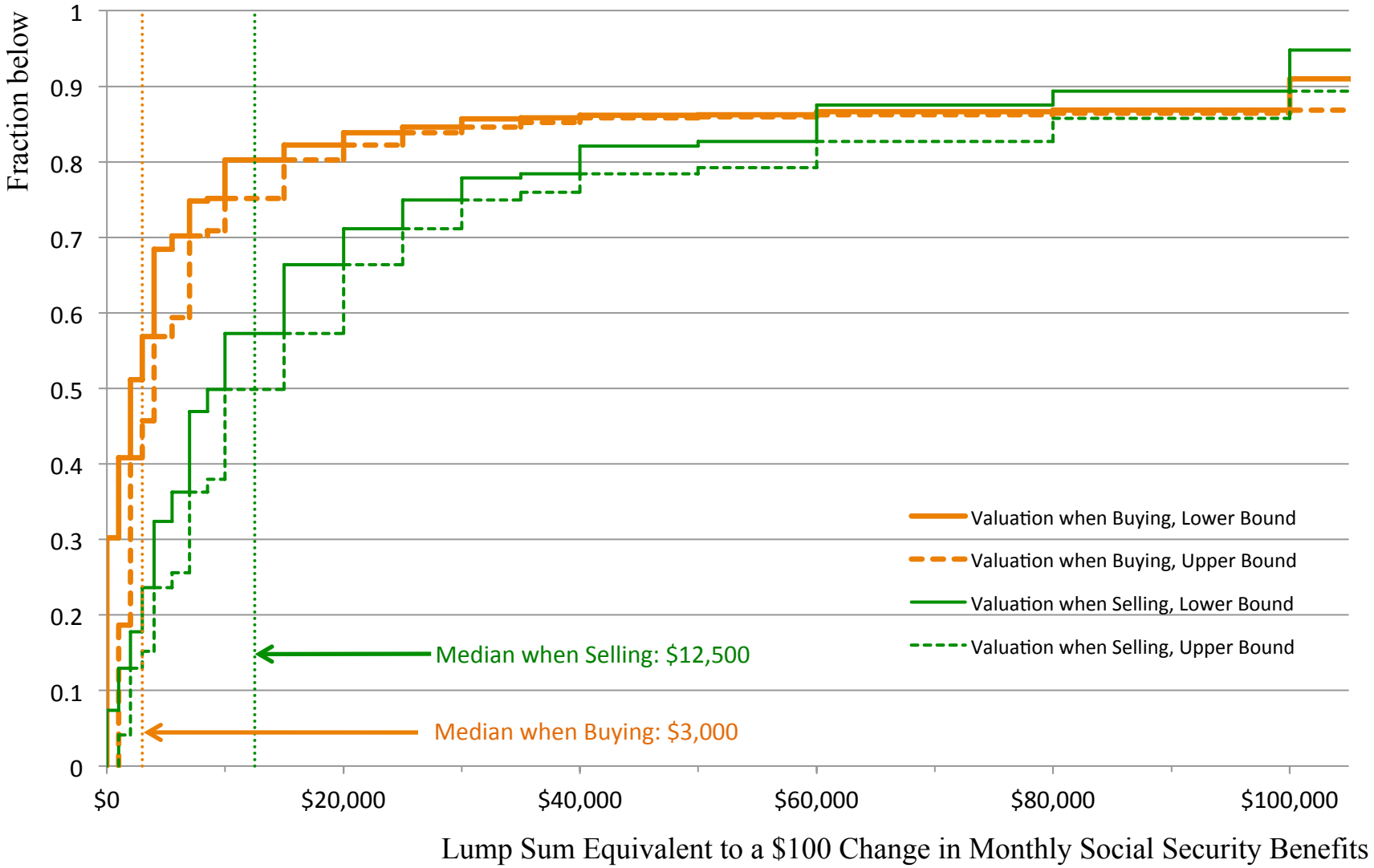
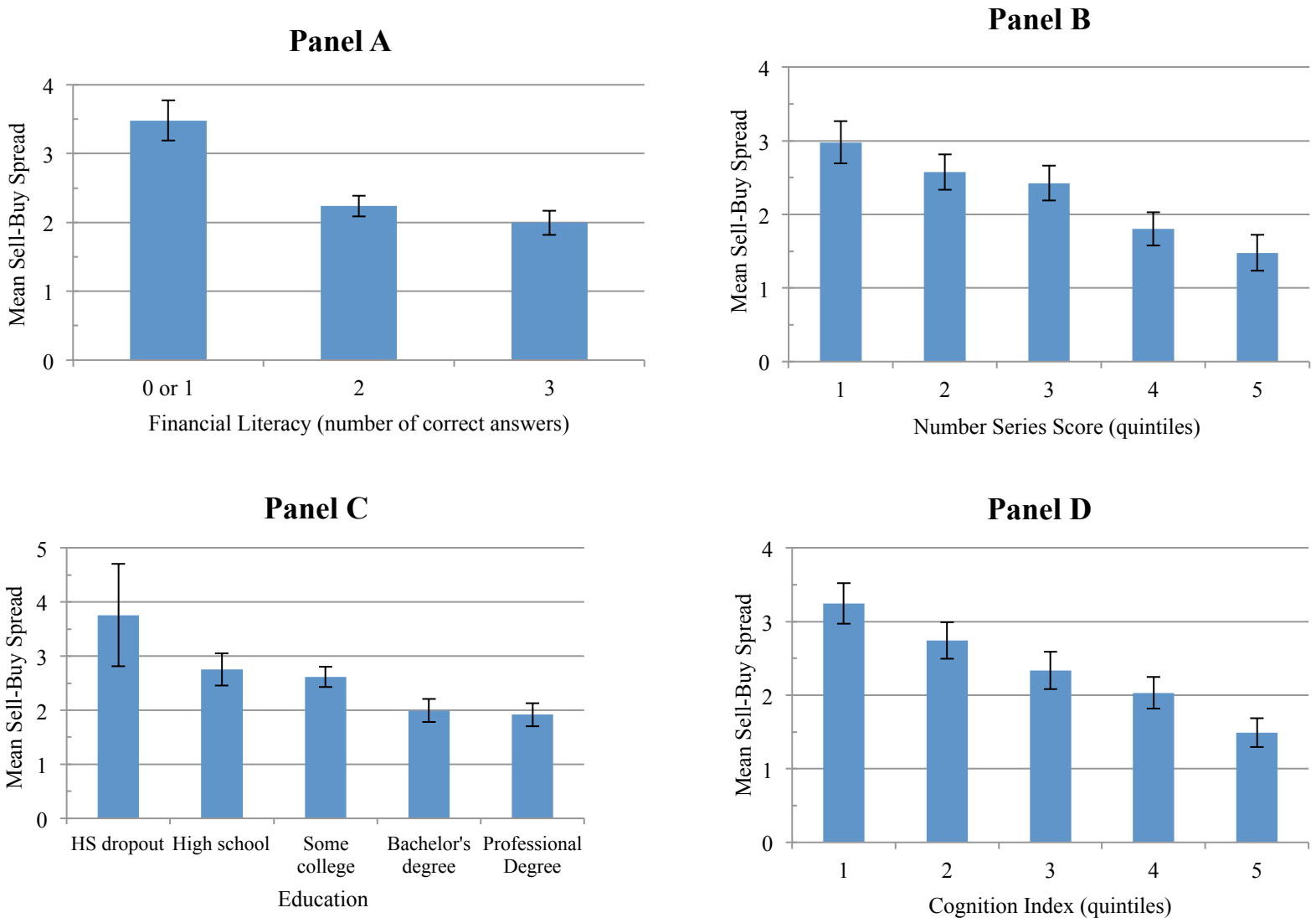


**Figure 3: Sell-Buy Spread by Measures of Decision-Making Ability**




Note: The whiskers represent 95% confidence intervals. The Sell-Buy Spread is measured as the absolute value of the difference between the log CV-Sell valuation and the log CV-Buy valuation of a $100 change in monthly Social Security benefits. For the Financial Literacy measure, we grouped those with no correct answers with those with one correct answer because there are very few observations (4%) with no correct answers.

**Table 1: Characteristics of the ALP Sample**

| | (1) ALP Sample Mean | (2) CPS Mean | (3) Difference ALP-CPS |
|---|---|---|---|
| Age | 51.4 | 46.2 | 5.19*** |
| Age: 18-34 | 0.16 | 0.31 | -0.15*** |
| Age: 35-49 | 0.25 | 0.27 | -0.02 |
| Age: 50-64 | 0.41 | 0.25 | 0.16*** |
| Age: 65+ | 0.18 | 0.17 | 0.01 |
| Female | 0.58 | 0.51 | 0.07*** |
| Married | 0.60 | 0.54 | 0.07*** |
| Race/Ethnicity | | | |
| Non-Hispanic White | 0.80 | 0.68 | 0.12*** |
| Non-Hispanic Black | 0.08 | 0.12 | -0.04*** |
| Hispanic | 0.09 | 0.14 | -0.05*** |
| Other Race/Ethnicity | 0.03 | 0.07 | -0.03*** |
| Education | | | |
| High School Dropout | 0.02 | 0.13 | -0.11*** |
| High School | 0.16 | 0.30 | -0.14*** |
| Some College | 0.37 | 0.28 | 0.09*** |
| Bachelor's Degree | 0.25 | 0.18 | 0.07*** |
| Professional Degree | 0.19 | 0.10 | 0.10*** |
| Ln Family Income | 10.89 | 10.77 | 0.13*** |
| Family Income: Below 25k | 0.18 | 0.24 | -0.07*** |
| Family Income: 25k-50k | 0.27 | 0.24 | 0.04*** |
| Family Income: 50k-75k | 0.21 | 0.18 | 0.03*** |
| Family Income: 75k-100k | 0.13 | 0.12 | 0.01** |
| Family Income: Above 100k | 0.21 | 0.23 | -0.02* |
| Household size | 2.68 | 3.00 | -0.33*** |
| Household size of one | 0.22 | 0.14 | 0.08*** |
| Household size of two | 0.36 | 0.33 | 0.03*** |
| Household size of three | 0.15 | 0.19 | -0.04*** |
| Household size of four + | 0.27 | 0.33 | -0.06*** |
| Region | | | |
| Northeast | 0.17 | 0.18 | -0.02* |
| Midwest | 0.24 | 0.22 | 0.02** |
| South | 0.35 | 0.37 | -0.01 |
| West | 0.24 | 0.23 | 0.01 |
| Observations | 2,112 | 146,785 | |

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%. In both the ALP and the CPS the sample is restricted to those aged 18 and older. The ALP sample was collected between June and August of 2011. The CPS data are from March 2011 and use CPS person weights; the ALP data are unweighted.

**Table 2: Correlations between Annuity Valuation Measures (All in Natural Logs)**

| Pairwise correlations | CV-Sell | EV-Sell | CV-Buy | EV-Buy |
|---|---|---|---|---|
| CV-Sell | 1 | | | |
| EV-Sell | 0.31*** | 1 | | |
| CV-Buy | -0.11*** | -0.17*** | 1 | |
| EV-Buy | -0.11*** | -0.15*** | 0.72*** | 1 |

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%. Each entry gives the pairwise correlation between the variable listed in the column and in the row. All four variables are a measures of the valuation that an individual places on $100 change in monthly Social Security benefits. See the text for exact definitions. All measures are expressed in logs of the midpoint between the upper and lower bounds. To correct for correlations induced by common experimental manipulations (such as the starting value) across the four variables, we regress each variable on the relevant experimental manipulations and take the residual. The correlations between the resulting residuals are shown in the Table; uncorrected pairwise correlations are very similar and provided in Online Appendix Table A.3.

**Table 3: Explaining the Sell-Buy Spread**

| | Dependent Variable: Absolute Value of Difference between Log CV-Sell and Log CV-Buy | | | |
|---|---|---|---|---|
| Explanatory Variables | (1) | (2) | (3) | (4) |
| Age 35 to 49 | -0.10 | 0.08 | 0.09 | 0.22 |
| | (0.13) | (0.13) | (0.13) | (0.13) |
| Age 50 to 64 | 0.05 | 0.33*** | 0.34*** | 0.42*** |
| | (0.12) | (0.12) | (0.12) | (0.13) |
| Age 65 and older | 0.44*** | 0.66*** | 0.68*** | 0.66*** |
| | (0.14) | (0.14) | (0.14) | (0.16) |
| Cognition index, standardized | | | -0.59*** | -0.41*** |
| | | | (0.04) | (0.05) |
| Financial literacy index, 0-3 scale | | -0.32*** | | |
| | | (0.06) | | |
| Education index, 1-5 scale | | -0.24*** | | |
| | | (0.04) | | |
| Number series score, standardized | | -0.31*** | | |
| | | (0.05) | | |
| Controls for demographics and preferences | No | No | No | Yes |
| Controls for experimental variation | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 0.0279 | 0.1230 | 0.1233 | 0.1681 |
| Number of observations | 2065 | 2065 | 2065 | 2065 |
| Mean of dependent variable | 2.58 | 2.58 | 2.58 | 2.58 |
| Standard deviation of dependent variable | 1.85 | 1.85 | 1.85 | 1.85 |

Notes: Robust standard errors between parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Each column contains an OLS regression of the Sell-Buy Spread (absolute value of the difference between log CV-Sell and log CV-Buy) on the explanatory variables listed in the rows. CV-Sell is the lump-sum amount given to the individual that would exactly compensate the individual for a $100 decrease in monthly Social Security benefits. CV-Buy is the lump-sum amount the individual is just willing to pay for a $100 increase in monthly Social Security benefits. All regressions also include controls for missing values of explanatory variables and controls for experimental manipulations, namely: log of starting value, asked after larger version, asked in wave 1, lump-sum option shown last. The financial literacy index is equal to the number of correct answers to three financial literacy questions (mean: 2.12 s.d.: 0.80). The education index equals 1 for high school dropouts, 2 for high school graduates, 3 for some college, 4 for bachelor's degree, and 5 for professional degree (mean: 3.42 s.d.: 1.05). The number series score is a standardized measure of performance on a number of questions that involve completing number series. The cognition index is the first principal component of the financial literacy index, the education index, and the number series score. The coefficients on the demographic and preference variables of the regression in column 4 are shown in Online Appendix Table A.4 column 1.

**Table 4: Effects of Randomizations and Interactions with the Cognition Index**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Dependent Variable: Log CV-Sell | | | |
| Explanatory Variables | Entire sample | Top quintile of cognition index | Bottom quintile of cognition index | Entire sample |
| Log of starting value | 0.37*** | 0.17 | 0.92*** | 0.39*** |
| | (0.07) | (0.13) | (0.21) | (0.07) |
| Asked after larger version | 0.70*** | 0.70*** | 0.77*** | 0.69*** |
| | (0.07) | (0.12) | (0.19) | (0.07) |
| Asked in wave 1 | 0.04 | 0.01 | 0.38** | 0.05 |
| | (0.07) | (0.12) | (0.19) | (0.07) |
| Lump-sum option shown last | 0.09 | 0.01 | -0.03 | 0.08 |
| | (0.07) | (0.12) | (0.19) | (0.07) |
| Log of starting value × Cognition index | | | | -0.20** |
| | | | | (0.08) |
| Asked after larger version × Cognition index | | | | -0.09 |
| | | | | (0.07) |
| Asked in wave 1 × Cognition index | | | | -0.03 |
| | | | | (0.07) |
| Lump-sum option shown last × Cognition index | | | | 0.03 |
| | | | | (0.07) |
| Cognition index | | | | -0.17*** |
| | | | | (0.04) |
| Adjusted $R^2$ | 0.0600 | 0.0832 | 0.0827 | 0.0737 |
| N | 2,090 | 385 | 412 | 2,090 |
| Mean of dependent variable | 10.02 | 9.82 | 10.27 | 10.02 |
| Standard deviation of dependent variable | 1.56 | 1.19 | 1.96 | 1.56 |

Notes: Robust standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Each column contains an OLS regression of the baseline CV-Sell measure on the explanatory variables listed in the rows. The baseline CV-Sell measure is the lump-sum amount given to the individual that would exactly compensate the individual for a $100 decrease in monthly Social Security benefits. CV-Sell is expressed in logs of the midpoint between the upper and lower bounds. The starting value for the annuity valuation was randomized at $10,000, $20,000, or $30,000. "Asked after larger version" equals one if the baseline CV-Sell measure was asked after a CV-Sell question in which Social Security benefits were varied by more than $100. Whether this occured was randomized. "Asked in wave 1" is a dummy variable that equals one if the CV-Sell question was asked in the first wave, and "Lump sum option shown last" is a dummy variable that equals one if the option involving the lump-sum amount was shown after the alternative option. Both dummy variables were randomized. The cognition index is the first principal component of the financial literacy index, the education index, and the number series score. All variables interacted with the cognition index are demeaned so that the coefficient on the cognition index can be interpreted as the effect of the cognition literacy index when the interaction variables are equal to their sample means.

**Table 5: Explaining Annuity Valuations**

| | Dependent Variable: Mean of Log CV-Sell and Log CV-Buy | | | |
|---|---|---|---|---|
| Explanatory Variables | (1) | (2) | (3) | (4) |
| Log actuarial value | 1.02*** | | 0.84*** | |
| | (0.25) | | (0.26) | |
| Log theoretical utility-based annuity value | | 0.04 | | 0.18 |
| | | (0.04) | | (0.13) |
| Age | -0.05*** | -0.02 | -0.04** | -0.01 |
| | (0.01) | (0.01) | (0.02) | (0.01) |
| Age squared/100 | 0.06*** | 0.02 | 0.04*** | 0.01 |
| | (0.02) | (0.01) | (0.02) | (0.01) |
| Female | -0.08 | 0.01 | -0.03 | 0.01 |
| | (0.06) | (0.05) | (0.06) | (0.06) |
| Married | 0.05 | 0.04 | 0.08 | 0.13* |
| | (0.06) | (0.06) | (0.06) | (0.07) |
| Black | 0.05 | 0.08 | 0.03 | 0.04 |
| | (0.12) | (0.12) | (0.12) | (0.12) |
| Hispanic | 0.34*** | 0.36*** | 0.32*** | 0.32*** |
| | (0.11) | (0.11) | (0.12) | (0.12) |
| Other | -0.08 | -0.08 | -0.08 | -0.09 |
| | (0.13) | (0.13) | (0.12) | (0.13) |
| Education index, 1-5 scale | | | -0.03 | -0.03 |
| | | | (0.03) | (0.03) |
| Log family income | | | 0.03 | 0.02 |
| | | | (0.04) | (0.04) |
| Owns an annuity | | | -0.07 | -0.04 |
| | | | (0.06) | (0.06) |
| Owns home | | | -0.16* | -0.16** |
| | | | (0.08) | (0.08) |
| Log financial wealth | | | 0.01 | -0.01 |
| | | | (0.02) | (0.03) |
| Self-reported health index, 1-5 scale | | | -0.03 | -0.03 |
| | | | (0.03) | (0.03) |
| Ever had kids | | | -0.03 | -0.04 |
| | | | (0.06) | (0.06) |
| Risk aversion (standardized) | | | 0.02 | 0.02 |
| | | | (0.03) | (0.03) |
| Precaution (standardized) | | | -0.07** | -0.07** |
| | | | (0.03) | (0.03) |
| Expects returns greater than 3% p.a. | | | 0.10* | 0.10* |
| | | | (0.06) | (0.06) |
| Confident SS will pay promised benefits, 1-4 scale | | | 0.12*** | 0.14*** |
| | | | (0.03) | (0.03) |
| Controls for experimental variation | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 0.0543 | 0.0473 | 0.0649 | 0.0607 |
| Number of observations | 2065 | 2065 | 2065 | 2065 |
| Mean of dependent variable | 9.18 | 9.18 | 9.18 | 9.18 |
| Standard deviation of dependent variable | 1.22 | 1.22 | 1.22 | 1.22 |

Notes: Robust standard errors between parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Each column contains an OLS regression of annuity valuation (mean of log CV-Sell and log CV-Buy) on the explanatory variables listed in the rows. CV-Sell is the lump-sum amount given to the individual that would exactly compensate the individual for a $100 decrease in monthly Social Security benefits. CV-Buy is the lump-sum amount the individual is just willing to pay for a $100 increase in monthly Social Security benefits. All regressions also include controls for missing values of explanatory variables and controls for experimental variation, namely: log of starting value, asked after larger version, asked in wave 1, lump-sum option shown last. To calculate the theoretical utility-based annuity value, we solve the lifecycle dynamic programming problem for a household that matches the respondent on age, gender, marital status, spousal age (if married), start date of the annuity, financial wealth, existing annuity wealth, and coefficient of risk aversion, assuming a real discount rate of three percent per year. We solve this lifecycle dynamic programming problem twice: once for the CV-Sell equivalent wealth and once for the CV-Buy equivalent wealth. We take the log of both amounts and average them. The education index equals 1 for high school dropouts, 2 for high school graduates, 3 for some college, 4 for bachelor's degree, and 5 for professional degree. Summary statistics and sources for the explanatory variables are provided in Online Appendix Table A.1.

**Table 6: Predictive Power of Actuarial Value by Quintile of the Cognition Index**

| Dependent Variable: Mean of Log CV-Sell and Log CV-Buy | (1) Coefficient on log actuarial value | (2) p-value on coefficient=1 | (3) Root MSE | (4) Adjusted $R^2$ | (5) N |
|---|---|---|---|---|---|
| Sample split by quintiles of the cognition index | | | | | |
| 1. Bottom quintile | 0.46 | 0.483 | 1.488 | 0.0922 | 404 |
| | (0.77) | | | | |
| 2. Second quintile | 0.76 | 0.686 | 1.246 | 0.0259 | 451 |
| | (0.59) | | | | |
| 3. Third quintile | 1.24** | 0.618 | 1.163 | 0.0204 | 392 |
| | (0.49) | | | | |
| 4. Fourth quintile | 0.77 | 0.650 | 1.034 | 0.0498 | 433 |
| | (0.50) | | | | |
| 5. Fifth quintile | 1.49*** | 0.340 | 0.889 | 0.0677 | 385 |
| | (0.51) | | | | |

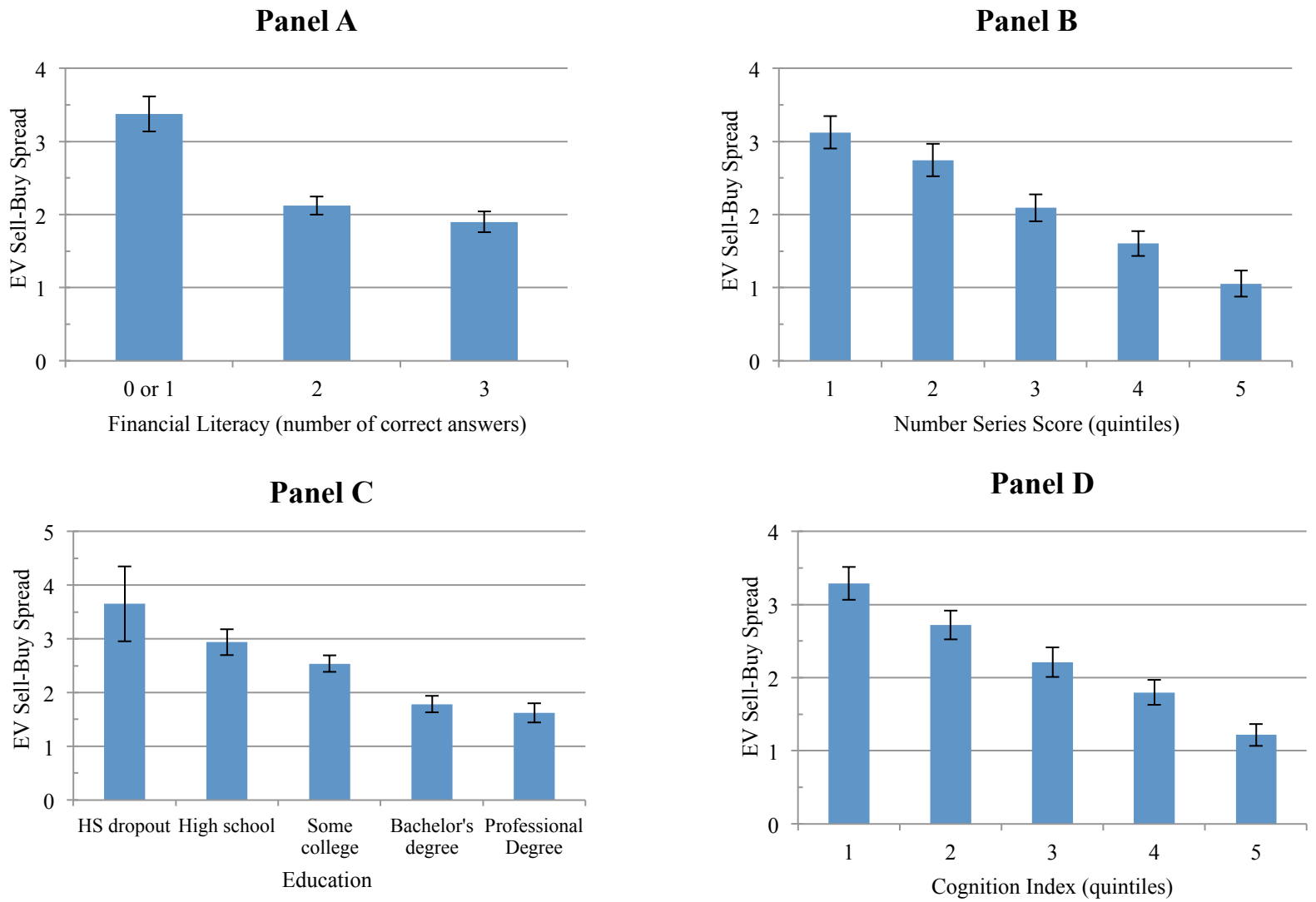
Notes: Robust standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Here we estimate specification 1 of Table 5 by subsample. Each row contains an OLS regression of the log annuity valuation (mean of CV-Sell and CV-Buy) on the log actuarial value and additional controls. Additional controls are those in specification 1 of Table 5. The cognition index is the first principal component of the financial literacy index, the education index, and the number series score.

# Online Appendices for:

# Cognitive Constraints on Valuing Annuities

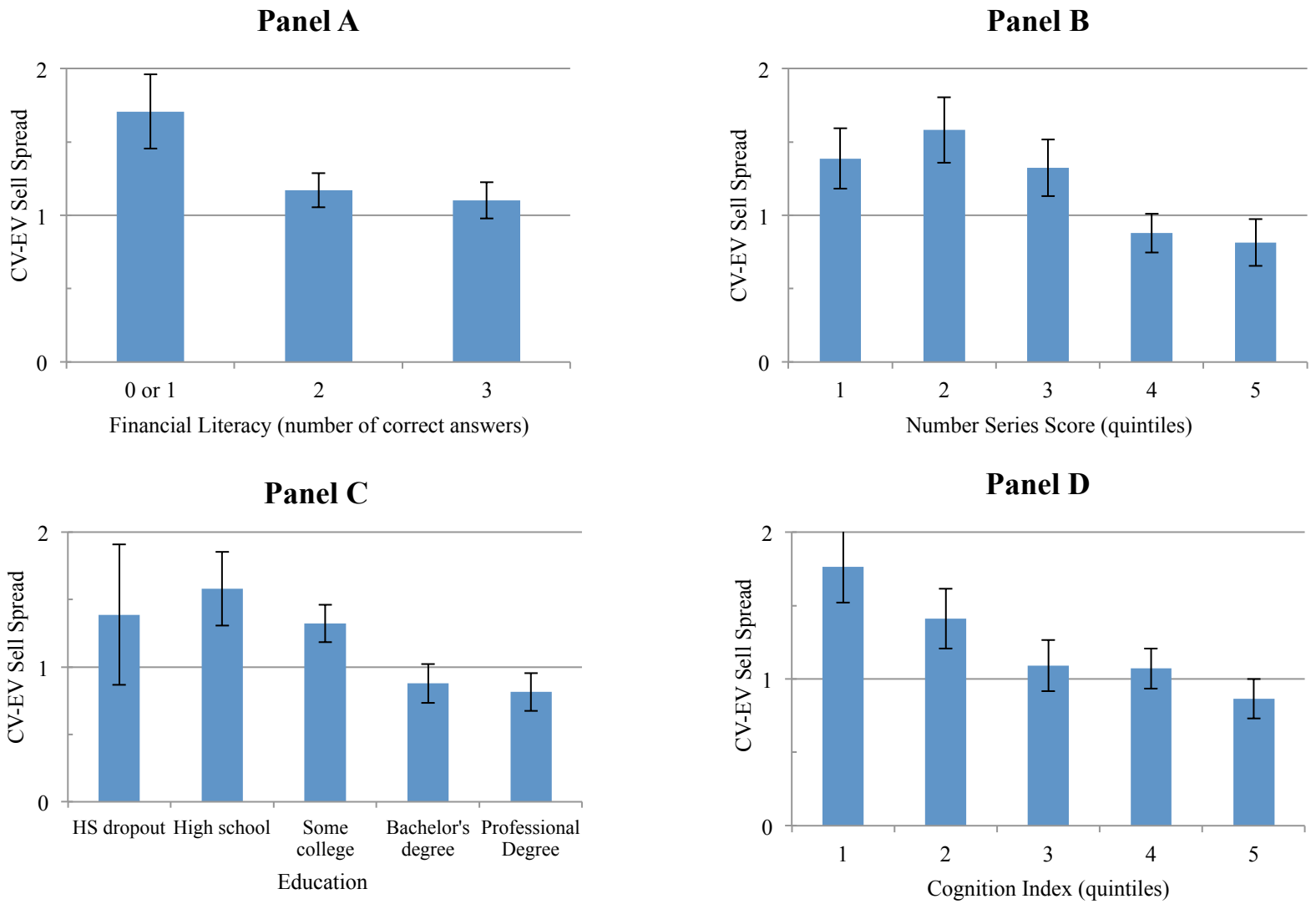
Jeffrey R. Brown, Arie Kapteyn, Erzo F.P. Luttmer, and Olivia S. Mitchell

**Figure A.1: EV Sell-Buy Spread by Measures of Decision-Making Ability**



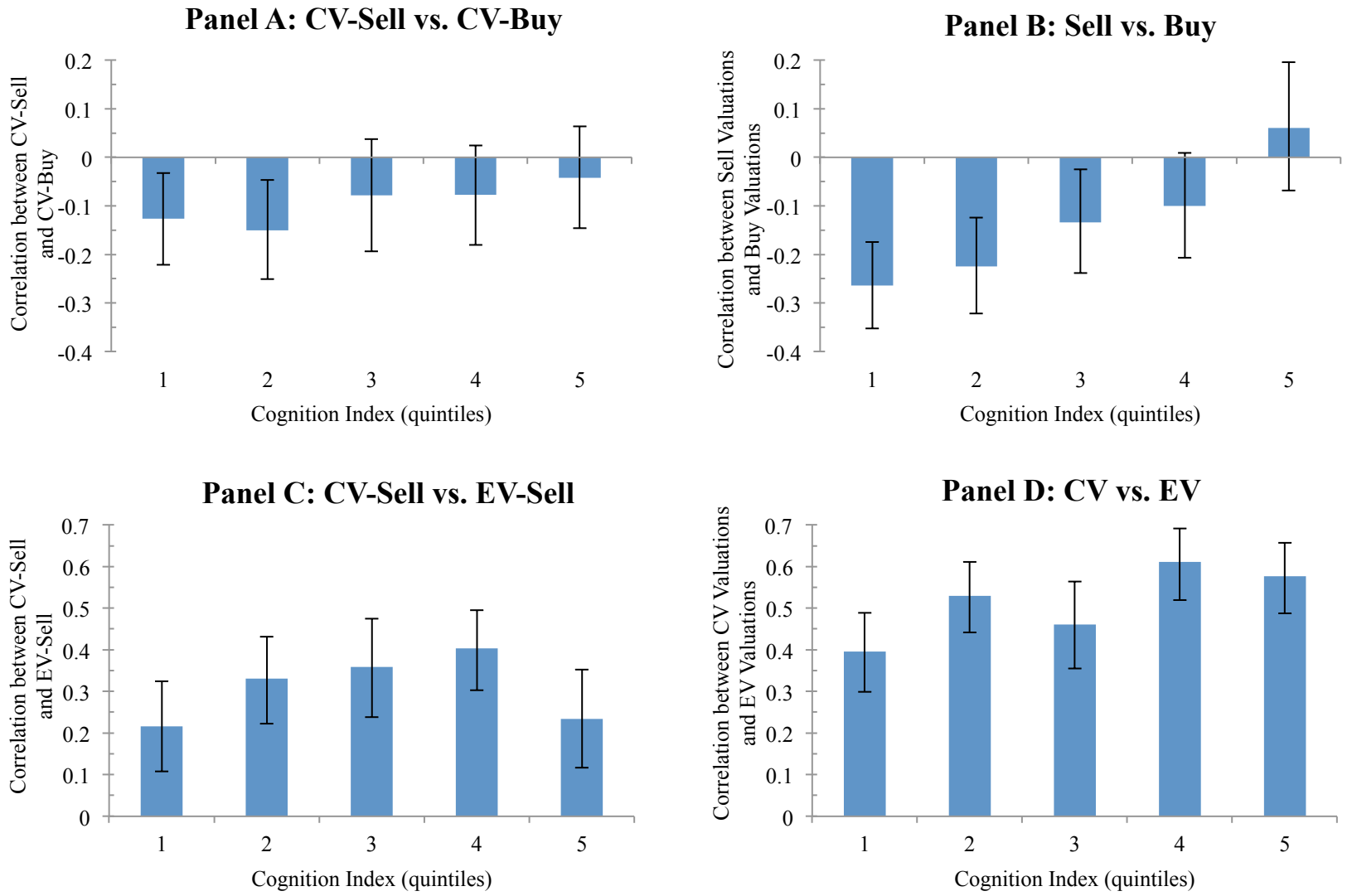

Note: The whiskers represent 95% confidence intervals. This figure is identical to Figure 3 except that the Sell-Buy Spread is based on EV valuations rather than CV valuations. The EV Sell-Buy Spread is measured as the absolute value of the difference between the log EV-Sell valuation and the log EV-Buy valuation of a $100 change in monthly Social Security benefits.

**Figure A.2: EV-CV Sell Spread by Measures of Decision-Making Ability**



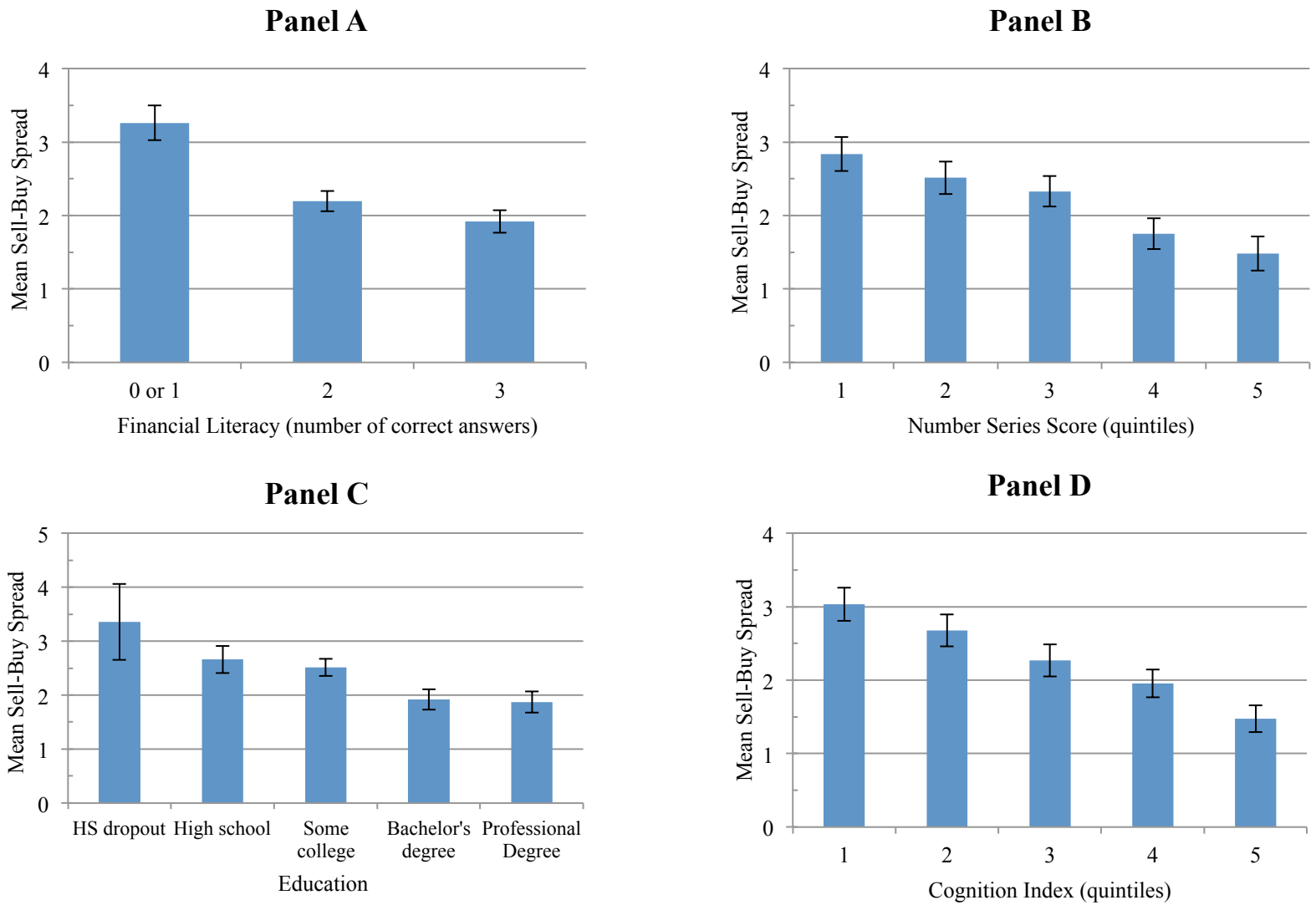

Note: The whiskers represent 95% confidence intervals. This figure is identical to Figure 3 except that the graphs plot the EV-CV Sell Spread rather than the CV Sell-Buy Spread. The EV-CV Sell Spread is measured as the absolute value of the difference between the log EV-Sell valuation and the log CV-Sell valuation of a $100 change in monthly Social Security benefits.

**Figure A.3: Correlations of Log Annuity Valuations by the Cognition Index**



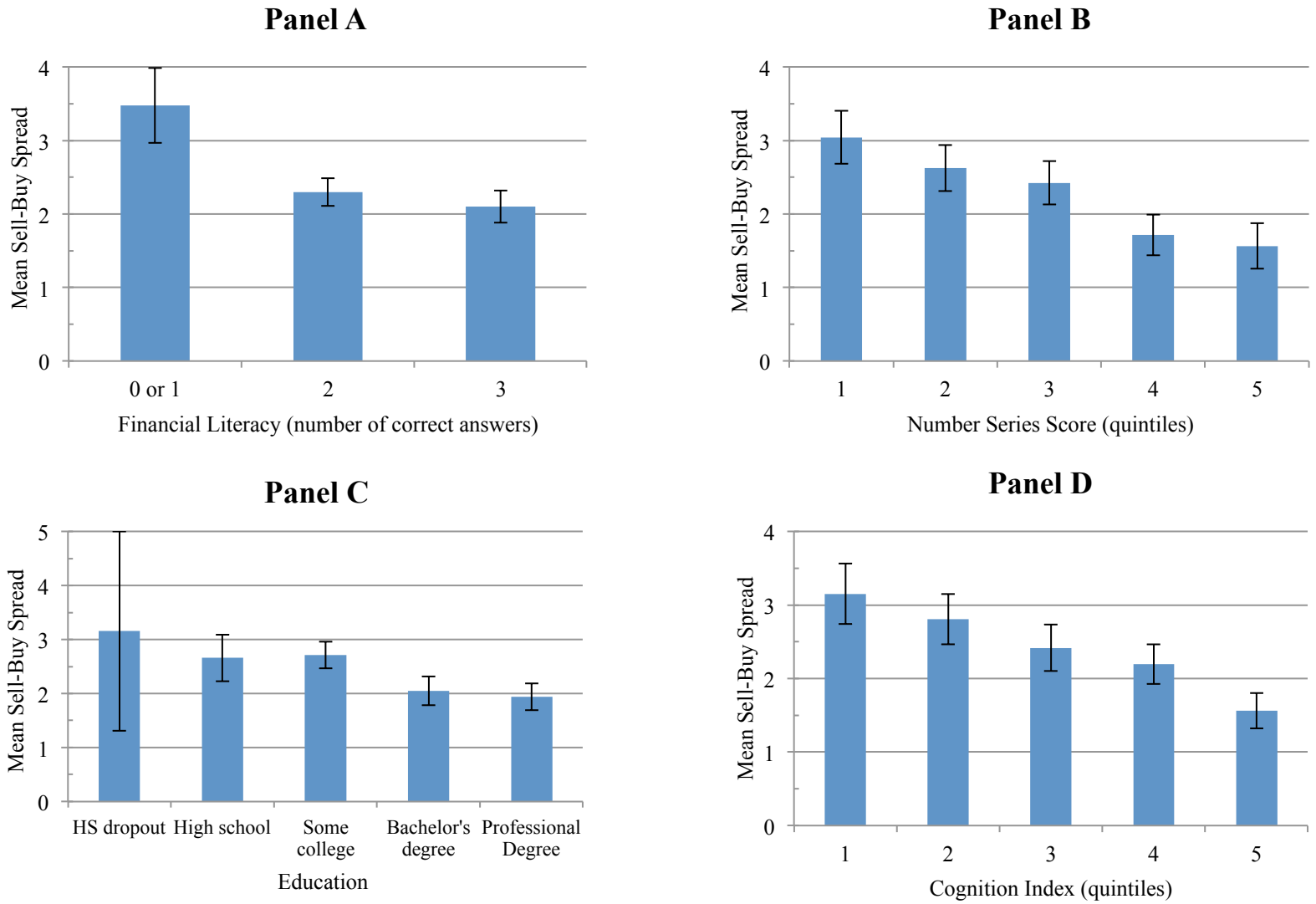

Note: The whiskers represent 95% confidence intervals. Confidence intervals are based on exact percentiles in 10,000 bootstrap replications. All annuity valuations are expressed in logs. The Sell Valuation is the average of log CV-Sell and log EV-Sell. The Buy Valuation is the average of log CV-Buy and log EV-Buy. The CV Valuation is the average of log CV-Sell and log CV-Buy. The EV Valuation is the average of log EV-Sell and log EV-Buy. To correct for correlations induced by common experimental manipulations (such as the starting value) across the four valuation measures, we regress each valuation measure on the relevant experimental manipulations and take the residual. These regressions are run separately for each quintile of the cognition index. The correlations between the resulting residuals are shown in the figure.

**Figure A.4: Winsorized Sell-Buy Spread by Measures of Decision-Making Ability**




Note: The whiskers represent 95% confidence intervals. This figure is identical to Figure 3 except that the Sell-Buy Spread was calculated based on annuity valuation measures that were winsorized at the 10th and 90th percentiles. The Sell-Buy Spread is measured as the absolute value of the difference between the winsorized log CV-Sell valuation and the winsorized log CV-Buy valuation of a $100 change in monthly Social Security benefits.

**Figure A.5: Sell-Buy Spread by Measures of Decision-Making Ability for the Age 50+ Sample**




Note: The whiskers represent 95% confidence intervals. This figure is identical to Figure 3 except that the sample is restricted to respondents age 50 and above. The Sell-Buy Spread is measured as the absolute value of the difference between the log EV-Sell valuation and the log EV-Buy valuation of a $100 change in monthly Social Security benefits.

## Table A.1: Further Summary Statistics

| | (1) Mean | (2) Std. Dev. | (3) N | (4) Source |
|---|---|---|---|---|
| *Annuity Valuation Measures* | | | | |
| CV-Sell (log of category midpoint) | 10.02 | 1.56 | 2090 | Q.2.3 |
| CV-Sell if $100 increment is shown first | 9.67 | 1.51 | 1046 | Q.2.3 |
| EV-Sell (log of category midpoint) | 9.48 | 1.71 | 2089 | Q.6.3 |
| CV-Buy (log of category midpoint) | 8.34 | 2.06 | 2086 | Q.6.3 |
| EV-Buy (log of category midpoint) | 8.51 | 2.17 | 2082 | Q.6.3 |
| Average of CV-Sell and CV-Buy (in logs) | 9.18 | 1.22 | 2065 | |
| CV Sell-Buy Spread (in logs) | 2.58 | 1.85 | 2065 | |
| Log actuarial value | 9.68 | 0.20 | 2112 | See note |
| Log theoretical utility-based annuity value | 9.38 | 0.79 | 2112 | See note |
| *Randomization Variables* | | | | |
| Log of starting value | 9.80 | 0.45 | 2112 | |
| Asked after larger version | 0.50 | 0.50 | 2112 | |
| Asked in wave 1 | 0.47 | 0.50 | 2112 | |
| Lump-sum option shown last | 0.52 | 0.50 | 2112 | |
| *Control Variables Not Already Listed in Table 1* | | | | |
| Financial literacy index | 2.12 | 0.80 | 2112 | Q.3.2.1 - Q.3.2.3 |
| Financial literacy index = 0 | 0.04 | 0.20 | 2112 | |
| Financial literacy index = 1 | 0.14 | 0.34 | 2112 | |
| Financial literacy index = 2 | 0.47 | 0.50 | 2112 | |
| Financial literacy index = 3 | 0.35 | 0.48 | 2112 | |
| Education index, 1-5 scale | 3.42 | 1.05 | 2112 | Preloaded from ALP |
| Number series score (standardized) | 0.00 | 1.00 | 2112 | Preloaded from ALP |
| Log family income (annual) | 10.89 | 0.93 | 2104 | Preloaded from ALP |
| Owns an annuity | 0.50 | 0.50 | 2110 | Q.3.5.1, Q.3.5.3 |
| Owns home | 0.75 | 0.43 | 1885 | Preloaded from ALP |
| Log financial wealth (if financial wealth ≥ $1000) | 11.71 | 1.51 | 1468 | Preloaded from ALP |
| Self-reported health index, 1-5 scale | 3.56 | 0.89 | 2109 | Q.3.1 |
| Ever had kids | 0.73 | 0.45 | 2090 | Preloaded from ALP |
| Risk aversion (standardized) | 0.00 | 1.00 | 2098 | Q.3.3.1 - Q3.3.6 |
| Precaution (standardized) | 0.00 | 1.00 | 2104 | Q.3.3.7 - Q3.3.8 |
| Expects returns greater than 3% p.a. | 0.41 | 0.49 | 2103 | Q.3.8.3 |
| Confident SS will pay promised benefits, 1-4 scale | 2.34 | 0.84 | 2109 | Q.3.7 |

Notes: The upperbound of the top category is assumed to be $1 million. Log actuarial value is calculated by us based on cohort mortality tables, age at annuitization, and sex, assuming a real interest rate of three percent per year. To calculate the theoretical utility-based annuity value, we solve the lifecycle dynamic programming problem for a household that matches the respondent on age, gender, marital status, spousal age (if married), start date of the annuity, financial wealth, existing annuity wealth, and coefficient of risk aversion assuming a real discount rate of three percent per year. We solve this lifecycle dynamic programming problem twice: once for the CV-Sell equivalent wealth and once for the CV-Buy equivalent wealth. We take the log of both amounts and average them. The education index corresponds to the education categories in Table 1, with higher values corresponding to higher levels of eduction. The number series score is based on six questions where a respondent was shown an incomplete sequence of numbers and asked to complete the sequence. Missing values (14% of observations) are set equal to the mean and variable is standized. "Owns an annuity" equals one for anyone who currently receives or in the future expects to receive annuity income other than from Social Security. Higher values of the self-reported health index correspond to better health. Risk aversion is the standardized sum of Q.3.3.1 to Q.3.3.6 (with Q.3.3.3, Q.3.3.5, and Q3.3.6 reverse coded). Precaution is the standardized sum of Q.3.3.7. and Q.3.3.8. Higher values of the variable "confidence that Social Security will pay promised benefits" correspond to greater levels of confidence.

**Table A.2: Characteristics of Individuals with Valuation Responses in the Tails of the Distribution**

| | Means by Group | | | | | |
|---|---|---|---|---|---|---|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | Entire Sample | Any Tail of CV-Sell or CV-Buy | Bottom Tail of CV-Sell Valuation | Top Tail of CV-Sell Valuation | Bottom Tail of CV-Buy Valuation | Top Tail of CV-Buy Valuation |
| *Basic Demographics* | | | | | | |
| Age | 51.4 | 51.9 | 50.6 | 53.3 | 52.6 | 48.9 |
| Female | 0.58 | 0.65*** | 0.63 | 0.70*** | 0.65*** | 0.66*** |
| Married | 0.60 | 0.55*** | 0.57 | 0.57 | 0.55*** | 0.53** |
| Black | 0.08 | 0.11*** | 0.14*** | 0.14*** | 0.11*** | 0.14*** |
| Hispanic | 0.09 | 0.13*** | 0.09 | 0.15*** | 0.11* | 0.18*** |
| Other | 0.03 | 0.04 | 0.05 | 0.03 | 0.04 | 0.03 |
| Ever had kids | 0.73 | 0.75*** | 0.77 | 0.71 | 0.75* | 0.75 |
| *Household Financial Characteristics* | | | | | | |
| Ln Family Income | 10.89 | 10.68*** | 10.75** | 10.60*** | 10.65*** | 10.62*** |
| Owns an annuity | 0.50 | 0.45*** | 0.43** | 0.44* | 0.46** | 0.37*** |
| Owns home | 0.75 | 0.71*** | 0.72 | 0.70 | 0.72** | 0.62*** |
| Ln financial wealth | 11.71 | 11.56*** | 11.68 | 11.62 | 11.46*** | 11.56 |
| Financial wealth equals zero | 0.07 | 0.10*** | 0.07 | 0.12*** | 0.10*** | 0.12*** |
| Financial wealth negative | 0.20 | 0.22*** | 0.24 | 0.19 | 0.21 | 0.29*** |
| Fraction of retirement income from Social Security | 0.76 | 0.78*** | 0.80** | 0.79 | 0.78** | 0.80** |
| *Indicators of Cognition* | | | | | | |
| Cognition Index, standardized | 0.00 | -0.33*** | -0.15** | -0.55*** | -0.32*** | -0.55*** |
| Financial literacy index, 0-3 scale | 2.12 | 1.96*** | 2.08 | 1.83*** | 1.96*** | 1.84*** |
| Education index, 1-5 scale | 3.42 | 3.18*** | 3.32 | 2.97*** | 3.17*** | 3.04*** |
| Number series score, standardized | 0.00 | -0.32*** | -0.21*** | -0.46*** | -0.30*** | -0.53*** |
| Gives 0% chance of dying between 75-85 years of age | 0.32 | 0.43*** | 0.40** | 0.49*** | 0.43*** | 0.44*** |
| *Preferences and Other Characteristics* | | | | | | |
| Risk aversion (standardized) | 0.00 | -0.18*** | 0.02 | -0.28*** | -0.25*** | -0.13** |
| Precaution (standardized) | 0.00 | 0.09*** | 0.13* | 0.11 | 0.10*** | 0.00 |
| Expects returns greater than 3% p.a. | 0.41 | 0.39* | 0.46 | 0.33** | 0.35*** | 0.44 |
| Confident SS will pay promised benefits, 1-4 scale | 2.34 | 2.39*** | 2.30 | 2.59*** | 2.39** | 2.41 |
| Self-reported health index, 1-5 scale | 3.56 | 3.45*** | 3.48 | 3.28*** | 3.45*** | 3.46* |
| Observations | 2112 | 1062 | 192 | 181 | 695 | 214 |

Notes: Significance stars indicate significance level of difference from first column. * significantly different from first column at 10%, ** significantly different from first column at 5%, *** significantly different from first column at 1%. An individual is included in a tail if he/she is in the highest or lowest 10% of CV-Sell or CV-Buy valuations, or he/she gave the highest or lowest possible valuation based on his/her randomly assigned starting value. Specifically, individuals in the Bottom Tail of the CV-Sell were willing to sell a $100 monthly Social Security Annuity for $4000 or less, individuals in the Top Tail of CV-Sell were unwilling to sell a $100 monthly Social Security Annuity for $200,000, individuals in the Bottom Tail of CV-Buy were unwilling to pay $2000 or more for a $100 monthly Social Security Annuity, and individuals in the Top Tail of CV-Buy were willing to pay $100,000 or more for a $100 monthly Social Security Annuity.

**Table A.3: Uncorrected Correlations between Annuity Valuation Measures (All in Natural Logs)**

| Pairwise correlations | CV-Sell | EV-Sell | CV-Buy | EV-Buy |
|---|---|---|---|---|
| CV-Sell | 1 | | | |
| EV-Sell | 0.32*** | 1 | | |
| CV-Buy | -0.10*** | -0.16*** | 1 | |
| EV-Buy | -0.10*** | -0.14*** | 0.72*** | 1 |

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%. Each entry gives the pairwise correlation between the variable listed in the column and in the row. This table shows that the results in Table 2 are not sensitive to the corrections for common experimental manipulations that were applied to the correlations in Table 2.

**Table A.4: Full Regressions Explaining the Sell-Buy Spread**

| Explanatory Variables | Dependent Variable: Absolute Value of Difference between Log CV-Sell and Log CV-Buy (1) | Dependent Variable: Absolute Value of Difference between Log EV-Sell and Log EV-Buy (2) | Dependent Variable: Winsorized CV Sell-Buy Spread (3) |
|---|---|---|---|
| Age 35 to 49 | 0.22 | 0.29* | 0.22* |
| | (0.13) | (0.15) | (0.12) |
| Age 50 to 64 | 0.42*** | 0.48*** | 0.41*** |
| | (0.13) | (0.15) | (0.12) |
| Age 65 and older | 0.66*** | 0.56*** | 0.65*** |
| | (0.16) | (0.19) | (0.14) |
| Cognition index, standardized | -0.41*** | -0.63*** | -0.38*** |
| | (0.05) | (0.05) | (0.04) |
| Female | 0.26*** | 0.30*** | 0.20*** |
| | (0.08) | (0.09) | (0.07) |
| Married | 0.08 | -0.03 | 0.00 |
| | (0.09) | (0.10) | (0.08) |
| Black | 0.49*** | 0.36* | 0.33** |
| | (0.17) | (0.19) | (0.15) |
| Hispanic | 0.27* | 0.54*** | 0.21* |
| | (0.15) | (0.18) | (0.13) |
| Other | 0.69*** | 0.29 | 0.46** |
| | (0.23) | (0.28) | (0.19) |
| Log family income | -0.05 | -0.02 | -0.04 |
| | (0.05) | (0.06) | (0.05) |
| Owns an annuity | -0.03 | -0.07 | -0.02 |
| | (0.08) | (0.10) | (0.07) |
| Owns home | -0.06 | -0.28** | -0.07 |
| | (0.11) | (0.13) | (0.10) |
| Self-reported health index, 1-5 scale | -0.10** | 0.07 | -0.07* |
| | (0.05) | (0.05) | (0.04) |
| Ever had kids | -0.15 | -0.11 | -0.08 |
| | (0.09) | (0.11) | (0.08) |
| Risk aversion (standardized) | -0.21*** | -0.13*** | -0.20*** |
| | (0.04) | (0.05) | (0.04) |
| Precaution (standardized) | 0.01 | 0.00 | 0.01 |
| | (0.04) | (0.05) | (0.04) |
| Expects returns greater than 3% p.a. | -0.15* | -0.18** | -0.15** |
| | (0.08) | (0.09) | (0.07) |
| Confident SS will pay promised benefits, 1-4 scale | 0.17*** | 0.17*** | 0.14*** |
| | (0.05) | (0.06) | (0.04) |
| Controls for experimental variation | Yes | Yes | Yes |
| Adjusted $R^2$ | 0.1681 | 0.1580 | 0.1730 |
| Number of observations | 2065 | 2067 | 2065 |
| Mean of dependent variable | 2.58 | 2.27 | 2.49 |
| Standard deviation of dependent variable | 1.85 | 2.10 | 1.63 |

Notes: Robust standard errors between parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Each column contains an OLS regression of the Sell-Buy Spread listed in the column heading on the explanatory variables listed in the rows. Column 1 shows all the coefficients of the regression in Table 3 column 4. Column 2 shows all the coefficients of the regression in Online Appendix Table A.5 column 4. Column 3 shows all the coefficients of the regression in Online Appendix Table A.12 column 4.

**Table A.5: Explaining the Sell-Buy Spread within EV Valuations**

| | Dependent Variable: Absolute Value of Difference between Log EV-Sell and Log EV-Buy | | | |
|---|---|---|---|---|
| Explanatory Variables | (1) | (2) | (3) | (4) |
| Age 35 to 49 | -0.20 | 0.03 | 0.05 | 0.29* |
| | (0.15) | (0.14) | (0.14) | (0.15) |
| Age 50 to 64 | -0.14 | 0.22* | 0.25* | 0.48*** |
| | (0.14) | (0.13) | (0.13) | (0.15) |
| Age 65 and older | 0.03 | 0.32** | 0.35** | 0.56*** |
| | (0.16) | (0.15) | (0.15) | (0.19) |
| Cognition index, standardized | | | -0.76*** | -0.63*** |
| | | | (0.05) | (0.05) |
| Financial literacy index, 0-3 scale | | -0.38*** | | |
| | | (0.06) | | |
| Education index, 1-5 scale | | -0.30*** | | |
| | | (0.05) | | |
| Number series score, standardized | | -0.43*** | | |
| | | (0.06) | | |
| Controls for demographics and preferences | No | No | No | Yes |
| Controls for experimental variation | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 0.0039 | 0.1327 | 0.1318 | 0.1580 |
| Number of observations | 2067 | 2067 | 2067 | 2067 |
| Mean of dependent variable | 2.27 | 2.27 | 2.27 | 2.27 |
| Standard deviation of dependent variable | 2.10 | 2.10 | 2.10 | 2.10 |

Notes: Robust standard errors between parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. This table is identical to Table 3, except that this table is based on EV valuations whereas Table 3 was based on CV valuations. Each column contains an OLS regression of the Sell-Buy Spread (absolute value of the difference between log EV-Sell and log EV-Buy) on the explanatory variables listed in the rows. EV-Sell is the lump-sum amount equivalent to a $100 increase in monthly Social Security benefits. EV-Buy is the lump-sum amount the individual is just willing to pay in lieu of a $100 decrease in monthly Social Security benefits. For further details, see the note to Table 3. The coefficients on the demographic and preference variables of the regression in column 4 are shown in Online Appendix Table A.4 column 2.

**Table A.6: Explaining the Spread Between CV-Sell and EV-Sell**

| | Dependent Variable: Absolute Value of Difference between Log CV-Sell and Log EV-Sell | | | |
|---|---|---|---|---|
| Explanatory Variables | (1) | (2) | (3) | (4) |
| Age 35 to 49 | -0.02 | 0.06 | 0.07 | 0.13 |
| | (0.10) | (0.10) | (0.10) | (0.11) |
| Age 50 to 64 | 0.06 | 0.19** | 0.19** | 0.28*** |
| | (0.09) | (0.09) | (0.09) | (0.11) |
| Age 65 and older | 0.14 | 0.24** | 0.25** | 0.33** |
| | (0.11) | (0.11) | (0.10) | (0.13) |
| Cognition index, standardized | | | -0.27*** | -0.22*** |
| | | | (0.03) | (0.04) |
| Financial literacy index, 0-3 scale | | -0.14*** | | |
| | | (0.05) | | |
| Education index, 1-5 scale | | -0.13*** | | |
| | | (0.03) | | |
| Number series score, standardized | | -0.13*** | | |
| | | (0.03) | | |
| Controls for demographics and preferences | No | No | No | Yes |
| Controls for experimental variation | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 0.0189 | 0.0537 | 0.0546 | 0.0592 |
| Number of observations | 2068 | 2068 | 2068 | 2068 |
| Mean of dependent variable | 1.42 | 2.49 | 2.49 | 2.49 |
| Standard deviation of dependent variable | 1.39 | 1.63 | 1.63 | 1.63 |

Notes: Robust standard errors between parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. This table is identical to Table 3, except that this table examines the spread between CV and EV sell valuations whereas Table 3 examined the CV Sell-Buy Spread. Each column contains an OLS regression of the absolute value of the difference between log CV-Sell and log EV-Sell on the explanatory variables listed in the rows. CV-Sell is the lump-sum amount given to the individual that would exactly compensate the individual for a $100 decrease in monthly Social Security benefits. EV-Sell is the lump-sum amount equivalent to a $100 increase in monthly Social Security benefits. For further details, see the note to Table 3.

**Table A.7: Cognition Index and Correlations Between Valuations**

| Explanatory Variables | Dependent Variable: CV-Buy (1) | Dependent Variable: Average of CV-Buy and EV-Buy (2) | Dependent Variable: EV-Sell (3) | Dependent Variable: Average of EV-Sell and EV-Buy (4) |
|---|---|---|---|---|
| CV-Sell | -0.13*** | | 0.35*** | |
| | (0.03) | | (0.03) | |
| CV-Sell × Cognition Index, standardized | 0.06 | | 0.02 | |
| | (0.03) | | (0.03) | |
| Average of CV-Sell and EV-Sell | | -0.23*** | | |
| | | (0.03) | | |
| Average of CV-Sell and EV-Sell | | 0.18*** | | |
| × Cognition Index, standardized | | (0.03) | | |
| Average of CV-Sell and CV-Buy | | | | 0.55*** |
| | | | | (0.02) |
| Average of CV-Sell and CV-Buy | | | | 0.10*** |
| × Cognition Index, standardized | | | | (0.02) |
| Cognition index, standardized | -0.06 | -0.14*** | -0.10** | -0.10*** |
| | (0.05) | (0.04) | (0.04) | (0.03) |
| Controls for experimental variation | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 0.0320 | 0.0731 | 0.1109 | 0.2800 |
| Number of observations | 2065 | 2105 | 2068 | 2028 |
| Mean of dependent variable | 8.33 | 8.43 | 9.47 | 8.98 |
| Standard deviation of dependent variable | 2.05 | 1.97 | 1.71 | 1.28 |

Notes: Robust standard errors between parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Each column contains an OLS regression of the variable listed in the column heading on the explanatory variables listed in the rows. All annuity valuation measures are in logs. All regressions include controls for experimental variation, namely: log of starting value, asked after larger version, asked in wave 1, lump-sum option shown last. All variables interacted with the cognition index are demeaned so that the coefficient on the cognition index can be interpreted as the effect of the cognition literacy index when the interaction variables are equal to their sample means. Columns 1 and 2 show that the negative correlation between buy and sell valuations decreases in size for higher values of the Cognition Index, though only significantly so in column 2. Columns 3 and 4 show that the positive correlation between CV and EV valuations increases in size for higher values of the Cognition Index, though only significantly so in column 4.

**Table A.8: Robustness of Predictive Power of Actuarial Value**

| | (1) | (2) | (3) | (4) | (5) | (6) | (7) |
|---|---|---|---|---|---|---|---|
| | Dependent Variable | Coefficient on log actuarial value | p-value on coefficient =1 | Controls | Root MSE | Adjusted $R^2$ | N |
| 1. | Mean of CV-Sell and CV-Buy | 1.02*** (0.25) | 0.940 | Basic | 1.187 | 0.0543 | 2065 |
| 2. | CV-Sell | 1.05*** (0.34) | 0.883 | Basic | 1.496 | 0.0816 | 2090 |
| 3. | CV-Buy | 0.98** (0.44) | 0.955 | Basic | 2.026 | 0.0315 | 2086 |
| 4. | EV-Sell | 0.74** (0.37) | 0.492 | Basic | 1.692 | 0.0190 | 2089 |
| 5. | EV-Buy | 0.84* (0.48) | 0.734 | Basic | 2.140 | 0.0269 | 2082 |
| 6. | Mean of CV-Sell and CV-Buy | 0.84*** (0.26) | 0.536 | Extensive | 1.180 | 0.0649 | 2065 |
| 7. | CV-Sell | 0.63* (0.34) | 0.281 | Extensive | 1.478 | 0.1034 | 2090 |
| 8. | CV-Buy | 1.03** (0.45) | 0.945 | Extensive | 2.012 | 0.0455 | 2086 |
| 9. | EV-Sell | 0.36 (0.38) | 0.095 | Extensive | 1.680 | 0.0330 | 2089 |
| 10. | EV-Buy | 0.96* (0.49) | 0.930 | Extensive | 2.129 | 0.0370 | 2082 |

Notes: Robust standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Each row contains an OLS regression of the log annuity valuation measure listed in column 1 on the log actuarial value and additional controls. The annuity valuation measures CV-Sell, CV-Buy, EV-Sell, and EV-Buy are defined in the text. All valuations are expressed in logs of the midpoint between the upper and lower bounds. Additional controls in rows 1-5 are those in specification 1 of Table 5, whereas the additional controls in rows 6-10 are those in specification 3 of Table 5. Rows 1 and 6 replicate columns 1 and 3 of Table 5, respectively.

**Table A.9: Robustness of Table 5 to Using Log CV-Sell as the Dependent Variable**

| | Dependent Variable: Log CV-Sell | | | |
|---|---|---|---|---|
| Explanatory Variables | (1) | (2) | (3) | (4) |
| Log actuarial value | 1.05*** | | 0.63* | |
| | (0.34) | | (0.34) | |
| Log theoretical utility-based annuity value | | 0.01 | | -0.01 |
| | | (0.04) | | (0.16) |
| Age | -0.03* | 0.00 | -0.01 | 0.01 |
| | (0.02) | (0.01) | (0.02) | (0.01) |
| Age squared/100 | 0.06*** | 0.01 | 0.02 | 0.00 |
| | (0.02) | (0.01) | (0.02) | (0.01) |
| Female | 0.03 | 0.12* | 0.04 | 0.10 |
| | (0.07) | (0.07) | (0.07) | (0.07) |
| Married | -0.03 | -0.04 | 0.06 | 0.06 |
| | (0.07) | (0.07) | (0.08) | (0.09) |
| Black | 0.03 | 0.04 | -0.06 | -0.06 |
| | (0.17) | (0.17) | (0.17) | (0.17) |
| Hispanic | 0.42*** | 0.43*** | 0.27* | 0.26* |
| | (0.14) | (0.14) | (0.15) | (0.15) |
| Other | 0.01* | 0.01 | 0.02 | 0.02 |
| | (0.22) | (0.22) | (0.22) | (0.22) |
| Education index, 1-5 scale | | | -0.07* | -0.07** |
| | | | (0.04) | (0.04) |
| Log family income | | | 0.01 | 0.01 |
| | | | (0.05) | (0.05) |
| Owns an annuity | | | -0.04 | -0.03 |
| | | | (0.07) | (0.07) |
| Owns home | | | -0.04 | -0.05 |
| | | | (0.10) | (0.10) |
| Log financial wealth | | | -0.03 | -0.03 |
| | | | (0.03) | (0.04) |
| Self-reported health index, 1-5 scale | | | -0.06 | -0.06 |
| | | | (0.04) | (0.04) |
| Ever had kids | | | -0.15* | -0.16* |
| | | | (0.08) | (0.08) |
| Risk aversion (standardized) | | | -0.10*** | -0.11*** |
| | | | (0.04) | (0.04) |
| Precaution (standardized) | | | -0.01 | -0.01 |
| | | | (0.04) | (0.04) |
| Expects returns greater than 3% p.a. | | | -0.09 | -0.09 |
| | | | (0.07) | (0.07) |
| Confident SS will pay promised benefits, 1-4 scale | | | 0.16*** | 0.17*** |
| | | | (0.04) | (0.04) |
| Controls for experimental variation | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 0.0816 | 0.0767 | 0.1034 | 0.1017 |
| Number of observations | 2090 | 2090 | 2090 | 2090 |
| Mean of dependent variable | 10.02 | 10.02 | 10.02 | 10.02 |
| Standard deviation of dependent variable | 1.56 | 1.56 | 1.56 | 1.56 |

Notes: Robust standard errors between parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Each column contains an OLS regression of annuity valuation (log CV-Sell) on the explanatory variables listed in the rows. This Table is identical to Table 5 except that the dependent variable is log CV-Sell instead of the average of log CV-Sell and log CV-Buy. For the remaining notes, see the note to Table 5.

**Table A.10: Robustness of Table 5 to Using Log CV-Buy as the Dependent Variable**

| | Dependent Variable: Log CV-Buy | | | |
|---|---|---|---|---|
| Explanatory Variables | (1) | (2) | (3) | (4) |
| Log actuarial value | 0.98** | | 1.03** | |
| | (0.44) | | (0.45) | |
| Log theoretical utility-based annuity value | | 0.09 | | 0.33 |
| | | (0.06) | | (0.22) |
| Age | -0.06** | -0.03* | -0.07** | -0.03 |
| | (0.03) | (0.02) | (0.03) | (0.02) |
| Age squared/100 | 0.06** | 0.02 | 0.06** | 0.02 |
| | (0.03) | (0.02) | (0.03) | (0.02) |
| Female | -0.19* | -0.11 | -0.11 | -0.07 |
| | (0.10) | (0.09) | (0.10) | (0.10) |
| Married | 0.11 | 0.10 | 0.09 | 0.18 |
| | (0.10) | (0.10) | (0.11) | (0.13) |
| Black | 0.12 | 0.18 | 0.20 | 0.21 |
| | (0.21) | (0.21) | (0.22) | (0.22) |
| Hispanic | 0.32 | 0.36* | 0.44** | 0.43** |
| | (0.20) | (0.20) | (0.21) | (0.21) |
| Other | -0.16 | -0.17 | -0.18 | -0.19 |
| | (0.24) | (0.24) | (0.23) | (0.23) |
| Education index, 1-5 scale | | | -0.01 | -0.01 |
| | | | (0.05) | (0.05) |
| Log family income | | | 0.04 | 0.04 |
| | | | (0.07) | (0.07) |
| Owns an annuity | | | -0.12 | -0.08 |
| | | | (0.10) | (0.10) |
| Owns home | | | -0.23 | -0.24* |
| | | | (0.15) | (0.15) |
| Log financial wealth | | | 0.06 | 0.02 |
| | | | (0.04) | (0.05) |
| Self-reported health index, 1-5 scale | | | -0.01 | -0.01 |
| | | | (0.05) | (0.06) |
| Ever had kids | | | 0.05 | 0.05 |
| | | | (0.11) | (0.10) |
| Risk aversion (standardized) | | | 0.15*** | 0.15*** |
| | | | (0.05) | (0.05) |
| Precaution (standardized) | | | -0.14*** | -0.14*** |
| | | | (0.05) | (0.05) |
| Expects returns greater than 3% p.a. | | | 0.28*** | 0.28*** |
| | | | (0.09) | (0.09) |
| Confident SS will pay promised benefits, 1-4 scale | | | 0.07 | 0.09 |
| | | | (0.06) | (0.06) |
| Controls for experimental variation | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 0.0315 | 0.0301 | 0.0455 | 0.0438 |
| Number of observations | 2086 | 2086 | 2086 | 2086 |
| Mean of dependent variable | 8.34 | 8.34 | 8.34 | 8.34 |
| Standard deviation of dependent variable | 2.06 | 2.06 | 2.06 | 2.06 |

Notes: Robust standard errors between parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. Each column contains an OLS regression of annuity valuation (log CV-Buy) on the explanatory variables listed in the rows. This Table is identical to Table 5 except that the dependent variable is log CV-Buy instead of the average of log CV-Sell and log CV-Buy. For the remaining notes, see the note to Table 5.

**Table A.11: Correlations Between Winsorized Annuity Valuation Measures (All in Natural Logs)**

| Pairwise correlations | CV-Sell | EV-Sell | CV-Buy | EV-Buy |
|---|---|---|---|---|
| CV-Sell | 1 | | | |
| EV-Sell | 0.32*** | 1 | | |
| CV-Buy | -0.10*** | -0.14*** | 1 | |
| EV-Buy | -0.09*** | -0.12*** | 0.72*** | 1 |

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%. This table is identical to Table 2 except that all annuity valuation measures are winsorized at the 10th and 90th percentiles. For further details, see the note to Table 2.

**Table A.12: Explaining the Winsorized Sell-Buy Spread**

| | Dependent Variable: Absolute Value of Difference between Log CV-Sell (winsorized) and Log CV-Buy (winsorized) | | | |
|---|---|---|---|---|
| Explanatory Variables | (1) | (2) | (3) | (4) |
| Age 35 to 49 | -0.05 | 0.11 | 0.11 | 0.22* |
| | (0.12) | (0.11) | (0.11) | (0.12) |
| Age 50 to 64 | 0.09 | 0.34*** | 0.35*** | 0.41*** |
| | (0.11) | (0.10) | (0.10) | (0.12) |
| Age 65 and older | 0.48*** | 0.68*** | 0.69*** | 0.65*** |
| | (0.12) | (0.12) | (0.12) | (0.14) |
| Cognition index, standardized | | | -0.53*** | -0.38*** |
| | | | (0.04) | (0.04) |
| Financial literacy index, 0-3 scale | | -0.29*** | | |
| | | (0.05) | | |
| Education index, 1-5 scale | | -0.22*** | | |
| | | (0.03) | | |
| Number series score, standardized | | -0.28*** | | |
| | | (0.04) | | |
| Controls for demographics and preferences | No | No | No | Yes |
| Controls for experimental variation | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 0.0354 | 0.1349 | 0.1351 | 0.1730 |
| Number of observations | 2065 | 2065 | 2065 | 2065 |
| Mean of dependent variable | 2.49 | 2.49 | 2.49 | 2.49 |
| Standard deviation of dependent variable | 1.63 | 1.63 | 1.63 | 1.63 |

Notes: Robust standard errors between parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. This table is identical to Table 3 except that the Sell-Buy spead was calculated based on annuity valuation measures that were winsorized at the 10th and 90th percentiles. For further details, see the note to Table 3. The coefficients on the demographic and preference variables of the regression in column 4 are shown in Online Appendix Table A.4 column 3.

**Table A.13: Effects of Randomizations for Winsorized CV-Sell Annuity Valuation**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Dependent Variable: Winsorized Log CV-Sell | | | |
| Explanatory Variables | Entire sample | Top quintile of cognition index | Bottom quintile of cognition index | Entire sample |
| Log of starting value | 0.30*** | 0.19* | 0.70*** | 0.31*** |
| | (0.06) | (0.11) | (0.14) | (0.05) |
| Asked after larger version | 0.62*** | 0.68*** | 0.62*** | 0.61*** |
| | (0.05) | (0.10) | (0.13) | (0.05) |
| Asked in wave 1 | 0.05 | 0.04 | 0.24* | 0.05 |
| | (0.05) | (0.10) | (0.13) | (0.05) |
| Lump-sum option shown last | 0.07 | 0.04 | 0.01 | 0.06 |
| | (0.05) | (0.10) | (0.13) | (0.05) |
| Log of starting value × Cognition index | | | | -0.11** |
| | | | | (0.06) |
| Asked after larger version × Cognition index | | | | -0.03 |
| | | | | (0.05) |
| Asked in wave 1 × Cognition index | | | | 0.00 |
| | | | | (0.05) |
| Lump-sum option shown last × Cognition index | | | | 0.04 |
| | | | | (0.05) |
| Cognition index | | | | -0.15*** |
| | | | | (0.03) |
| Adjusted $R^2$ | 0.0783 | 0.1089 | 0.0991 | 0.0933 |
| N | 2090 | 385 | 412 | 2090 |
| Mean of dependent variable | 10.01 | 9.82 | 10.27 | 10.01 |
| Standard deviation of dependent variable | 1.20 | 1.19 | 1.96 | 1.20 |

Notes: Robust standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. This table is identical to Table 4 except that the dependent variable is winsorized at the 10th and 90th percentiles. For further details, see the note to Table 4.

**Table A.14: Explaining Winsorized Annuity Valuations**

| | Dependent Variable: Mean of Winsorized Log CV-Sell and Winsorized Log CV-Buy | | | |
|---|---|---|---|---|
| Explanatory Variables | (1) | (2) | (3) | (4) |
| Log actuarial value | 0.93*** | | 0.79*** | |
| | (0.23) | | (0.24) | |
| Log theoretical utility-based annuity value | | 0.04 | | 0.17 |
| | | (0.03) | | (0.12) |
| Age | -0.05*** | -0.02* | -0.04*** | -0.01 |
| | (0.01) | (0.01) | (0.01) | (0.01) |
| Age squared/100 | 0.06*** | 0.02 | 0.04*** | 0.01 |
| | (0.01) | (0.01) | (0.02) | (0.01) |
| Female | -0.08 | -0.01 | -0.04 | 0.00 |
| | (0.05) | (0.05) | (0.06) | (0.06) |
| Married | 0.06 | 0.05 | 0.08 | 0.13* |
| | (0.05) | (0.05) | (0.06) | (0.07) |
| Black | 0.09 | 0.12 | 0.09 | 0.09 |
| | (0.11) | (0.11) | (0.11) | (0.11) |
| Hispanic | 0.32*** | 0.35*** | 0.33*** | 0.33*** |
| | (0.10) | (0.11) | (0.11) | (0.11) |
| Other | -0.01 | -0.02 | -0.02 | -0.03 |
| | (0.12) | (0.12) | (0.11) | (0.12) |
| Education index, 1-5 scale | | | -0.02 | -0.02 |
| | | | (0.03) | (0.03) |
| Log family income | | | 0.02 | 0.02 |
| | | | (0.04) | (0.04) |
| Owns an annuity | | | -0.06 | -0.03 |
| | | | (0.06) | (0.06) |
| Owns home | | | -0.15** | -0.16** |
| | | | (0.08) | (0.08) |
| Log financial wealth | | | 0.01 | -0.01 |
| | | | (0.02) | (0.03) |
| Self-reported health index, 1-5 scale | | | -0.02 | -0.03 |
| | | | (0.03) | (0.03) |
| Ever had kids | | | -0.03 | -0.04 |
| | | | (0.06) | (0.06) |
| Risk aversion (standardized) | | | 0.02 | 0.02 |
| | | | (0.03) | (0.03) |
| Precaution (standardized) | | | -0.07** | -0.07** |
| | | | (0.03) | (0.03) |
| Expects returns greater than 3% p.a. | | | 0.12** | 0.12** |
| | | | (0.05) | (0.05) |
| Confident SS will pay promised benefits, 1-4 scale | | | 0.11*** | 0.12*** |
| | | | (0.03) | (0.03) |
| Controls for experimental variation | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 0.0529 | 0.0463 | 0.0633 | 0.0590 |
| Number of observations | 2065 | 2065 | 2065 | 2065 |
| Mean of dependent variable | 9.17 | 9.17 | 9.17 | 9.17 |
| Standard deviation of dependent variable | 1.13 | 1.13 | 1.13 | 1.13 |

Notes: Robust standard errors between parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. This table is identical to Table 5 except that the dependent variable was calculated based on annuity valuation measures that were winsorized at the 10th and 90th percentiles. For further details, see the note to Table 5.

**Table A.15: Predictive Power of Actuarial Value by the Cognition Index for Winsorized Outcomes**

| Dependent Variable: Mean of Log CV-Sell and Log CV-Buy | (1) Coefficient on log actuarial value | (2) p-value on coefficient =1 | (3) Root MSE | (4) Adjusted $R^2$ | (5) N |
|---|---|---|---|---|---|
| Sample split by quintiles of cognition index | | | | | |
| 1. Bottom quintile | 0.44 | 0.431 | 1.373 | 0.0847 | 404 |
| | (0.71) | | | | |
| 2. Second quintile | 0.45 | 0.309 | 1.135 | 0.0186 | 451 |
| | (0.54) | | | | |
| 3. Third quintile | 1.27*** | 0.559 | 1.085 | 0.0194 | 392 |
| | (0.45) | | | | |
| 4. Fourth quintile | 0.83* | 0.720 | 0.973 | 0.0520 | 433 |
| | (0.46) | | | | |
| 5. Fifth quintile | 1.32*** | 0.492 | 0.847 | 0.0703 | 385 |
| | (0.47) | | | | |

Notes: Robust standard errors between parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. This table is identical to Table 6 except that the dependent variable was calculated based on annuity valuation measures that were winsorized at the 10th and 90th percentiles. For further details, see the note to Table 6.

**Table A.16: Correlations between Annuity Valuation Measures for the Age 50+ Sample (All in Natural Logs)**

| Pairwise correlations | CV-Sell | EV-Sell | CV-Buy | EV-Buy |
|---|---|---|---|---|
| CV-Sell | 1 | | | |
| EV-Sell | 0.29*** | 1 | | |
| CV-Buy | -0.11*** | -0.17*** | 1 | |
| EV-Buy | -0.11*** | -0.17*** | 0.72*** | 1 |

Notes: * significant at 10%, ** significant at 5%, *** significant at 1%. This table is identical to Table 2 except that the sample is restricted to respondents age 50 and above. For further details, see the note to Table 2.

**Table A.17: Explaining the Sell-Buy Spread for the Age 50+ Sample**

| | Dependent Variable: Absolute Value of Difference between Log CV-Sell and Log CV-Buy | | | |
|---|---|---|---|---|
| Explanatory Variables | (1) | (2) | (3) | (4) |
| Age 65 and older | 0.39*** | 0.33*** | 0.34*** | 0.20* |
| | (0.11) | (0.11) | (0.11) | (0.12) |
| Cognition index, standardized | | | -0.58*** | -0.40*** |
| | | | (0.05) | (0.06) |
| Financial literacy index, 0-3 scale | | -0.25*** | | |
| | | (0.08) | | |
| Education index, 1-5 scale | | -0.23*** | | |
| | | (0.05) | | |
| Number series score, standardized | | -0.36*** | | |
| | | (0.06) | | |
| Controls for demographics and preferences | No | No | No | Yes |
| Controls for experimental variation | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 0.0468 | 0.1374 | 0.1358 | 0.1807 |
| Number of observations | 1223 | 1223 | 1223 | 1223 |
| Mean of dependent variable | 2.68 | 2.68 | 2.68 | 2.68 |
| Standard deviation of dependent variable | 1.82 | 1.82 | 1.82 | 1.82 |

Notes: Robust standard errors between parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. This table is identical to Table 3 except that the sample is restricted to respondents age 50 and above. For further details, see the note to Table 3.

**Table A.18: Effects of Randomizations for the Age 50+ Sample**

| | (1) | (2) | (3) | (4) |
|---|---|---|---|---|
| | Dependent Variable: Log CV-Sell | | | |
| Explanatory Variables | Entire sample | Top quintile of cognition index | Bottom quintile of cognition index | Entire sample |
| Log of starting value | 0.36*** | 0.20 | 0.92*** | 0.40*** |
| | (0.10) | (0.15) | (0.29) | (0.10) |
| Asked after larger version | 0.78*** | 0.92*** | 0.88*** | 0.75*** |
| | (0.08) | (0.14) | (0.27) | (0.09) |
| Asked in wave 1 | 0.02 | 0.04 | 0.44* | 0.03 |
| | (0.08) | (0.14) | (0.26) | (0.09) |
| Lump-sum option shown last | 0.00 | 0.00 | -0.27 | -0.03 |
| | (0.08) | (0.14) | (0.27) | (0.09) |
| Log of starting value × Cognition index | | | | -0.16 |
| | | | | (0.10) |
| Asked after larger version × Cognition index | | | | -0.04 |
| | | | | (0.09) |
| Asked in wave 1 × Cognition index | | | | -0.08 |
| | | | | (0.09) |
| Lump-sum option shown last × Cognition index | | | | 0.13 |
| | | | | (0.09) |
| Cognition index | | | | -0.20*** |
| | | | | (0.05) |
| Adjusted $R^2$ | 0.0729 | 0.1384 | 0.0881 | 0.0900 |
| N | 1236 | 262 | 200 | 1236 |
| Mean of dependent variable | 10.12 | 9.89 | 10.55 | 10.12 |
| Standard deviation of dependent variable | 1.53 | 1.20 | 1.94 | 1.53 |

Notes: Robust standard errors in parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. This table is identical to Table 4 except that the sample is restricted to respondents age 50 and above. For further details, see the note to Table 4.

**Table A.19: Explaining Annuity Valuations for the Age 50+ Sample**

| | Dependent Variable: Mean of Log CV-Sell and Log CV-Buy | | | |
|---|---|---|---|---|
| Explanatory Variables | (1) | (2) | (3) | (4) |
| Log actuarial value | 1.61*** | | 1.61*** | |
| | (0.49) | | (0.50) | |
| Log theoretical utility-based annuity value | | 0.10** | | 0.33** |
| | | (0.05) | | (0.16) |
| Age | -0.17* | 0.07 | -0.18** | 0.04 |
| | (0.09) | (0.05) | (0.09) | (0.05) |
| Age squared/100 | 0.16** | -0.05 | 0.17** | -0.02 |
| | (0.08) | (0.04) | (0.08) | (0.04) |
| Female | -0.05 | 0.08 | -0.03 | 0.05 |
| | (0.08) | (0.07) | (0.08) | (0.07) |
| Married | 0.05 | 0.06 | 0.06 | 0.17* |
| | (0.07) | (0.07) | (0.08) | (0.10) |
| Black | 0.09 | 0.15 | 0.10 | 0.11 |
| | (0.18) | (0.18) | (0.17) | (0.17) |
| Hispanic | 0.13 | 0.21 | 0.10 | 0.13 |
| | (0.20) | (0.20) | (0.21) | (0.21) |
| Other | -0.30 | -0.26 | -0.28 | -0.26 |
| | (0.22) | (0.21) | (0.22) | (0.22) |
| Education index, 1-5 scale | | | 0.01 | 0.01 |
| | | | (0.04) | (0.04) |
| Log family income | | | 0.05 | 0.06 |
| | | | (0.05) | (0.05) |
| Owns an annuity | | | -0.03 | 0.00 |
| | | | (0.08) | (0.08) |
| Owns home | | | -0.21* | -0.19* |
| | | | (0.11) | (0.11) |
| Log financial wealth | | | 0.02 | -0.03 |
| | | | (0.03) | (0.04) |
| Self-reported health index, 1-5 scale | | | -0.01 | -0.02 |
| | | | (0.04) | (0.04) |
| Ever had kids | | | -0.09 | -0.09 |
| | | | (0.08) | (0.08) |
| Risk aversion (standardized) | | | -0.02 | -0.03 |
| | | | (0.04) | (0.04) |
| Precaution (standardized) | | | -0.07* | -0.07* |
| | | | (0.04) | (0.04) |
| Expects returns greater than 3% p.a. | | | 0.10 | 0.09 |
| | | | (0.07) | (0.07) |
| Confident SS will pay promised benefits, 1-4 scale | | | 0.12*** | 0.13*** |
| | | | (0.04) | (0.04) |
| Controls for experimental variation | Yes | Yes | Yes | Yes |
| Adjusted $R^2$ | 0.0584 | 0.0534 | 0.0710 | 0.0661 |
| Number of observations | 1223 | 1223 | 1223 | 1223 |
| Mean of dependent variable | 9.17 | 9.17 | 9.17 | 9.17 |
| Standard deviation of dependent variable | 1.19 | 1.19 | 1.19 | 1.19 |

Notes: Robust standard errors between parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. This table is identical to Table 5 except that the sample is restricted to respondents age 50 and above. For further details, see the note to Table 5.

**Table A.20: Predictive Power of Actuarial Value by the Cognition Index for the Age 50+ Sample**

| Dependent Variable: Mean of Log CV-Sell and Log CV-Buy | (1) Coefficient on log actuarial value | (2) p-value on coefficient =1 | (3) Root MSE | (4) Adjusted $R^2$ | (5) N |
|---|---|---|---|---|---|
| Sample split by quintiles of the cognition index | | | | | |
| 1. Bottom quintile | 2.52* | 0.297 | 1.429 | 0.1055 | 196 |
| | (1.45) | | | | |
| 2. Second quintile | 3.55*** | 0.035 | 1.196 | 0.0530 | 256 |
| | (1.20) | | | | |
| 3. Third quintile | 1.16 | 0.889 | 1.198 | 0.0211 | 239 |
| | (1.17) | | | | |
| 4. Fourth quintile | 0.74 | 0.757 | 1.017 | 0.0999 | 270 |
| | (0.84) | | | | |
| 5. Fifth quintile | 0.22 | 0.364 | 0.899 | 0.0531 | 262 |
| | (0.86) | | | | |

Notes: Robust standard errors between parentheses. * significant at 10%, ** significant at 5%, *** significant at 1%. This table is identical to Table 6 except that the sample is restricted to respondents age 50 and above. For further details, see the note to Table 6.

## Online Appendix A: The Rand American Life Panel

*Sample Construction*

Our survey was conducted in the RAND American Life Panel (ALP). The ALP consists of a panel of U.S. households that regularly takes surveys over the Internet. An advantage over most other Internet panels is that the respondents to the ALP need not have Internet when they get recruited (as described in more detail below) and thus can be based on a probability sample of the U.S. population.[1] This is in contrast with so-called convenience Internet samples, where respondents are volunteers who already have Internet and, for example, respond to banners placed on frequently visited web-sites, in which they are invited to complete surveys and earn money by doing so. The problem with convenience Internet samples is that their statistical properties are unknown. There is fairly extensive literature comparing probability Internet samples like the ALP to convenience Internet samples, as well as literature seeking to establish if convenience samples can somehow be made population-representative by reweighting.

For instance, Chang and Krosnick (2009) simultaneously administered the same questionnaire (on politics) to an RDD (random digit dialing) telephone sample, an Internet probability sample, and a non-probability sample of volunteers who do Internet surveys for money. They found that the telephone sample had the most random measurement error, while the non-probability sample had the least. At the same time, the latter sample exhibited the most bias (also after reweighting), producing the most accurate self-reports from the most biased sample. The probability Internet sample exhibited more random measurement error than the non-probability sample (but less than the telephone sample) and less bias than the non-probability Internet sample. On balance, the probability Internet sample produced the most accurate results. Yeager et al. (2009) conducted a follow-up study comparing one probability Internet sample, one RDD telephone sample, and seven non-probability Internet samples and a wider array of outcomes. Their conclusions were the same: both the telephone sample and the probability Internet sample showed the least bias; reweighting the non-probability samples did not help (for some outcomes, the bias got worse; for others, better). They also found that response rates do not appear critical for bias. Even with relatively low response rates, the probability samples yielded

[1] Other probability Internet surveys include the Knowledge Networks panel in the U.S. (http://www.knowledgenetworks.com/knpanel/index.html), and the CentERpanel and LISS panel in the Netherlands (http://www.centerdata.nl/en/centerpanel and http://www.centerdata.nl/en/MESS ). Of these panels, the CentERpanel is the oldest (founded in 1991).

unbiased estimates. It is not clear *a priori* why non-probability samples do so much worse. As the authors note, it appears that there are some fundamental differences between Internet users and non-Internet users that cannot be redressed by reweighting. Indeed, Couper et al. (2007) and Schonlau et al. (2009) show that weighting and matching do not eliminate differences between estimates based on samples of respondents with and without Internet access. Several other studies point at equally mixed results, including Vehovar et al. (1999); Duffy et al. (2005); Malhotra and Krosnick (2007); Taylor (2000); and Loosveldt and Sonck (2008).

ALP respondents have been recruited in one of four ways. Most were recruited from respondents ages 18+ to the Monthly Survey (MS) of the University of Michigan's Survey Research Center (SRC). The MS is the leading consumer sentiment survey that incorporates the long-standing Survey of Consumer Attitudes and produces, among others, the widely used Index of Consumer Expectations. Each month, the MS interviews approximately 500 households, 300 of which are a random-digit-dial (RDD) sample and 200 of which are re-interviewed from the RDD sample surveyed six months previously. Until August 2008, SRC screened MS respondents by asking them if they would be willing to participate in a long-term research project (with approximate response categories "no, certainly not," "probably not," "maybe," "probably," "yes, definitely"). If the response category is not "no, certainly not," respondents were told that the University of Michigan is undertaking a joint project with RAND. They were asked if they would object to SRC sharing information about them with RAND so that they could be contacted later and asked if they would be willing to actually participate in an Internet survey. Respondents who did not have Internet were told that RAND would provide them with free Internet. Many MS respondents were interviewed twice. At the end of the second interview, an attempt was made to convert respondents who refused in the first round. This attempt included mentioning the fact that participation in follow-up research carries a reward of $20 for each half-hour interview. Respondents from the Michigan monthly survey without Internet were provided with so-called WebTVs (http://www.webtv.com/pc/), which allowed them to access the Internet using their television and a telephone line. The technology enabled respondents who lacked Internet access to participate in the panel and, further, use the WebTVs for browsing the Internet or email. The ALP has also recruited respondents through a snowball sample (respondents suggesting friends or acquaintances who might also want to participate), but we do not use any respondents recruited through the snowball sample in our paper. A new group of respondents

(approximately 500) has been recruited after participating in the National Survey Project created at Stanford University with SRBI. This sample was recruited in person, and at the end of their one-year participation, respondents were asked whether they were interested in joining the RAND American Life Panel. Most of these respondents were given a laptop and broadband Internet access. Recently, the American Life Panel has begun recruiting based on a random mail and telephone sample using the Dillman et al. method (2008), with a goal of achieving 5,000 active panel members, including a 1,000-person Spanish language subsample. If these new participants do not yet have Internet access, they are also provided with a laptop and broadband Internet access.

*Calculation of Social Security Benefits*

For most ALP respondents, we have previously estimated monthly Social Security benefits (described in Brown et al., 2013). To do so, we took respondents through a fairly detailed set of questions asking about years in which they had labor earnings and an approximation of earnings in those years. We then fed these earnings through a benefit calculator provided by SSA to calculate individuals' "Primary Insurance Amount" (PIA), which is equivalent to the benefit the individual would receive if he were to retire at his normal retirement age. Next, we applied SSA's actuarial adjustment for earlier or later claiming. We also asked respondents if the estimated benefit amount seemed reasonable to them, and we gave them an opportunity to change this estimate if they believed it was not a good approximation. All subsequent lump-sum and annuity questions then pivot off this estimated monthly Social Security benefit amount.

For the few respondents who indicated they did not expect to receive benefits (nor expect one from a living or deceased spouse), we imputed "standard monthly benefit amounts" based on age, sex, and educational level. We then asked these respondents to assume, for the purposes of the questions to follow, that they would receive this benefit, as follows:

> *Even though we understand that you are not eligible to receive Social Security benefits, we would like to ask you to complete this survey assuming you would be eligible. In other words, please answer in this survey what you would have done or chosen if you would be eligible for Social Security benefits.*

## Online Appendix References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# Online Appendix B – Survey Instrument

## Introduction for users of this survey instrument

- **The survey instrument was fielded as well-being modules 179 and 180 on the RAND American Life Panel (ALP)**
- **Items which are bolded are instructions to programmer or comments to the reader.**
- **Items which are non-bolded are asked of respondents.**
- **Items shown on the screen in bold are marked by  for the start of the bolded text and by  at the end of the bolded text.**
- **We changed the names of the four elicitation methods in the written up version of the paper compared to the names used in this survey instrument. CV-minus corresponds to CV-Buy, EV-minus to EV-Buy, CV-plus to CV-Sell, and EV-plus to EV-Sell.**

**A. Randomizations**

**We independently randomize the following variables:**

1. **VERSION_A [0, 1]: whether we ask CV-plus in wave 1 or wave 2**
   **1 if we ask CV-Plus in wave 1 of the survey (survey version A)**
   **0 otherwise**
2. **VAR_ORDER [1, 6]: Order of CV-minus**
   1. **Order: CV-minus, EV-plus, EV-minus**
   2. **Order: CV-minus, EV-minus, EV-plus**
   3. **Order: EV-plus, CV-minus, EV-minus**
   4. **Order: EV-plus, EV-minus, CV-minus**
   5. **Order: EV-minus, CV-minus, EV-plus**
   6. **Order: EV-minus, EV-plus, CV-minus**
3. **LS_FIRST [0, 1]: whether we ask the option that mentions the lumpsum amount first**
   **1 if we ask the option with the lumpsum amount first**
   **0 otherwise**
4. **SMALLTOLARGE [0, 1]: the order in which we present the changes in SS**
   **1 if we show the $\Delta$SS from smallest to largest**
   **0 otherwise**
5. **LS_STARTVALUE [1, 3]: Size of the first lumpsum amount shown**
   1. **low starting value ($10,000)**
   2. **medium starting value ($20,000)**
   3. **high starting value ($30,000)**
6. **ORDER_STOCK [1,2]: Order of choices in Q.3.2.3**
   1. **List "single company stock" first**
   2. **List "stock mutual fund" first**

**If VAR_ORDER=1 OR VAR_ORDER=2, we set CVM_ORDER = 1**
**If VAR_ORDER=3 OR VAR_ORDER=5, we set CVM_ORDER = 2**
**If VAR_ORDER=4 OR VAR_ORDER=6, we set CVM_ORDER = 3**

**If VAR_ORDER=3 OR VAR_ORDER=4, we set EVP_ORDER = 1**
**If VAR_ORDER=1 OR VAR_ORDER=6, we set EVP_ORDER = 2**
**If VAR_ORDER=2 OR VAR_ORDER=5, we set EVP_ORDER = 3**

**If VAR_ORDER=5 OR VAR_ORDER=6, we set EVM_ORDER = 1**
**If VAR_ORDER=2 OR VAR_ORDER=4, we set EVM_ORDER = 2**
**If VAR_ORDER=1 OR VAR_ORDER=3, we set EVM_ORDER = 3**

**B. Survey waves and versions A and B**

**We fielded the survey in two waves. We have two versions, version A and version B. The only difference between these versions is that in version B the order of sections 2 and 6 is switched (compared to version A). The survey instrument below is for version A. The following table specifies the order for the sections for versions A and B.**

| | Version A | Version B |
|---|---|---|
| Wave 1 | Section 1 ("Intro wave 1") | Section 1 ("Intro wave 1") |
| | Section 2 ("CVPlus") | Section 6 ("Other tradeoffs") |
| | Section 3 ("Background") | Section 3 ("Background") |
| | Section 4 ("Close wave 1") | Section 4 ("Close wave 1") |
| | | |
| Wave 2 | Section 5 ("Intro wave 2") | Section 5 ("Intro wave 2") |
| | Section 6 ("Other tradeoffs") | Section 2 ("CVPlus") |
| | Section 7 ("No Political Risk") | Section 7 ("No Political Risk") |
| | Section 8 ("Close wave 2") | Section 8 ("Close wave 2") |

**Respondents with the VERSION_A=1 are given version A and respondents with VERSION_A=0 are given version B.**

**C. Syntax**

**Note:**

- **The number between parentheses before a choice box was not displayed on the screen. It only indicates how that choice should be coded.**
- **Comments between square brackets are programming notes.**
- **Variable names between square brackets were replaced by the contents of the variable.**

**D. Lookup tables (matrices) for Lumpsum amounts and BEN_DEFAULT**

**The following tables show lumpsum (one-time Social Security payment) 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 | |

**Table1: Lumpsum amounts for LOW starting value**

**We put the values of the table 1 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 | |

**Table2: Lumpsum amounts for MEDIUM starting value**

**We put the values of the table 2 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 | |

**Table3: Lumpsum amounts for HIGH starting value**

**We put the values of the table 3 in the 16x5 matrix LS_HIGH. The $i^{th}$ row and $j^{th}$ column of this matrix is denoted by LS_HIGH[i,j]**

**The following code was used for the BEN_DEFAULT value table:**

**EDUCATION** **1 = less than high school (< 12 years)**
**2= high school degree (12 years),**
**3=some college (>12 and < 16 years)**
**4 = college degree (= 16 years)**
**5 = more than college (>16 years)**

**The variable BEN_DEFAULT was created and set to the following values:**

| Education | Gender | Marital status | BEN_DEFAULT |
|---|---|---|---|
| 1 (<12 years) | Female | Married | 660 |
| 2 (12 years) | Female | Married | 790 |
| 3 (> 12 years and <16 years) | Female | Married | 850 |
| 4 (16 years) | Female | Married | 830 |
| 5 (>16 years) | Female | Married | 850 |
| 1 (<12 years) | Male | Married | 1070 |
| 2 (12 years) | Male | Married | 1280 |
| 3 (> 12 years and <16 years) | Male | Married | 1270 |
| 4 (16 years) | Male | Married | 1330 |
| 5 (>16 years) | Male | Married | 1360 |
| 1 (<12 years) | Female | Not Married | 920 |
| 2 (12 years) | Female | Not Married | 1080 |
| 3 (> 12 years and <16 years) | Female | Not Married | 1120 |
| 4 (16 years) | Female | Not Married | 1230 |
| 5 (>16 years) | Female | Not Married | 1160 |
| 1 (<12 years) | Male | Not Married | 1040 |
| 2 (12 years) | Male | Not Married | 1190 |
| 3 (> 12 years and <16 years) | Male | Not Married | 1130 |
| 4 (16 years) | Male | Not Married | 1350 |
| 5 (>16 years) | Male | Not Married | 1380 |

## INITIALIZATIONS: BEGINNING OF SURVEY

**[NOTE: THIS IS THE BEGINNING OF THE SURVEY.]**

**Preloaded variables from previous waves that are used in skip patterns are:**

**GENDER** 1 = male; 2 = female

**AGE** The respondent's current age in years

**HIGHESTEDUCATION**
1 Less than 1st grade
2 1st, 2nd, 3rd, or 4th grade
3 5th or 6th grade
4 7th or 8th grade
5 9th grade
6 10th grade
7 11th grade
8 12th grade NO DIPLOMA
9 HIGH SCHOOL GRADUATE high school DIPLOMA or the equivalent (For example: GED)
10 Some college but no degree
11 Associate degree in college Occupational/vocational program
12 Associate degree in college Academic program
13 Bachelor's degree (For example: BA,AB,BS)
14 Master's degree (For example: MA,MS,MEng,MEd,MSW,MBA)
15 Professional School Degree (For example: MD,DDS,DVM,LLB,JD)
16 Doctorate degree (For example: PhD,EdD)

**For missing values/ answers for variables mentioned above, the questions were asked again in the beginning of wave 1. The variable "MARRIED" was collected regardless of whether data was available. The following question was asked to all respondents in the beginning of wave 1.**

**[MARRIED] Married**

Are you currently married?
(0) Not Currently Married
(1) Currently married

**Other preloaded questions include:**

**PIA_EST** Estimated PIA (Social Security Primary Insurance Amount) based on previous questions asked about earnings history. So this is the Social Security benefit one would get if one claimed at full retirement age.

**WORK_FOR_PAY** 1 YES; 2 NO. This is a standard variable that records whether the respondent has ever worked for pay. If this variable was missing for any respondent then they were asked the following question:

**[WORK_FOR_PAY] Work For Pay**

Did you work for pay more than 10 years?
(1) Yes
(2) No

**A new data-only variable SPOUSE was created:**
**Set SPOUSE = "husband" if GENDER=="female"**
**Set SPOUSE = "wife" if GENDER=="male"**

**A new data only variable FLAGHYPO was created and set FLAGHYPO=0.**
**A new data only variable USE_DEFAULT was created and set USE_DEFAULT=0.**

## SECTION 1: INTRODUCTION TO WAVE 1

**[NOTE: THIS SECTION FINDS THE SOCIAL SECURITY STATUS, ELIGIBILITY, AND CLAIM AGE OF RESPONDENTS. IT ESTIMATES THE SOCIAL SECURITY BENEFIT AMOUNT OF RESPONDENTS BASED ON THEIR AGE, EARNINGS HISTORY, AND YEARS IN THE WORK FORCE AND PROVIDES RESPONDENTS AN OPPORTUNITY TO CORRECT THE ESTIMATE. THIS SECTION WAS ASKED OF ALL RESPONDENTS.]**

---

[**WAIT_WARNING]** Wait Warning
The page after this may take several seconds to load. Please click the next button now, and do not click your browser's back button while the page is loading. Thank you.

---

**Q.1.1: [INTRODUCTION TO SECTION 1]**
We are interested in understanding how and when people would like to receive their Social Security benefits.

In this survey, we sometimes ask questions that are difficult to answer exactly. Please take time to consider the questions and give us your best guess even if you do not know the exact answer. Having your best guess will be very helpful to us.

Thank you very much for your participation!

---

**Q.1.2: [SS_STATUS] Social Security Status**

In this survey, we mean by "Social Security benefits" any benefits that you yourself receive or will receive from the Social Security program, including retiree, disability, spouse, or survivor benefits.

Which of the following statements best describes you?

(1) ☐ I receive Social Security benefits now.
(2) ☐ I don't receive Social Security benefits now but, under current law, I will be eligible to receive them in the future.
(3) ☐ I will never be eligible under current law to receive Social Security benefits.

**[Create new variable SS_STATUS_ORIG, and set SS_STATUS_ORIG=SS_STATUS]**

---

**[ASK IF SS_STATUS=3]**
**Q.1.3: [SS_ELIG] Social Security Eligibility**

Why do you think you will never be eligible to receive Social Security benefits?

(1) ☐ My main job was/is not covered by Social Security.
(2) ☐ I don't have or will not have a sufficient work history to become eligible for Social Security benefits.
(3) ☐ I do not think Social Security will be around by the time I would start claiming benefits
(4) ☐ Other: _____ [Give open-ended text box]

---

**[SHOW IF SS_ELIG=3]**
**Q.1.4: [SS_AROUND] Assume Social Security will still be around**

Please answer the questions in this survey assuming that current Social Security rules still apply when you first claim Social Security benefits. Thank you.

**[IF SS_ELIG=3, SET SS_STATUS=2]**

---

**[ASK IF SS_STATUS=3]**
**Q.1.5: [SSEL_SPOUSE] Eligible For Social Security Based on Spouse**

People who are not eligible to receive Social Security based on their own work history may receive Social Security benefits based on the earnings history of their spouse, late spouse, or ex-spouse.

Do you think you may be eligible to receive benefits based on the past or future earnings of your **[SPOUSE]**, late **[SPOUSE]**, ex-**[SPOUSE]**, or perhaps a future **[SPOUSE]**?

(1) ☐ Yes
(2) ☐ No

**[IF SSEL_SPOUSE==1 AND SS_STATUS==3: SET SS_STATUS=2]**
**[IF (SSEL_SPOUSE==2 OR SSEL_SPOUSE=MISSING) AND SS_STATUS==3: SET FLAGHYPO=1]**

---

**[ASK IF FLAGHYPO=1]**
**[If FLAGHYPO=1 AND AGE>=62, SET SS_STATUS=1] /* if eligible, they would be claiming */**
**[If FLAGHYPO=1 AND AGE<62, SET SS_STATUS=2] /* if eligible, they would not yet have claimed */**
**[If FLAGHYPO=1, SET CLAIM_AGE=62]**
**[If FLAGHYPO=1, SET BEN_EST=BEN_DEFAULT]**
**Q.1.6: [HYPOELIGIBLE] Hypothetically Eligible**

Even though we understand that you are not eligible to receive Social Security benefits, we would like to ask you to complete this survey assuming you would be eligible. In other words, please answer in this survey what you would have done or chosen if you would be eligible for Social Security benefits.

The typical Social Security benefit for **[If MARRIED=1, insert** "a married"**; if MARRIED=0, insert** "an unmarried"**] [If GENDER="male" insert** "man"**; if GENDER="female" insert** "woman"**]** with **[insert the respondent's educational attainment based on the categories in EDUCATION]** is $[BEN_DEFAULT] per month.

For the purpose of this survey, let's assume that you **[If SS_STATUS==2, insert** "are supposed to"**]** get a Social Security benefit of $[BEN_DEFAULT] per month, and that you **[If SS_STATUS==1, insert** "started receiving"; **If SS_STATUS==2, insert** "would start receiving"**]** Social Security benefits at age 62.

**[If FLAGHYPO=1, GO TO SECTION 2]**

---

**Q.1.7.1: [CLAIM_AGE] Social Security benefits claim age**
**[ASK IF SS_STATUS==1 (RECEIVING BENEFITS):]**
At what age did you start receiving Social Security benefits?
At age: _____

**Q.1.7.2: [CHECKCLAIM_AGE1 ] CHECK CLAIM AGE**
**[ASK IF SS_STATUS==1 AND CLAIMING AGE > CALCULATED AGE]**

You told us earlier that you are already receiving Social Security benefits. Therefore, the age at which you started receiving Social Security benefits cannot be higher than your current age. Please go back and revise your answer.

**Q.1.7.3**: **[CLAIM_AGE] Social Security benefits claim age**
**[ASK IF SS_STATUS==2 (NOT RECEIVING BENEFITS YET)]:**
At what age do you plan to start receiving Social Security benefits?
At age: _____

**Q.1.7.4**: [**CHECKCLAIM_AGE1 ] Check Claim Age**
**[ASK IF SS_STATUS==2 (NOT RECEIVING BENEFITS YET) AND CLAIMING AGE < CALCULATED AGE]:**
You told us earlier that you are not currently receiving Social Security benefits. Therefore, the age at which you plan to start receiving Social Security benefits cannot be lower than your current age. Please go back and revise your answer.

**[ALWAYS: (THE CODE BELOW ENSURES CLAIM_AGE WILL NEVER BE MISSING)]**
**[SET CLAIM_AGE_ORIG=CLAIM_AGE]**
**[SET CLAIM_AGE=MAX(AGE+1, 62) IF CLAIM_AGE=MISSING AND SS_STATUS==2]**
**[SET CLAIM_AGE=MIN(AGE, 62) IF CLAIM_AGE=MISSING AND SS_STATUS==1]**

---

**[NOTE: THE SERIES OF QUESTIONS 1.8.1-1.8.6 BELOW WERE ONLY ASKED IF THE VARIABLE PIA_EST WAS MISSING (AND THEREFORE COULD NOT BE PRELOADED). THE VARIABLE PIA_EST CONTAINS THE ESTIMATED SOCIAL SECURITY MONTHLY BENEFITS IF THE PERSON CLAIMS BENEFITS AT THE FULL RETIREMENT AGE, AND IS BASED ON A SERIES OF QUESTIONS ASKED**

**PREVIOUSLY IN THE AMERICAN LIFE PANEL ABOUT THE PERSON'S WORK HISTORY. THE SERIES OF QUESTIONS AND THE SKIP LOGIC BELOW IS IDENTICAL TO THE EARLIER SERIES OF QUESTIONS ASKED TO ESTIMATE PIA_EST.]**

---

**[IF WORK_FOR_PAY ≠ "YES" OR PIA_EST ≠ missing, Skip Q1.8.1 through Q.1.8.6]**

**Q.1.8.1: [YEAR_START_WORK] Year Start Work For Pay**

In what year did you first start to work for pay?

**[Note to programmer: Insert "a drop down box from 1900 to 2011"]**

---

**[ASK IF YEAR_ START_WORK < YEAR_OF_BIRTH + 14]**

**Q.1.8.2: [WORKED_TO_EARLY] Start Working Before 14**

You said you started working before you were 14 years old. You indicated that you started working before you were 14 years old. For what follows, we will just assume that pay from age 14 on counts. If you believe you made an error in entering the date you began working, you may go back and change it.

---

**Q.1.8.3: [INCOME_INTRO] Income Introduction**

We would now like to ask you some more information about the period when you started working for pay (in [YEAR_START_WORK]) up to now.

---

**[Note to Programmer: LOOP FROM 1 TO [number of questions INCOME_CAT] DO: /* number of periods loop */**

**Q.1.8.4: [INCOME_NOT_WORK] Income Not Work**

**[Insert** "[income cat start year fill] - [income cat end year fill]"**]** Was there ever a time when you did not work in the "[income cat start year fill] - [income cat end year fill]" period?

---

(1) ☐ Yes
(2) ☐ No

---

**[ASK IF INCOME_NOT_WORK=YES]**

**Q.1.8.5: [INCOME_NOT_WORK_HOW_LONG] Income Not Work Months**

**[Insert** "[income cat start year fill] - [income cat end year fill]"**]** How many months in total do you estimate not working for pay in the "[income cat start year fill] - [income cat end year fill]" period?

(1) ☐ _____ [Give open-ended text box allowing only integers]

---

**[ASK IF INCOME_CAT fill amount 1 = and INCOME_CAT fill amount 2 = and INCOME_CAT fill amount 3]**

**Q.1.8.6: [INCOME_CAT] Income categories**

**[Insert** "[income cat start year fill] - [income cat end year fill]"**]** Could you please give us an estimate of how much you were making on average per year in the "[income cat start year fill] - [income cat end year fill]" period "[fill for income cat question]?

(1) ☐ More than $[INCOME_CAT fill amount 1]
(2) ☐ Between $[INCOME_CAT fill amount 2] and $[INCOME_CAT fill amount 1]
(3) ☐ Between $[INCOME_CAT fill amount 3] and $[INCOME_CAT fill amount 2]
(4) ☐ Less than $[INCOME_CAT fill amount 3]

**End Do /* End of number of periods loop */**

**[Note to programmers: based on the responses to Q1.8.1 through Q1.8.6, calculate PIA_EST using the same algorithm as used in the earlier ALP module]**

---

**[NOTE TO PROGRAMMERS: PLEASE USE THE VARIABLE PIA_EST (PRELOADED OR CALCULATED FROM Q.1.8.1-Q.1.8.6) AND THE VARIABLE CLAIM_AGE ASKED ABOVE TO COMPUTE THE ESTIMATED MONTHLY SOCIAL SECURITY BENEFITS FOR EACH RESPONDENT IF THEY START CLAIMING AT CLAIM_AGE. PLEASE USE THE SOCIAL SECURITY AGE ADJUSTMENT RULES**

**APPROPRIATE FOR THE BIRTH COHORT THAT THE RESPONDENT BELONGS TO IN THIS CALCULATION. PLEASE NAME THE RESULTING VARIABLE BEN_EST_ORIG1.]**

**IF BEN_EST_ORIG1 ≥ 200, THEN SET BEN_EST_ORIG=BEN_EST_ORIG1.**
**IF BEN_EST_ORIG1 < 200, THEN SET BEN_EST_ORIG=200**
**IF BEN_EST_ORIG1 = MISSING, THEN SET BEN_EST_ORIG=MISSING.**

---

**[SHOW IF SS_STATUS==1 (CURRENTLY RECEIVING BENEFITS) AND (AGE ≥ 60 OR BEN_EST_ORIG=MISSING)]**
**Q.1.9: [BEN_LEVEL] Social Security Benefits Level**

Approximately how much are your monthly Social Security benefits?

Even if you do not know exactly, please give your best guess.

(As before, please report any Social Security benefits paid to you yourself (by check or direct deposit), not benefits paid to any other member in your household).

$_____ **[NUMBER BOX WITH RANGE 0-3500]** per month.

**[Note to programmers: please record the first answer to this question in BEN_LEVEL1.**

**[Display If BEN_LEVEL1 (social security benefits level) > 3500]**
**[checkBEN_LEVEL3500] Social Security Benefits Level Check > 3500**

> Due to how Social Security calculates your benefits, it is very unlikely that your monthly benefit will be this high. Please go back and change your answer to something between $0 and $3500 per month.

**[Display If BEN_LEVEL1 (social security benefits level) < 0]**
**[checkBEN_LEVEL0] Social Security Benefits Level Check <0**

> Monthly Social Security benefits cannot be negative. Please go back and change your answer to something between $0 and $3500 per month.

**The final response for all respondents should be recorded in the variable BEN_LEVEL.]**

**[SET BEN_EST=BEN_LEVEL]**
**[GO TO Q.1.13, "USE_DEFAULT"]**

---

**[Ask if BEN_EST_ORIG ≠ missing:]**
**Q.1.10: [BEN_OVERRIDE, BEN_NEW] ESTIMATED SOCIAL SECURITY BENEFITS**

Based on the information you have provided to us about your own earnings history, we estimate that, under current Social Security Law, you are supposed to get a Social Security retirement benefit of approximately $[BEN_EST_ORIG] per month if you claim benefits at age [CLAIM_AGE].

Think of any dollar amount mentioned in this survey in terms of what a dollar buys you today (because Social Security will adjust future dollar amounts for inflation).

Our estimate does not take into account Social Security benefits you may receive based on the earnings of a past or current spouse.

Do you think our estimate is about right for benefits you yourself are supposed to get from the Social Security program whether these benefits are retiree, disability, spouse, or survivor benefits?

(1) ☐ Yes, I believe the Social Security benefits I am supposed to get are roughly $[BEN_EST_ORIG] per month.
(2) ☐ No, I believe the Social Security benefits I am supposed to get are roughly $_____ **[NUMBER BOX WITH RANGE 0-6000, variable name: BEN_NEW]** per month.

**The instrument made sure that those who check option 2 fill in the number box; and they were reminded once if they left it blank. The first answer to their question was recorded in BEN_NEW1.**

**[DISPLAY IF BEN_NEW1 (benefits new) > 6000]**
**[checkBEN_NEW6000] Benefits New Check > 6000**

Due to how Social Security calculates your benefits, it is very unlikely that your monthly benefit will be this high. Please go back and change your answer to something between $0 and $6000 per month.

**[DISPLAY If BEN_NEW1 (benefits new) < 0 ]**
**[checkBEN_NEW0] Benefits New Check < 0**

Monthly Social Security benefits cannot be negative. Please go back and change your answer to something between $0 and $6000 per month.

**[DISPLAY IF BEN_OVERRIDE==2 and BEN_NEW == missing]**
**[checkBEN_NEWempty] Benefits New Check Value Empty**

You selected the second option but did not fill in a value. Your answers are important to us. Please go back and fill in a value.

**The final response for the number box for each respondent was recorded in the variable BEN_NEW.]**

**IF BEN_OVERRIDE==1, SET BEN_EST=BEN_EST_ORIG**
**IF BEN_OVERRIDE==2, SET BEN_EST=BEN_NEW**

---

**[ASK IF BEN_OVERRIDE==2]**
**Q.1.11 [OVERRIDE_WHY] Reason why R changed our estimate**

Thank you for correcting our estimate of your Social Security benefits. We are interested in knowing what this correction was based on. Please check all boxes that apply.

(1) ☐ I know the amount of Social Security that I am supposed to get from my annual Social Security mailing
(2) ☐ I included Social Security survivor benefits that you did not include in your estimate
(3) ☐ I included Social Security spousal benefits that you did not include in your estimate
(4) ☐ I included Social Security disability benefits that you did not include in your estimate
(5) ☐ Your estimate simply didn't appear right to me
(6) ☐ Other _____ [Give open-ended text box]

**[Note to programmer: Respondent is allowed to select multiple options]**

---

**[Ask if BEN_EST_ORIG=missing:]**
**Q.1.12: [BEN_EST_OWN]**

In this question, we would like get your estimate of the Social Security benefits you are supposed to get under current law if you claim benefits at age [CLAIM_AGE].

As a point of reference, the typical Social Security benefit for **[If MARRIED=1, insert** "a married"**; if MARRIED=0, insert** "an unmarried"**] [If GENDER="male" insert** "man"**; if GENDER="female" insert** "woman"**]** with **[insert the respondent's educational attainment based on the categories in EDUCATION]** is $[BEN_DEFAULT] per month.

Please give your answer in terms of what a dollar buys you today (because Social Security will adjust future dollar amounts for inflation). Please report benefits you yourself are supposed to get from the Social Security program whether these benefits are retiree, disability, spouse, or survivor benefits?

Even if you do not know exactly, please give your best guess.

I believe the Social Security benefits I am supposed to get are roughly $_____ **[NUMBER BOX WITH RANGE 0-6000, variable name: BEN_EST_OWN]** per month if I claim benefits at age [CLAIM_AGE].

**[DISPLAY IF BEN_EST_OWN1 (benefits estimate own) > 6000]**
**[checkBEN_EST_OWN6000] Benefits Estimate Own Check > 6000**

Due to how Social Security calculates your benefits, it is very unlikely that your monthly benefit will be this high. Please go back and change your answer to something between $0 and $6000 per month.

**[DISPLAY IF BEN_EST_OWN1 (benefits estimate own) <0]**
**[checkBEN_EST_OWN0 benefits estimate own check < 0]**

Monthly Social Security benefits cannot be negative. Please go back and change your answer to something between $0 and $6000 per month.

**The final response for the number box for all respondents were recorded in the variable BEN_EST_OWN.]**

**[Set BEN_EST=BEN_EST_OWN]**

---

**[Ask if BEN_EST=missing]**
**Q.1.13 [USE_DEFAULT, BEN_EST_RAW]: Tell respondent that we are using a default amount for his/her SS benefits**

The typical Social Security benefit for **[If MARRIED=1, insert** "a married"**; if MARRIED=0, insert** "an unmarried"**] [If GENDER="male" insert** "man"**; if GENDER="female" insert** "woman"**]** with **[insert the respondent's educational attainment based on the categories in EDUCATION]** is $[BEN_DEFAULT] per month. For the rest of the survey, let's assume that you **[If SS_STATUS==2, insert** "are supposed to"**]** get a Social Security benefit of $[BEN_DEFAULT] per month.

**[Ask if BEN_EST<200]**
**Q.1.14 [USE_DEFAULT, BEN_EST_RAW]: Tell respondent that we are using a default amount for his/her SS benefits**

Thank you for providing us with your estimated Social Security benefits of $[BEN_DEFAULT] per month. Some of the questions that follow only apply for Social Security benefits of at least $200 per month. For purposes of answering the remaining questions in this survey, we would therefore like to ask you to please assume that your Social Security benefits would be $200 per month.

**[Set BEN_EST_RAW=BEN_EST]**
**[Set BEN_EST=BEN_DEFAULT]**
**[Set USE_DEFAULT=1]**

---

## SECTION 2: CV-PLUS ANNUITY TRADE-OFF QUESTIONS

---

**[NOTE: A COMPENSATING VARIATION (CV-PLUS) MEASURE IS ELICITED IN THIS SECTION. HERE RESPONDENTS ARE ASKED TO MAKE A TRADE-OFF CHOICE BETWEEN REPONDENTS' EXISITING SOCIAL SECURITY MONTHLY BENEFIT LEVEL AND THEIR EXISTING SOCIAL SECURITY MONTLY BENENIT AMOUNT MINUS A VARYING AMOUNT (SS_VARAMT) AND AN ADDITION OF A ONE-TIME PAYMENT /LUMPSUM AMOUNT (LS_AMT).]**

---

**Q.2.1. [TRADEOFF – INTRO]. Introduction to annuity tradeoff questions**

In the next few questions, we are going to ask you to make a number of choices about Social Security benefits.

Please assume that all amounts shown are after tax (i.e., you don't owe any tax on any of the amounts we will show you).

Think of any dollar amount mentioned in this survey in terms of what a dollar buys you today (because Social Security will adjust future dollar amounts for inflation).

---

**[WAIT_WARNING]** Wait Warning

The page after this may take several seconds to load. Please click the next button now, and do not click your browser's back button while the page is loading. Thank you.

---

**[Notes to programmers:**

**There are two nested loops in this section.**

1. **The outer loop has 2, 3 or 4 iterations and loops over the change in the Social Security amount: SS_VARAMT. The outerloop is indexed by the variable i. (The number of iterations depends on the respondent's estimated Social Security benefits. For most respondents there are four iterations, but the number is lower for a few respondents with very low benefit amounts).**

2. **The inner loop has 4 or 5 iterations and loops over the amount of the one-time payment offered: LS. The inner loop is indexed by the variable j. (The number if iterations is generally 4. It is only 5 when we set SS_VARAMT=100)**

**Let the variable SS_VARAMT be a vector of length N_VARAMT. Let SS_VARAMT[i] denote the $i^{th}$ element of SS_VARAMT.**

**Initialization of SS_VARAMT**

**If BEN_EST < 300**
**Set N_VARAMT=2**
**SS_VARAMT={100, BEN_EST}**
**Endif**

**If BEN_EST ≥ 300 AND BEN_EST<600**
**Set N_VARAMT=3**
**Create the vector AMT={200, 300, 400}**
**Delete elements of AMT that are greater than (BEN_EST-100)**
**Pick at random one element of AMT, call this element AMTRND**
**Set SS_VARAMT={100, BEN_EST, AMTRND}**
**Endif**

**If BEN_EST ≥ 600**
**Set N_VARAMT=4**

**Create the vector AMT={200, 300, 400, 600, 700, 800, 900, 1000, 1100, 1200, 1300, 1400, 1500, 1600, 1700, 1800, 1900, 2000} /* Note that the amount 500 is missing from this list on purpose */**
**Delete elements of AMT that are greater than (BEN_EST-100)**
**Pick at random one element of AMT, call this element AMTRND**
**Set SS_VARAMT={100, 500, BEN_EST, AMTRND}**
**Endif**

**If SMALLTOLARGE==1**
**Sort the elements if SS_VARAMT from smallest to largest (i.e. such that SS_VARAMT[i] < SS_VARAMT[i+1] for all i)**
**Else**
**Sort the elements if SS_VARAMT from largest to smallest (i.e. such that SS_VARAMT[i] > SS_VARAMT[i+1] for all i)**
**Endif**

**Initialization of 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**

**Start of the nested loops that ask CV-PLUS**

**For i=1 to N_VARAMT /* START OF THE OUTER LOOP FOR CVPLUS */**

**If SS_VARAMT=100**
**Set N_LS=5**
**Else**
**Set N_LS=4**
**Endif**

---

**[Show if i>1]**
**Q.2.2:[CV-Plus Roadmap] Roadmap to new series of CV-plus tradeoff question.**

Now we would like to show a similar series of questions about choices between two money amounts, but the amount of the Social Security benefits in one of the options is different from before.

As before, please assume that all amounts shown are after tax (i.e., you don't owe any tax on any of the amounts we will show you).

As before, please think of any dollar amount mentioned in this survey in terms of what a dollar buys you today (because Social Security will adjust future dollar amounts for inflation).

---

**Q.2.3: [CVPLUS]: CV-PLUS TRADE-OFF QUESTION**
**Set ROW=1**
**For j=1 to N_LS /* START OF THE INNER LOOP FOR CVPLUS*/**
**[If j = 1, Display: ]**
In this question, we are going to ask you to make a choice between two money amounts.
**[Else, Display:]**
Now we ask you the same question but with a different amount for the one-time payment.
**[Endif]**

Please click on the option that you would prefer.
**[SHOW IF MARRIED==1:]** Benefits paid to your [SPOUSE] will stay the same for either choice.

Suppose Social Security gave you a choice between:

**[If LS_FIRST=0, Display: ]**
(1) ☐ Receiving your **[If SS_STATUS==1, insert** "current"**; if SS_STATUS==2, insert** "expected"**]** Social Security benefit of $[BEN_EST] per month.
or
**[If BEN_EST ≤ SS_VARAMT, Display: ]**
(2) ☐ Receiving no Social Security benefits but receiving a one-time payment of $[LS_AMT[ROW,j]] **[If CLAIM_AGE>AGE+1, insert** "at age [CLAIM_AGE]"**; else insert** "one year from now"**]**.
**[Else Display:]**
(2) ☐ Receiving a Social Security benefit of $[BEN_EST - SS_VARAMT[i]] per month and receiving a one-time payment of $[LS_AMT[ROW,j]] **[If CLAIM_AGE>AGE+1, insert** "at age [CLAIM_AGE]"**; else insert** "one year from now"**]**.
**[Endif]**

**[Else Display:]**

**[If BEN_EST ≤ SS_VARAMT, Display: ]**
(2) ☐ Receiving no Social Security benefits but receiving a one-time payment of $[LS_AMT[ROW,j]] **[If CLAIM_AGE>AGE+1, insert** "at age [CLAIM_AGE]"**; else insert** "one year from now"**]**.
**[Else Display:]**
(2) ☐ Receiving a Social Security benefit of $[BEN_EST - SS_VARAMT[i]] per month and receiving a one-time payment of $[LS_AMT[ROW,j]] **[If CLAIM_AGE>AGE+1, insert** "at age [CLAIM_AGE]"**; else insert** "one year from now"**]**.
**[Endif]**
or
(1) ☐ Receiving your **[If SS_STATUS==1, insert** "current"**; if SS_STATUS==2, insert** "expected"**]** Social Security benefit of $[BEN_EST] per month.

**[Endif]**

**[If Respondent selects option 1 (so NOT the one-time payment)]**
**[Set ROW=ROW+2^(4-j)] /* Note: this will increase the offered one-time payment in the next iteration */**
**[Endif]**

**[If the respondent does not check either option, prompt once using the standard ALP language in situations like these (something along the lines of "Are just sure you do not want to choose between these two options."). If the respondent still does not answer, set j=5 so that we skip out of the inner loop to the next iteration of the outer loop]**

**j=j+1 /* END OF THE INNERLOOP FOR CV PLUS */**
**EndFor**
**i=i+1**
**EndFor /* END OF THE OUTERLOOP FOR CV PLUS */**

## SECTION 3: BACKGROUND QUESTIONS

**[NOTE: THIS SECTION ASKS QUESITONS IN ORDER TO COLLECT CONTROL VARIABLES SUCH AS SUBJECTIVE HEALTH, FINANCIAL LITERACY, RISK AVERSION, ANNUITY HOLDINGS, MORTALITY EXPECTATIONS, PERCEPTION OF POLITICAL RISK, AND LIQUIDITY CONSTRAINTS. ]**

---

**Q.3.1: [HEALTH] Subjective Health** *[ms1_C901]*

Would you say your health is . . .?

(1) Excellent
(2) Very good
(3) Good
(4) Fair
(5) Poor

---

**Financial Literacy**

**Q 3.2.1 [INT_RATE_LITERACY] Interest rate literacy** *[ms5_L001]*

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?

(1) More than $102
(2) Exactly $102
(3) Less than $102
(4) Don't Know

---

**Q 3.2.2 [INFLATION] Inflation Literacy** *(ms5_L003)*

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?

(1) More than today
(2) Exactly the same as today
(3) Less than today
(4) Don't Know

---

**Q 3.2.3 [SAFER] Stock literacy** *[ms5_P002]*

Please tell us whether this statement is true or false? Buying a **[If ORDER_STOCK=1, insert "**single company stock**"; else insert "**stock mutual fund**"]** usually provides a safer return than a **[If ORDER_STOCK=1, insert "**stock mutual fund**"; else insert "**single company stock**"]**.

(1) True
(2) False
(3) Don't know

---

**Q 3.2.4 [FINKNOWL] Self-rated Financial Knowledge** *[ms33_FINKNOWL]*

How would you rate your knowledge about financial matters?

(1) Very High
(2) High
(3) Moderate
(4) Low
(5) Very Low

---

**Q 3.2.5 [HS_FIN_EDUC_PROGRAM] High school financial education programs** *[ms5_B003]*

Did your high school offer financial education programs?

(1) Yes
(2) No

---

**Q 3.2.6 [EMP_FIN_EDUC_PROGRAM] Employer's financial education program** *[ms5_Z001]*
Did any of the employers you work for or worked for offer financial education programs (for example retirement seminars)?

(1) Yes
(2) No
(3) Don't know

---

**Q 3.2.7 [RET_SAV_PLAN] Retirement savings plan** [JV357 in HRS]
Have you developed a plan for retirement saving?

(1) Yes
(2) More or less
(3) No

[IF RET_SAV_PLAN = 1 skip to Q3.2.8, IF RET_SAV_PLAN = 2 skip to Q3.2.8, IF RET_SAV_PLAN = 3 skip to Q3.3.1]

---

**Q 3.2.8 [RET_SAV_PLAN_1] Able to stick to retirement saving plan** *[JV358 in HRS]*
How often have you stuck to this plan: would you say always, mostly, rarely, or never?

(1) Always
(2) Mostly
(3) Rarely
(4) Never

---

**Questions on Risk Aversion and Precautionary Savings Motives**

**[NOTE: Options from 1 to 7 are included for the following questions where 1 indicates "completely agree" and 7 indicates "completely disagree".]**

**[RISKAVERSION_INTRO]:** The following statements concern saving and taking risks. Please indicate for each statement to what extent you agree or disagree, on a scale from 1 to 7. Here 1 indicates you "completely agree" and 7 indicates you "completely disagree."

**Q 3.3.1 [SPAAR1] Safe investments 1**
I think it is more important to have safe investments and guaranteed returns, than to take a risk to have a chance to get the highest possible returns.

**Q 3.3.2 [SPAAR2] Safe investments 2**
I would never consider investing in the stock market because I find it too risky.

**Q 3.3.3 [SPAAR3] Safe investments 3**
If I think an investment will be profitable, I am prepared to borrow money to make this investment.

**Q 3.3.4 [SPAAR4] Safe investments 4**
I want to be certain that my investments are safe.

**Q 3.3.5 [SPAAR5] Safe investments 5**
I think I should take greater financial risks to improve my financial position.

**Q 3.3.6 [RISKREWARD] Risk Reward**
I am prepared to take the risk to lose money, when there is also a chance to gain money.

**Q 3.3.7 [PRE_MOTIVES1] Precautionary motives 1**
I save to have some money to cover unforeseen expenses

**Q 3.3.8 [PRE_MOTIVES2] Precautionary motives 2**
I save to have enough money in my bank account to be sure I will be able to meet my financial liabilities

---

**Planning Horizon**

**Q 3.4 [FIN_PLAN] Financial planning methods** *[MS16_FD004]*

In deciding how much of their income to spend or save, people are likely to think about different financial planning periods. In planning your household saving and spending, which time period is most important to you?

(1) Next few months
(2) Next year
(3) Next few years
(4) Next 5-10 years
(5) Longer than 10 years
(6) I don't plan

---

**Annuity Holdings**

**Q 3.5.1 [ANNUITY_NOW] Any receipt of pension or annuity benefits now**

Not including Social Security benefits, do you **[If MARRIED=1, insert "** and your [SPOUSE]**"]** currently receive any monthly pension or benefits that will continue for as long as you live?

(7) Yes
(8) No
(9) Other _____

**[IF ANNUITY_NOW = 1, skip to 3.5.2, IF ANNUITY_NOW = 2, skip to 3.5.3, IF ANNUITY_NOW = 3, skip to 3.5.3]**

---

**Q 3.5.2 [ANNUITY_NOW1] Current monthly pension or annuity benefits**

If you add it all up, about how much is the total amount per month? $ _____

---

**Q 3.5.3 [ANNUITY_LATER] Monthly pension or annuity benefits later**

Not including Social Security benefits, do you **[If MARRIED=1, insert "** and your [SPOUSE]**"]** anticipate receiving in the future any monthly pension or payments that will continue for as long as you live?

(1) Yes
(2) No
(3) Other _____

**[IF ANNUITY_LATER = 1 skip to 3.5.4, IF ANNUITY_LATER = 2 skip to 3.6.1, IF ANNUITY_LATER = 3 skip to 3.6.1]**

---

**Q 3.5.4 [ANNUITY_LATER1] Monthly pension or annuity benefits 1**

Adding it all up, about how much will the total amount be per month? $ _____

---

**Mortality Expectations**

**[Note to Programmer: ASK Q3.6.1 IF AGE < 65, ELSE GO TO Q3.6.2]**

**Q 3.6.1 [MORT_EXP1] Mortality expectations 1** [HRS LP028 ]

What is the percent chance that you will live to be 75 or more? Please move the slider below to indicate what you think will be the chance that you will live to be 75 or more where 0 means "absolutely no chance" and 100 means "absolutely certain".

**[Note to Programmer: Slider is inserted as shown below:]**

```
     |-----------------------------------------------------------------|
    00---10---20---30---40---50---60---70---80---90---100
Absolutely                                      Absolutely
No chance                                        Certain
```

---

**[ASK Q3.6.2 IF AGE < 90, ELSE GO TO Q3.7]**
**Q 3.6.2 [MORT_EXP2] Mortality expectations 2** [HRS LP029]
**[Note to Programmer:**
**Fill values assigned as follows**
**85 (IF AGE IS LESS THAN 65) /* note: this non-monotonic pattern follows the HRS version of this question */**
**80 (IF AGE IS 65-69)**
**85 (IF AGE IS 70-74)**
**90 (IF AGE IS 75-79)**
**95 (IF AGE IS 80-84)**
**100 (IF AGE IS 85+)]**

What is the percent chance that you will live to be **[FILLVALUE]** or more? Please move the slider below to indicate what you think will be the chance that you will live to be **[FILLVALUE]** or more, where 0 means "absolutely no chance" and 100 means "absolutely certain".

**[Note to Programmer: Slider inserted as shown below:]**

```
     |-----------------------------------------------------------------|
   00---10---20---30---40---50---60---70---80---90---100
Absolutely                                      Absolutely
No chance                                       Certain
```

---

**Q.3.7: [PLCTCL_TRST] Perception of political risk** *[Greenwald language]*
How confident are you that the Social Security system will be able to provide you with the level of future benefits you are supposed to get under current law?

(1) Very confident
(2) Somewhat confident
(3) Not too confident
(4) Not at all confident

---

**Expected Returns**
**[The following questions are displayed as a table]**
**Q 3.8.1 [SAV_PLAN_1] Saving Plan 1**
Suppose you received an additional $10,000 this year. Thinking about your household financial situation, how do you think you would use it?

Please type how much of the $10,000 you would use for each action in the boxes below. You can put the money in as many or as few categories as you wish.

About how much of it do you think you would use to:

| | | |
|---|---|---|
| (1) | spend | $_____ |
| (2) | pay off credit cards | $_____ |
| (3) | pay off other debt | $_____ |
| (4) | save | $_____ |
| (5) | other | $_____ |

**Respondents are prompted to make sure the amounts add to $10,000**
**[ DISPLAY IF total <> 10000 ]**
**[checkSAV_PLAN_1total] check total**
Your total adds up to $[]. Please go back and change the numbers in the table so they add up to $10,000 or choose next to continue.

---

**[The following questions are displayed as a table]**
**Q 3.8.2 [SAV_PLAN_2] Saving Plan 2**
Now assume that you cannot spend the $10,000, but have to save it for the future. How would you do that?

Please type how much of the $10,000 you would use for each action in the boxes below. You can put the money in as many or as few categories as you wish. Please do not use commas, dollar signs or decimal points.

(1) Put some in the bank $_____
(2) Invest some in bonds $_____
(3) Invest some in CDs $_____
(4) Invest some in stocks $_____
(5) Buy property/real estate $_____
(6) Other $_____

**[NOTE: Respondents are prompted to make sure the amounts add to $10,000.]**
**[ DISPLAY IF total <> 10000 ]**
**[checkSAV_PLAN_2total] check total**
Your total adds up to $[] Please go back and change the numbers in the table so they add up to $10,000 or choose next to continue.]

**Q 3.8.3 [SAV_PLAN_3] Saving Plan 3**
Of the $10,000 that you had to save, about how much do you think you might earn on it per year, on average?

(1) Less than or equal to 0%,
(2) 1-3%,
(3) 4-6%,
(4) 7-9%
(5) 10-12%
(6) 13% or more

---

**Liquidity Constraints**

**Q 3.9.1 [ComeUp5000] Come up with $5000**

If you had to, could you come up with $5,000 **[If CLAIM_AGE>AGE+1, insert** "by age CLAIM_AGE"**; else insert** "within one year from now"**]**?

(1) Yes, I am certain I could
(2) I probably could
(3) I probably could not
(4) No, I definitely could not

**[Ask if ComeUp5000=1 or ComeUp5000=2]**
**Q 3.9.2 [FromWhere5000_MC, FromWhere_Box] How would you get the $5000**

How would you come up with this $5000?

Choose all that apply:

(1) I would use my current savings or investments
(2) I would save the money out of my income between now and **[If CLAIM_AGE>AGE+1, insert** "age CLAIM_AGE"**; else insert** "one year from now"**]**?
(3) I would borrow it from family or friends
(4) I would use one or more credit cards
(5) I would use a home equity loan or home mortgage
(6) I would take out a payday loan or use a pawnshop
(7) I would sell something that I own, not including my home
(8) I would work additional hours, now or in the future
(9) Other: _____ [provide open-ended text box]

---

## SECTION 4: CLOSING OF WAVE 1

**[NOTE: THIS IS ASKED OF ALL RESPONDENTS AT THE END OF WAVE 1.]**

**Q 4.1.1: [CS_001] HOW PLEASANT INTERVIEW**
Could you tell us how interesting or uninteresting you found the questions in this interview?

(1) Very interesting
(2) Interesting
(3) Neither interesting nor uninteresting
(4) Uninteresting
(5) Very uninteresting

**Q 4.1.2: [CS_003] Comments**
Do you have any other comments on the interview? Please type these in the box below.
**[Insert Open box]**

## SECTION 5: INTRODUCTION TO WAVE 2

**[NOTE: THIS SECTION ASKS THE EITHER THE CV-PLUS VERSION (VERSION B) OR THE OTHER VARIATIONS WHICH CONSISTS OF CV-MINUS, EV-PLUS AND EV-MINUS (VERSION A) DEPENDING ON THE RANDOMIZATION. IT ALSO ASKS THE "NO POLITICAL RISK VERSION" OF CV-PLUS TO ALL RESPONDENTS.]**

**[WAIT_WARNING] Wait Warning**

The page after this may take several seconds to load. Please click the next button now, and do not click your browser's back button while the page is loading. Thank you.

**Q.5.1. [WAVE2_INTRO] Introduction to wave 2**
Recently, we asked you a number of questions about when and how you would like to receive your Social Security benefits.

We very much appreciate your help. Today, we would like to ask you some more questions about this.

Once again, please take time to consider the questions and give us your best guess even if you do not know the exact answer. Having your best guess will be very helpful to us.

Thank you very much for your participation!

**[If SS_STATUS==2 and FLAGHYPO=0 (not currently receiving SS and not hypothetical benefits), show:]**
**Q5.2. [BENEFIT_REMINDER] Reminding the respondent about his/her benefits**

We would like to remind you that in the prior survey we used $[BEN_EST] as the monthly Social Security benefits that your are supposed to get under current law if you claim benefits at age [CLAIM_AGE].

As before, we mean by "Social Security benefits" any benefits that you yourself receive or will receive from the Social Security program, including retiree, disability, spouse, or survivor benefits.

**[IF SS_ELIG=3, DISPLAY:] /* So to those who said in wave 1 that they thought SS would no longer be around */**

Please answer the questions in this survey assuming that current Social Security rules still apply when you first claim Social Security benefits. Thank you.

**[ENDIF]**

---

**[If FLAGHYPO=1, Show]**
**Q.5.3: [ReminderHypoEligible] Reminder for those ineligble, but who answer questions hypothetically**

Even though you told us in the prior survey that you are not eligible to receive Social Security benefits, we would like to again ask you to complete our survey assuming you would be eligible. In other words, please answer in this survey what you would have done or chosen if you would be eligible for Social Security benefits.

The typical Social Security benefit for **[If MARRIED=1, insert** "a married"**; if MARRIED=0, insert** "an unmarried"**] [If GENDER="male" insert** "man"**; if GENDER="female" insert** "woman"**]** with **[insert the respondent's educational attainment based on the categories in EDUCATION]** is $[BEN_DEFAULT] per month.

For the purpose of this survey, let's assume that you **[If SS_STATUS==2, insert** "are supposed to"**]** get a Social Security benefit of $[BEN_DEFAULT] per month, and that you **[If SS_STATUS==1, insert** "started receiving"; **If SS_STATUS==2, insert** "would start receiving"**]** Social Security benefits at age 62.

## SECTION 6: CV-MINUS AND EV ANNUITY TRADE-OFF QUESTIONS

---

**[NOTE: COMPENSATING VARIATION (CV-MINUS ) AND EQUILVALENT VARIATION (EV-PLUS/EV-MINUS) MEASURES ARE ELICITED IN THIS SECTION. SPECIFICALLY, RESPONDENTS ARE ASKED TO MAKE A TRADE-OFF CHOICE BETWEEN:**

**1) CV-MINUS: REPONDENTS' EXISITING SOCIAL SECURITY MONTHLY BENEFIT LEVEL AND THEIR EXISTING SOCIAL SECURITY MONTLY BENENIT AMOUNT WITH AN INCREMENT OF A VARYING AMOUNT (SS_VARAMT) MINUS A ONE-TIME PAYMENT /LUMPSUM AMOUNT (LS_AMT).**

**2) EV-PLUS: REPONDENTS' EXISITING SOCIAL SECURITY MONTHLY BENEFIT LEVEL WITH A ONE-TIME PAYMENT/LUMPSUM AMOUNT (LS_AMT) AND REPONDENTS' EXISITING SOCIAL SECURITY MONTHLY BENEFIT LEVEL WITH AN INCREMENT OF A VARYING AMOUNT (SS_VARAMT)**

**3) EV-MINUS: REPONDENTS' EXISITING SOCIAL SECURITY MONTHLY BENEFIT LEVEL MINUS A ONE-TIME PAYMENT/LUMPSUM AMOUNT (LS_AMT) AND REPONDENTS' EXISITING SOCIAL SECURITY MONTHLY BENEFIT LEVEL WITH A DECREMENT OF A VARYING AMOUNT (SS_VARAMT). ]**

---

**Q.6.1. [TRADEOFF – INTRO]. Introduction to annuity tradeoff questions**

In the next few questions, we are going to ask you to make a number of choices about Social Security benefits.

Please assume that all amounts shown are after tax (i.e., you don't owe any tax on any of the amounts we will show you).

Think of any dollar amount mentioned in this survey in terms of what a dollar buys you today (because Social Security will adjust future dollar amounts for inflation).

---

**[WAIT_WARNING] Wait Warning**

The page after this may take several seconds to load. Please click the next button now, and do not click your browser's back button while the page is loading. Thank you.

---

**[Note to programmer:**

**There are two nested loops in this section.**

1. **The outer loop has 3 iterations and loops over the version of the tradeoff question that is asked (either CV-Minus, EV-Plus, or EV-minus). The outerloop is indexed by the variable i.**

2. **The inner loop has 4 iterations and loops over the amount of the one-time payment offered: LS. The inner loop is indexed by the variable j.**

**Initialization of SS_VARAMT**
**Set SS_VARAMT=100**

**Initialization of 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**

**Start of the nested loops that ask other versions of the tradeoff questions**

**For i=1 to 3 /* START OF THE OUTER LOOP FOR OTHER TRADEOFF QUESTIONS */**

---

**[Show if i>1]**
**Q.6.2: [Roadmap other versions] Roadmap to other tradeoff questions.**
Now we would like to show a different series of questions about choices about Social Security benefits.

As before, please assume that all amounts shown are after tax (i.e., you don't owe any tax on any of the amounts we will show you).

As before, think of any dollar amount mentioned in this survey in terms of what a dollar buys you today (because Social Security will adjust future dollar amounts for inflation).

---

**Q.6.3: [OtherTradeoff]: OTHER VERSIONS OF TRADE-OFF QUESTION**

**Set ROW=1**

**For j=1 to 4 /* START OF THE INNER LOOP FOR OTHER TRADEOFF QUESTIONS */**

**[If j = 1, Display: ]**
In this question, we are going to ask you to make a choice between two money amounts.
**[Else, Display:]**
Now we ask you the same question but with a different amount for the one-time payment.
**[Endif]**

Please click on the option that you would prefer.

**[SHOW IF MARRIED==1:]** Benefits paid to your [SPOUSE] will stay the same for either choice.

Suppose Social Security gave you a choice between:

**[If CVM_ORDER==i] /* THIS GIVES THE CV-MINUS VERSION */**

**[Note to programmer: The way the ROW variable is updated depends on how each option is numbered]**

**[If LS_FIRST=0, Display: ]**

(2) ☐ Receiving your **[If SS_STATUS==1, insert** "current"**; if SS_STATUS==2, insert** "expected"**]** Social Security benefit of $[BEN_EST] per month.

or

(1) ☐ Receiving a Social Security benefit of $[BEN_EST + SS_VARAMT] per month and making a one-time payment of $[LS_AMT[ROW,j]] **[If CLAIM_AGE>AGE+1, insert** "at age CLAIM_AGE"**; else insert** "one year from now"**]** to Social Security.

**[Else Display:]**

(1) ☐ Receiving a Social Security benefit of $[BEN_EST + SS_VARAMT] per month and making a one-time payment of $[LS_AMT[ROW,j]] **[If CLAIM_AGE>AGE+1, insert** "at age CLAIM_AGE"**; else insert** "one year from now"**]** to Social Security.

or

(2) ☐ Receiving your **[If SS_STATUS==1, insert** "current"**; if SS_STATUS==2, insert** "expected"**]** Social Security benefit of $[BEN_EST] per month.

**[Endif]**

**[Endif] /* End of CV-Minus version */**

**[If EVP_ORDER==i] /* THIS GIVES THE EV-PLUS VERSION */**

**[Note to programmer: The way the ROW variable is updated depends on how each option is numbered]**

**[If LS_FIRST=0, Display:]**

(1) ☐ Receiving a Social Security benefit of $[BEN_EST + SS_VARAMT] per month.

or

(2) ☐ Receiving your **[If SS_STATUS==1, insert** "current"**; if SS_STATUS==2, insert** "expected"**]** Social Security benefit of $[BEN_EST] per month and receiving a one-time payment of $[LS_AMT[ROW,j]] **[If CLAIM_AGE>AGE+1, insert** "at age CLAIM_AGE"**; else insert** "one year from now"**]**.

**[Else Display:]**

(2) ☐ Receiving your **[If SS_STATUS==1, insert** "current"**; if SS_STATUS==2, insert** "expected"**]** Social Security benefit of $[BEN_EST] per month and receiving a one-time payment of $[LS_AMT[ROW,j]] **[If CLAIM_AGE>AGE+1, insert** "at age CLAIM_AGE"**; else insert** "one year from now"**]**.

or

(1) ☐ Receiving a Social Security benefit of $[BEN_EST + SS_VARAMT] per month.

**[Endif]**

**[Endif] /* End of EV-Plus Version */**

**[If EVM_ORDER==i] /* THIS GIVES THE EV-MINUS VERSION */**

**[Note to programmers: The way the ROW variable is updated depends on how each option is numbered]**

**[If LS_FIRST=0, Display: ]**

**[If BEN_EST ≤ SS_VARAMT, Display: ]**
(2) ☐ Receiving no Social Security benefits.
**[Else Display:]**
(2) ☐ Receiving a Social Security benefit of $[BEN_EST - SS_VARAMT] per month.
**[Endif]**
or
(1) ☐ Receiving your **[If SS_STATUS==1, insert** "current"**; if SS_STATUS==2, insert** "expected"**]** Social Security benefit of $[BEN_EST] per month and making a one-time payment of $[LS_AMT[ROW,j]] **[If CLAIM_AGE>AGE+1, insert** "at age CLAIM_AGE"**; else insert** "one year from now"**]** to Social Security.

**[Else Display:]**

(1) ☐ Receiving your **[If SS_STATUS==1, insert** "current"**; if SS_STATUS==2, insert** "expected"**]** Social Security benefit of $[BEN_EST] per month and making a one-time payment of $[LS_AMT[ROW,j]] **[If CLAIM_AGE>AGE+1, insert** "at age CLAIM_AGE"**; else insert** "one year from now"**]** to Social Security.
or
**[If BEN_EST ≤ SS_VARAMT, Display: ]**
(2) ☐ Receiving no Social Security benefits.
**[Else Display:]**
(2) ☐ Receiving a Social Security benefit of $[BEN_EST - SS_VARAMT] per month.
**[Endif]**

**[Endif]**
**[Endif]** **/* End of EV-Minus version */**

**[If Respondent selects option 1]** **/*so making the one-time payment (for CV-minus and EV-minus) or NOT receiving the one-time payment (for EV-plus) */**
**[Set ROW=ROW+2^(4-j)]** **/* Note: this will increase the size of one-time payment in the next iteration, so it makes option 1 less attractive */**
**[Endif]**

**[If the respondent does not check either option, prompt once using the standard ALP language in situations like these (something along the lines of "Are you sure you do not want to choose between these two options."). If the respondent still does not answer, set j=5 so that we skip out of the inner loop to the next iteration of the outer loop]**

**j=j+1** **/* END OF THE INNERLOOP FOR OTHER TRADEOFF QUESTIONS */**
**EndFor**
**i=i+1**
**EndFor** **/* END OF THE OUTERLOOP FOR OTHER TRADEOFF QUESTIONS */**

## SECTION 7: NO-POLITICAL-RISK TRADE-OFF QUESTION

**[NOTE: THIS SECTION REPLICATES ONE OF THE COMPENSATION VARIATION MEASURES (CV-PLUS) BUT ASSUMING THAT THERE IS NO POLITICAL RISK. IT IS ASKED OF ALL RESPONDENTS AT THE END OF WAVE 2.]**

---

**Q.7.1. [NOPOLRISK – INTRO]. Introduction to annuity tradeoff question without political risk**

The next few questions are similar to the questions we have asked before about choices about Social Security benefits but with one difference:
 From now on, please assume that you are absolutely certain to receive all income promised as future Social Security benefits or as a future one-time payment. In other words, please assume that it is absolutely certain that Social Security will make payments as promised, and that there is no chance at all of any benefit changes in the future other than the trade-offs discussed in the question below. 

As before, please assume that all amounts shown are after tax (i.e., you don't owe any tax on any of the amounts we will show you).

As before, think of any dollar amount mentioned in this survey in terms of what a dollar buys you today (because Social Security will adjust future dollar amounts for inflation).

---

**[NOTE TO PROGRAMMER:**
**Initialization of SS_VARAMT**

**Set SS_VARAMT=100**

**Initialization of 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 ]**

---

**Q.7.2: [NOPOLRISK]: NO-POLITICAL-RISK VERSION OF CV-PLUS TRADE-OFF QUESTION**
**Set ROW=1**
**For j=1 to 4 /* START OF THE NOPOLRISK LOOP */**

**[If j = 1, Display: ]**
In this question, we are going to ask you to compare and make a choice between two money amounts.
**[Else, Display:]**
Now we ask you the same question but with a different amount for the one-time payment.
**[Endif]**

**Reminder: ** Please assume that you are absolutely certain to receive all income promised as future Social Security benefits or as a future one-time payment. In other words, please assume that it is absolutely certain that Social Security will make payments as promised, and that there is no chance at all of any benefit changes in the future other than the trade-offs discussed in the question below. **<end b>**

Please click on the option that you would prefer.
**[SHOW IF MARRIED==1:]** Benefits paid to your [SPOUSE] will stay the same for either choice.

Suppose Social Security gave you a choice between:

**[If LS_FIRST=0, Display: ]**

(1) ☐ Receiving your **[If SS_STATUS==1, insert** "current"**; if SS_STATUS==2, insert** "expected"**]** Social Security benefit of $[BEN_EST] per month.

or

**[If BEN_EST ≤ SS_VARAMT, Display: ]**

(2) ☐ Receiving no Social Security benefits but receiving a one-time payment of $[LS_AMT[ROW,j]] **[If CLAIM_AGE>AGE+1, insert** "at age CLAIM_AGE"**; else insert** "one year from now"**]**.

**[Else Display:]**

(2) ☐ Receiving a Social Security benefit of $[BEN_EST - SS_VARAMT] per month and receiving a one-time payment of $[LS_AMT[ROW,j]] **[If CLAIM_AGE>AGE+1, insert** "at age CLAIM_AGE"**; else insert** "one year from now"**]**.

**[Endif]**

**[Else Display:]**

**[If BEN_EST ≤ SS_VARAMT, Display: ]**

(2) ☐ Receiving no Social Security benefits but receiving a one-time payment of $[LS_AMT[ROW,j]] **[If CLAIM_AGE>AGE+1, insert** "at age CLAIM_AGE"**; else insert** "one year from now"**]**.

**[Else Display:]**

(2) ☐ Receiving a Social Security benefit of $[BEN_EST - SS_VARAMT] per month and receiving a one-time payment of $[LS_AMT[ROW,j]] **[If CLAIM_AGE>AGE+1, insert** "at age CLAIM_AGE"**; else insert** "one year from now"**]**.

**[Endif]**

or

(1) ☐ Receiving your **[If SS_STATUS==1, insert** "current"**; if SS_STATUS==2, insert** "expected"**]** Social Security benefit of $[BEN_EST] per month.

**[Endif]**

**[If Respondent selects option 1 (so NOT the one-time payment)]**

**[Set ROW=ROW+2^(4-j)] /* Note: this will increase the offered one-time payment in the next iteration */**

**[Endif]**

**[If the respondent does not check either option, prompt once using the standard ALP language in situations like these (something along the lines of "Are just sure you do not want to choose between these two options."). If the respondent still does not answer, set j=5 so that we skip out of the inner loop to the next iteration of the outer loop]**

**j=j+1 /* END OF THE NOPOLRISK LOOP */**

**EndFor**

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**Liquidity Constraints**

**[ASK Q 7.3.1 – Q 7.3.4 IF lowest value of lumpsum amount in CV MINUS respondent was unwilling to pay <100000]**
**Q 7.3.1 [CanPayLS] Could respondent pay the lumpsum in CV-Minus**
**[Generate a variable CVM_MIN that is equal to the lowest value of the lumpsum amount in the CV-MINUS question that the respondent was unwilling to pay. So, CVM_MIN is the minimum of the sequence of [LS_AMT[ROW,j]] displayed in CVMINUS restricted to those j where the respondent chose option (2).]**

Previously, you told us you would rather receive your [**If SS_STATUS==1, insert** "current"; **if SS_STATUS==2, insert** "expected"] Social Security benefit of **$[**BEN_EST] per month than make a one-time payment of **$[**CVM_MIN] **[If CLAIM_AGE>AGE+1, insert "**at age CLAIM_AGE**"; else insert "**one year from now**"]** to receive a Social Security benefit of $**[**BEN_EST + SS_VARAMT] per month.

Please indicate your reason for this choice:

(1) I cannot come up with $[CVM_MIN] [If CLAIM_AGE>AGE+1, insert "by age CLAIM_AGE"; else insert "within one year from now"].

(2) I could come up with $[CVM_MIN] but I do not want to use the money this way.

**[ASK IF Could respondent pay the lumpsum in CV-Minus = I cannot come up with $^FLCVM_MIN ^FLCanPayLS3]**
**[Ask if CanPayLS=1 :]**
**Q 7.3.2 [PayIfHadMoney] Would R pay the LS if R had the money?**

Suppose you had an additional $[CVM_MIN] in savings **[If CLAIM_AGE>AGE+1, insert** "at age CLAIM_AGE"**; else insert** "one year from now"**]**, do you think you would make a one-time payment of $[CVM_MIN] **[If CLAIM_AGE>AGE+1, insert** "at age CLAIM_AGE"**; else insert** "one year from now"**]** to receive a Social Security benefit of $[BEN_EST + SS_VARAMT] per month (instead of receiving your **[If SS_STATUS==1, insert "**current**"; if SS_STATUS==2, insert "**expected**"]** Social Security benefit of $[BEN_EST] per month)?

(1) Yes
(2) No

**[ASK IF Would R pay the LS if R had the money = No ]**
**[Ask if PayIfHadMoney =2 :]**
**[The following questions are displayed as a table]**

**Q.7.3.3: [ WhyNotHypo] Why not pay LS even if R had the money**

Why do you choose not to make a one-time payment of $[CVM_MIN] **[If CLAIM_AGE>AGE+1, insert** "at age CLAIM_AGE"**; else insert** "one year from now"**]** to receive a Social Security benefit of $[BEN_EST + SS_VARAMT] per month even if you had at least $[CVM_MIN] in savings?

Why do you choose not to make a one-time payment of $[CVM_MIN] **[If CLAIM_AGE>AGE+1, insert** "at age CLAIM_AGE"**; else insert** "one year from now"**]** to receive a Social Security benefit of $[BEN_EST + SS_VARAMT] per month even if you had an additional $[CVM_MIN] in savings?

Please choose the main reason:

(1) I don't expect to live long enough for this to be a good deal
(2) I believe I can invest the money better on my own
(3) I would prefer to spend more money now rather than having more to spend later
(4) I would prefer to use the money to help pay for an upcoming large expense
(5) I would prefer to save the money for an emergency
(6) I would prefer to leave the money to my family
(7) I don't trust that the government will make good on the deal
(8) Other:_____ [provide open-ended text box]

**Else**

**[The following questions are displayed as a table]**
**[Ask if CanPayLS=2 :]**
**Q 7.3.4 [WhyNotActual] Why not pay LS even if R had the money**

Why do you choose not to make a one-time payment of $[CVM_MIN] [If CLAIM_AGE>AGE+1, insert "at age CLAIM_AGE"; else insert "one year from now"] to receive a Social Security benefit of $[BEN_EST + SS_VARAMT] per month even though you can come up with $[CVM_MIN]?

Why do you choose not to make a one-time payment of $[CVM_MIN] **[If CLAIM_AGE>AGE+1, insert** "at age CLAIM_AGE"**; else insert** "one year from now"**]** to receive a Social Security benefit of $[BEN_EST + SS_VARAMT] per month even though you can come up with $[CVM_MIN]?

Please choose the main reason:

(1) I don't expect to live long enough for this to be a good deal
(2) I believe I can invest the money better on my own
(3) I would prefer to spend more money now rather than having more to spend later
(4) I would prefer to use the money to help pay for an upcoming large expense
(5) I would prefer to save the money for an emergency
(6) I would prefer to leave the money to my family
(7) I don't trust that the government will make good on the deal
(8) Other:_____ [provide open-ended text box]

**[ASK IF CALCULATED AGE < 65]**
**Q.7.4.1: [P028] Die Before 75**

What is the percent chance that you will die before age 75? Please move the slider below to indicate what you think will be the chance that you will die before age 75, where 0 means "absolutely no chance" and 100 means "absolutely certain".

**[ASK IF CALCULATED AGE < 90]**
**Q.7.4.2: [ P029] Die Before [85, 90, 95, 100]**

What is the percent chance that you will die before age [85/90/95/100]? Please move the slider below to indicate what you think will be the chance that you will die before age [85/90/95/100], where 0 means "absolutely no chance" and 100 means "absolutely certain".

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## SECTION 8. CLOSING OF WAVE 2

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**[NOTE: THIS IS ASKED OF ALL RESPONDENTS AT THE END OF WAVE 2.]**

**Q 8.1: [CS_001] HOW PLEASANT INTERVIEW**
Could you tell us how interesting or uninteresting you found the questions in this interview?

(1) Very interesting
(2) Interesting
(3) Neither interesting nor uninteresting
(4) Uninteresting
(5) Very uninteresting

**Q 8.2: [CS_003]** Comments
Do you have any other comments on the interview? Please type these in the box below.
**[Insert Open box]**

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**Online Appendix C: Can a Kinked Utility Function Rationalize the Results?**

In this online appendix, we examine whether our results can be rationalized using a kinked utility function, i.e., by a utility specification that is typically used to explain endowment or status quo effects. As explained in more detail below, while we find that a kinked utility function (with marginal utility falling discontinuously for units of the good above the reference point) could explain the observed choices in the CV version, such a kinked utility function cannot explain the observed choices for the EV version. In short, a kinked utility function cannot simultaneously explain our findings for the CV and the EV choices.

To see this, recall the four types of choices we offered respondents, as described by the table in the text:

**Four Variants of the Annuity Valuation Tradeoff Question**

| | "Sell" Version | | "Buy" Version | |
|---|---|---|---|---|
| | Choice A | Choice B | Choice A | Choice B |
| Compensating Variation (CV) | [*SSB-X*] + *LS* | [*SSB*] | [*SSB+X*] − *LS* | [*SSB*] |
| Equivalent Variation (EV) | [*SSB*] + *LS* | [*SSB+X*] | [*SSB*] − *LS* | [*SSB-X*] |

Note: *SSB* stands for current/expected monthly Social Security benefits, *X* is the amount by which monthly Social Security benefits would change and *LS* is a one-time, lump-sum payment. Positive amounts are received by the individual while negative amounts indicate a payment by the individuals. Amounts between square brackets are paid monthly for as long as the individual lives, whereas *LS* is a one-time payment. The individual is asked to elect Choice A or Choice B.

Given that *SSB* is the current or expected amount of Social Security Benefits, it would be the natural reference point, and we denote it by *Ref* in the table below. We used *X*=$100 and found *LS* ≈ $13,000 in the sell version and *LS* ≈ $3,000 in the buy versions. Hence, our findings can be summarized by:

**Findings for the Annuity Valuation Tradeoff Question**

| | "Sell" Version | | "Buy" Version | |
|---|---|---|---|---|
| | Choice A | Choice B | Choice A | Choice B |
| Compensating Variation (CV) | [*Ref-100*] + *13,000* | [*Ref*] | [*Ref+100*] − *3,000* | [*Ref*] |
| Equivalent Variation (EV) | [*Ref*] + *13,000* | [*Ref+100*] | [*Ref*] − *3,000* | [*Ref-100*] |

Note: *Ref* stands for the reference point current/expected monthly Social Security benefits. Positive amounts are received by the individual while negative amounts indicate a payment by the individuals. Amounts between square brackets are paid monthly for as long as the individual lives, whereas amounts outside square brackets are a one-time payment. The individual is asked to elect Choice A or Choice B.

Suppose that the individual's utility from Social Security benefits ($Y$) takes the standard kinked form used to explain endowment effects:

$$U(Y) = \alpha\, Y - \beta\, (Y\text{-}Ref)\, \mathbf{1}(Y>Ref),$$

where $\alpha$ denotes the marginal utility of Social Security benefits below the reference level and $\beta$ denotes the decrease in marginal utility of Social Security that occurs at the reference point. In other words, $\beta=0$ implies there is no kink, and $0<\beta<\alpha$ denotes the case where marginal utility falls discontinuously at the kink but remains positive. Finally, $\mathbf{1}(.)$ denotes the indicator function, i.e., $\mathbf{1}(.)$ equals one if the expression between parentheses is true and zero otherwise.

If we make the standard assumption that U(.) is money metric, then the choices for the CV version can be rationalized by solving:

CV-Sell: $U(Ref\text{-}100) + 13{,}000 = U(Ref) \rightarrow \alpha\,(Ref\text{-}100) + 13000 = \alpha\, Ref \rightarrow \alpha = 130$
CV-Buy: $U(Ref+100) - 3{,}000 = U(Ref) \rightarrow \alpha\,(Ref+100) - 100\,\beta - 3000 = \alpha\, Ref \rightarrow \beta = 100$

In short, the CV choices can indeed be rationalized by a standard kinked utility function, where the marginal utility of Social Security benefits is 130 below the kink point, but falls to 130-100=30 after the kink point.

However, this same utility function cannot rationalize the EV choices:

EV-Sell: $U(Ref) + 13000 = U(Ref+100) \rightarrow \alpha\, Ref + 13000 = \alpha\,(Ref+100) - 100\beta \rightarrow 13000 = 100(\alpha-\beta)$
EV-Buy: $U(Ref) - 3000 = U(Ref\text{-}100) \rightarrow \alpha\, Ref - 3000 = \alpha\,(Ref\text{-}100) \rightarrow 3000 = 100\alpha$

Clearly, using the values $\alpha = 130$ and $\beta = 100$ that we obtained in the CV case above cannot rationalize the EV choices. In short, the observed choices for CV and EV are not simultaneously consistent with a single kinked utility function. Moreover, the EV choices can be rationalized only by $\alpha = 30$ and $\beta = -100$. The negative value of $\beta$ implies that the marginal utility *increases* as we pass the reference point; below the reference point, the marginal utility is 30 whereas it is 30-(-100)=130 above the reference point. In short, the EV choices cannot be rationalized by a standard kinked utility function where marginal utility falls discontinuously as the reference point is passed.