# ARC Centre of Excellence in Population Ageing Research

# Working Paper 2019/2

**Flexible long-term care insurance: An experimental study of demand**

Shang Wu, Hazel Bateman, Ralph Stevens and Susan Thorp

This paper can be downloaded without charge from the ARC Centre of Excellence in Population Ageing Research Working Paper Series available at www.cepar.edu.au

# Flexible long-term care insurance: An experimental study of demand

Shang Wu*, Hazel Bateman†, Ralph Stevens‡, and Susan Thorp§

March, 2019

**ABSTRACT**

We examine stated preferences for long-term care insurance that pays extra income instead of reimbursing care costs. Our results show that long-term care income insurance is likely to provide two important benefits to aging societies. First, it can facilitate flexible, informal, long-term care – seniors who plan to rely on family members for extensive care find income insurance particularly attractive. Second, it can enhance risk-pooling – if long-term care income insurance were available, many seniors would release funds set aside to self-insure against the risk of needing long-term care to purchase additional longevity insurance. Our results also rule out adverse selection into the long-term care income insurance product on objective risk factors. However, participants who subjectively rate themselves at higher risk of needing long-term care will select into insurance, indicating either adverse selection that is based on private information or subjective mismeasurement of future care costs.

**Keywords:** Long-term care insurance; aged care; informal care; retirement incomes; annuity experiment.

**JEL Classifications:** G22, I13, D14, J32

---

*CEPAR, UNSW Sydney and First State Super; E: Shang_Wu@firststatesuper.com.au

†Corresponding author. CEPAR and School of Risk and Actuarial Studies, UNSW Sydney. T: +61293853096; F: +61293851883; E: h.bateman@unsw.edu.au

‡CEPAR, Netspar and CPB Netherlands Bureau of Economic Policy Analysis; E: R.S.P.Stevens@cpd.nl

§Discipline of Finance, The University of Sydney and CEPAR; E: susan.thorp@sydney.edu.au

# 1 Introduction

Between 50 and 65% of people aged 65 years old or older will need long-term care at some time before they die (Ameriks et al., 2018; Hewitson et al., 2011; Productivity Commission, 2011; Colombo et al., 2011). Many elderly people whose health is in decline will receive this long-term care from unpaid, close, family members. Informal, home-based care is increasingly favored by elderly people and governments, even in countries where formal long-term care is more common, such as in the US, Europe, and Australia. As the usage rates of residential care decline, the elderly and their families are calling for more flexible support (Muir, 2017).

The care that family members provide is usually unpaid, but it is certainly not costless.[1] Caregivers bear substantial implicit and explicit costs such as the opportunity cost of time spent, loss of earnings from paid employment (Colombo et al., 2011; Schmitz and Westphal, 2017), and detriments to physical and mental health (Do et al., 2015). These losses are not reimbursed by the typical, private insurance policies for long-term care now on offer and are only partially offset in public systems that pay caregivers. Accordingly, the monetary costs of informal care remain uninsured, and the elderly finance them out-of-pocket.

Despite the prevalence and increasing importance of informal care, most studies in this area have investigated long-term care insurance that reimburses expenses. There is little research into the demand for, and thus the viability of, insurance products that cover the costs of both informal and formal care.

In this paper, we study the demand for a new product for long-term care insurance. The product that we test pays a regular income whenever the insured person needs care, irrespective of the actual "formal" care costs incurred. In principle, seniors can use this flexible insurance to pay for formal care, or to compensate informal caregivers. This kind of malleable insurance payout could potentially free up precautionary savings for other purposes (Ko, 2016; Mommaerts, 2016) like the purchase of longevity insurance (Turra and Mitchell, 2008; Reichling and Smetters, 2015; Lockwood, 2018; Wu et al., 2016).

A major challenge for the research into the viability of new products for long-term care insurance is the lack of data on preferences. Given this constraint, we base our findings on a comprehensive collection of stated preferences. The data on stated preferences overcome the difficulties in analyzing revealed preference data, such as uncontrolled and complex institutional settings and market incompleteness, while maintaining implications for decisions in real life (Louviere et al., 2000). Our data on preferences

---

[1]The consensus of international studies puts the annual cost of home or institutional long-term care as at least as high as the average disposable income for the over 65 year-old population (Muir, 2017; Boyer et al., 2017; Ameriks et al., 2018).

come from an experimental survey with approximately 1,000 participants, all close to retirement. Our goals are 1) to investigate selection effects in the demand for the long-term care income insurance, 2) to examine the connection between preferences for informal care and the potential demand for a long-term care income product, and 3) to examine whether, and to what extent, access to a long-term care income product could release precautionary savings for the purchase of longevity insurance.

The task that the participants in our experimental survey complete resembles the portfolio allocation decisions commonly encountered by newly retired people. In the survey, we offer the participants monetary incentives to learn about three retirement products. The first is the new long-term care (LTC) income insurance product, and the other two are the existing products of a life annuity and a liquid investment account. Participants then share their hypothetical retirement savings between these products through a series of carefully constructed choices. The LTC income insurance product requires a single premium paid at purchase in exchange for income benefits if the purchaser is functionally unable to perform the basic activities of daily living (ADL) or is diagnosed with dementia. While the LTC income insurance does not fully reimburse all care expenditures, it does pay disability-contingent income whether professional care services are purchased or not. The survey also collects an array of information about each participant, such as demographics, health, and characteristics and subjective expectations about the need for care and its potential sources.

Our data comes from Australia, which is an ideal setting for a number of reasons. First, the publicly financed LTC system in Australia shares many features with other developed countries, especially the UK, such as the absence of a private market for LTC insurance, so our results have a general application. Second, since Australians are very unlikely to have experienced a private market for LTC insurance, they are more likely to accept the hypothetical scenarios in the survey and less likely to import experiences with different LTC insurance products into their deliberations. Third, Australians are more familiar with decisions that involve the allocation of retirement savings than people in many other countries, because almost all Australian workers participate in the mandatory defined contribution (DC) retirement saving system. Even average workers in Australia accumulate substantial balances in their retirement accounts that they are free to manage themselves (Clare, 2017). For these reasons, decisions about managing retirement wealth are consequential, relevant, and imminent for our participants.

We present three main findings about the demand for LTC income insurance. First, we find that adverse selection does not seriously impede the market for this type of insurance. We find no evidence of significant selection effects based on *objective* measures of exposure to the LTC risk. This feature of

LTC income insurance stands in marked contrast to care insurance policies that are based on expense reimbursement and that require underwriting to prevent adverse selection (Sloan and Norton, 1997; Brown and Finkelstein, 2007; Webb, 2009). At the same time, while we find some evidence of adverse selection based on *subjective* measures that are unobservable to the insurer, such as self-reported chances of needing residential care, we also uncover advantageous selection effects (de Meza and Webb, 2001; Finkelstein and McGarry, 2006). Participants who are more aware of their LTC risk and accordingly adjust their behavior, more strongly demand the LTC income insurance. All things considered, we conclude that LTC income insurance is more likely to be commercially viable than expense-reimbursement insurance, because it does not require much underwriting, has little adverse selection, and consequently can come at a lower price.

Second, while previous studies find that informal care is a *substitute* for expense-reimbursement insurance (Pauly, 1990; Zweifel and Strüwe, 1998), we find that it is a *complement* to the LTC income insurance.[2] Our results show that people who expect to receive extensive care from close family members have a stronger demand for LTC income insurance than those who do not. This complementarity exists either because informal care users want insurance that allows flexibility and control, or because income insurance allows gifts to caregivers that exceed the costs of professional care. This conjecture is verified by our finding that LTC income insurance does not complement *low-level* informal care but is complementary to *high-level* informal care for women. Women are more likely to call on help from people who are not their partners and who are therefore more likely to expect compensation, while men are more likely to rely on uncompensated care from their partners. The complementarity between extensive informal care and LTC income insurance that we uncover here is likely to be critical to raising LTC insurance coverage among seniors.

Third, we solve part of the long standing puzzle of weak demand for life annuities. We show that if people can access LTC income insurance, they are more likely to release precautionary savings and purchase longevity insurance (life annuities). Previous studies offer mixed evidence on the effects from LTC risk and health costs on the demand for longevity insurance. On one hand, people could *raise* annuitization to insure against LTC risk, especially if they expect that this risk will be high late in retirement (Davidoff et al., 2005; Pang and Warshawsky, 2010; Peijnenburg et al., 2017) with the intention of using the increasing-with-age mortality credits to save out of their life annuity and buffer care costs.

---

[2] Empirical studies show that in many countries most people who need care rely on unpaid care from close family members (e.g., Kaye et al., 2010; Productivity Commission, 2011; Norton, 2016), and informal care substitutes for paid formal care both home care (Pezzin et al., 1996) and nursing home care (Charles and Sevak, 2005).

For these people, LTC insurance is a substitute for life annuities (Davidoff, 2009). On the other hand, people might *decrease* annuitization and instead hold more liquid wealth to self-insure against LTC risk (Turra and Mitchell, 2008; Reichling and Smetters, 2015; Wu et al., 2016). For these people, LTC insurance complements life annuities (Ameriks et al., 2011; Ameriks et al., 2015). We examine the relationship between LTC and longevity insurances by collecting participants' stated preferences for life annuities when LTC income insurance is not available. The results show that around half of participants change their annuitization decisions when they can purchase LTC income insurance. Of these, some treat longevity insurance as a substitute (hedge) for LTC costs in the absence of LTC insurance. However, a larger proportion treat the LTC income insurance as a complement to longevity insurance, particularly those with lower LTC risk. This complementarity means that a "bundle" of longevity insurance and LTC income insurance might encourage the purchase of longevity insurance by unhealthy individuals (Brown and Warshawsky, 2013).

Our results can inform product innovation in LTC public policy. Policy responses to LTC needs range from tax financing (Nordic countries), social insurance (Germany, Japan, and the Netherlands), means-tested support (Australia, the UK, and the US), and cash payments (Austria, the Czech Republic, and Italy) (Colombo et al., 2011; CEPAR, 2014; Norton, 2016). However, irrespective of the financing format, public LTC costs are high and rapidly increasing, and in OECD countries are expected to at least double over the next 40 years (de la Maisonneuve and Martins, 2015). Only a few countries have private markets for LTC insurance that can complement or supplement public support (Ameriks et al., 2015; Poterba et al., 2017; Asher et al., 2017).

We also add to the body of research on the underdeveloped private markets for LTC insurance. While standard economic models propose LTC insurance as a remedy that can free older people to spend more of their precautionary savings (Ameriks et al., 2011), such insurance is not sold at all in many countries, and even where it is available, few people buy it. In the US, the coverage rate of private LTC insurance is around 7% (LIMRA, 2017), while in Europe a recent study that used SHARE data identifies large variations between countries but with low overall coverage, with the exception of France and Israel (Bucher-Koenen et al., 2017). There is no private market at all for LTC insurance in the UK or Australia. Explanations for the low demand in LTC insurance include adverse selection (Sloan and Norton, 1997; Finkelstein and McGarry, 2006; Brown and Finkelstein, 2009; Webb, 2009), poor product design (Brown and Finkelstein, 2007), availability of public care (Sloan and Norton, 1997; Brown and Finkelstein, 2008), means-testing of public benefits (De Nardi et al., 2016; Braun et al., 2016), reliance

on unpaid caregivers (Pauly, 1990; Zweifel and Strüwe, 1998; Brown et al., 2012), self-insurance using home equity (Davidoff, 2010), (non-strategic) bequest motives (Pauly, 1990; Lockwood, 2014), limited awareness of risk (Zhou-Richter et al., 2010), and state-dependent utility (Brown and Finkelstein, 2009). Our results are consistent with several of these explanations and show that LTC income insurance can potentially encourage stronger demand. In fact, an increasingly popular product in the US is an annuity product that has a LTC rider (LIMRA, 2017).

The remainder of the paper is structured as follows: in the next section, we describe the experimental survey. In Section 3, we report the descriptive statistics for the experimental choices and participants' characteristics. Section 4 presents econometric results that focus on selection effects and the connection between preferences for and access to informal care and the demand for LTC income insurance. We then investigate the relationship between longevity insurance and LTC income insurance, and its effect on precautionary savings. Section 5 concludes.

## 2 Method

In this section we describe the sample selection and the choice task. Then, we describe the structure of the financial products that participants considered in the tasks and the collection of participants' characteristics.

### 2.1 Sample and incentives

We sampled 1,008 people aged 55-64 years old in October 2015 from a panel of over 180,000 Australians maintained by the web panel Lightspeed GMI.[3] We excluded people who said they had dementia, or they needed help with two or more activities of daily living (ADLs), because these conditions made them immediately eligible for LTC-contingent income, and therefore disqualified from purchasing the insurance policy. We put eligible participants into eight (2×4) treatment groups based on gender (2 groups) and their net wealth that excluded the family home (4 groups). This grouping made a roughly even distribution of participants across wealth groups, while ensuring that participants made decisions that matched their financial circumstances (Table 1). Overall, the sample aligned with the Australian population aged 55-64 except that our participants were better educated and had higher personal income on average, which was probably because of the minimum net wealth requirements for participation.[4]

---

[3]Appendix A provides a brief explanation of the financing of LTC in Australia.

[4]Table 10 in Appendix B compares the demographics of the sample with the Australian population of the same age.

Table 1: Categorization of wealth groups

The table presents four wealth groups based on participants' self-reported net wealth and corresponding assigned hypothetical retirement savings. Net wealth equals total assets less total liabilities but excludes the family home and its mortgage.

| Net wealth | Wealth group | Hypothetical retirement savings |
|---|---|---|
| Less than A$100,000 | 1 | A$50,000 |
| A$100,000 to less than A$250,000 | 2 | A$175,000 |
| A$250,000 to less than A$500,000 | 3 | A$375,000 |
| A$500,000 or higher | 4 | A$1,000,000 |

The web panel provider recruited participants by email invitation. We paid participants A$4 if they completed the survey but also gave them a chance to earn a bonus of up to A$3. The bonus motivated participants to pay attention to information about the three products in the choice task - it depended on participants' answers to a quiz that tested how much product information they could recall (DellaVigna and Pope, 2018).[5]

The online survey started with questions that filtered out ineligible participants and was followed by the experimental task. Then, three more sections followed that collected an array of information about the participants. The median time participants took to complete the survey was 30 minutes. Within the survey, we checked the participants' inattention using two instructional manipulation checks (IMC)[6] (Oppenheimer et al., 2009); and at completion we asked participants to assess the clarity of the survey over six levels that ranged from "completely clear" to "completely confusing". Over half of the participants reported that the survey was "completely clear" or "mostly clear", while only 5% found the survey "mostly confusing" or "completely confusing".[7]

## 2.2  Financial products

Participants compare three financial products in a three-stage task that shows their most preferred mix of products. The first product is LTC insurance that provides a fixed regular income for the period of time

---

[5]Ideally, we would offer an incentive payment to participants that was compatible with the hypothetical allocations of their retirement savings made in the experimental tasks. However, an incentive payment that is compatible with the trade-off between LTC insurance coverage and liquidity is a complicated multi-period payment that continues over the whole of retirement and is thus infeasible in this experiment.

[6]We repeated questions about dementia and ADL limitations two times in the survey. A participant failed an IMC if either the answers provided in an IMC were not consistent with his or her previous answers, or the participant failed to recognize that these questions had appeared before. Under this criteria, 9% of participants failed the IMCs.

[7]The dynamic version of the survey is available at: http://survey.confirmit.com/wix3/p3074038853.aspx. A full set of screenshots from the survey that include the wording of all questions and instructions is available in Online Appendix A at https://cepar.edu.au/sites/default/files/OnlineAppendix_March%202019.pdf.

the insured needs care. When the insured person has either dementia and/or needs help with at least two ADLs out of (i) eating, (ii) bathing, (iii) dressing, (iv) toileting, and (v) getting into or out of bed, the insurer pays the agreed income.[8] The insurer stops the income payments if the insured dies or recovers from these conditions. The product does not guarantee to cover the total formal care expenditure, since the costs of care can exceed the income benefits. The regular income can be used at the discretion of the insured to pay for professional care, for care provided by family members, or to cover other expenses. The second product is an immediate life annuity that provides a fixed lifetime income that is indexed to inflation. The third product is a liquid investment account where the holder can make withdrawals at any time.

We anticipated that participants might find it hard to understand these products, so we conducted two focus groups in November 2014 and March 2015 to inform the design of the experimental tasks and the words used to describe the products. We found that Australians understood the labels "Aged care income", "Lifetime annual income", and "Account-based pension" best.[9]

We priced the life annuity and the LTC income insurance at actuarially fair value that was based on gender and a risk-free, real interest rate of 3%. We took both the mortality probabilities and health transition probabilities for pricing the life annuity and the LTC income product from estimates by Brown and Warshawsky (2013), who used data from the Health and Retirement Study (HRS) 1998 (Wave 4) to 2008 (Wave 9). Brown and Warshawsky (2013) estimated the transition probabilities of a continuous-time Markov Chain of 11 health states, including death.[10] We used the first four states to describe the current health of survey participants (see Table 2). The remaining seven states (those with more than one limitation or death), together with the first four, described how participants' health evolved over time. The health transition probabilities are gender- and age-dependent. We used these estimated health transition probabilities to price the life annuity and the LTC income insurance.[11] Because the hypothetical scenario in the experiment asked people to make the decisions as if they were 65, everyone

---

[8]In reality, these limitations on ADLs are usually determined by a physician to reduce moral hazard.

[9]Long-term care is called "aged care" in Australia. As not all annuities provide longevity insurance in Australia (and purchases of term annuities are far more common than life annuities), the life annuity is labeled "Lifetime annual income". The "Account-based pension" is the most popular decumulation product for DC pension plans (i.e., superannuation funds) in Australia. It is a liquid investment account that allows an individual to choose their asset allocation and make regular withdrawals that are subject to tax concessions for those that meet the prescribed minimum drawdown limits. These limits are ignored in the experimental design.

[10]This actuarial health transition model is similar to the one developed by Robinson (1996), which is widely used in the literature (Brown and Finkelstein, 2007, 2008) as well as by insurance companies, regulators, and government agencies.

[11]We note that the health transitions are estimated from US data while the survey is given to a sample of Australians. This is because there is no available Australian data to estimate a similar multi-state health transition model in retirement. For comparison, Brown and Finkelstein (2008) estimate that the probability of using LTC for a 65 year-old American male (female) is 40 (54)%, while the probability of requiring care for a 65 year-old Australian male (female) is 48 (68)% according to the Productivity Commission (2011).

of the same gender faced the same price for the LTC income insurance.[12]

Table 2: Classification of health states

The table illustrates the classification of health states (1 - 4). Heart problems refer to heart attack, coronary heart disease, angina, congestive heart failure, or other heart problems. Lung disease refers to chronic lung diseases like chronic bronchitis and emphysema.

| Health state | History of major illness | Self-reported health | Disability status |
|---|---|---|---|
| 1 | None | Good to Excellent | 0 ADL |
| 2 | None | Poor to Fair | 0 ADL |
|  | None | All | 1 ADL |
| 3 | Heart problems or diabetes, but not both | All | 0-1 ADL |
| 4 | Heart problems and diabetes, or lung disease, or stroke | All | 0-1 ADL |

## 2.3 Experimental task

We designed the task, first, to assess whether high- or low-risk purchasers demand the LTC income insurance; second, to examine the connection between preferences for informal care and LTC income insurance; and third, to better understand the connection between the LTC income insurance, longevity risk insurance, and liquid precautionary savings.

The experimental task started with introductory information about how people could meet retirement expenses, such as the estimated average chance and costs of LTC in Australia (Productivity Commission, 2011).[13] We then asked participants to compare their chances of needing in-home care and residential care against an average person of their gender. After that, we described the three products in the experimental task, illustrated the prices, and explained the opportunity for bonus earnings for correct answers in a recall quiz.[14] Next, we described the setting for their decision: a simple situation where everyone was paid a flat-rate public pension, was not subject to taxation, and could be confident that the insurers would not default.[15]

---

[12]The LTC income insurance is not priced according to a purchaser's current health, because the differences in actuarially fair prices across health states are small (Brown and Warshawsky, 2013).

[13]We used the term "aged care" in the survey rather than "long-term care (LTC)" because it is better understood by Australians. To control for the effects of public support on aged care that are subject to complex means testing rules, we also abstracted from the means testing rules and only presented the unsubsidized costs of care to participants.

[14]We summarized the important features of the products in a table that also pops up during the task if participants put their cursor on the product names.

[15]The public pension in Australia is the Age Pension that is means-tested and covers more than 70% of Australians over the eligibility age of 65 (Department of Social Services, Australian Government, 2018). We labeled the public pension in the experiment as "Age Pension" but also told participants explicitly both in the instructions and in the experiment questions that the amount of income from the public pension was constant and would not change with the choices they made.

The experimental task presented the hypothetical scenario to participants and asked them to answer nine questions in a sequential choice architecture to reduce the cognitive load of a potentially complex choice set (Besedeš et al., 2015). Before answering the questions, participants read the following: "We are now going to present you with a series of hypothetical scenarios and ask you to make decisions about the allocation of your retirement savings to the various retirement income product options we have shown you. Ignoring your own financial circumstances for the moment, we want you to imagine you are 65 years old, about to retire, and own your own home."



Figure 1: Allocation question for a male in wealth group 3

Questions one to four (Q1 - Q4) measured the participants' stated demand for disability-contingent income from their LTC insurance at fixed and increasing levels of lifetime annual (public pension and annuity) income. Q1 asked participants how much income from LTC insurance they would like to buy with their (hypothetical) retirement savings, given that they also receive an inflation-linked lifetime income of A\$22,000 per annum from the public pension (basic retirement income). The retirement savings that were not spent on LTC insurance remained in a liquid investment account (account-based pension). The participants made their choices by moving a slider, and as they did so, they could see changes in their LTC-contingent (aged care) income and related changes in their liquid wealth (i.e., the account-based pension balance). As the LTC-contingent income was priced at the actuarially fair value that was based on the health transition model, these trade-offs were always constrained to the amount of retirement

savings endowed to the participants. Figure 1 shows the first question of the experimental task with a screen shot for a male in wealth group 3.

In Q1, we allocated 0% of retirement savings to the life annuity; Q2-Q4 repeated the same decision but we increased the lifetime income by adding an immediate life annuity to the public pension that cost 25%, 50%, and 75%, respectively, of participants' retirement savings. As a result, the amount of money that participants could allocate to the LTC income insurance or the liquid investment account was restricted to 75%, 50%, and 25% of their retirement savings in Q2-Q4 respectively.

The next two choice questions (Q5-Q6) asked participants to rank three alternative saving allocations. The three alternatives in Q5 were the allocations that the participants' selected in questions Q2-Q4 (under partial annuitization). Q6 then took the highest ranked alternative from Q5 together with the participants' choice from Q1 (zero annuitization) and a third alternative that assumed full annuitization (i.e., no LTC income or savings in the investment account) and asked participants to rank these. Q5 and Q6 together thus elicited the participants' preferred allocations for the three products.

Question 7 (Q7) measured how access to LTC insurance affected the demand for life annuities. In this question, we told participants that the LTC income insurance was no longer available. We asked them to rank three options: first, their preferred allocation (from Q6), but where the money they spent on LTC income insurance was refunded to their investment account with the level of lifetime income remaining the same; second, option 1 with 25 percentage points higher annuitization; and third, option 1 with 25 percentage points lower annuitization.

Questions 8 and 9 collected the complementary information: how participants would finance any purchases of LTC insurance they might make in the future (Q8); and whether they preferred LTC insurance benefits paid as income (labeled as fixed payments) or expense-reimbursement (labeled as reimbursement) (Q9). The experimental task concluded with a recall quiz on the key features of the three products. The recall quiz consisted of six questions that comprised two questions for each product. The participants received 50 cents in bonus earnings for each of the six questions they answered correctly.

## 2.4 Participants' characteristics

Following the experimental task, the participants completed three sets of questions relating to: 1) risk attitudes, patience, and preferences for spending on different health conditions; 2) objective measures of exposure to LTC risk and subjective measures such as longevity, smoking status, bequests, experience of providing care, purchase of private health insurance, availability of informal care, and planning for

financing care; and 3) personal characteristics such as education, employment status, household income, financial literacy (Lusardi and Mitchell, 2009), numeracy (Lipkus et al., 2001), and retirement planning as well as knowledge of and past experience with various retirement income and insurance products. Other demographic questions - age, country of birth, years of living in Australia, marital status, health status, and wealth - were asked at the beginning of the survey.

# 3  Descriptive statistics

This section reports the preliminary results from the key experimental task and survey responses. We begin with a sketch of the participants' preferences for LTC income followed by their preferred mix of LTC income insurance, life annuity, and investment account and then tabulate the information on their demographics, preferences, and expectations.

## 3.1  Summary statistics: Choices of LTC income insurance

Figure 2 graphs the cumulative distributions of the percentage of liquid retirement savings allocated to the LTC income product in Q1-Q4. Around 85% of participants indicated they would purchase the LTC income product over all levels of annuitization. As the level of annuitization increases from 0% to 75%, the percentage of remaining savings allocated to LTC income insurance generally increases, which indicates the participants wanted a nominal amount of LTC-contingent income.

Table 3 presents the distribution of LTC contingent income that participants chose. The median LTC-contingent income levels are similar to the actual costs of LTC in Australia; the median income decreases from A\$50,700 (A\$35,300) at a 0% level of annuitization to A\$18,800 (A\$11,800) at a 75% level of annuitization for males (females). Although females are more likely to need LTC (Brown and Finkelstein, 2007), the higher median amount of LTC-contingent income for males (while having a similar percentage of retirement savings allocated to LTC income insurance as shown in Figure 2) is probably a response to fair pricing, which makes the LTC income product 33% less expensive for males than females.[16]

Although the majority of participants trade off liquidity and LTC insurance coverage as annuitization increases, we also observe two other types of decisions. Around 17% of participants chose a fixed nominal

---

[16]The extremely large values at high percentiles are typically observed in stated preferences (Ameriks et al., 2011). These either reflect true preferences for those who believed they would transit into LTC states soon, or they are reporting errors due to a misunderstanding of the experimental tasks or product features.
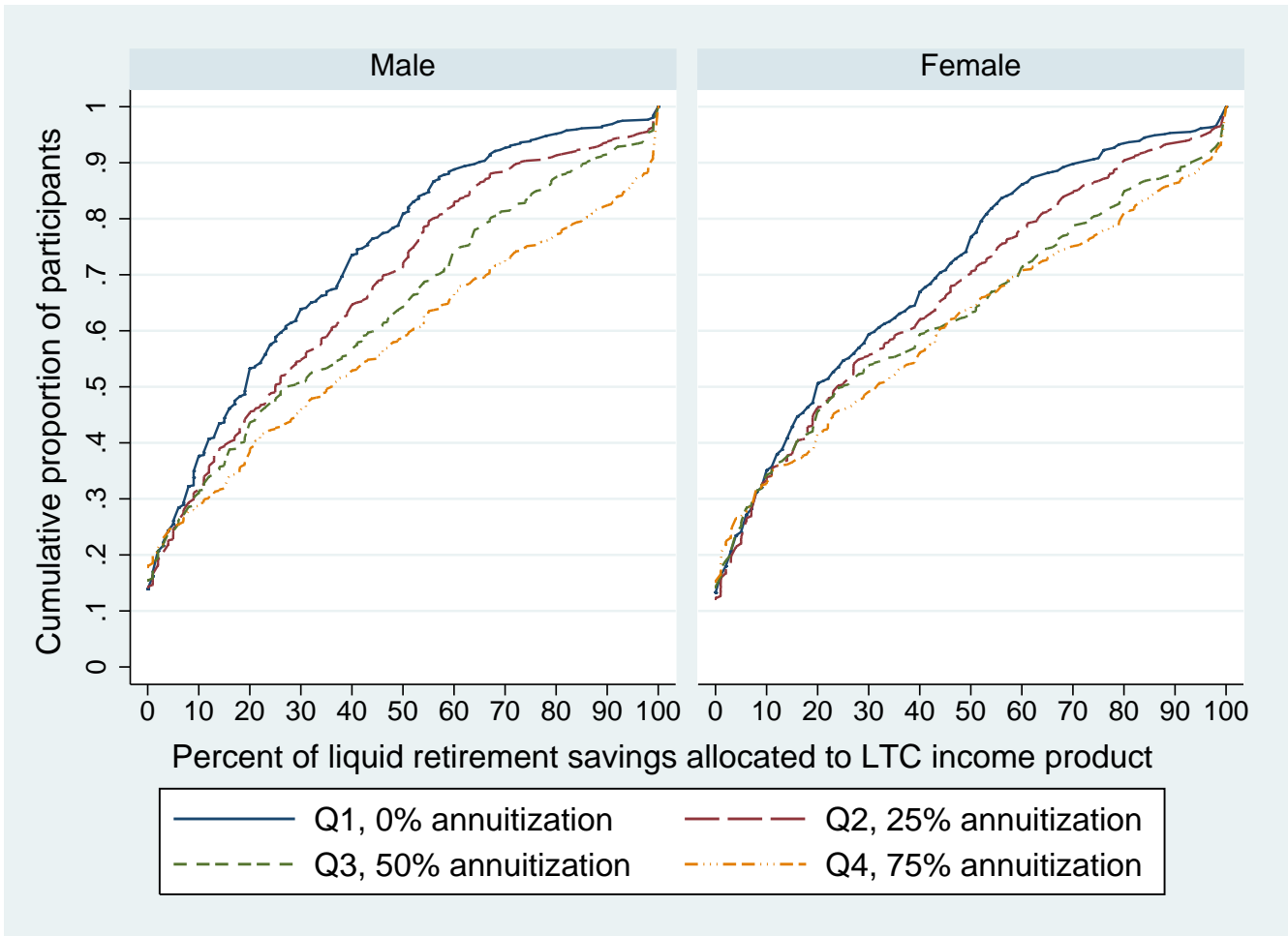
Figure 2: Cumulative distribution of percentage of liquid retirement savings allocated to the LTC income insurance at predetermined levels of annuitization. Data used in the calculations is from Q1-Q4 in the survey.

Table 3: Percentiles of annual long-term-care-contingent income chosen (in A$000)

The table presents selected percentiles, mean, and standard deviations of annual LTC-contingent income chosen at predetermined levels of annuitization for both genders. Data is from Q1-Q4 in the task.

| | Males | | | | Females | | | |
| | Annuitization | | | | Annuitization | | | |
| Percentiles | 0% | 25% | 50% | 75% | 0% | 25% | 50% | 75% |
|---|---|---|---|---|---|---|---|---|
| 1% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 15% | 0.8 | 1.2 | 0.0 | 0.0 | 1.3 | 1.2 | 0.3 | 0.0 |
| 25% | 18.0 | 17.7 | 7.9 | 4.5 | 10.5 | 9.0 | 5.0 | 2.0 |
| 50% | 50.7 | 50.4 | 34.7 | 18.8 | 35.3 | 30.2 | 22.5 | 11.8 |
| 75% | 150.0 | 135.0 | 105.0 | 65.6 | 100.0 | 89.3 | 70.0 | 41.2 |
| 90% | 435.0 | 382.5 | 292.5 | 142.5 | 243.8 | 215.2 | 150.0 | 84.2 |
| 95% | 750.0 | 585.0 | 465.0 | 266.3 | 500.0 | 330.0 | 305.0 | 142.5 |
| 99% | 1230.0 | 1001.3 | 735.0 | 375.0 | 950.0 | 660.0 | 495.0 | 250.0 |
| Mean | 150.0 | 125.6 | 97.3 | 55.0 | 96.1 | 78.6 | 59.2 | 31.0 |
| Standard deviation | 254.9 | 196.3 | 153.1 | 83.2 | 164.8 | 125.6 | 96.5 | 49.6 |
| $N$ | 518 | 518 | 518 | 518 | 490 | 490 | 490 | 490 |

LTC-contingent income, even at the expense of exhausting their liquid savings, and around 14% of participants purchased little LTC-contingent income regardless of the level of annuitization.

### 3.1.1 Summary Statistics: Allocations of retirement savings

Conventional life-cycle models predict that when markets are complete, retirees should insure both longevity risk and LTC risk, and preserve savings for intentional bequests (e.g., Ameriks et al., 2011). However, the participants in this experiment have several reasons to preserve liquid wealth. First, they may need to cover very high care costs that exceed LTC income. Second, they may have to cover large uninsurable expenses, such as a car purchase. It may, in fact, be optimal for some participants to purchase no LTC or longevity insurance.

Figure 3 illustrates the cumulative distribution of allocations of retirement savings to LTC income insurance, the life annuity, and the investment account, respectively. Around 75% of participants chose to "spend" at least some of their savings on LTC income.[17] The median annual LTC-contingent income chosen is around A$45,000. These results put the stated demand for LTC income well above the actual demand in real markets (Ameriks et al., 2018). We also find that over 40% of the participants do not purchase the life annuity at all and about 20% allocated less than 10% of their retirement savings to the

---

[17]Note that this number is lower than the 85% reported in Section 3.1 (Figure 2), as just over 10% of participants choose full annuitization in Q6.

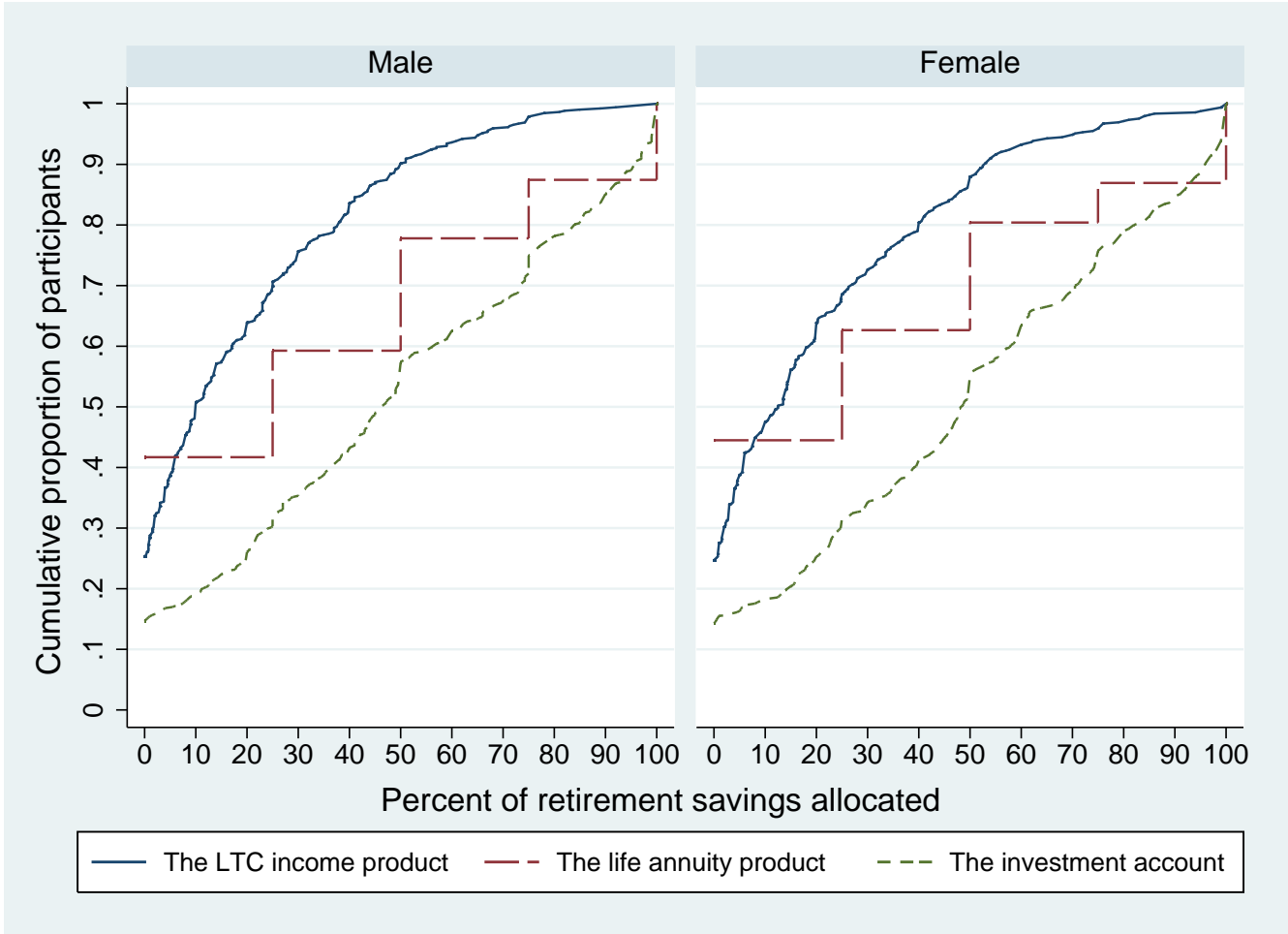Figure 3: Cumulative distribution for allocation of retirement savings. The figure shows the cumulative distribution of the percentage of retirement savings allocated to the LTC income product (continuous from 0% to 100%), the life annuity product (discrete from 0% to 100% at an interval of 25 percentage points), and the investment account (continuous from 0% to 100%). Data used in the calculations is from Q6 in the task.

investment account.

Table 4: Percentiles of the ratio of LTC-contingent income to survival-contingent income

This table displays selected percentiles and the mean and standard deviations of the ratio of LTC-contingent income to survival-contingent income for different wealth groups. The amount of survival-contingent income includes both the income from life annuities (chosen by the participant) and the public pension income (given as fixed). The ratio is calculated by using the data from Q6 of the task. Wealth groups are classified as in Table 1.

| | Males | | | | | Females | | | | |
| | Wealth group | | | | | Wealth group | | | | |
| Percentiles | 1 | 2 | 3 | 4 | All | 1 | 2 | 3 | 4 | All |
|---|---|---|---|---|---|---|---|---|---|---|
| 1% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 10% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 15% | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| 25% | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.2 | 0.0 | 0.0 |
| 50% | 0.7 | 1.4 | 1.6 | 2.0 | 1.3 | 0.5 | 0.9 | 1.7 | 1.1 | 0.9 |
| 75% | 1.4 | 2.8 | 4.1 | 6.8 | 3.0 | 1.1 | 2.1 | 3.5 | 5.0 | 2.1 |
| 90% | 2.0 | 4.9 | 13.0 | 25.1 | 8.0 | 1.6 | 3.3 | 7.8 | 9.1 | 5.3 |
| 95% | 2.3 | 7.1 | 14.4 | 35.5 | 14.1 | 1.9 | 4.4 | 11.1 | 23.6 | 8.4 |
| 99% | 3.0 | 11.9 | 22.8 | 62.7 | 44.9 | 2.3 | 7.5 | 15.8 | 37.9 | 24.0 |
| Mean | 0.8 | 2.1 | 3.5 | 6.8 | 3.4 | 0.7 | 1.3 | 2.8 | 4.0 | 2.1 |
| Standard deviation | 0.8 | 2.4 | 4.9 | 12.1 | 7.4 | 0.6 | 1.6 | 3.5 | 7.4 | 4.2 |
| $N$ | 136 | 133 | 96 | 153 | 518 | 141 | 121 | 115 | 113 | 490 |

We also calculate the ratio of LTC-contingent income to survival-contingent income for all participants and report selected percentiles in Table 4.[18] We find that over three quarters of the participants chose a ratio below three. The LTC- to survival-contingent income ratio generally increases with wealth because the fixed public pension is a large component of the allocations of participants with low wealth but a declining share of the allocations of wealthier participants.[19]

## 3.2  Summary Statistics: Participant characteristics

Table 5 displays the summary statistics for the participants' characteristics. We present these in terms of the exposure to and awareness of LTC risk and alternative sources of financing or providing LTC and

---

[18]$L_i = \frac{INC_i^{LTC}}{INC_i^S}$, where $INC_i^{LTC}$ represents the annual amount of LTC-contingent income chosen by subject $i$ in Q6, and $INC_i^S$ represents the annual amount of survival-contingent income chosen by subject $i$ in Q6. The amount of survival-contingent income includes both the income from life annuities (chosen by the participant) and the public pension income (given as fixed).

[19]We note that the average stated preference ratios (2.1 for males and 1.3 for females with wealth of A\$375,000 — wealth group 3) conform to predictions of the calibrated life-cycle model in a related paper (see Wu et al., 2016). Wu et al. (2016) use the same classification of health states to estimate that the optimal ratio of LTC-contingent income over survival-contingent income is about 2 (1) for males (females) in health state 1 and with a total retirement wealth of A\$500,000 (including the expected present value of annuity income as well as liquid wealth). The corresponding group in the survey is wealth group 2. Participants in this group have A\$375,000 retirement savings with a flat public pension of A\$22,000 per year, which roughly amounts to total retirement wealth of A\$500,000.

in terms of utility parameters and control variables such as financial capabilities, product and system knowledge, retirement planning, and demographics. In the following, we present some discussion of the key variables that relate to selection effects and informal care.[20]

### 3.2.1 Measures of long-term-care risk

Objective measures of exposure to LTC risk can help identify selection effects, like health status, smoking status, and past care. The product pricing model outlined in Section 2.2 assumes that prices are gender-specific.[21] We measure the health status of survey participants against four health states that we defined in Table 2. The majority of participants are in Health state 1, while 5.7% of participants reported being smokers, and 6.2% had received care in the past five years.

In addition, a person may have private information about his or her LTC risk that the objective risk measures may not identify. Our three subjective indicators of exposure to LTC risk are subjective life expectancy and the self-assessed need for homecare or residential care, respectively. For the latter two variables the choices were "lower than", "about the average", or "higher than" other people of their gender. From the participants' answers, we coded two ordinal variables *Chance of needing homecare* and *Chance of needing residential care*.

Participants, on average, were subjectively pessimistic about their survival prospects. The average deviation of subjective life expectancy relative to cohort life expectancy was negative (-3.186), which is in line with Wu et al. (2015). However, participants were more likely to be optimistic than pessimistic about their probability of needing in-home or residential care: around 40% rated their chances of needing care as below average, compared with fewer than 8% who rated their chances as above average. The small number of participants who reported a higher-than-average chance of needing residential care were consistent with unrealistic optimism about health problems that other studies found (Weinstein, 1982, 1987) and with the optimism about survival when the question was asked as a comparative judgment, that is, relative to the average person (Beshears et al., 2014).

Using these variables, we are able to evaluate selection effects based on subjective risk assessments. None of these three variables is observable by a product provider, and selection based on any of them cannot be addressed by underwriting. Moreover, we do not know the extent to which an *ex ante* selection based on these variables has an impact on *ex post* benefit payments. For example, participants with sub-

---

[20]Other variables are discussed in Online Appendix B.

[21]Note that the price of the LTC income product offered in the survey does not depend on age. Therefore, we need to include age to examine if there is a selection effect, since it affects the price in a general pricing model. Further, eligible participants could be people who need help with one ADL or who have recovered from needing help with one or more ADL.

jective indicators of high LTC risk could in fact be high risks, or they could have higher risk perceptions, which can lead to better health behaviors and thus low risks.

### 3.2.2 Awareness of long-term-care risk

Indicators of exposure to LTC could also capture awareness of LTC risk (Zhou-Richter et al., 2010). We construct a categorical variable *Financial planning for LTC* that indicates the preparedness for financing LTC. Responses are "Do not know needs and costs of LTC", "Have set aside money", and "Expect to rely on government". We also include a binary variable *Care provider* for participants who had themselves provided care in the past five years. Around 50% of participants had "set aside money", while just over 40% responded that they "do not know needs and costs" with the remaining 8% reported that they expected to rely on the government. Just over one quarter of participants had provided care in the past five years.

### 3.2.3 Availability of informal care and home-ownership

We are particularly interested in the relation between the demand for LTC income insurance and informal care. Thus, we collect data on the availability of informal care for both low-level and extensive care as well as whether participants are partnered and the number of children they have (if any). Around 70% of participants had access to low-level informal care, and 50% to high-level care. Around 30% of participants were not partnered, and the average number of children was close to two. Another potential substitute for LTC is home ownership: we find that 80% of survey participants were homeowners.

## Table 5: Participants' Characteristics: Summary statistics

The table displays the definitions and summary statistics for participants characteristic variables from survey responses.

| Variable: | Mean | Standard deviation | Variable type |
|---|---|---|---|
| *Objective measures of exposure to LTC risk* | | | |
| Female | 0.486 | 0.500 | Binary |
| Age | 59.539 | 2.838 | Continuous in years |
| Health state | | | Categorical |
|    1 | 0.597 | | Proportion in this group |
|    2 | 0.090 | | Proportion in this group |
|    3 | 0.196 | | Proportion in this group |
|    4 | 0.116 | | Proportion in this group |
| Current smoker | 0.157 | 0.364 | Binary |
| Received care | 0.062 | 0.240 | Binary |
| *Subjective indicators of exposure to LTC risk* | | | |
| Subjective life expectancy | -3.186 | 8.946 | Continuous in years |
| Chance of needing homecare | | | Categorical |
|    Lower than the average | 0.365 | | Proportion in this group |
|    Equal to the average | 0.559 | | Proportion in this group |
|    Higher than the average | 0.076 | | Proportion in this group |
| Chance of needing residential care | | | Categorical |
|    Lower than the average | 0.410 | | Proportion in this group |
|    Equal to the average | 0.530 | | Proportion in this group |
|    Higher than the average | 0.061 | | Proportion in this group |
| *Awareness of LTC risk* | | | |
| Financial planning for LTC | | | Categorical |
|    Have set aside money but may need help | 0.508 | | Proportion in this group |
|    Expect to rely on government | 0.083 | | Proportion in this group |
|    Do not know needs and costs | 0.409 | | Proportion in this group |
| Care provider | 0.262 | 0.440 | Binary |
| *Availability of informal care and home ownership* | | | |
| Source of some (low) care | | | Categorical |
|    Informal care only | 0.376 | | Proportion in this group |
|    Informal care and other sources | 0.328 | | Proportion in this group |
|    No informal care | 0.296 | | Proportion in this group |
| Source of extensive (high) care | | | Categorical |
|    Informal care only | 0.219 | | Proportion in this group |
|    Informal care and other sources | 0.282 | | Proportion in this group |
|    No informal care | 0.499 | | Proportion in this group |
| Non-partnered | 0.326 | 0.469 | Binary |
| Number of children | 1.961 | 1.465 | Continuous |
| Non-homeowner | 0.191 | 0.394 | Binary |
| *Measures of utility parameters* | | | |
| Willingness to take risk (WTR) | 3.975 | 2.594 | Continuous on a 0-10 scale |
| Patience | 6.360 | 2.427 | Continuous on a 0-10 scale |
| Utility in bad health | 4.253 | 2.181 | Continuous on a 0-10 scale |
| Chance of A$100K bequest | 52.589 | 42.451 | Percentage points |
| Prefer reimbursement | 0.421 | 0.494 | Binary |
| *Individual capability and knowledge about retirement financial products* | | | |
| No. of mistakes in Financial literacy | 0.648 | 0.836 | Continuous a 0-3 scale |
| No. of mistakes in Numeracy | 1.298 | 1.091 | Continuous a 0-3 scale |
| Earnings from recall quiz | 3.119 | 1.705 | Continuous in dollars |
| General product knowledge | 8.495 | 1.870 | Continuous on a 0-10 scale |
| Knowledge on life annuity | 2.167 | 1.576 | Continuous on a 0-5 scale |
| Knowledge on LTCI | 1.217 | 1.587 | Continuous on a 0-5 scale |
| No private health insurance | 0.382 | 0.486 | Binary |
| *Retirement planning* | | | |
| Intend to retire before 65 | 0.493 | 0.500 | Binary |
| Financial planning for retirement | 0.782 | 0.413 | Binary |
| Retirement spending change | -17.005 | 24.292 | Percentage points |
| *Demographics and other controls* | | | |
| Not born in Australia | 0.243 | 0.429 | Binary |
| Bachelor degree or above | 0.327 | 0.469 | Binary |
| Work status | | | Categorical |
|    Full time | 0.270 | | Proportion in this group |
|    Part time | 0.206 | | Proportion in this group |
|    Unemployed/not in labor force | 0.384 | | Proportion in this group |
|    Retired | 0.140 | | Proportion in this group |
| Household gross income | 73.672 | 55.188 | Continuous in thousand dollars/Year |
| Wealth group | | | Categorical |

Table 5 – continued

| Variable: | Mean | Standard deviation | Variable type |
|---|---|---|---|
| 1 | 0.275 | | Proportion in this group |
| 2 | 0.252 | | Proportion in this group |
| 3 | 0.209 | | Proportion in this group |
| 4 | 0.264 | | Proportion in this group |

# 4   Results and Discussion

In this section, we begin by using data obtained from questions Q1 to Q4 in the experimental survey to estimate econometric models to discover who demands LTC income insurance. First, we determine whether an allocation to LTC income insurance is made mainly by people who are more likely to need to claim the benefit, that is, whether there are selection effects. Second, we determine whether people expect to use the LTC income insurance to fund informal as well as formal care. Whether a market for LTC income insurance is viable depends on the answers to these two questions. After that, we examine the impact of having access to LTC income insurance on the demand for life annuities with the data obtained from Q7 of the experimental task.

## 4.1   Demand for LTC income insurance: Selection and informal care effects

Using data from Q1-Q4, we estimate two random effects models. In the first model, we use a random-effects probit specification to analyze the decision to purchase LTC income insurance or not:

$$Z_{ij}^{\star} = X_i'\beta + \delta A + \nu_i + \epsilon_{i,j}, \qquad \text{for } i = 1, 2, \ldots, N \text{ and } j = 1, 2, 3, 4 \tag{1}$$

with

$$Z_{ij} = \begin{cases} 1, & \text{if } Z_{ij}^{\star} > 0, \\ 0, & \text{otherwise,} \end{cases}$$

where $Z_{ij}^{\star}$ is a latent variable that can be interpreted as the utility gain of purchasing LTC income insurance compared to not purchasing it; $Z_{ij}$ is the observed binary variable that equals one if participant $i$ purchased LTC income insurance in question $j$ (i.e., Q1-Q4) and zero otherwise; $X_i$ is a vector of covariates for participant $i$ with the coefficient vector $\beta$; $A$ is a $(4 \times 1)$ vector, where the $j^{\text{th}}$ element equals one for question $j$ and zero otherwise; $\delta$ is the corresponding coefficient vector for $A$; $\nu_i$ captures

the unobservable effects for participant $i$ and is assumed to be i.i.d. normally distributed with a mean of zero and variance $\sigma_\nu^2$; and the residual $\epsilon_{ij}$ for participant $i$ in question $j$ is assumed to be independent of $\nu_i$ and i.i.d. normally distributed with a mean of zero and $\sigma_\epsilon^2$. The conditional probability of purchasing LTC income insurance for participant $i$ in question $j$ is thus given by:

$$\Pr(Z_{ij} = 1 | X_i, A, \nu_i) = \Phi\left(\frac{X_i'\beta + \delta A + \nu_i}{\sigma_\epsilon}\right). \tag{2}$$

We estimate the parameters in Equation (1) using maximum likelihood.

In the second model, we study the demand for LTC-contingent income conditional on purchasing the LTC income product by using the same set of data from Q1-Q4. We use OLS to estimate:

$$\log(Y_{ij} | Z_{ij} = 1, X_i, A) = X_i'\beta + \delta A + \gamma_i + \mu_{ij}, \tag{3}$$

where $Y_{ij}$ represents the amount of LTC-contingent income purchased by participant $i$ in question $j$; $\gamma_i$ captures the unobservable effects for participant $i$ and is assumed to be i.i.d. normally distributed with a mean of zero and variance $\sigma_\gamma^2$; and the residual $\mu_{ij}$ for participant $i$ in question $j$ is assumed to be independent of $\gamma_i$ and i.i.d. normally distributed with a mean of zero and $\sigma_\mu^2$.

### 4.1.1 Selection effects

Table 6 displays the estimation results for Equations (1) for the purchase decision and (3) for the amount of LTC-contingent income conditional on purchase that relate to LTC risk and informal care.[22] We find that objective measures of exposure to LTC risk do not significantly influence the decision to purchase the LTC income product. These measures explain little variation in the amount of LTC-contingent income demanded by participants. Of all variables in this category, only *Female* and *Current smoker* have a significant and negative effect on the whole sample for the amount of LTC-contingent income demanded, but not on the probability of purchase. As the pricing of the LTC income product is gender specific, the significance of *Female* does not signal any selection effects because it does not lead to a different price and is possibly due to the pricing difference between males and females. The negative effect of *Current smoker* on the amount of LTC-contingent income indicates that there could be an advantageous selection effect. Those who are less inclined to invest in their health (they remain a smoker) are less inclined to purchase larger amounts of LTC insurance. In general, there is little indication of adverse selection based

---

[22]Table C1 in Online Appendix C displays the full set of estimation results.

on the objective measures, which is consistent with the result that the actuarially fair prices of the LTC income product across current health states are very similar (Brown and Warshawsky, 2013).

In contrast to the objective measures, the subjective risk assessments do significantly alter demand for LTC income insurance. The participants who rated their chance of needing residential care as lower than average were less likely to purchase LTC income insurance. However, those who put their chance at higher-than-average were (much) more likely to purchase the product, and conditional on the purchase they demanded 55% more LTC-contingent income.[23] In fact, all 35 male participants and 25 out of 26 female participants in our survey who said they had a higher-than-average chance of needing residential care indicated that they would purchase the product. Therefore, the corresponding coefficient estimate is positively infinite for males (resulting in an estimated probability of purchasing the product equal to one) and very large for the sample. The insignificant coefficient for females is due to its small sample size, though the coefficient estimate is very large too.

Moreover, we find that the participants who were more aware of LTC risk were more likely to purchase LTC income insurance, and they purchased more. In particular, the demand for LTC-contingent income per year for participants who had set aside money for LTC risk was 28% higher, conditional upon purchase. This high demand for the LTC income product indicates that those who are aware of LTC risk change their behavior by saving more. This change in behavior signals that there are possible advantageous selection effects present, as those who are more aware of LTC risk, and are willing to invest in their health capital, have a stronger demand for the LTC income product.

Our finding of selection effects based on subjective measures is inconclusive. On the one hand, adverse selection exists in that the participants have a stronger demand for LTC income insurance. The extent of the adverse selection depends on the extent to which the self-reported chance of needing residential care is informative of the future need for LTC for our sample of 54 to 64 year-old participants. On the other hand, a higher awareness and willingness to invest in health leads to a higher demand for the LTC product, which could indicate advantageous selection as these people maintain good health for longer.

### 4.1.2 Informal care

Consistent with Pauly (1990) and Zweifel and Strüwe (1998), who show that informal care is a substitute for expense-reimbursement LTC insurance, our results in Table 6 indicate that the availability of some (low-level) informal care reduces the demand for LTC-contingent income.

---

[23]We calculate this percentage as $\exp(x) - 1$ where $x$ is the coefficient estimate.

Table 6: Determinants of demand for LTC income insurance given income streams

The table displays the estimates of the average partial effects for Equation (1) in columns (1), (2), and (3) and the coefficients for Equation (3) in columns (4), (5), and (6). The data for the estimation come from Q1-Q4 of the survey. The dependent variable for columns (1), (2), and (3) is a binary variable that equals one if a participant purchased LTC income insurance and zero otherwise. The dependent variable for columns (4), (5), and (6) is the natural logarithm of the amount of annual LTC-contingent income for those who purchased LTC income insurance. In these columns, we report only independent variables that belong to "Objective measures of exposure to LTC risk", "Subjective indicators of exposure to LTC risk", "Awareness of LTC risk", and "Availability of informal care". Table C1 in Online Appendix C displays the full results. An estimated average partial effect of $+\infty$ indicates that the associated independent variables perfectly predict the purchase of LTC income insurance. Robust standard errors (Huber-White) are shown in parentheses. Asterisks for $\sigma_\nu$ indicate significance of the random effects that are derived from likelihood ratio tests (for columns (1), (2), and (3)) and Breusch and Pagan Lagrange multiplier tests (for columns (4), (5), and (6)). The *, **, and *** indicate significance at the 10, 5, and 1% levels, respectively.

| Dependent variable: | Purchase LTC income product | | | Log (annual LTC-contingent income) | | |
|---|---|---|---|---|---|---|
| | Sample (1) | Male (2) | Female (3) | Sample (4) | Male (5) | Female (6) |
| *Objective measures of exposure to LTC risk* | | | | | | |
| Female | 0.001 | | | -0.459*** | | |
| | (0.008) | | | (0.077) | | |
| Age | -0.000 | 0.001 | 0.000 | -0.013 | -0.018 | -0.018 |
| | (0.001) | (0.003) | (0.002) | (0.013) | (0.018) | (0.018) |
| Health state: base case = 1 | | | | | | |
| 2 | -0.007 | -0.067 | 0.028* | 0.073 | 0.134 | 0.077 |
| | (0.018) | (0.055) | (0.016) | (0.133) | (0.163) | (0.198) |
| 3 | 0.001 | -0.015 | 0.017 | 0.005 | 0.021 | -0.040 |
| | (0.010) | (0.023) | (0.017) | (0.095) | (0.115) | (0.158) |
| 4 | 0.003 | 0.001 | 0.012 | 0.122 | -0.040 | 0.434*** |
| | (0.011) | (0.023) | (0.023) | (0.111) | (0.155) | (0.157) |
| Current smoker | -0.006 | 0.003 | -0.014 | -0.297*** | -0.206 | -0.423** |
| | (0.011) | (0.025) | (0.019) | (0.105) | (0.129) | (0.170) |
| Received care | -0.012 | -0.063 | 0.021 | 0.142 | -0.045 | 0.299 |
| | (0.023) | (0.062) | (0.019) | (0.144) | (0.201) | (0.192) |
| *Subjective indicators of exposure to LTC risk* | | | | | | |
| Subjective life expectancy | -0.001 | -0.002* | -0.000 | 0.004 | 0.009* | -0.004 |
| | (0.000) | (0.001) | (0.001) | (0.004) | (0.005) | (0.007) |
| Chance of needing homecare: base case = average | | | | | | |
| Lower than the average | 0.007 | -0.004 | 0.009 | -0.032 | 0.003 | -0.130 |
| | (0.011) | (0.023) | (0.022) | (0.104) | (0.131) | (0.185) |
| Higher than the average | -0.019 | -0.109 | 0.015 | -0.203 | -0.121 | -0.161 |
| | (0.037) | (0.107) | (0.030) | (0.179) | (0.224) | (0.319) |
| Chance of needing residential care: base case = average | | | | | | |
| Lower than the average | -0.025* | -0.056** | -0.015 | -0.039 | -0.207 | 0.176 |
| | (0.014) | (0.027) | (0.025) | (0.101) | (0.129) | (0.177) |
| Higher than the average | 0.015** | $+\infty$*** | 0.026** | 0.441*** | 0.465** | 0.097 |
| | (0.006) | (n.a) | (0.012) | (0.169) | (0.188) | (0.339) |
| *Awareness of LTC risk* | | | | | | |
| Financial planning for LTC: base case = do not know needs and costs | | | | | | |
| Have set aside money but may need help | 0.025** | 0.058** | 0.022 | 0.245*** | 0.388*** | 0.194 |
| | (0.010) | (0.023) | (0.015) | (0.082) | (0.113) | (0.121) |
| Expect to rely on government | 0.012 | 0.034 | 0.022 | -0.026 | 0.102 | -0.127 |
| | (0.016) | (0.035) | (0.026) | (0.138) | (0.163) | (0.244) |
| Care provider | -0.005 | 0.021 | -0.021 | -0.077 | -0.108 | -0.043 |
| | (0.009) | (0.021) | (0.016) | (0.081) | (0.107) | (0.118) |
| *Availability of informal care and home ownership* | | | | | | |
| Source of some (low) care: base case = no informal care | | | | | | |
| Informal care only | -0.002 | -0.012 | 0.006 | -0.202* | -0.374** | -0.004 |
| | (0.014) | (0.035) | (0.021) | (0.116) | (0.154) | (0.173) |
| Informal care and other sources | 0.006 | 0.037 | -0.010 | -0.246** | -0.225 | -0.181 |
| | (0.012) | (0.027) | (0.023) | (0.115) | (0.163) | (0.168) |
| Source of extensive (high) care: base case = no informal care | | | | | | |
| Informal care only | 0.016 | 0.052* | -0.011 | 0.230** | 0.208 | 0.366** |
| | (0.011) | (0.027) | (0.029) | (0.110) | (0.141) | (0.174) |
| Informal care and other sources | 0.012 | 0.034 | 0.006 | 0.265*** | 0.078 | 0.411*** |
| | (0.011) | (0.028) | (0.016) | (0.099) | (0.137) | (0.144) |
| Non-partnered | 0.009 | 0.043* | 0.002 | -0.034 | -0.035 | 0.010 |
| | (0.010) | (0.026) | (0.017) | (0.092) | (0.133) | (0.127) |
| Number of children | 0.001 | -0.001 | 0.003 | 0.030 | -0.046 | 0.108*** |
| | (0.003) | (0.007) | (0.005) | (0.025) | (0.036) | (0.034) |
| Non-homeowner | -0.013 | 0.015 | -0.049* | -0.038 | 0.060 | -0.215 |
| | (0.011) | (0.024) | (0.026) | (0.103) | (0.121) | (0.169) |
| N | 4032 | 1932 | 1960 | 3443 | 1753 | 1690 |
| Log likelihood | -983.712 | -494.137 | -463.635 | | | |
| $R^2$ (overall) | | | | 0.508 | 0.504 | 0.525 |
| $\sigma_\nu$ | 2.675*** | 2.612*** | 2.462*** | 1.057*** | 1.018*** | 1.086*** |

23

Further, we observe that the availability of receiving extensive care from close family members is associated with stronger demand for LTC income insurance. For extensive care, column (2) of Table 6 shows that males who plan to rely on family members have a higher probability of purchasing the LTC income product than those who do not plan to do so (significant at 10%). The results of column (4) also show that people who have access to extensive care from family members demand about 30% more LTC-contingent income per year than those who do not. We conclude that LTC income insurance complements the availability of extensive informal care.

The results in columns (5) and (6) in Table 6 provide supporting evidence that the availability of extensive care from family members is significant for females but insignificant for males. Hence, the result that this is associated with stronger demand for the LTC income product is mainly driven by females. These women have a stronger needs for *inter vivos* transfers to facilitate informal care by their children or related caregivers.

There are two further results that support this view. First, the number of children has a positive and significant effect on the product demand for females, but an insignificant (and negative) effect for males (see columns (5) and (6) of Table 6). Second, we also find that the negative impact of post-mortem bequest motives to children only appears for females, where *inter vivos* transfers are probably a substitute for (strategic) post-mortem transfers.[24] Therefore, the LTC income product is a substitute for bequests to children by mothers. For other sources of financing, we find that neither home ownership nor an expectation of relying on the government for care influence the demand for the LTC income product.

In contrast to the typical expense-reimbursement insurance, an LTC income product compensates people who rely on either informal care or professional care. In our sample, 22% of participants declare that they would prefer to receive extensive (high-level) care only from close family members. Another 28% of participants indicate informal care as one of the sources of extensive care. Hence, the potential market for the LTC income product covers a much larger proportion of the population than the expense-reimbursement LTC insurance by including people who prefer informal care. More importantly, the finding that the LTC income product complements the need and desire to rely on family members for extensive care indicates a stronger demand among these people.

---

[24]These results are reported in Online Appendix C.

## 4.2 Demand for income in health and disability: Selection and informal care effects

In this subsection, we examine the demand for LTC-contingent income in participants' optimal allocation of total retirement savings. To do so, we consider the situation where participants can choose their allocations to longevity insurance as well as LTC insurance. This expansion of the choice set is important because of the possible interaction between the demand for LTC and longevity insurance (e.g., Davidoff, 2009). We examine this relation by using the data from Q6 that reflect participants' optimal mix of LTC-contingent income, survival-contingent income, and liquid wealth.

We estimate a model of the ratio of LTC-contingent income to survival-contingent income with the following OLS:

$$L_i = X_i'\beta + \varepsilon_i, \tag{4}$$

where $L_i$ denotes the ratio of LTC-contingent income over survival-contingent income preferred by participant $i$. The amount of survival-contingent income includes both the income from life annuities (chosen by the participant) and the public pension income (given as fixed). The residual $\varepsilon_i$ for participant $i$ is assumed to be i.i.d. with a mean of zero and variance $\sigma_\varepsilon^2$.

Table 7 presents the regression results for Equation (4). Since the dependent variable is the ratio of LTC-contingent income per year to survival-contingent income per year, a positive and significant coefficient indicates that, cross-sectionally, the variable leads to a stronger preference for LTC-contingent income than for survival-contingent income.

### 4.2.1 Selection effects

Consistent with previous results we find that objective measures of exposure to LTC risk explain little variation in participants' preferences about the mix of income streams. The coefficient on *Smoker*, which has a negative impact on the demand for LTC-contingent income in column (4) of Table **??** becomes insignificant (column (1)), although it is still significant and negative for males. This change may be because smoking negatively affects expected lifetimes (Belanger et al., 2002) that reduces the demand for life annuities to a similar extent as for LTC income insurance.

Consistent with the results, we also find that the expectations of needing residential care are important. The ratio of LTC-contingent income to survival-contingent income preferred by those with a higher chance of needing residential care is 2.264 units higher than those at the average.

The results also show that females who have experience providing care have stronger preferences for LTC-contingent income than for survival-contingent income. The estimated coefficients (column (1)) for both *Care provider* and *Have set aside money* are positive for the whole sample, although they are not significant. These results are consistent with the finding that participants who have a better awareness of LTC risk have a stronger demand for LTC insurance.

### 4.2.2 Informal care

Similarly, these results confirm that the distinction between low-level (some) care and extensive care is important. For example, participants who would only rely on family members for low-level care chose a lower ratio of LTC-contingent to survival-contingent income than participants who would not (significant at the 10% level in column (1)). However, participants who would only rely on family members for extensive care showed a stronger preference for LTC-contingent income than those who did not expect to use informal care. These results are mostly driven by females. An exception is that males have a significant and positive coefficient for *Informal care only* in column (2) of Table 7, but this is also with a negative sign for the variable *Informal care and other sources*.

Overall, these results are largely consistent with the findings in Section 4.1.1 and Section 4.1.2. Thus, our findings about the influence of LTC risk factors and the availability of informal care on the demand for LTC-contingent income hold, both when the amount of survival-contingent income is exogenously given to participants, and when it is endogenously chosen by participants.

### 4.3 Precautionary savings and demand for LTC income insurance

In this subsection, we examine the impact of having access to LTC income insurance on the demand for longevity insurance. We use the data obtained from Q7 of the experimental task, which asked participants how they would like to re-allocate their retirement savings when LTC income insurance was no longer offered. By default, we deposited the amount of money the participant previously allocated to LTC income insurance (in Q6) back into their investment account. Q7 allowed participants to increase or decrease their annuitization level by 25% or keep it unchanged [25]. The answers to Q7 measure the within-participant effect of having access to LTC income insurance on the demand for life annuities. In this way, we are able to minimize, if not eliminate, the effects of other participant-specific factors.

In Section 4.3.1, we first carry out a univariate test on whether the proportion of participants who

---

[25]A magnitude of change as much as 25% (the same as the increment in Q1-Q4) is required because otherwise one would not be able to identify whether the change is due to the treatment or rounding behaviors.

Table 7: Determinants of the optimal mix of income streams

The table displays the estimates of the coefficients for Equation (4). The data for the estimation come from Q6 of the survey. The dependent variable is the ratio of annual LTC-contingent income over annual survival-contingent income. Only independent variables that belong to "Objective measures of exposure to LTC risk", "Subjective measures of exposure to LTC risk", "Awareness of LTC risk", and "Availability of informal care" are shown. Table C2 in Online Appendix C contains the full results. Robust standard errors (Huber-White) are shown in parentheses. The *, **, and *** indicate significance at 10, 5, and 1% levels, respectively.

| Dependent variable: | LTC-contingent income/survival-contingent income | | |
|---|---|---|---|
| | Sample (1) | Male (2) | Female (3) |
| *Objective measures of exposure to LTC risk* | | | |
| Female | -1.392*** | | |
| | (0.432) | | |
| Age | -0.086 | -0.121 | -0.037 |
| | (0.057) | (0.100) | (0.064) |
| Health state: base case = 1 | | | |
| 2 | 0.091 | 0.042 | 0.461 |
| | (0.584) | (0.999) | (0.511) |
| 3 | -0.212 | 0.115 | -0.377 |
| | (0.509) | (0.738) | (0.604) |
| 4 | 0.701 | 0.564 | 0.819 |
| | (0.667) | (1.082) | (0.596) |
| Current smoker | -0.505 | -1.498** | 0.359 |
| | (0.408) | (0.631) | (0.535) |
| Received care | -0.449 | -0.699 | -0.283 |
| | (0.760) | (1.141) | (0.544) |
| *Subjective indicators of exposure to LTC risk* | | | |
| Subjective life expectancy | 0.007 | 0.029 | -0.012 |
| | (0.018) | (0.026) | (0.027) |
| Chance of needing homecare: base case = average | | | |
| Lower than the average | 0.251 | 0.381 | -0.299 |
| | (0.468) | (0.748) | (0.457) |
| Higher than the average | -0.499 | 0.921 | -1.946** |
| | (0.676) | (1.180) | (0.908) |
| Chance of needing residential care: base case = average | | | |
| Lower than the average | -0.647 | -1.374** | 0.301 |
| | (0.413) | (0.669) | (0.395) |
| Higher than the average | 2.264** | 3.188** | 0.507 |
| | (1.054) | (1.529) | (1.000) |
| *Awareness of LTC risk* | | | |
| Financial planning for LTC: base case = do not know needs and costs | | | |
| Have set aside money | 0.387 | 0.552 | 0.433 |
| | (0.336) | (0.594) | (0.396) |
| Expect to rely on government | -0.534 | -0.533 | -0.525 |
| | (0.369) | (0.625) | (0.493) |
| Care provider | 0.277 | -0.285 | 1.067** |
| | (0.382) | (0.615) | (0.453) |
| *Availability of informal care and home ownership* | | | |
| Source of some (low) care: base case = no informal care | | | |
| Informal care only | -0.883* | -0.397 | -1.385*** |
| | (0.496) | (0.912) | (0.483) |
| Informal care and other sources | -0.299 | 0.503 | -1.099** |
| | (0.571) | (1.061) | (0.474) |
| Source of extensive (high) care: base case = no informal care | | | |
| Informal care only | 2.120*** | 2.312** | 1.841*** |
| | (0.595) | (0.982) | (0.711) |
| Informal care and other sources | 0.607 | -0.437 | 0.876* |
| | (0.513) | (0.959) | (0.465) |
| Non-partnered | 0.472 | 0.949 | -0.043 |
| | (0.457) | (0.809) | (0.379) |
| Number of children | 0.089 | 0.077 | 0.094 |
| | (0.118) | (0.211) | (0.126) |
| Non-homeowner | 0.158 | 1.014 | -0.699 |
| | (0.501) | (0.860) | (0.429) |
| N | 1008 | 518 | 490 |
| $R^2$ | 0.183 | 0.226 | 0.206 |

chose to increase their level of annuitization was equal to the proportion of participants who chose to decrease it. In Section 4.3.2 we estimate a multinomial logit model to explain the heterogeneity in the participants' reactions. We denote the choice of participant $i$ by $M_i$ and use no change in the level of annuitization ($M_i = 2$) as the base outcome. The specifications for the probabilities of participant $i$ preferring a decrease ($M_i = 1$) and an increase ($M_i = 3$) in annuitization level are given by:

$$\log \left( \frac{\Pr(M_i = 1 | X_i)}{\Pr(M_i = 2 | X_i)} \right) = X_i' \beta_1 \text{ and} \tag{5}$$

$$\log \left( \frac{\Pr(M_i = 3 | X_i)}{\Pr(M_i = 2 | X_i)} \right) = X_i' \beta_3 \tag{6}$$

where $X_i$ is the set of participant $i$ specific covariates (including an intercept), $\beta_1$ and $\beta_3$ are the coefficients for outcomes 1 and 3 respectively and can be interpreted as the marginal effects on log-odds of outcomes 1 and 3 relative to the base outcome, that is, 2. We estimate these equations jointly using maximum likelihood.

### 4.3.1 Re-allocation to life annuity when LTC income insurance is withdrawn

Table 8 shows how participants responded when LTC income insurance was no longer offered. Fewer than half kept their level of annuitization unchanged which therefore led to an increase in their investment account balances by the amount of money allocated to LTC income insurance.

Table 8: Distribution of responses to the unavailability of the LTC income product

|  | Change of annuitization level | | |
|---|---|---|---|
|  | -25% | 0% | 25% |
| Percent of participants | 31.9 | 48.3 | 19.8 |
| 95% confidence interval | (27.6, 36.2) | (43.7, 52.9) | (16.1, 23.5) |

We find that more participants decreased their level of annuitization to boost their liquid wealth than increased it (significant at a 5% level). Therefore, for most participants whose portfolio choices were materially affected by whether they had access to LTC income insurance, the insurance allowed them to release precautionary savings kept for self-insuring against LTC risk (and therefore purchase additional longevity insurance). Nonetheless, there was still around 20% of the participants who used life annuities as a hedging instrument in the absence of the LTC income product.

### 4.3.2 Participant characteristic effects on re-allocation to life annuity

Table 9 presents the coefficient estimates of the multinomial logit model specified in Equations (5) and (6). We find that participants with low LTC risk, in either objective or subjective measures, were more likely to decrease their level of annuitization when the LTC income product was no longer offered on the market than an average or high LTC risk individual.

Table 9: Regression of participants' responses to the withdrawal of the LTC income product

This table presents the estimates of the coefficients for the Equations (5) and (6). The data for the estimation come from Q7 of the survey. The sample includes participants who chose partial annuitization in the presence of LTC income insurance in Q7 of the survey. The dependent variables are the choices of participants with respect to their level of annuitization when LTC income insurance was no longer offered. Independent variables that do not show significance at the 5% level for at least one column are not reported in this table but are in Online Appendix C. Robust standard errors (Huber-White) are shown in parentheses. The *, **, and *** indicate significance at the 10, 5, and 1% levels, respectively.

| Base outcome: No change in annuitization | Decrease by 25% | Increase by 25% |
|---|---|---|
| | (1) | (2) |
| *Objective measures of exposure to LTC risk* | | |
| Health state: base case = 1 | | |
| 2 | 0.621 | 0.413 |
| | (0.513) | (0.543) |
| 3 | -0.006 | -0.034 |
| | (0.359) | (0.402) |
| 4 | -1.072** | 0.030 |
| | (0.478) | (0.443) |
| *Subjective indicators of exposure to LTC risk* | | |
| Chance of needing residential care: base case = average | | |
| Lower than the average | 1.074*** | 0.687 |
| | (0.405) | (0.442) |
| Higher than the average | -0.590 | 0.523 |
| | (0.881) | (0.849) |
| *Awareness of LTC risk* | | |
| Financial planning for LTC: base case = do not know needs and costs | | |
| Have set aside money | -0.195 | -0.683** |
| | (0.284) | (0.317) |
| Expect to rely on government | -0.794 | -0.023 |
| | (0.580) | (0.642) |
| *Retirement planning* | | |
| Financial planning for retirement | 0.598 | 1.016** |
| | (0.406) | (0.516) |
| *Demographics and other controls* | | |
| Wealth group: base case = 1 | | |
| 2 | -1.154*** | 0.317 |
| | (0.435) | (0.570) |
| 3 | -2.818*** | -0.092 |
| | (0.486) | (0.585) |
| 4 | -2.533*** | -0.065 |
| | (0.474) | (0.595) |
| $N$ | | -389.964 |
| Log likelihood | | 445.000 |

In the absence of LTC insurance coverage, the demand for life annuities for the low LTC risk participants is substantially reduced, because they need liquid wealth to self-insure. However, the effect of having access to LTC income insurance on the demand for life annuities is limited for participants with high LTC risk, because their own lower survival prospects make life annuities relatively expensive (as a result of risk pooling pricing). This result does not contradict the findings in Section 4.1.1 (Table 6).

Participants with higher perceived LTC risk are more likely to purchase LTC income insurance, and they purchase more, while participants with lower LTC risk are more likely to purchase more life annuities after they obtain coverage for LTC. These results mean that offering LTC insurance coverage may strengthen the demand for life annuities for healthy participants but does little to solve the annuitization puzzle (Yaari, 1965; Davidoff et al., 2005) for the unhealthy participants, which highlights the importance of bundling longevity insurance and LTC insurance.[26]

We also find that participants who had a financial plan for retirement were more likely to increase their level of annuitization and to view life annuities as an alternative product to hedge LTC risk when LTC income insurance was no longer offered. On the contrary, poorer participants (wealth group 1) were more likely to decrease their level of annuitization by sacrificing longevity protection to hold more liquid wealth as a precaution against LTC risk.

## 5   Conclusions

Although substantial LTC risk has led to a conservative drawdown of wealth by retirees (Ameriks et al., 2011, 2015; Ooijen et al., 2015; Asher et al., 2017), the private markets for LTC insurance are thin or nonexistent in most developed countries. Earlier studies mainly focus on expense-reimbursement LTC insurance policies that provide benefits for paid LTC services. We show that a more flexible product that pays a regular income when the insured person needs care has a large potential demand, in particular for those relying on informal care. A large and increasing proportion of seniors are not using residential care facilities but are relying on unpaid LTC from close family members. Thus, a flexible LTC insurance policy that offers LTC-contingent income, whether payments are made for formal LTC services or not, may better suit their needs.

In this paper, we present the results of an experimental survey of the demand for an LTC income insurance that focuses on selection effects, the role of informal care, and the impact on precautionary savings. Using stated preference data collected from the survey, we find that the estimated demand for the LTC income insurance is much larger than actual LTC insurance holdings. This finding leads us to conclude that imperfections in the existing LTC insurance contribute to the low demand for LTC insurance coverage in current markets, which is consistent with Brown and Finkelstein (2007) and Ameriks et al. (2018).

---

[26]Wu et al. (2016) show that the optimal survival-contingent income for participants in health state 4 is higher when LTC income insurance is provided in bundle with longevity insurance.

In contrast to expense-reimbursement LTC insurance policies in which underwriting is needed to prevent adverse selection (Sloan and Norton, 1997; Finkelstein and McGarry, 2006; Brown and Finkelstein, 2007; Webb, 2009), we find no evidence of selection effects based on the objective measures of exposure to LTC risk. However, we do find that the subjective measures of LTC risk matter when they contain private information, such as participants' self-reported chances of needing residential care. An alternative explanation for this result is that the subjective measures we collect do not contain private information, but what we observe is stronger demand from people who perceive more LTC risk. In other words, we observe a kind of advantageous selection. Overall, these findings indicate that LTC income insurance could be offered without substantial underwriting (and at a price without loadings for adverse selection and the underwriting costs). This finding sheds light on the commercial viability of the product.

More importantly, we find that the demand for LTC income insurance is stronger for people (especially females) who plan to rely on family members for extensive care. To put it differently, the product complements the availability of extensive, informal care, rather than substitutes for it, as is the case for expense-reimbursement LTC insurance (Pauly, 1990; Zweifel and Strüwe, 1998). This result has important practical implications: not only can flexible LTC income insurance cover a much larger proportion of the population by including those who prefer to use informal care, it can also be more attractive to this group of people than expense-reimbursement policies.

We also investigate the demand for longevity insurance when people can simultaneously insure LTC risk. Having access to LTC income insurance changes the annuitization decisions of around half of participants. A proportion of participants see longevity insurance as a substitute (hedge) for LTC costs in the absence of LTC insurance. However, there is a larger proportion who would use the availability of LTC insurance to release precautionary savings in order to purchase more longevity insurance, particularly those with lower LTC risk. This finding means that for healthy participants, the availability of the LTC income product offers a partial solution to the annuity puzzle.

While our research findings can support a viable market for LTC income insurance, providers would need to consider a number of practical implementation issues. These include the efficacy of providing cash payments to the elderly and cognitively impaired (Norton, 2016), the attractiveness (or not) of a single premium at retirement in terms of affordability and present bias, effective assessment and monitoring of disability status to address moral hazard issues, and the challenges associated with the communication of a complex product to potential purchasers.

# Appendix A   Financing long-term care (LTC) in Australia

In most cases, LTC is referred to as "aged care" in Australia. The 2016 Census identified just over 3.6 million Australians aged 65 or above, which represented 15.3% of the population. About one-fifth of this group needed help with one or more ADLs, which represented 150,000 people who lived in a residential care facility (CEPAR, 2014).

Similar to the US and the UK, the publicly financed aged care system in Australia is means tested (Department of Health and Ageing, Australian Government, 2012). This system compares with the tax-funded schemes popular in Nordic countries and social insurance in other OECD countries. Unlike the US, but similar to the UK, there is no private market for LTC insurance in Australia. Subject to approval from an eligibility assessment authority as required by the Aged Care Assessment Team (ACAT), people who need care either in their own home or in a residential care facility receive financial support from the Australian government. The amount of support is determined by means testing rules, which are integrated with the means-tested public pension (the age pension).[27] In aggregate, the Australian governments expenditures on aged care were around 0.9% of GDP in 2014-15 and are projected to increase to 1.7% of GDP in the next half century (The Treasury, Australian Government, 2015). However, the total costs of aged care includes public expenditures, out of pocket private expenditures, and the costs associated with informal care.

People who receive care in their own home are required to pay a basic daily fee, a means-tested care fee, and fees for any additional services that are not covered by their care package (e.g., haircuts at home). The basic daily fee is set at 17.5% of the single age pension.[28] The means-tested care fee is subject to an income test. Typically, individuals whose income is within the (Age Pension) Income Free Area, which corresponds to yearly income less than A\$26,328 for singles and combined yearly income less than A\$40,408 for couples in September 2017 (most likely full age pensioners), do not need to pay any care fees, as all costs are paid by the government. For those whose yearly income is above this area, their income-tested care fee increases by A\$0.50 per year for every dollar of income in excess up to annual caps of A\$5,313.28 for part age pensioners and A\$10,626.59 for non-pensioners, as of September 2017. The costs of additional services that are not covered by the home-care package are out of pocket.

People who receive care in a residential facility are required to pay a basic daily fee, a means-tested

---

[27]All amounts and means testing rules are for the six months from September 2017 see Department of Health, Australian Government (2017). Thresholds are indexed and adjusted twice per year, with new rates published by the government in March and September of each year.

[28]In September 2017, this fee corresponded to A\$10.17 per day.

care fee, an accommodation payment, and fees for any additional services. The basic daily fee is 85% of the single basic rate of age pension. In September 2017, this fee corresponded to A\$49.42 per day. Both the care fee and accommodation payment are means tested by income and assets with the value of family home included in the assets test (up to a capped amount) unless the home is occupied by a spouse or dependent children. Combined, these corresponded to A\$162,815.20 in September 2017. The results of both tests are used to determine the amount of the care fee and the accommodation payment payable by care users. Similar to home-care users, an annual cap applies to the means-tested care fees for residential care, as of September 2017. The means-test rules apply to the accommodation payment such that age pensioners will have their accommodation costs paid in full or in part by the Australian government. Other people will need to pay the accommodation price they negotiate with their aged-care facility. The accommodation can be paid as a daily accommodation payment (DAP) or a refundable accommodation deposit (RAD). The maximum RAD that can be charged without prior approval of the Aged Care Pricing Commissioner is A\$550,000. The cost of additional services — such as more food options, daily newspapers, and access to discretionary services such as podiatry — are out of pocket,

On top of these provisions, the system also provides a lifetime stop-loss scheme on the amount of care fees paid out of pocket, although individuals are still liable to pay the daily fees, the accommodation payment, and fees for any additional services. There is a lifetime cap, amounting to A\$62,256 as of September 2017. Individuals are not required to pay more than this amount for means-tested care fees (both for home care and residential care) in their lifetime.

The Australian government also provides support to informal caregivers through a Carer Allowance (a supplement to cover some costs of caring) and a Carer Payment (for those unable to work as a result of caring). In 2014, around 220,000 Australian aged 65 or above received informal care from those who received a Carer Payment. In total, these cost the government an additional A\$7 billion that is estimated to grow annually at a rate of over 6

## Appendix B   Sample Demographics

Table 10 compares the demographic characteristics of the sample with Australian Bureau of Statistics Census data. Overall the sample matches the Australian population aged 55-64, with the exceptions that the sample is better educated and has higher personal income on average. These exceptions are possibly because we select participants with at least a minimum net wealth and with access to the internet.

Table 10: Demographics

The table compares the demographic characteristics of survey participants with the Australian Census's data on the population. The survey samples 1,008 Australians aged 55-64 who do not have dementia or need help with two or more activities of daily living. The population data come from the Australian Bureau of Statistics 2011 Census of Population and Housing.

| Variable | Population % | Sample % | Variable | Population % | Sample % |
|---|---|---|---|---|---|
| Gender | | | High school completion | | |
|   Male | 49.4 | 51.4 |   Year 12 | 40.5 | 63.2 |
|   Female | 50.6 | 48.6 |   Year 11 | 9.8 | 8.6 |
| Age | | |   Year 10 | 31.1 | 22.8 |
|   55 | 10.9 | 9.6 |   Year 9 | 9.3 | 3.8 |
|   56 | 10.6 | 9.1 |   Year 8 or less | 8.2 | 1.5 |
|   57 | 10.2 | 10.1 |   Did not go to school | 1.1 | 0.1 |
|   58 | 10.2 | 9.8 | | | |
|   59 | 9.9 | 11.4 | Tertiary qualification | | |
|   60 | 9.8 | 9.7 |   Post graduate | 4.1 | 7.4 |
|   61 | 9.7 | 10.2 |   Graduate Diploma/Certificate | 2.5 | 9.3 |
|   62 | 9.4 | 9.6 |   Bachelor Degree | 12.5 | 16.0 |
|   63 | 9.4 | 10.9 |   Vocational Diploma | 9.9 | 18.0 |
|   64 | 9.9 | 9.4 |   Vocational Certificate | 20.1 | 23.7 |
| Marital status | | |   None of the above | 50.9 | 25.6 |
|   Never married | 8.1 | 10.9 | | | |
|   Widowed | 4.3 | 3.4 | | | |
|   Divorced/Separated | 20.7 | 18.4 | Personal income | | |
|   Married/De facto | 66.9 | 67.4 |   Negative or no income | 7.6 | 7.6 |
| Work status | | |   A$1 to A$20,799 | 28.8 | 24.8 |
|   Employed (FT) | 37.3 | 27.0 |   A$20,800 to A$41,599 | 24.3 | 25.2 |
|   Employed (PT) | 23.1 | 20.6 |   A$41,600 to A$64,999 | 18.4 | 20.7 |
|   Unemployed | 2.4 | 5.8 |   A$65,000 to A$103,999 | 13.4 | 16.0 |
|   Not in labor force | 37.2 | 46.6 |   A$104,000 or more | 7.6 | 5.7 |

## Acknowledgments

# References

Ameriks, J., Briggs, J., Caplin, A., Shapiro, M. D., and Tonetti, C. (2018). The long-term-care insurance puzzle: Modeling and measurement. Working Paper w22726, National Bureau of Economic Research.

Ameriks, J., Briggs, J. S., Caplin, A., Shapiro, M. D., and Tonetti, C. (2015). Long-term care utility and late in life saving. Working Paper w20973, National Bureau of Economic Research.

Ameriks, J., Caplin, A., Laufer, S., and Van Nieuwerburgh, S. (2011). The joy of giving or assisted living? Using strategic surveys to separate public care aversion from bequest motives. *Journal of Finance*, 66(2):519–561.

Asher, A., Meyricke, R., Thorp, S., and Wu, S. (2017). Age pensioner decumulation: Responses to incentives, uncertainty and family need. *Australian Journal of Management*, 42(4):583–607.

Belanger, A., Martel, L., Berthelot, J., and Wilkins, R. (2002). Gender differences in disability-free life expectancy for selected risk factors and chronic conditions in Canada. *Journal of Women and Aging*, 14(1-2):61–83.

Besedeš, T., Deck, C., Sarangi, S., and Shor, M. (2015). Reducing choice overload without reducing choices. *Review of Economics and Statistics*, 97(4):793–802.

Beshears, J., Choi, J. J., Laibson, D., Madrian, B. C., and Zeldes, S. P. (2014). What makes annuitization more appealing? *Journal of Public Economics*, 116:2–16.

Boyer, M., De Donder, P., Fluet, C., Leroux, M.-L., and Michaud, P.-C. (2017). Long-term care insurance: Knowledge barriers, risk perception and adverse selection. Working Paper w23918, National Bureau of Economic Research.

Braun, R. A., Kopecky, K. A., and Koreshkova, T. (2016). Old, sick, alone, and poor: A welfare analysis of old-age social insurance programmes. *The Review of Economic Studies*, 84(2):580–612.

Brown, J. and Warshawsky, M. (2013). The life care annuity: A new empirical examination of an insurance innovation that addresses problems in the markets for life annuities and long-term care insurance. *Journal of Risk and Insurance*, 80(3):677–704.

Brown, J. R. and Finkelstein, A. (2007). Why is the market for long-term care insurance so small? *Journal of Public Economics*, 91(10):1967–1991.

Brown, J. R. and Finkelstein, A. (2008). The interaction of public and private insurance: Medicaid and the long-term care insurance market. *American Economic Review*, 98(3):1083–1102.

Brown, J. R. and Finkelstein, A. (2009). The private market for long-term care insurance in the United States: A review of the evidence. *Journal of Risk and Insurance*, 76(1):5–29.

Brown, J. R., Goda, G. S., and McGarry, K. (2012). Long-term care insurance demand limited by beliefs about needs, concerns about insurers, and care available from family. *Health Affairs*, 31(6):1294–1302.

Bucher-Koenen, T., Schultz, J., and Spinder, M. (2017). Long term care insurance across Europe. In Börsch-Supan, A., Kneip, T., Litwin, H., Myck, M., and Weber, G., editors, *Ageing in Europe-supporting policies for an inclusive society*, pages 353 – 368. Walter de Gruyter GmbH & Co KG, Berlin.

CEPAR (2014). Aged care in Australia: Part I Policy, demand and funding. CEPAR Research Brief 2014/01, ARC Centre of Excellence in Population Ageing Research (CEPAR). Available at: http://www.cepar.edu.au/research-briefs.aspx.

Charles, K. K. and Sevak, P. (2005). Can family caregiving substitute for nursing home care? *Journal of Health Economics*, 24(6):1174–1190.

Clare, R. (2017). Superannuation balances by age and gender. ASFA Research and Resource Centre, The Association of Superannuation Funds of Australia Limited (ASFA).

Colombo, F., Llena-Nozal, A., Mercier, J., and Tjadens, F. (2011). *Help Wanted? Providing and Paying for Long-Term Care*. OECD Publishing, Paris, France.

Davidoff, T. (2009). Housing, health, and annuities. *Journal of Risk and Insurance*, 76(1):31–52.

Davidoff, T. (2010). Home equity commitment and long-term care insurance demand. *Journal of Public Economics*, 94(1):44–49.

Davidoff, T., Brown, J. R., and Diamond, P. A. (2005). Annuities and individual welfare. *American Economic Review*, 95(5):1573–1590.

de la Maisonneuve, C. and Martins, J. O. (2015). The future of health and long-term care spending. *OECD Journal: Economic Studies*, 2014(1):61–96.

de Meza, D. and Webb, D. C. (2001). Advantageous selection in insurance markets. *Review of Economic Studies*, 32(2):249–262.

De Nardi, M., French, E., and Jones, J. B. (2016). Medicaid insurance in old age. *American Economic Review*, 106(11):3480–3520.

DellaVigna, S. and Pope, D. (2018). What motivates effort? evidence and expert forecasts. *The Review of Economic Studies*, 85(2):1029–1069.

Department of Health and Ageing, Australian Government (2012). Living longer. living better. aged care reform package. Available at: http://www.health.gov.au/internet/publications/ publishing.nsf/Content/ageing-living-longer-living-better-reform-package-toc.

Department of Health, Australian Government (2017). Schedule of fees and charges for residential and home care: From 20 September 2017. Available at: https://agedcare.health.gov.au/schedule-of-fees-and-charges-for-residential-and-home-care-from-20-september-2017.

Department of Social Services, Australian Government (2018). Annual report 2017-18. Available at: https://www.dss.gov.au/.

Do, Y. K., Norton, E. C., Stearns, S. C., and Van Houtven, C. H. (2015). Informal care and caregiver's health. *Journal of Health Economics*, 24(2):224–237.

Finkelstein, A. and McGarry, K. (2006). Multiple dimensions of private information: Evidence from the long-term care insurance market. *American Economic Review*, 96(4):938–958.

Hewitson, B., Seale, B., and Joyce, L. (2011). Public engagement exploring care and support funding options. Technical report 224301, May 2011, TNS BMRB on behalf of the Commission on Funding of Care and Support (the Dilnot Commission). Available at: http://dilnotcommission.dh.gov.uk/2011/05/18/report-of-qualitative-research-now-available-2.

Kaye, H. S., Harrington, C., and LaPlante, M. P. (2010). Long-term care: Who gets it, who provides it, who pays, and how much? *Health Affairs*, 29(1):11–21.

Ko, A. (2016). An equilibrium analysis of the long-term care insurance market. Working paper, University of Pennsylvania.

LIMRA (2017). Combination Products Giving Life Back to Long-term Care Market. Available at: https://www.limra.com/Posts/PR/Industry_Trends_Blog/Combination_Products_Giving_Life_Back_to_Long-term_Care_Market.aspx.

Lockwood, L. M. (2014). Incidental bequests: Bequest motives and the choice to self-insure late-life risks. Working Paper No. w20745, National Bureau of Economic Research.

Lockwood, L. M. (2018). Incidental bequests and the choice to self-insure late-life risks. *American Economic Review*, 108(9):2513 – 2550.

Louviere, J. J., Hensher, D. A., and Swait, J. D. (2000). *Stated choice methods: Analysis and applications.* Cambridge University Press, Cambridge.

Mommaerts, C. (2016). Long-term care insurance and the family. Working paper, University of Wisconsin-Madison.

Muir, T. (2017). Measuring social protection for long-term care. Working paper 93, OECD Publishing.

Norton, E. (2016). Health and long term care. In Piggott, J. and Woodland, A., editors, *Handbook of the economics of population aging*, pages 951–990. Elsevier, Amsterdam.

Ooijen, R., Alessie, R., and Kalwij, A. (2015). Saving behavior and portfolio choice after retirement. *De Economist*, 163(3):353–404.

Oppenheimer, D. M., Meyvis, T., and Davidenko, N. (2009). Instructional manipulation checks: Detecting satisficing to increase statistical power. *Journal of Experimental Social Psychology*, 45(4):867–872.

Pang, G. and Warshawsky, M. (2010). Optimizing the equity-bond-annuity portfolio in retirement: The impact of uncertain health expenses. *Insurance: Mathematics and Economics*, 46(1):198–209.

Pauly, M. V. (1990). The rational nonpurchase of long-term-care insurance. *Journal of Political Economy*, 98(1):153–168.

Peijnenburg, K., Nijman, T., and Werker, B. J. (2017). Health cost risk: A potential solution to the annuity puzzle. *The Economic Journal*, 127(603):1598–1625.

Pezzin, L. E., Kemper, P., and Reschovsky, J. (1996). Does publicly provided home care substitute for family care? Experimental evidence with endogenous living arrangements. *Journal of Human Resources*, 31(3):650–676.

Poterba, J., Venti, S., and Wise, D. (2017). What determines end of life asset? A retrospective view. In Wise, D. A., editor, *Insights in the Economics of Aging*. The University of Chicago Press, Chicago.

Productivity Commission (2011). Caring for older Australians, Report No.53, Final inquiry report. Available at: http://www.pc.gov.au/projects/inquiry/aged-care/report.

Reichling, F. and Smetters, K. (2015). Optimal annuitization with stochastic mortality and correlated medical costs. *American Economic Review*, 105(11):3273–3320.

Robinson, J. (1996). A long-term care status transition model. presented at the 1996 Bowles Symposium on the Old-Age Crisis: Actuarial Opportunities. Georgia State University, September.

Schmitz, H. and Westphal, M. (2017). Informal care and long-term labor market outcomes. *Journal of Health Economics*, 56:1–18.

Sloan, F. A. and Norton, E. C. (1997). Adverse selection, bequests, crowding out, and private demand for insurance: Evidence from the long-term care insurance market. *Journal of Risk and Uncertainty*, 15(3):201–219.

The Treasury, Australian Government (2015). Intergenerational report 2015. Available at: http://www.treasury.gov.au/PublicationsAndMedia/Publications/2015/2015-Intergenerational-Report.

Turra, C. M. and Mitchell, O. (2008). The impact of health status and out-of-pocket medical expenditures on annuity valuation. In Ameriks, J. and Mitchell, O. S., editors, *Recalibrating Retirement Spending and Saving*, pages 227–250. Oxford University Press, Oxford.

Webb, D. C. (2009). Asymmetric information, long-term care insurance, and annuities: The case for bundled contracts. *Journal of Risk and Insurance*, 76(1):53–85.

Weinstein, N. D. (1982). Unrealistic optimism about susceptibility to health problems. *Journal of Behavioral Medicine*, 5(4):441–460.

Weinstein, N. D. (1987). Unrealistic optimism about susceptibility to health problems: Conclusions from a community-wide sample. *Journal of Behavioral Medicine*, 10(5):481–500.

Wu, S., Bateman, H., and Stevens, R. (2016). Optimal portfolio choice with health contingent income products: The value of life care annuities. Working Paper 2016/17, ARC Centre of Excellence in Population Ageing Research (CEPAR).

Wu, S., Stevens, R., and Thorp, S. (2015). Cohort and target age effects on subjective survival probabilities: Implications for models of the retirement phase. *Journal of Economic Dynamics and Control*, 55:39–56.

Yaari, M. E. (1965). Uncertain lifetime, life insurance, and the theory of the consumer. *Review of Economic Studies*, 32(2):137–150.

Zhou-Richter, T., Browne, M. J., and Gründl, H. (2010). Don't they care? Or, are they just unaware? Risk perception and the demand for long-term care insurance. *Journal of Risk and Insurance*, 77(4):715–747.

Zweifel, P. and Strüwe, W. (1998). Long-term care insurance in a two-generation model. *Journal of Risk and Insurance*, 65(1):13–32.