HEDG

HEALTH, econometrics AND DATA GROUP

THE UNIVERSITY of York

WP 24/11

The market for life care annuities: using housing wealth to manage longevity and long-term care risk

Jochem de Bresser; Marike Knoef and Raun van Ooijen

August 2024

http://www.york.ac.uk/economics/postgrad/herc/hedg/wps/

The market for life care annuities: using housing wealth to manage longevity and long-term care risk

Jochem de Bresser[a] Marike Knoef[a] Raun van Ooijen[b*]

[a]Tilburg Universiy, P.O. Box 90153, 5000 LE Tilburg, the Netherlands

[b]University of Groningen and University Medical Center Groningen,
P.O. Box 800, 9700 AV Groningen, the Netherlands

July 26, 2024

Abstract

There is rising interest in combined insurance products to finance long-term care (LTC) and retirement income. We analyze the market for life care annuities, which combine life annuities and LTC insurance, and examine how reverse mortgages can extend accessibility. These combined retirement finance products offer several benefits, such as reducing adverse selection, enabling consumption smoothing, and enhancing financial well-being at advantaged ages while keeping housing as a savings commitment. Using a discrete choice experiment conducted in a large representative panel in the Netherlands among individuals aged 40 to 66 reveals that 40% would opt for LTC-only annuities – which pay out between 500 and 1250 euros per month when having LTC needs – at market prices regardless of whether the payment mode is a monthly premium or a reverse mortgage. Reverse mortgages as a payment mode increase the demand for more expensive life care annuities by 8%-points. Further, the results show that a well-designed small menu of life care annuities could serve most individuals, with accessibility significantly extended when using reverse mortgages as a funding source.

Keywords: long-term care, life care annuities, reverse mortgages, discrete choice experiment, saving motives, health expectations

JEL classification: D14, I13, J14, J18

*Corresponding author: Raun van Ooijen; e-mail: r.van.ooijen@rug.nl. We are grateful to the comments and suggestions by Sander Boxebeld, Marianne Tenand, Pieter Bakx, Michael Hurd and participants of the Netspar workshops, the Dutch Health Econometrics Workshop, and Tinbergen Institute Seminar.

1 Introduction

The use of formal long-term care (LTC) is increasing due to population aging and a decline in the availability of informal care (Pestieau and Ponthiere, 2012; Costa-Font et al., 2017). This creates challenges for governments determining the balance between public and private funding, as well as for individuals and households managing the twin risks of health and longevity. Given the high costs and burden that LTC can pose, it is crucial to plan for it and secure financial strategies to manage potential future needs. Therefore, one could expect a flourishing market in private insurance. Yet, while the LTC insurance market is growing in some countries, e.g., Germany and France, it remains small worldwide (Swartz, 2013). This could be due to the rigid design of existing policies, which reimburse only specific costs (Wu et al., 2022) and do not allow buyers to tap into their most valuable asset: the value of their home (Mayhew et al., 2010).[1]

Life care annuities bundle LTC insurance with pension (or life) annuities. That is, monthly benefits change if the recipient cannot perform at least two activities of daily living (ADLs). They have been proposed as useful tools to increase welfare and, as a consequence of the negative correlation between LTC and longevity risk, reduce adverse selection (Murtaugh et al., 2001; Brown and Warshawsky, 2013; Chandra et al., 2023; Van der Vaart et al., 2024). Payment through reverse mortgages could substantially extend the accessibility of such products (Mayhew et al., 2010). Moreover, the use of reverse mortgages can increase the value of such products, as research shows that reverse mortgages can substantially increase welfare by smoothing consumption over the life cycle (Nakajima and Telyukova, 2017). Finally, whereas traditional reverse mortgage products break the commitment device that home equity offers, this is not the case for these combined products, as wealth is still locked away for the future. This is especially helpful for the many households that suffer from temptation (Kovacs and Moran, 2022) or have a bequest motive (Ameriks et al., 2008, 2020).

While there are strong theoretical arguments for combining pensions, LTC insurance,

[1] See e.g., Cocco and Lopes (2020); Hanewald et al. (2016); Shao et al. (2019) on the value of reverse mortgages.

and reverse mortgages, we know little about the preferences for these new combination products and the interaction between preferences and budget constraints that drive demand. This paper investigates the demand for these combined products by providing individuals with a choice of realistic retirement finance products carefully designed in collaboration with a large insurance company.

This paper builds upon a growing literature using stated preferences to examine the demand for LTC insurance (Boyer et al., 2020; Wu et al., 2022; de Bresser et al., 2022). Our contribution lies in its unique integration of three important areas: pensions, LTC, and reverse mortgages. Note that whereas homeowners can use home equity, renters need savings to be able to make a lump sum payment. While there is substantial literature on each of these topics individually, this paper brings them together in a comprehensive approach to retirement risk planning. A closely related paper is St-Amour and Michaud (2023), which also studies annuities, LTC insurance, and reverse mortgages. However, their stated preference experiment does not analyze the joint demand for retirement finance products but examines them separately. Moreover, rich survey data on income and wealth allow us to disentangle preferences for annuities and modes of payment from budget constraints.

Our data consists of a discrete choice (paired conjoint) experiment in the Longitudinal Internet Studies for the Social Sciences (LISS) panel, a large representative household panel in the Netherlands. We use ten choices between two financial products followed by probabilistic opt-outs to elicit the willingness to pay (WTP) for each attribute for each respondent in the panel. These individual-specific preferences are used in combination with detailed data on income and wealth to model the market equilibrium for different life care annuities. We estimate an adapted mixed logit model, taking into account recall errors and possible rounded answers of respondents. Finally, we relate the WTP to respondents' circumstances and expectations, using a large set of variables derived in an accompanying survey.

The Netherlands provides a relevant setting to investigate the market for life care annuities. While it has one of the most generous and well-developed pension and LTC

systems, occupational pensions have become less generous. Furthermore, in 2015 the Dutch government took substantial measures to control LTC costs, including higher co-payments and regional budgets shifting LTC expenses to individuals (Alders and Schut, 2019). At the time of the survey, the institutions distinguished between non-residential medical care, nursing home care, and social and domestic support. Mandatory health insurance covers all non-residential medical care and has a relatively low deductible of 385-885 euros per year (2018 values). Publicly funded nursing homes for those who need help around the clock require a contribution that is means-tested and falls in one of two regimes depending on length of stay and family situation. Long-term nursing home residents face a high contribution regime which caps contributions at 28k euros per year and includes non-housing wealth in excess of 30k euros in the means test. These contributions to nursing home care are large enough to absorb one's income and eventually deplete one's wealth (until 30k euros). In principle, domestic and social care are provided informally by family and friends. Only if such informal support is not available do municipalities step in, in which case social care is subject to income-dependent co-payments up to 6k euros per year.

Our results indicate that while preferences for (combined) LTC and life annuities and payment modes vary widely, there would be a viable market for well-designed products. Cheaper LTC-only annuities have premiums that range from 50 euros per month from age 40 to 200 euros per month from age 66 (until benefits start). Around 40-45% of the individuals would want to buy such a product at actuarially fair prices, regardless of whether the payment is a lump sum or a premium. Effective demand is 20-30% if we impose that premiums cannot exceed 5% of income. A lump sum of no more than 20% of assets also yields an effective demand of 30%. Preference-based demand for more expensive products that include a non-care annuity paid by lump sums is 30-40%, which is 8 %-points higher than demand based on premiums. Housing wealth contributes in making life care annuities affordable.

Across the grid of attributes, both constrained and unconstrained demand are highest for LTC care-only annuities that are paid for by relatively low premiums or a lump sum.

In terms of the variation in WTP across the sample, we corroborate the complementarity between life care annuities and informal care documented in Wu et al. (2022) as those who expect informal care to be available have higher WTPs than those who do not.

The remainder of the paper proceeds as follows. Section 2 describes the design of the discrete choice experiment and the model used to estimate preferences. Section 3 presents the data and Section 4 contains the results. Section 5 concludes.

2 Stated choice experiment

2.1 General setup and formulation

While paired conjoint analysis has good external validity for the relative importance of product attributes in real-world choices (Hainmueller et al., 2015), careful design of the survey and in particular the choice scenarios is crucial to obtain reliable preference estimates. LTC comes with its own set of challenges in this respect since LTC may not be salient for all respondents, and individuals may find it unpleasant to imagine a situation in which they require care. In the Netherlands a reform in 2015 increased individual and social responsibility, shifted the emphasis from residential to non-residential care, decentralized care from the national government to municipalities, and cut the total budget by 5% (Maarse and Jeurissen, 2016). Hence, we start the survey with a short description of the institutional context in place in 2018 (emphasis in original):

> *Before you answer the following questions, we first explain how long-term care*[2] *is currently organized.*
>
> *The government distinguishes between two types of long-term care:*
>
> - *People who need care day and night are entitled to long-term care in a* ***nursing home****. This concerns intense care.*
> - *People who require lighter care receive long-term care* ***at home****. That may be organized in three different ways:*
>
> 1. *People receive nursing and medical care through their* ***health insurance****.*

[2]The following definition of LTC was shown when respondents hovered the cursor over the phrase 'long-term care': "*You need long-term care if you need help with personal care, e.g., washing and getting dressed, with getting into or out of bed, with visiting the toilet, with eating a meal, or with getting up or sitting down.*"

2. *People receive domestic care and housekeeping support from the **municipality**.*
3. *People do not receive other help and social support from the government, but have to arrange this themselves, by asking **help from volunteers** in one's social circle (e.g., one's partner, family, friends, or neighbours).*

*There is a deductible for long-term care from the government. The level of that deductible depends on your financial situation. At this moment, the deductible for a single elderly who receives care from the **municipality** is around:*

- *34 euro/month at a before-tax income of 20,000 euro per year*
- *190 euro/month at a before-tax income of 40,000 euro per year*
- *500 euro/month at a before-tax income of 80,000 euro per year*

After this description of the institutional framework, the survey asks a number of questions regarding one's current need for and receipt of LTC, expectations regarding future use of LTC, and perceptions of the availability of informal care and of expenditures while in need of LTC. The survey also asks whether and how respondents take LTC into account in their financial planning and qualitative questions about one's risk and time preferences as well as bequest motive. It then presents statements about care, such as the preference for formal or informal care. It assesses wealth, housing equity for homeowners and savings for renters, and expected pension benefits at the household level. At this point the survey proceeds with an introduction to the choices that are the focus of this paper. For homeowners, the text is as follows (emphasis in original):

The next questions concern an imaginary new financial product.

Imagine you can buy a financial product that pays an additional sum on top of your pension starting from age 67, which depends on your health.

This product has the following characteristics:

- *You receive a monthly amount on top of your pension if you **do not** need long-term care.*
- *You receive a monthly amount on top of your pension if you do need long-term care. You will receive that amount for a certain period, for instance 5 or 10 years or as long as you need long-term care. Afterwards it reverts to the amount that you receive if you **do not** need long-term care.*
- *You can buy this product by paying a fixed monthly premium and/or a one-off payment out of your housing equity. You stop paying the premium when the product starts to pay out. If you use home equity to purchase*

the product you will pay a lower premium. The payment out of home equity will take place when your home is sold or at the death of the last surviving owner. You can continue to live in your home.

- *If you buy this product there is a waiting time of one year. If you need long-term care within that year the product will lapse and you will receive back all money paid.*

Other features:

- *You can spend the money freely. For instance, you could buy more or more luxurious long-term care (such as professional homecare services), but you may also spend it on taxi fares, a meal service, a gardener, or a cleaner. You are free to give the money to someone who provides informal care or spend it on hobbies or travel.*
- *An independent party assesses whether you need long-term care based on objective criteria. You need long-term care if you need help with* ***at least two*** *of the following six activities:*
  - *Personal hygiene*
  - *Dressing and undressing*
  - *Walking around a single-floor home*
  - *Using the restroom*
  - *Sitting down and getting up from a chair*
  - *Eating*
- *All monetary amounts are per person. Assume that prices in the future will be the same as now.*
- *There is no risk that the financial institution from which you buy this product will not honor its commitments or changes the conditions at a later time.*

Next, respondents receive the vignette questions. For homeowners the vignettes contain the following content:

Example:

	Product A	Product B
Annuity 1: Monthly annuity as from age 67 — if you do not need long-term care	0 euro/month	250 euro/month
Annuity 2: Monthly annuity as from age 67 — if you do need long-term care	500 euro/month	500 euro/month
Maximum duration of annuity 2 (afterwards or when you no longer need care the payments revert to annuity 1)	10 years	5 years
Monthly premium until benefits start	95 euro/month	0 euro/month
Payment from home equity	0 euro	37,205 euro

Which of these products would you choose?

Product A
Product B

Product A

- *Does not pay off as long as you do not need long-term care.*
- *If you do need long-term care you will receive 500 euros per month for a maximum duration of 10 years (or as long as you need care during this period).*
- *The premium is 95 euros per month. You stop paying this premium when you need long-term care (so that the payments start).*
- *You cannot use a lump sum from your home equity to buy this product.*

Product B

- *Pays, from age 67, 250 euros per month on top of your pension as long as you do not need long-term care.*
- *If you do need long-term care the annuity is increased to 500 euros per month on top of your pension for a maximum period of 5 years (or as long as you need care during this period). Afterwards the annuity reverts to 250 euros per month.*
- *You do not pay a premium for this product, but you do pay a one-off sum of 37,205 euros from your home equity.*

After the choice between A and B, we ask respondents for the probability that they would buy their preferred product:

> *What is the probability that you would buy product [preferred product]?*
> *Please answer on a scale from 0 to 100, where 0 means 'definitely not' and 100 means 'certainly'.*
> *... %*

According to the structure of the example above, the respondent is presented with ten choices between two life care annuities. Each choice is followed by an opt-out that asks

the percentage chance that the respondent would buy the preferred product. Thus, the data consists of ten forced choices between two life care annuities and ten opt-outs per respondent. Note that for renters, savings are mentioned instead of home equity.

The combination of premium and lump sum varies around a realistic cash value for each product based on the age brackets 40-55 and 56-66. They are actual market prices as computed by an insurance company. For example, the monthly premium for product A is 60 euros for ages 40-55 (until benefits start) and 95 euros for ages 56-66 (until benefits start). The one-off sums for product B are 30,341 and 37,205 euros respectively. Both contracts A and B are canceled if one needs LTC within 1 year after buying the product (one receives all premiums back).

In the field of health economics, it is particularly important to choose an appropriate mode of payment for the setting at hand if respondents are to take costs into account (Essers et al., 2010; Pedersen et al., 2011; Sever et al., 2019; Genie et al., 2021). The design of the stated choice experiment suits the institutions in place and presents respondents with familiar choices. In particular, most Dutch have experience with regular annuities financed by premiums, since almost all workers are covered by mandatory occupational pensions. They receive yearly updates regarding their forecasted pensions and have access to an online platform with the same information. Moreover, while basic health insurance is compulsory for all citizens, every year people have the option to switch insurers and/or purchase top-up insurance for additional services, e.g., dental care or physiotherapy. An annuity that changes depending on care needs fits that context well.

2.2 Design of the choices

Choice experiments elicit preferences locally around predetermined levels of product attributes. We worked with a large insurance company to help select relevant combinations of features and payments. As mentioned above, the levels of premiums and lump sums are based on an actuarial pricing model that was designed in close collaboration with the insurer. That pricing model uses gender-specific mortality rates for people without LTC needs taken from the population mortality table of the Royal Dutch Actuarial

Table 1: Attributes and levels used for life care annuities

Attribute	Description	Levels
Annuity 1 – non-care	Monthly annuity when NOT in need of care	0, 250, 500 euros/month
Annuity 2 – care	Monthly annuity when in need of care	0, 250, 500, 1000, 1250 euros/month
Duration	Maximum duration of annuity 2	5 yrs, 10 yrs, lifelong
Lump-sum payment	One-off payment from home equity (homeowners) or savings (renters)	0, max. 30k, max. 60k, max. 140k
Monthly premium	Premium paid until benefits start	70%, 100%, 130% of market premium

Association (Royal Dutch Actuarial Association, 2016). The onset of LTC needs ages people by three years and the probabilities for receipt of formal LTC have been estimated on administrative records from Statistics Netherlands (Van der Vaart et al., 2024). Prices take into account an initial fixed cost of 200 euro and a monthly cost of 30 euro. We calculate market-consistent combinations of premiums and lumps sums for the reference ages of 50 (shown to respondents aged 40-55) and 60 (ages 56-66). The alternatives presented to respondents set payments equal to their market values, or 30% lower or higher.

Table 1 lists the attribute levels of the life care annuities included in the survey. The non-care annuity takes values 0, 250, or 500 euro per month and the LTC annuity varies between 0 and 1250 euro per month. The care annuity may be higher, the same, or lower than the non-care annuity.

The dependence between premiums, lump sums, annuities, and durations complicates the design of the choice scenarios. Optimal design chooses combinations of attribute values to minimize standard errors for a given choice model, e.g., a mixed logit, at given values of the parameters (Bliemer and Rose, 2009). We use the software package NGene to generate optimal choices for each of the two age brackets. Premiums and lump sums are constrained such that they vary around actuarially fair combinations given age of the respondent and features of the products. Since no suitable preference estimates existed at the time the experiment was designed, we employ a Bayesian optimal design that allows

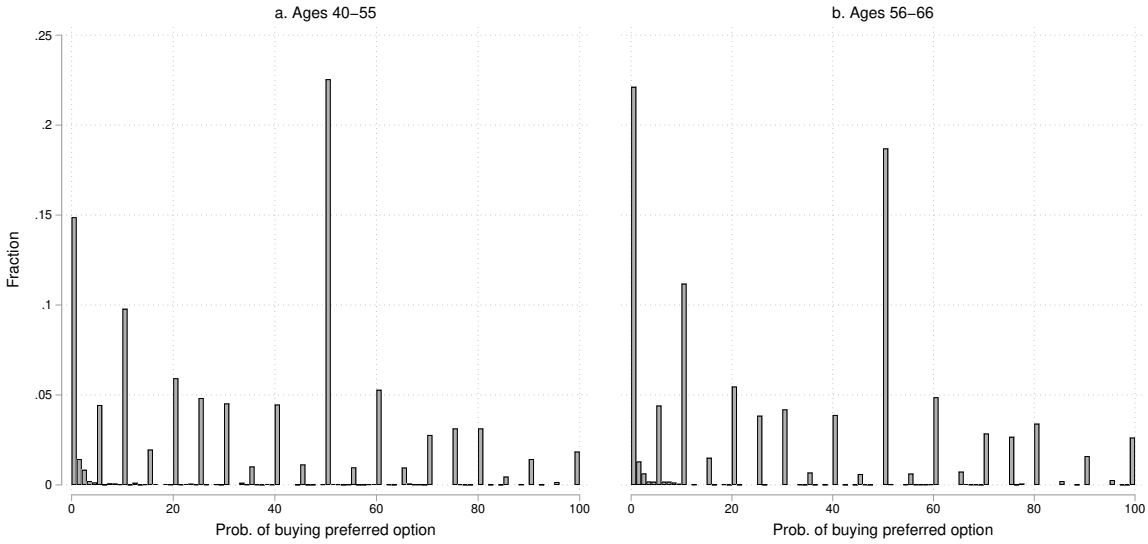


Figure 1: Histograms of reported probabilities of purchasing one's preferred life care annuity (bin width: 1 percentage point)

for uncertainty in the parameters of the mixed logit that is used to generate optimal choice scenarios. The priors in both health states assume that individuals prefer higher annuities compared to lower annuities, and that they prefer a longer duration of the LTC annuity only if it exceeds the non-LTC annuity. Furthermore, they prefer to pay lower premiums and lump sums.

2.3 Model

Our model is an adaptation of the Mixed Logit modified to accommodate both discrete choices, i.e., between two life care annuities, and probabilistic opt-outs. The starting point is that individuals may not be certain what they would choose in real life when answering the vignette questions. Such uncertainty may reflect incomplete knowledge of one's preferences or ambiguity in the description of the choice situation or of the alternatives (Manski et al., 2000). This uncertainty on the side of a decision maker has been called *resolvable uncertainty* to emphasize that it is a complication of hypothetical rather than actual choice (Pedersen et al., 2020). While such uncertainty is ruled out by standard Logit models, Figure 1 shows substantial doubt in the probabilistic opt-outs with no more than a quarter of probabilities equal to zero or one hundred percent. Moreover,

the data are bunched at zero, fifty, and other multiples of ten percentage points. The model thus incorporates resolvable uncertainty for survey respondents and allows for rounding of reported probabilities.

The utility respondent i derives from alternative j in choice t is given by

$$U_{itj} = v_{itj} + \varepsilon_{itj} \tag{1}$$

v_{itj} is a function of the attributes of j, known to the respondent, and ε_{itj} is resolvable uncertainty that is not known to the respondent. We model v_{itj} as linear in the attributes and allow for individual-level variation in preferences:

$$\begin{aligned} v_{itj} &= -\alpha_i \left(-p_{itj} + \mathbf{x}'_{itj}\boldsymbol{\gamma}_i\right) \\ \begin{bmatrix} \ln\left(-\alpha_i\right) \\ \boldsymbol{\gamma}_i \end{bmatrix} &\sim \mathcal{N}\left(\begin{bmatrix} \mu_\alpha \\ \boldsymbol{\mu}_\gamma \end{bmatrix}, \boldsymbol{\Sigma}_{\alpha,\gamma}\right) \end{aligned} \tag{2}$$

where p_{itj} denotes the monthly premium for life care annuity j and the vector $\mathbf{x}$ collects the other attributes (both price and attributes are set to zero for the outside option). The preferences for attributes $\boldsymbol{\gamma}_i$ are expressed as Willingness To Pay (WTP) in terms of the monthly premium in order to facilitate interpretation and the log-normal specification for negative price sensitivity $-\alpha_i$ ensures that individuals prefer lower premiums.

Resolvable uncertainty ε_{itj} is IID across individuals, choices, and alternatives and follows a type 1 extreme value distribution. Hence, in a choice between alternatives A and B the probability that A gives the higher utility is equal to

$$Q_{itA} \equiv \Pr\left(U_{itA} > U_{itB}\right) = \frac{\exp\left(v_{itA}\right)}{\exp\left(v_{itA}\right) + \exp\left(v_{itB}\right)} \times 100\% \tag{3}$$

Responses are driven by the true probability Q_{itA} perturbed by recall error η_{it}:

$$Q^*_{itA} = Q_{itA} + \eta_{it}; \qquad \eta_{it} \sim \mathcal{N}\left(0, \sigma^2_{\eta,t}\right) \tag{4}$$

Recall errors are independent across individuals and choice scenarios. While unobserved

heterogeneity in preferences allows for rich variation in responses between individuals, recall errors capture reporting noise across different choice scenarios of the same individual. The variance of the recall error depends on choice scenario t because it may differ between deterministic and probabilistic questions.

The way the latent probabilities Q^*_{itA} translate into reported decisions varies between the two types of questions. In the deterministic choices between two products the respondent chooses product A if the latent probability Q^*_{itA} is at least 50 percent:

$$P_{it}\left(\text{choose } A\right) = \begin{cases} 100 & \text{if } Q^*_{itA} \geq 50\% \\ 0 & \text{if } Q^*_{itA} < 50\% \end{cases} \tag{5}$$

The probabilistic opt-outs allow respondents to report Q^*_{itA} rounded to the nearest integer (in combination with censoring at zero and one hundred percent). However, the bunching at multiples of 10 %-points in the histograms in Figure 1 indicates that the vast majority of respondents round more coarsely. Following De Bresser and Van Soest (2013) and Kleinjans and Van Soest (2014), we model rounding as an ordered Probit in which responses are rounded to multiples of 1, 5, 10, 25, or 50 %-points. Let these five levels of rounding be indexed by $r = 1, ..., 5$. Rounding is governed by:

$$\begin{aligned} &r_{it} = r \iff \tau_{r-1} < r^*_{it} \leq \tau_r; \quad \tau_0 = -\infty, \tau_5 = \infty \\ &r^*_{it} = \zeta_i + \rho_{it}; \quad \rho_{it} \sim \mathcal{N}\left(0, 1\right) \end{aligned} \tag{6}$$

Individual effects ζ_i are jointly normal with preferences and allow rounding to be persistent across probabilities reported by a given individual. Idiosyncratic rounding shocks ρ_{it} are independent across individuals and choices. For a given level of rounding r the reported probability to opt in, i.e., choose A in probabilistic opt-out t, is

$$P_{it}\left(\text{choose } A\right) = \text{round}\left(Q^*_{itA}, r_{it}\right) \tag{7}$$

where $\text{round}\left(Q^*_{itA}, r_{it}\right)$ is the latent probability Q^*_{itA} rounded according to the index r_{it} (e.g., $\text{round}\left(31.5, 3\right) = 30$: the latent prob. 31.5 rounded to 10 %-points gives a reported

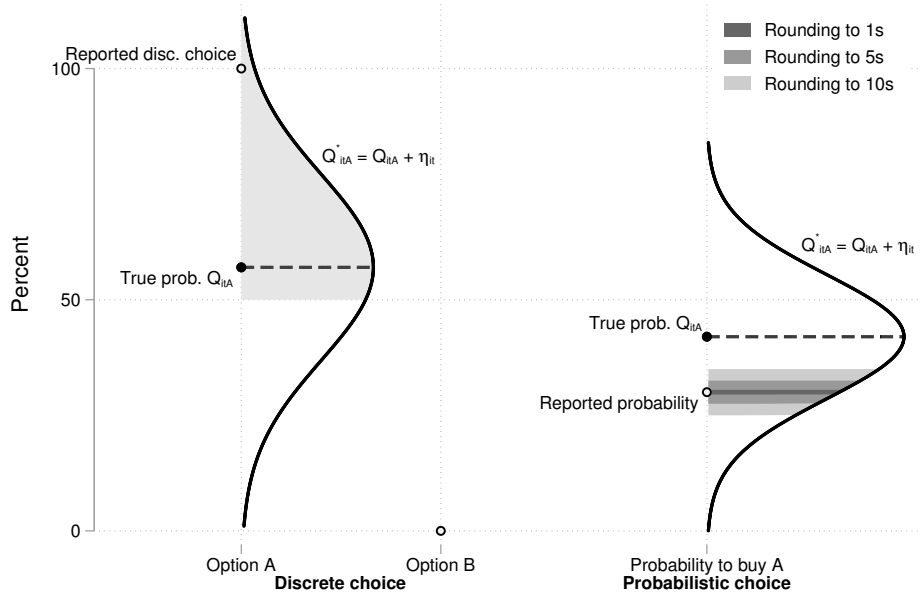


Figure 2: Illustration of the model (shaded areas are likelihood contributions)

probability of 30%).

Figure 2 illustrates the model. The leftmost part of the figure shows a deterministic choice between products A and B for which the reported choice is A (i.e., P_{it} (choose A) = 100%). This implies that the latent probability Q^*_{itA} is at least 50%. The normal distribution around true probability Q_{itA} reflects the recall error η_{it} and leads to a likelihood contribution of

$$\Pr\left(P_{it}\left(\text{choose } A\right) = 100\%\right) = \Pr\left(Q^*_{itA} \geq 50\%\right) = \Phi\left(\frac{Q_{itA} - 50}{\sigma_{\eta,t}}\right) \tag{8}$$

where $\Phi\left(\cdot\right)$ is the CDF of the standard normal distribution. This likelihood contribution is represented by the shaded area in the figure.

The rightmost part of Figure 2 visualizes the subsequent choice between option A and no purchase, for which the utility is normalized to zero. The reported probability of buying A is 30%, which is consistent with rounding to multiples of 1, 5, or 10 %-points. Each level of rounding implies different bounds for the latent probability. For 30% the bounds are $(29.5; 30.5)$, $(27.5; 32.5)$ and $(25; 35)$ respectively. Figure 2 shows the probabilities that Q^*_{itj} falls in these intervals as shaded areas under the distribution of the recall error. The likelihood contribution averages the probability that Q^*_{itj} falls in each interval $(LB_r; UB_r)$

across the relevant rounding levels r:

$$\begin{aligned}\Pr\left(P_{it}\left(\text{choose } A\right)=30\%\right) &= \sum_{r\in\{1,2,3\}} \Pr\left(r_{it}=r\right)\times\Pr\left(LB_r<Q^*_{itA}\leq UB_r\right)\\ &= \sum_{r\in\{1,2,3\}} \left(\Phi\left(\tau_r-\zeta_i\right)-\Phi\left(\tau_{r-1}-\zeta_i\right)\right) \\ &\quad\times\left(\Phi\left(\frac{UB_r-Q_{itA}}{\sigma_{\eta,t}}\right)-\Phi\left(\frac{LB_r-Q_{itA}}{\sigma_{\eta,t}}\right)\right)\end{aligned} \tag{9}$$

The bounds are indexed by r to denote their dependence on the level of rounding. Reported probabilities equal to zero or one hundred are censored so only one bound is relevant.

Equations 8 and 9 show that conditional on unobserved heterogeneity the likelihood combines probabilities from normal distributions and is thus easy to compute. The model is estimated by Maximum Simulated Likelihood where we integrate numerically across the distribution of preferences and the rounding effect.

3 Data

3.1 Survey and sample

Data were collected in the LISS panel (Longitudinal Internet Studies for the Social sciences) in August 2018. The LISS panel is an internet panel representative for the non-institutionalized population that is administrated by Centerdata at Tilburg University.[3] The response rate was 82%, of which 94% completed the questionnaire. The sample size for the stated choice experiment is 1642 respondents: 799 for ages 40-55 and 843 for ages 56-66.

3.2 Descriptive statistics

Appendix B reports descriptive statistics for demographic variables, income, wealth, expectations and preferences. About half of the sample is female and almost three quarters live with a partner. Two-thirds are married, and the combined rate of widowhood

[3]More information, including data and codebooks, can be found at `https://www.lissdata.nl`.

and divorce is much higher in the 56-66 age group (21%) than in the 40-55 age group (13%). The opposite applies to never having been married. The 40-55 age group is more highly educated than the 56-66 year olds with a smaller fraction in the lowest education category, 18% compared to 28%, and a larger fraction in the middle group, 42% compared to 33%. Most 40-55 year-olds list employment as their most important activity (71%), while salaried work is less common in the older sample (44%) and retirement is much more prevalent (15%).

Both samples have similar average after-tax personal incomes (around 1700-1800 euros per month) and household incomes (3200-3500 euros per month). Importantly for the relevance of the option to pay for insurance policies by means of a reverse mortgage, just over three quarters of both samples own their home. The average house value is around 300k euros for both the younger and older age group. Given the average current mortgages of 204k and 107k, many homeowner hold substantial wealth in their home at the time of the survey. Both samples expect to have a remaining mortgage debt around 90k euros on average when they retire. This affluence of homeowners stands in stark contrast to renters, who report average financial wealth of 17k and 26k at the time of the survey. While reverse mortgages may thus enable a substantial share of homeowners to purchase even an expensive life care annuity, the lump sum payment will matter less for renters.

Table B3 presents descriptives for relevant expectations regarding LTC. We use subjective probabilities for LTC utilization and survival to construct piecewise linear distributions for each respondent and summarize those distributions by their expected value and standard deviation. On average respondents expect to use LTC for 2.5-2.9 years. There is substantial variation in the expected values with a cross-sectional standard deviation of 2.2 years in both samples. Average uncertainty as captured by the standard deviations is 2.7-3.0 years and uncertainty itself varies between respondents with a standard deviation around 1.5 years. As for longevity, on average, respondents expect to live to age 81-83, but their expectations reflect large uncertainty since the average standard deviations are 10-13 years. The expected values of LTC use and longevity are negatively correlated: average expected LTC use is around 3 years for those who expect to die before age 75 and

less than 2.5 years for those who expect to live to age 90 (Figure B1a.). While previous work has shown this negative correlation in objective risks (Warshawsky et al., 2002; Van der Vaart et al., 2024), the fact that it also occurs in subjective expectations corroborates the potential for bundling of annuities and LTC income protection to overcome adverse selection. Subjective uncertainty is positively correlated across the two variables.

While half of the 40-55 age group expect informal care to be available, only 29% expect so in the older age group and 41% expect the opposite. Financial planning is more prevalent in the older group with 46% having a plan compared to 34% in the younger group. Both groups overwhelmingly expect medical expenditures to increase at the onset of ADL limitations yet are split evenly on the development of non-medical expenditures.

Previous work shows that contextual factors, such as trust in financial institutions, are important drivers for life (care) annuities. For example, high perceived risk of default for financial institutions may suppress demand (Ameriks et al., 2016), and aversion to public nursing homes may stimulate it (Ameriks et al., 2011). In our representative sample, we find that trust in financial institutions is high, with only 10% expressing low confidence that financial institutions will meet their obligations. Such confidence is supported by the robustness of the sector in which re-insurance is common and defaults exceedingly rare. 60% of the respondents expect government funding for LTC to decline over the next ten years and only 20% expect the opposite. Public care aversion is not prevalent with 70% giving answers around the middle of the scale. Financial independence in the event of LTC is important to the Dutch: almost 90% find it important and 45% agree to the fullest extent (more information can be found in Figure B2).

3.3 Probabilistic opt-outs and data quality

The choice scenarios consist of ten forced choices between two life care annuities, each of which is followed by a probabilistic opt-out eliciting the probability that the respondent would purchase the preferred alternative. Figure 1 presents descriptive statistics of the reported probabilities. The average probability is about 33% (with a standard deviation of about 28 %-points). 15-22% of the reported probabilities are equal to zero, and Table 2

Table 2: Descriptive statistics of the probability to purchase one's preferred alternative

	a. Age 40-55		**b. Age 56-66**	
	Mean	(Std. dev.)	Mean	(Std. dev.)
Fraction of respondents who...				
...only report zeros	0.09	(0.29)	0.15	(0.36)
...only report 50s	0.10	(0.30)	0.09	(0.29)
...only report 100s	0.01	(0.07)	0.01	(0.10)
N (individuals)	799		843	

shows that 9-15% of the respondents only report zeros. Previous work on subjective probabilities has paid particular attention to bunching at fifty percent since that may indicate a lack of understanding, i.e., epistemic uncertainty, rather than experienced uncertainty (Fischhoff and Bruine de Bruin, 1999; Bruine de Bruin et al., 2000). Fifties account for around 20% of the reported probabilities. Only 10% of the respondents report fifties for all ten opt-outs. So, if epistemic uncertainty is constant across probabilities reported by a given respondent it does not appear to be a large concern for these data. Hence, we do not model epistemic uncertainty and interpret all bunching as driven by rounding of underlying subjective probabilities.

While we formulate a model to analyze a combination of discrete and probabilistic choices, another option could be to discretize the probabilities and estimate a Mixed Logit model. In addition to the loss of information such discretization entails it would also have to specify a cutoff for reported probabilities below which someone is assumed to opt out. Fifty percent would seem a logical choice, but the fact that around 20% of probabilities are exact fifties means model estimates are sensitive to how one categorizes these responses. Our model utilizes all information in the data and avoids the arbitrary but consequential assignment of fifties.

Appendix C assesses data quality by means of response times. We find clear evidence that sequences that consist only of zeros take shorter than those with fewer zeros. However, the median duration of sequences that contain only fifties is comparable to that of sequences with no fifties at all. The timestamps thus support the notion that these probabilities express genuine uncertainty about choices and are not mere reporting anomalies. Self

evaluations at the end of the survey show that three quarters of respondents found the questionnaire clear. About half found the survey difficult, and around 70% enjoyed participating.

4 Results

This section proceeds in two steps. Section 4.1 presents the estimates for the Mixed Logit model with resolvable uncertainty (explained in Section 2.3). Next, Section 4.2 analyzes associations of preferences with predictors such as expectations regarding care use and the availability of informal care. In Section 5 we analyze demand for life care annuities and how this is affected by different payment modes and budget constraints.

4.1 Estimation results

Table 3 presents the estimates for the Mixed Logit model with resolvable uncertainty for the sample of 40-55 year-olds. Panels a. and b. describe the mixing distribution of preferences, expressed in WTP space, while panel c. contains the estimates relating to recall errors and to rounding. The signs of the mean WTPs for the different attributes in panel 3a. are in line with intuition. On average, people are willing to pay a monthly premium of 36 euros for a non-care annuity of 100 euros per month and the mean WTP for a 100 euro care annuity is 15 euros per month. As a reference, in the vignettes an additional 100 euro non-care annuity is associated with an increase in premium of 60 euros/month and a 100 euro extra care annuity raises the premium by 15 euros, keeping the other attributes constant. On this metric a person with preferences at the means would want to purchase the care annuity but not the non-care annuity. However, the standard deviations (showing preference heterogeneity) are large at 55 and 25 euros/month for non-care and care annuities, respectively, and preferences thus vary widely. Based on this distribution of tastes, around 33% of the population of 40-55 year-olds would prefer to purchase the non-care annuity, and 51% would purchase the care annuity.

On average people place a high value on longer durations of care annuities: the mean

Table 3: Mixed logit model with resolvable uncertainty for ages 40-55

a. Preferences in WTP space

	Preferences[a]				Market premiums[d]	
	Mean		Standard deviation		Premium	Frac. WTP ≥ premium
Log-sensitivity to negative premium	-5.833	(0.0526)	1.232	(0.0467)		
Non-care annuity (100s €/month)	35.572	(2.865)	55.159	(3.141)	59.63	0.33
Care annuity (100s €/month)	14.847	(1.001)	24.518	(1.448)	14.52	0.51
Duration care annuity (baseline: 5 yrs)						
Duration: 10 yrs	38.817	(10.956)	148.593	(11.186)	21.26	0.55
Duration: lifelong	145.607	(10.727)	162.696	(11.004)	34.65	0.75
Lump sum (1000s €)	-4.950	(0.301)	4.390	(0.222)	-6.81	0.66
ASC 1st option in forced choice[b]	13.815	(5.779)	–			
Interaction 1st option × opt out[c]	-181.121	(9.596)	–			

b. Correlation matrix for preferences and rounding

	Log-premium sensitivity	Non-care annuity	Care annuity	Duration: 10 yrs	Duration: lifelong	Lump sum	Rounding
Log-sensitivity to negative premium	1						
Non-care annuity	-0.55***	1					
Care annuity	-0.51***	0.96***	1				
Duration: 10 yrs	-0.11*	0.47***	0.68***	1			
Duration: lifelong	-0.34***	0.62***	0.80***	0.97***	1		
Lump sum	-0.11	-0.38***	-0.26***	0.00	-0.03	1	
Rounding	-0.29***	-0.04*	0.08***	0.17***	0.20***	0.10**	1

c. Reporting behavior

Log standard deviation recall error			Rounding model		
Forced, deterministic, choices	3.810	(0.0283)	τ_1	-7.951	(0.320)
Probabilistic opt outs	2.577	(0.00532)	τ_2	-2.320	(0.157)
			τ_3	2.202	(0.155)
			τ_4	3.850	(0.169)
			Std. dev. ind. effect	5.0571	(0.225)
Individuals	799				
Log-likelihood[e]	-22,029.56				

[a] The preference for negative premiums follows a log-normal distribution, log-premium sensitivity and the other preferences follow a multivariate normal distribution.

[b] Alternative-Specific Constant (ASC): indicator for the first, left-most, alternative in a discrete, forced, choice scenario.

[c] Interaction of first alternative (opt in) with indicator for probabilistic opt out.

[d] Market premiums used in vignettes refer to age 50 and are obtained as slopes in the OLS regressions:
$premium = \beta_0 + \beta_1 non\text{-}careann + \beta_2 careann + \beta_3 \mathbb{I}\{\text{duration: 10 yrs}\} + \beta_4 \mathbb{I}\{\text{duration: life long}\} + \beta_5 lumpsum + \varepsilon$

[e] Likelihood simulated using 1000 Halton draws.

The data consist of 10 forced, discrete, choices between two life care annuities and 10 corresponding probabilistic choices between the preferred alternative and an opt out for each respondent.

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10

WTPs to increase the duration from five years to ten years or life long are 39 and 146 euros/month. The corresponding increases in actuarial premiums are much lower at 21 and 35 euros per month, respectively. There is large heterogeneity in preferences for durations as reflected in standard deviations of 149 euros/month for ten years and 163 euros/month for a life long care annuity. These estimates imply that 55% would want to pay for the upgrade to ten rather than five years of care annuity and 75% would opt for the life long version.

One unique feature of the stated choice experiment is the inclusion of two different ways to pay for the insurance policies: by monthly premiums or by a lump sum from home equity (homeowners) or from savings (renters). On average people are willing to pay a lump sum of 1000 euro in exchange for a premium reduction of 5 euros/month. The tradeoff that would be offered by the insurance company is more favorable, with the premium being reduced by 7 euros. At 4 euros/month the standard deviation of WTPs for the lump sum is smaller than its mean, in contrast to the levels and durations of annuities. According to this mixing distribution, 66% would be willing to trade off lower premiums for a lump sum.

The estimates in panel 3a. that govern the distribution of sensitivities to monthly premiums are precise and follow the general pattern of substantial preference heterogeneity. Finally, the model also includes two non-random alternative-specific constants for the first, leftmost, alternative in a forced choice and for opting in according to the probabilistic opt outs. These parameters are not intended to capture preferences, but instead are commonly included in the analysis of choice experiments to filter out response biases. For instance, the left-right reading direction in the Dutch language may predispose respondents to the first alternative regardless of the attributes of that option (Ryan et al., 2018). Indeed, the estimates indicate that respondents attach a higher value to the first alternative in a forced choice. Furthermore, they attach a substantially lower value to opting in than would be consistent with their forced choices.

While panel a. focuses on one attribute at a time, panel b. of Table 3 contains the estimated correlations between preferences for the different attributes. Correlations

between similar features are high: the correlation between tastes for the care and non-care annuities is 0.96, and that between both extensions of the care annuity is 0.97. A high WTP for the care annuity is associated with a stronger preference for long durations, with correlations of 0.68 and 0.80. The preference for the non-care annuity is also significantly, but less strongly, correlated with duration (0.47 and 0.62). Having a high WTP for either annuity is associated with a larger required reduction in monthly premiums in order to accept a lump sum, but correlations are weak at -0.38 and -0.26. Rounding behavior correlates significantly yet weakly with preferences for most attributes: correlations range from -0.29 for price sensitivity to 0.20 for the life long duration.

Panel c. presents estimates that relate to reporting behavior. The standard deviation of recall errors is larger for the forced choices than for the opt outs, which indicates that inconsistencies between the decisions of a given respondent are more common among the former. As for rounding, at 5.06 the standard deviation of the individual effect is much larger than that of the idiosyncratic error which is normalized to one. Hence, the rounding effect generates substantial persistence. The thresholds are well-separated relative to estimation uncertainty: they are all at least 10 standard errors apart. The rounding probabilities in Table D2 of Appendix D translate these thresholds into probabilities for the different extents of rounding. Rounding to multiples of 10 is dominant: it accounts for around 95% of probabilities.

Appendix D also presents estimation results for the age group 56-66. While the mean WTPs for both types of annuities are close to zero and not significant, the variation is even larger than for the age group 40-55. The standard deviations for the non-care and care annuities are 137 and 49 euros/month, respectively, and the mixing distribution implies that WTP exceeds the market premiums for 15% and 22% of the population. These fractions are less than half as large as for the younger age group, which reflects both the lower mean WTPs and the higher premiums charged in the older group. The same pattern of lower mean WTPs and much higher standard deviations among the 56-66 year-olds is obtained for longer durations, resulting in 39% willing to pay for a ten-year care annuity and 52% for a life long annuity. Regarding the lump sum, the mean willingness to accept

a single payment in lieu of the monthly premium is similar to the younger sample and 83% would want to make that trade at the market rate.

Comparing the two age-based samples, the overall pattern emerges that lower mean WTPs and more heterogeneity combined with higher premiums result in substantially lower demand for annuities in the older age group. However, so far the actuarial fair premium corresponds to a single overall average per broad age bracket, which neither reflects a particular combination of attributes nor the exact age of the prospective buyer. Moreover, the mixing distribution is a poor approximation of the situation faced by any one individual buyer both in terms of preferences and of the budget constraint. Therefore, the analysis of market demand below looks at fully specified products and uses the 20 decisions reported by a respondent to construct individual-specific proxies for preferences. It also leverages survey data on income and wealth to impose budget constraints and evaluate whether preferred purchases of insurance would be feasible.

Appendix E studies the fit of the model. For both types of choices (forced choices and opt outs) the model fit is satisfactory. The overall fit is better for the opt outs, with R-squares around 0.80, than for the forced choices, with R-squares around 0.15.

4.2 Variation in preferences

Before analyzing demand and the accessibility of (combined) retirement finance products, we examine variation in individual-specific estimates of WTP. Appendix I presents estimates from linear regressions of WTP on demographics, expectations, and preferences. Two predictors stand out among demographics: in the younger age bracket women value the products lower than men and disabled people in the older bracket value the life-care annuities more highly than those without disabilities. Young women have a lower WTP for both annuities, 5-10 euros/month lower than men, and are also less willing to pay a higher premium for longer durations of the care annuities (their WTPs are around 35 euros/month lower on average). Note that these differences control for expected care use and survival, both of which should make the products more attractive to women who live longer and utilize more LTC. Even conditional on those variables, disabled people in the

older group are willing to pay substantially more for higher (15-42 euros/month) or longer (60-68 euros/month) annuities. Their experience may give people with work-limiting disabilities a different appreciation of the practical use of life care annuities.

Expectations regarding LTC use matter for the older age group: an extra year of expected care is associated with a 5.5 and 2.6 eu/month increase in the WTP for the non-care and the care annuities respectively. Such additional year of utilization also predicts a 13 eu/month higher WTP for longer durations of the care annuity. Subjective risk as captured by the standard deviations of the distributions of future care utilization does not predict WTPs, but more subjective risk is associated with lower sensitivity to price. While expected LTC use does not enter the models for the younger sample significantly, subjective survival does with longer longevity predicting higher WTPs for both annuities.

While most associations discussed above are in line with sound financial planning, e.g., higher expected use predicts a stronger interest in protective products, a more puzzling association arises between the expected availability of informal care and individual preferences. Relative to those who expect informal care to be available, those who think it will not be available have a lower WTP for both annuities and for the longer durations in both age-based subsamples. Those respondents also have a higher sensitivity to price. These associations are in line with Wu et al. (2022) and illustrate the complementarity between life care annuities and informal care. However, this pattern emerges only among those who indicate they do not have a plan on how to deal with the costs of LTC, be that through saving, housing wealth, or pension income. This group is at a high risk of requiring formal care, yet they do not have a plan in place and express lower interest in a type of product that may help them.

As for preferences, those who value money more highly in good health than in bad health, as indicated by allocation of a larger share of a hypothetical sum to good-health states of the world, have lower WTPs for both annuities and for longer durations of the care annuity, indicating the relevance of health-state depended on retirement finance products (Koijen et al., 2016; Ameriks et al., 2020).

5 Demand for life care annuities

5.1 Main analysis

This section combines individual-specific preference estimates with market prices to evaluate demand for life care annuities. We simulate the demand for different products that vary in terms of the levels of both annuities and the duration of the care annuity, as well as the combination of premium and lump sum used as funding source. As a first step we select nine example products that cover the range of cash values of the products included in the survey, since those values provide a meaningful metric on which to compare the multidimensional bundles of attributes. Premiums, lump sums, and cash values depend on the age of purchase but not on the gender of the buyer because gender-based differentiation is forbidden by EU regulation (Barr, 2010; Chen et al., 2022). In line with the US market, payments do not condition on risk factors such as pre-existing conditions (Boyer et al., 2020).

Figure 3 shows that cash values and corresponding monthly premiums increase with the age of purchase, as older ages leave less time for returns on payments to accumulate and increase the likelihood that a buyer will live to collect annuities. These products fall in three groups with cash values of 10-20k, 30-40k, and 50-60k at age 40. Each group shares a level of the non-care annuity: 0, 250, or 500 euro per month. Within the groups the care annuity varies between 250 and 1250 euro and higher annuities are combined with shorter durations.

Premiums in Figure 3a. are calculated for a lump sum equal to zero. They are fairly high relative to monthly after-tax incomes: premiums for care-only annuities start around 50 euros/month, 2% of average personal income, at age 40 and increase to around 200 euros/month or 9% of average income at age 66. Annuities that also pay out when one does not need care start at around 200-300 euros/month, 8-12% of average income, and quickly become unaffordable when purchased at later ages, crossing 1000 euros/month around age 60. The large gap in premiums between products that only pay a care annuity and those that also contain a regular annuity partly reflects the different periods over which

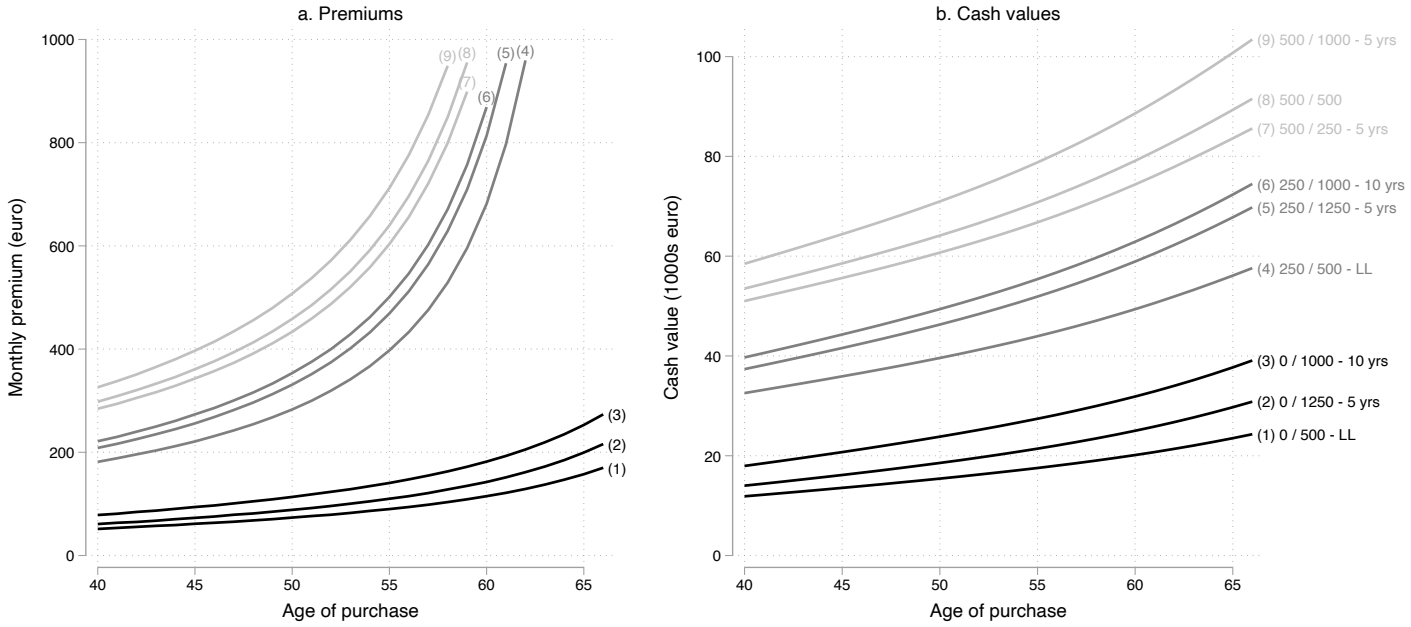


Figure 3: Actuarially fair premiums and cash values of different life care annuities as a function of the age at which products are purchased. Premiums remain constant as from the age of purchase and should be paid until the benefits start. The characteristics of the products (1) to (9) are explained in graph b on the right (noncare annuity / care annuity - duration of care annuity).

premiums are paid. Since products do not allow simultaneous premiums and payouts, all products that include a non-care annuity impose that premium payments stop at age 67. Care-only annuities, on the other hand, specify premiums to be paid until ADL limitations occur, with an upper limit at age 100. Hence, while the premium for a care-only annuity of 500 euros/month, product (1) in Figure 3, is based on payments across many years even when purchased at age 66, at that age the regular annuity of 500 euros per month, product (8), has to be funded with only 12 monthly premiums.

Cash values too are high relative to the financial wealth of renters, for which the 75th percentiles are 7.5k euros for ages 40-55 and 24k euros for ages 56-66. This already indicates that affordability through the lump sum is an issue for these individuals. However, homeowners do appear in a good position to afford the one-off payment, since the 25th percentile of home values is 200k euros and both age groups expect a value net of mortgage of more than 100k around the time of retirement (the statutory retirement age is between 67 and 70 for the birth cohorts included in the sample).

We simulate demand for these products $j = 1, ..., 9$ as the fraction of 40-66-year-olds that would choose the product over the outside option for which all attributes are set to zero. This is analogous to the way probabilistic opt-outs are modeled in the data. Demand is the cross-sectional average probability of choosing j:

$$D_j\left(p_j\right) = \bar{\check{Q}}_j\left(p_j\right) = \frac{1}{\sum_{w_i}} \sum_{i=1}^{n} w_i Q\left(p_j | \mathbf{x}_j, \check{\alpha}_i, \check{\boldsymbol{\gamma}}_i\right) \tag{10}$$

where the price p_j, consisting of premiums and/or lump sums, varies between 70% and 130% of its age-specific market value. w_i are weights based on the population distributions of age in years; gross personal income, gender, living with a partner, and homeownership for the two age groups 40-55 and 56-66; and assets, savings or housing, for four age/homeownership groups. More information on these weights is provided in Appendix G.

While respondents may take their budget into account when stating their choices, the survey does not impose restrictions when eliciting preferences. Indeed, the kernel regressions of preferences on income and wealth reported in Appendix F do not show strong

associations between WTPs and financial resources for most of the sample. Therefore, we juxtapose the unconstrained demand $D_j(p_j)$ with constrained demand $D_j^c(p_j)$ that sets simulated probabilities of purchase to zero if the premium exceeds a fraction ξ_1 of net personal income or the lump sum (LS) exceeds a fraction ξ_2 of assets:

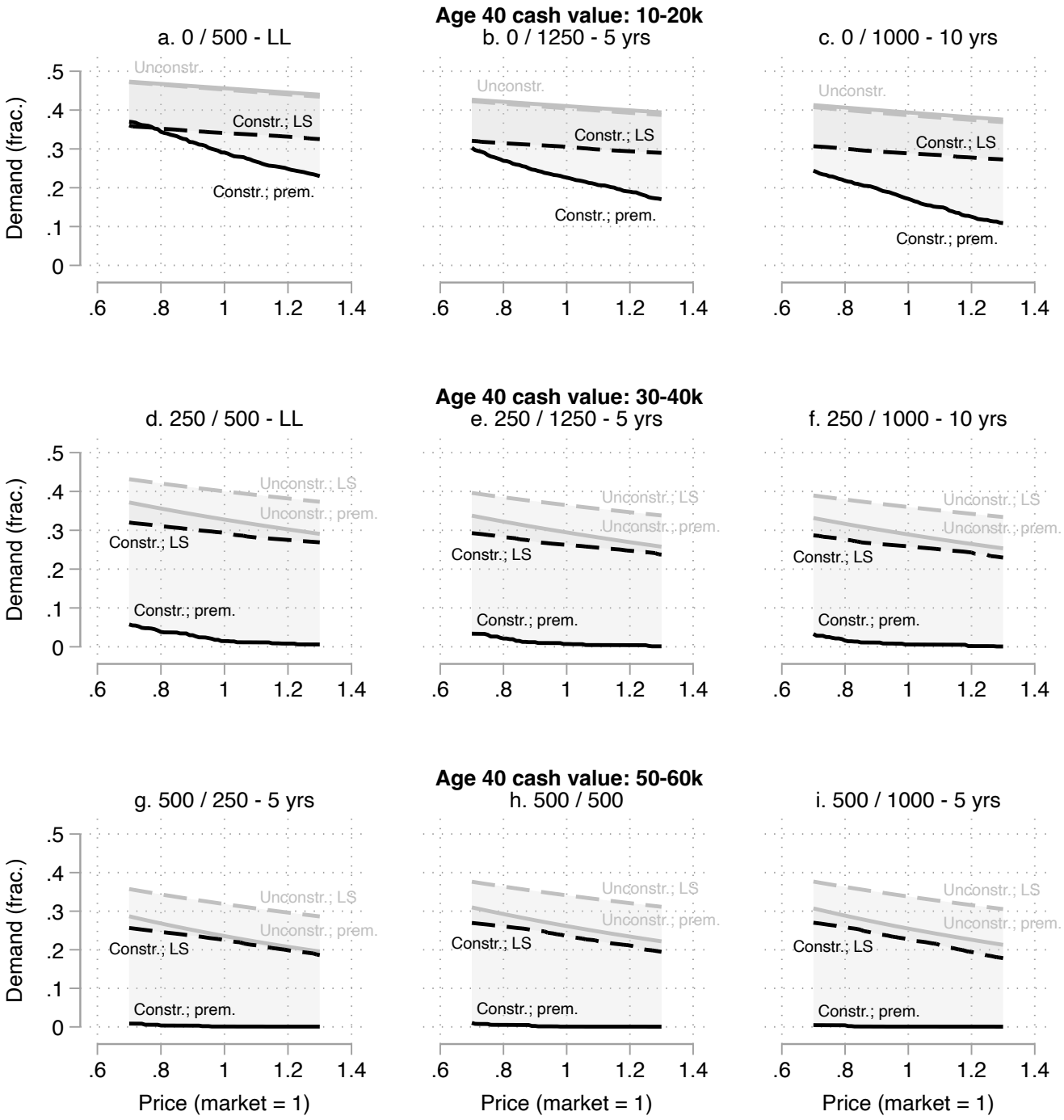
$$D_j^c(p_j) = \bar{\breve{Q}}_j^c(p_j) = \frac{1}{\sum_{w_i}} \sum_{i=1}^{n} w_i \mathbb{I}\left\{\text{prem.}_j \leq \xi_1 y_i \wedge \text{LS}_j \leq \xi_2 a_i\right\} Q\left(p_j | \mathbf{x}_j, \breve{\alpha}_i, \breve{\boldsymbol{\gamma}}_i\right) \tag{11}$$

where $\mathbb{I}\{\cdot\}$ is an indicator equal to one if its argument is true and zero otherwise, y_i is after-tax personal income, and a_i the value of financial assets for renters and the value of one's house for homeowners. We set the budget constraint to 5% of net personal income and 50% of assets in the benchmark and assess the sensitivity of demand to the choice of ξ_1 and ξ_2.

Figure 4 contains both unconstrained and constrained demand for the nine life care annuities. Each product is either paid fully by a premium or by a lump sum: the figure does not include combinations of the two payment methods. Looking first at unconstrained demand, the grey lines in the figure, around 40-45% of 40 to 66-year-olds would prefer to buy the care-only annuities at market prices (panels a.-c. in Figure 4). This demand is similar regardless of whether payment takes the form of a premium or a lump sum. Moreover, preferences are not sensitive to price since demand declines by less than 5 %-points when prices increase from 70% to 130% of the market rate.

Restricting demand based on 5% of net personal income or 50% of assets changes the picture markedly. If annuities are paid for by a lump sum, demand drops to 30-35% and price sensitivity remains similar to that for unconstrained demand. If premiums are used instead around 17-30% is willing and able to buy the care annuity at market prices. Furthermore, premium-constrained demand is more sensitive to the level of premiums than are unconstrained demand: it declines by 12 %-points as premiums vary around the market rate.

The other panels in Figure 4 show larger differences in unconstrained demand between payment methods: demand for more expensive products is around 8 %-points higher for the lump sum compared to the premium. This reflects the fact that most respondents



Products: [non-care annuity (eu/month)] / [care annuity (eu/month)] - [duration care annuity (LL = LifeLong)]

Figure 4: Constrained and unconstrained demand for different life care annuities (constrained demand imposes a budget constraint of 5% of after-tax income or 50% of the value of assets)

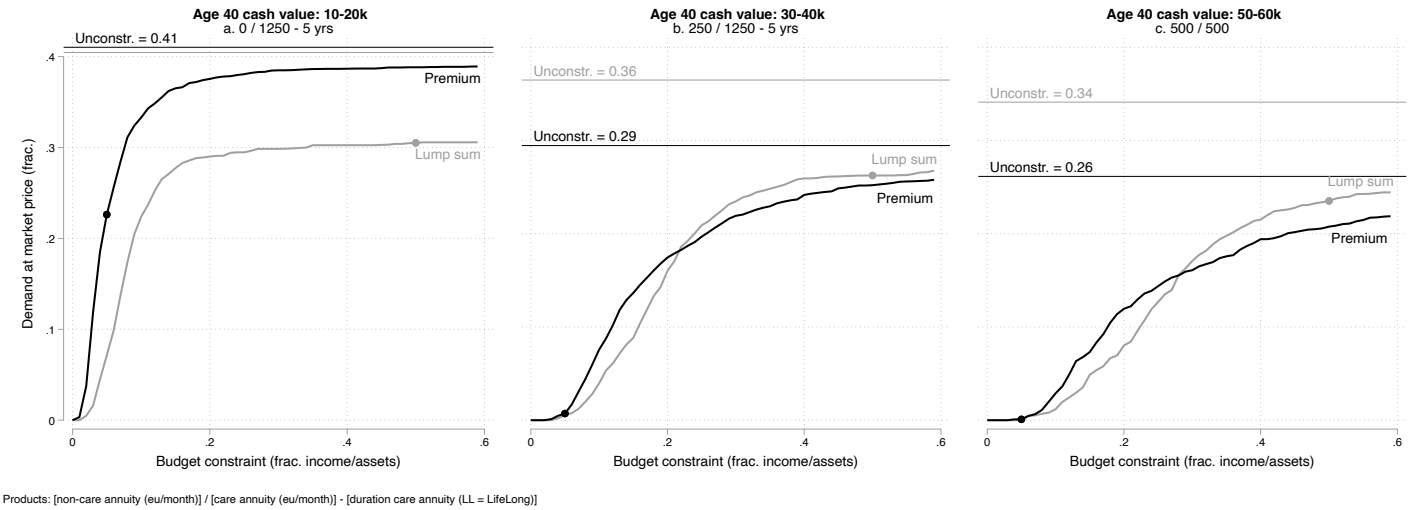


Figure 5: Constrained demand for life care annuities at market prices as function of budget constraint

are willing to trade off these two payment types at less favorable rates than the market would offer: they would accept a smaller reduction in premium per euro of lump sum. For payments by means of a market-conform lump sum demand for all three groups of products is relatively similar at 30-40%. Premium-based products elicit demand between 22 and 32%.

The effect of imposing a budget constraint is even more dramatic for the more expensive annuities in panels d.-i. of Figure 4 compared to the cheaper ones. Demand is reduced by 10 %-points under the lump sum when we take the budget constraint into account, which puts it in the same 20-30% range as unconstrained demand based on premiums. The budget constraint at 5% of net personal income negates demand for all annuities that include a non-care component. While around a quarter would want to buy even larger life care annuities at market premiums, they cannot afford them without tapping into their wealth.

Figure 5 shows how constrained demand at market prices varies with the level of the budget constraint. The three life care annuities in Figure 5 are the middle ones in terms of cash value from the groups in Figure 4 and the constraints at 5% of net personal income and 50% of assets are indicated as circles.

Demand for the cheaper care-only annuity in panel 5a. increases more quickly with the

affordability constraint on premiums compared to the more expensive annuities in panels b. and c. While demand for the former increases from 22% to around 38% when the constraint is loosened from 5 to 20% of net income, constrained demand for the combined annuities only grows to 12-18%. Hence, the finding that larger annuities paid by premiums are unaffordable for many who would want them is robust. Interestingly, demand under the lump sum is lower than that under premiums for the smaller care-only annuity at all levels of the budget constraint. This is due to the fact that the lump sum is only feasible for homeowners, while lower premiums on care-only annuities are affordable for many renters too. For larger annuities demand under the lump sum is lower than demand based on premiums at tight constraints and eventually higher as the constraints are relaxed.

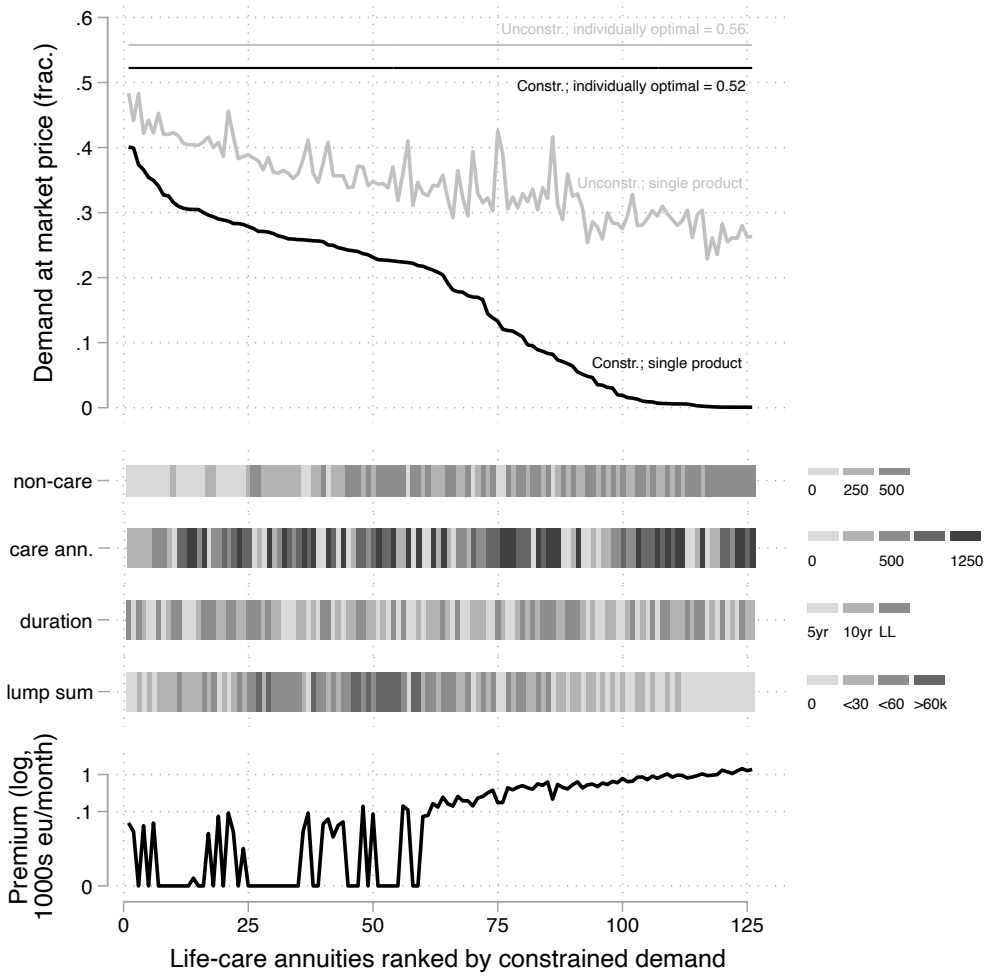


Figure 6: Demand for all 126 products at market prices and budget constraints of 5% of net income and 50% of assets

So far, the focus has been on a selection of life care annuities that span the range of cash values, providing a summary that contains both cheaper and more expensive products. Alternatively, one may ask which product would elicit the highest demand out of 126 bundles of attributes that were considered when constructing the stated choice experiment. Figure 6 ranks all products by constrained demand under budget constraints at 5% of income and 50% of assets. While constrained demand decreases from 40% to 0%, unconstrained demand ranges between 49% and 22%. To put these numbers in perspective, the top panel in Figure 6 also includes the maximal demand if each respondent gets the annuity that maximizes that person's probability of purchase. Under such complete menus, unconstrained and constrained demand would be 0.56 and 0.52 respectively, though note that different products may maximize the two demands for a given individual. It is striking that demand for the single most popular product is only 7-12 %-points below that which offers the full menu for every respondent to choose from.

The lower panels of Figure 6 show the products' attributes. High-demand products tend to have a low, mostly zero, non-care annuity which translates into a relatively low cash value. Moreover, most high-demand products are paid for in part or in full by a lump sum so that the premiums are below 100 euro per month. The reverse applies to low-demand products, which have large non-care annuities and are paid for entirely by high premiums.

5.2 Robustness analysis

Appendix H presents variants of the analysis in Figures 4 and 5 that look at subsamples or change the way demand is simulated. Figures H1 and H2 consider heterogeneity across education and across opinions regarding LTC in the Netherlands. While less educated individuals express greater preference for the care-only annuity, demand is 45% compared to 40% for their more educated peers, they are markedly less able to afford that product through premiums. While effective demand under a budget constraint at 5% of income is 30% among college graduates, it is only 12% among those with the lowest level of education. This difference is reduced from 18 to 6 %-points if payment is through a lump

sum and more than 25% of the lowest educated can afford the care-only annuity that way. Low trust in financial institutions is associated with a 5-7 %-points lower unconstrained demand for life care annuities.

Appendix H also shows demand curves for all nine products under different budget constraints (Figure H3). Constrained demand for smaller annuities paid through premiums and for larger annuities paid through lump sums are sensitive to reasonable variation in the constraint, which shifts demand by around 15 %-points. On the other hand, demand for small products based on lump sums and for large products paid by premiums are less sensitive to the level of the budget constraint. Figure H4 allows for payment by combinations of premiums and lump sums. Demand under these combinations is always between the boundary cases of full premiums and full lump sums, so full lump sums are the payment method that maximizes constrained demand for the products considered at budget constraints of 5% of income and 50% of assets. The stark differences between homeowners and renters are illustrated in Figure H5, which shows how demand at market prices changes with the levels of the budget constraints. Unconstrained demand is similar regardless of homeownership, but while homeowners can afford unconstrained demand almost entirely through the lump sum if they spend 30-50% of their housing assets, demand for renters never reaches 10% even if they were to spend all their assets on the care-only annuity. Reasonable budget constraints on premiums render larger annuities unaffordable for both homeowners and renters. Splitting the sample by age reveals differences in preferences: unconstrained demands based on premiums and lump sums are 20 and 10 %-points lower respectively for ages 56-66, which translates into similar differences for constrained demand.

Figure H7 probes the robustness of simulated demand to inclusion of the estimated Alternative-Specific Constants (ASCs). The analysis above omits ASCs under the assumption that they reflect reporting behavior rather than true preferences and thus would not affect demand. This is the most likely explanation for the ASC for the leftmost alternative in the forced choices, since that option does not differ systematically from the rightmost product in terms of its attributes. However, the negative ASC for purchasing one's pre-

ferred product may reflect a true distaste for life-care annuities. Figure H7 indicates that simulated demand is not sensitive to inclusion of the ASC in utility: the differences are never larger than 5-7 %-points for both constrained and unconstrained demand. Figure H8 visualizes the impact of the survey weights on the analysis. Unconstrained demand is not affected by weighting, it drops by no more than 3 %-points. Constrained demand based on lump sums is similarly robust, but constrained demand based on premiums declines by up to 8 %-points when all observations receive equal weight. Appendix G shows that higher incomes are under-represented in the sample, which suppresses demand based on premiums. Weighting observations to bring the income distribution in line with the population thus puts more weight on richer respondents and increases constrained demand under premiums, since the budget constraint compares premiums with incomes. As a final robustness check, Figure H9 considers sensitivity of the results to which questions are taken into account when computing individual-specific preferences. While the mixing distribution of preferences is estimated from both forced choices and opt-outs, we can nonetheless use only one type of question when approximating the preferences of an individual respondent. The Appendix shows that results for both unconstrained and constrained demand are robust to using only one type of question, with differences below 3 %-points.[4]

6 Conclusion

Aging societies around the world face the dual challenges of managing incomes through longer retirements and funding the increasing costs of LTC. Furthermore, previous research shows that reverse mortgages enable households to better smooth consumption, with huge potential welfare gains. In this study we therefore investigate financial products that

[4]Figure H9 shows that simulated demand based on both types of questions lies between demand based exclusively on either type. It is always closer to demand based on probabilistic opt-outs. This reflects the interpretation of reported probabilities as more precise than discrete forced choices, since the latter are subject to extreme rounding. Further analysis confirms that variation in individual-specific preferences based on both types of questions is driven primarily by the opt-outs, with which they correlate more strongly than preferences based on deterministic forced choices (correlations are in the ranges 0.92-0.98 and 0.35-0.43 respectively). Moreover, preferences based only on probabilistic opt-outs have larger coefficients in predictive regressions that control for both variables (0.87-0.92 compared with 0.12-0.44 for preferences based only on deterministic forced choices).

combine pensions, LTC insurance, and reverse mortgages.

Life care annuities, which pay an income that depends on the recipient's ability to perform activities of daily living (ADLs), are attractive tools to manage longevity and LTC risk. From the demand-side perspective they allow buyers to spend their income freely and prevent coverage issues inherent in LTC insurance that is based on reimbursement (Mayhew et al., 2010). In particular, life care annuities may be used to compensate providers of informal care (Wu et al., 2022), and are more appropriate than standard annuities for agents who want to protect a bequest against the expenses of means-tested nursing home care (Ameriks et al., 2008). The combination with a reverse mortgage increases the accessibility of these products, while not breaking the role of housing as a savings commitment (as is the case with traditional reverse mortgages). Finally, from the supply perspective, bundling the two products is useful since their risks are negatively correlated and bundling may mitigate adverse selection (Warshawsky et al., 2002).

While the value of life care annuities has been acknowledged, this paper is the first to confront demand with supply for realistic products in terms of prices and features.[5] A key issue with life care annuities is their high price. Therefore, we collaborated with an insurance company to design products that are purchased with a combination of premiums and/or a lump sum paid out of housing equity (homeowners) of savings (renters). The dominance of housing wealth in household portfolios makes it a powerful resource to manage the risks of old age (Mayhew et al., 2010). Our analysis disentangles preferences and budget constraints to elucidate the extent to which people are willing and able to unlock this potential.

This paper focuses on the Netherlands where non-residential medical care is covered by mandatory health insurance but private contributions to nursing home care could be as high as 28,000 euro per year at the time the data were collected in 2018. Both income and wealth were included in the earnings test for nursing homes and for many these costs were, and still are, high enough to absorb one's income and deplete accumulated wealth. We analyze stated preferences as there was no market for life care annuities in the Netherlands.

[5]Other papers analyze different combinations of products, such as LTC annuities that include life insurance (e.g., Boyer et al., 2020).

Moreover, stated preferences allow us to disentangle preferences from (budget) constraints. Note that a carefully designed paired conjoint analysis has excellent external validity for the relative importance of attributes in real-world behavior (Hainmueller et al., 2015).

Our dataset consists of 40-66 year-olds in the LISS panel, a broadly representative household panel from the Dutch population (Van der Laan, 2009). The products are defined by a combination of a non-care annuity; a care annuity that switches on when the policy holder is unable to perform at least two ADLs; a maximum duration of this care annuity; and a combination of a monthly premium and lump sum that varies exogenously around its age-specific market value. Homeowners take on a deferred reverse mortgage to be paid when they sell their home or upon the death of the longest living owner, whereas renters pay this lump sum out of their savings. The choice data consist of ten deterministic choices between two products and ten probabilistic opt-outs in which respondents indicate the probability that they would buy their preferred product. To accommodate the fact that respondents doubt whether they would buy the life care annuities, the analysis is based on a new version of the mixed logit model that allows for this uncertainty. We use the estimated model to compute individual-specific preference estimates that condition on the twenty choices of a respondent.

The estimation results indicate that preferences for the different attributes of life care annuities vary widely between individuals, with standard deviations of the mixing distributions of willingness-to-pay that are larger than the means. Around 40% would want to buy a relatively inexpensive care-only annuity between 500 and 1250 euro per month at market prices regardless of whether the payment vehicle is a monthly premium or a lump sum. The mode of payment does affect desired demand for more expensive products that include a non-care annuity of 250 or 500 euro per month. Most people are willing to trade off the premium and lump sum at a less favorable rate than offered in the market, so demand is 8 %-points higher when the payment is a lump sum compared to a premium. With lump sum payments, 30-40% would prefer to buy the mid and high-value non-care annuities.

While preferences are such that desired demand is higher under lump sum payments

than under premiums, this difference is exacerbated when we impose budget constraints. A budget constraint at 5% of net income reduces premium-based demand for the care-only annuities from 40% to 20-30%. Restricting the lump sum to 20% of assets, on the other hand, results in an effective demand around 30%. Premiums for more elaborate products that include non-care annuities are prohibitively expensive: even if respondents would spend 10% of their net income on premiums, effective demand would not be more than 5-8% (relative to an unconstrained demand around 27%). Lump sums would be more viable, with a constraint at 40% of assets generating an effective demand around 25%. While renters value the annuities similarly to homeowners, they do not in the aggregate accumulate sufficient assets to pay the lump sums and thus would be excluded from this market.

Analyzing demand across a grid of attributes, the products with the highest constrained demand are those that have no non-care annuity and are thus relatively inexpensive. The lower demand for non-care annuities probably reflects their higher price in combination with universal and mandatory public and occupational pensions that replace around 70% of pre-retirement income and negate longevity risk in the Dutch context. Even a single care-only annuity of 250 euro per month can generate a demand up to 40%, compared with 52% if each individual were able to buy one of the products that maximize their constrained demand. Hence, a small menu of well-designed life care annuities would suffice to serve most individuals.

Overall, this study supports the value and viability of life care annuities to help individuals balance incomes across future states of the world. There is scope to design marketable products that buyers want and can purchase to insure their income when ADL limitations occur. While premiums are an appropriate mode of payment for care-only annuities, more expensive combined products require one to tap into housing wealth in order to realize that promise. Consequently, life care annuities are unlikely to be a good fit for renters who accumulate little financial wealth in lieu of housing.

References

Alders, P. and Schut, F. T. (2019). The 2015 long-term care reform in the Netherlands: Getting the financial incentives right? Health Policy, 123(3):312–316.

Alós-Ferrer, C., Fehr, E., and Netzer, N. (2021). Time will tell: Recovering preferences when choices are noisy. Journal of Political Economy, 129(6):1828–1877.

Ameriks, J., Briggs, J., Caplin, A., Shapiro, M. D., and Tonetti, C. (2016). Late-in-life risks and the under-insurance puzzle.

Ameriks, J., Briggs, J., Caplin, A., Shapiro, M. D., and Tonetti, C. (2020). Long-Term-Care Utility and Late-in-Life Saving. Journal of Political Economy, 128(6):2375–2451.

Ameriks, J., Caplin, A., Laufer, S., and Van Nieuwerburgh, S. (2008). Annuity valuation, long-term care, and bequest motives. In Ameriks, J. and Mitchell, O. S., editors, Recalibrating Retirement Spending and Saving, pages 1–28. Oxford Scholarship Online.

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. The journal of finance, 66(2):519–561.

Barr, N. (2010). Long-term care: a suitable case for social insurance. Social policy & administration, 44(4):359–374.

Bliemer, M. and Rose, J. (2009). Designing stated choice experiments: state of the art. In Kitamura, R., Yoshii, T., and Yamamoto, T., editors, The expanding sphere of travel behaviour research, selected papers from the 11th IATBR Conference, pages 499–537, United Kingdom. Emerald Publishing.

Boyer, M. M., De Donder, P., Fluet, C., Leroux, M.-L., and Michaud, P.-C. (2020). Long-Term Care Insurance: Information Frictions and Selection. American Economic Journal: Economic Policy, 12(3):134–169.

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. The Journal of Risk and Insurance, 80(3):677–703.

Bruine de Bruin, W. B., Fischhoff, B., Millstein, S. G., and Halpern-Felsher, B. L. (2000). Verbal and numerical expressions of probability:"it's a fifty–fifty chance". Organizational behavior and human decision processes, 81(1):115–131.

Chandra, A., Coile, C., and Mommaerts, C. (2023). What can economics say about alzheimer's disease? Journal of Economic Literature, 61(2):428–70.

Chen, A., Fuino, M., Sehner, T., and Wagner, J. (2022). Valuation of long-term care options embedded in life annuities. Annals of Actuarial Science, 16(1):68–94.

Cocco, J. F. and Lopes, P. (2020). Aging in Place, Housing Maintenance, and Reverse Mortgages. The Review of Economic Studies, 87(4):1799–1836.

Costa-Font, J., Courbage, C., and Zweifel, P. (2017). Policy Dilemmas in Financing Long-term Care in Europe. Global Policy, 8(S2):38–45.

De Bresser, J. (2019). Measuring subjective survival expectations – Do response scales matter? Journal of Economic Behavior & Organization, 165:136–156.

de Bresser, J., Knoef, M., and van Ooijen, R. (2022). Preferences for in-kind and in-cash home care insurance. Journal of Health Economics, 84:102626.

De Bresser, J. and Van Soest, A. (2013). Survey response in probabilistic questions and its impact on inference. Journal of Economic Behavior & Organization, 96:65–84.

Essers, B. A., van Helvoort-Postulart, D., Prins, M. H., Neumann, M., and Dirksen, C. D. (2010). Does the inclusion of a cost attribute result in different preferences for the surgical treatment of primary basal cell carcinoma? a comparison of two discrete-choice experiments. Pharmacoeconomics, 28:507–520.

Fischhoff, B. and Bruine de Bruin, W. (1999). Fifty–fifty= 50%? Journal of Behavioral Decision Making, 12(2):149–163.

Genie, M. G., Ryan, M., and Krucien, N. (2021). To pay or not to pay? cost information processing in the valuation of publicly funded healthcare. Social Science & Medicine, 276:113822.

Hainmueller, J., Hangartner, D., and Yamamoto, T. (2015). Validating vignette and conjoint survey experiments against real-world behavior. Proceedings of the National Academy of Sciences, 112(8):2395–2400.

Hanewald, K., Post, T., and Sherris, M. (2016). Portfolio choice in retirement—what is the optimal home equity release product? Journal of Risk and Insurance, 83(2):421–446.

Kleinjans, K. J. and Van Soest, A. (2014). Rounding, focal point answers and nonresponse to subjective probability questions. Journal of Applied Econometrics, 29(4):567–585.

Koijen, R. S., Van Nieuwerburgh, S., and Yogo, M. (2016). Health and mortality delta: Assessing the welfare cost of household insurance choice. The Journal of Finance, 71(2):957–1010.

Kovacs, A. and Moran, P. (2022). Breaking the commitment device: the effect of home equity withdrawal on consumption, saving, and welfare. CEPR Discussion Paper Series.

Maarse, J. H. and Jeurissen, P. P. (2016). The policy and politics of the 2015 long-term care reform in the netherlands. Health Policy, 120(3):241–245.

Manski, C. F., Wolpin, K. I., and Weber, E. U. (2000). Analysis of choice expectations in incomplete scenarios. Elicitation of Preferences, pages 49–72.

Mayhew, L., Karlsson, M., and Rickayzen, B. (2010). The role of private finance in paying for long term care. The Economic Journal, 120(548):F478–F504.

Murtaugh, C. M., Spillman, B. C., and Warshawsky, M. J. (2001). In sickness and in health: An annuity approach to financing long-term care and retirement income. The Journal of Risk and Insurance, 68(2):225–253.

Nakajima, M. and Telyukova, I. (2017). Reverse mortgage loans: A quantitative analysis. The Journal of Finance, 72(2):911–950.

Pedersen, L. B., Kjær, T., Kragstrup, J., and Gyrd-Hansen, D. (2011). Does the inclusion of a cost attribute in forced and unforced choices matter?: Results from a web survey applying the discrete choice experiment. Journal of Choice Modelling, 4(3):88–109.

Pedersen, L. B., Mørkbak, M. R., and Scarpa, R. (2020). Handling resolvable uncertainty from incomplete scenarios in future doctors' job choice–probabilities vs discrete choices. Journal of choice modelling, 34:100199.

Pestieau, P. and Ponthiere, G. (2012). The public economics of increasing longevity. Review of Public Economics, 200(1):35–68.

Royal Dutch Actuarial Association (2016). Life tables by the Royal Dutch Actuarial Association. `https://www.actuarieelgenootschap.nl/kennisbank/periodetafels.htm`.

Ryan, M., Krucien, N., and Hermens, F. (2018). The eyes have it: Using eye tracking to inform information processing strategies in multi-attributes choices. Health economics, 27(4):709–721.

Sever, I., Verbič, M., and Sever, E. K. (2019). Cost attribute in health care dces: Just adding another attribute or a trigger of change in the stated preferences? Journal of choice modelling, 32:100135.

Shao, A. W., Chen, H., and Sherris, M. (2019). To borrow or insure? long term care costs and the impact of housing. Insurance: Mathematics and Economics, 85:15–34.

St-Amour, P. and Michaud, P.-C. (2023). Longevity, health and housing risks management in retirement. NBER Working Paper w31038.

Swartz, K. (2013). Searching for a Balance of Responsibilities: OECD Countries' Changing Elderly Assistance Policies. Annual Review of Public Health, 34(1):397–412.

Train, K. (2003). Discrete Choice Methods with Simulation. Cambridge University Press, Cambridge.

Van der Laan, J. (2009). Representativity of the LISS panel. Statistics Netherlands discussion paper 09041.

Van der Vaart, J., Alessie, R., Groneck, M., and Van Ooijen, R. (2024). Combining insurance to accommodate selection effects in the markets for life annuities and long-term care insurance. Working paper.

Warshawsky, M. J., Spillman, B., and Murtaugh, C. (2002). Integrating life annuities and long-term care insurance: Theory, evidence, practice, and policy.

Wu, S., Bateman, H., Stevens, R., and Thorp, S. (2022). Flexible insurance for long-term care: A study of stated preferences. Journal of Risk and Insurance, 89(3):823–858.

Appendix

A Description of the choice situation and example of a choice set

De volgende vragen gaan over een denkbeeldig nieuw financieel product.

Stel u kunt een financieel product kopen dat vanaf volgende maand een bedrag uitkeert bovenop uw pensioen dat afhankelijk is van uw gezondheid.

Dit product heeft de volgende kenmerken:

- U ontvangt maandelijks een bedrag bovenop uw pensioen als u **geen** langdurige zorg nodig hebt.
- U ontvangt maandelijks een bedrag bovenop uw pensioen als u langdurige zorg nodig hebt. U ontvangt dit bedrag gedurende een bepaalde periode, bijvoorbeeld 5 of 10 jaar of zolang u langdurige zorg nodig hebt. Daarna verandert de uitkering weer terug naar het bedrag dat u ontvangt als u **geen** langdurige zorg nodig hebt.
- U kunt dit product kopen door het betalen van een vaste maandelijkse premie en/of door eenmalig een deel van het vermogen uit de eigen woning te gebruiken.
  U stopt met het betalen van een premie vanaf het moment dat het product een bedrag uitkeert.
  Als u vermogen uit de eigen woning gebruikt betaalt u geen of een lagere premie. Het bedrag uit de eigen woning wordt betaald bij de verkoop van de woning ofwel aan het einde van uw leven of het leven van uw eventuele overgebleven partner. U kunt dus gewoon in uw woning blijven wonen.
- Bij het kopen van het product geldt een wachttijd van bijvoorbeeld 1 of 3 jaar. Als u binnen deze periode al langdurige zorg nodig hebt komt het product te vervallen en krijgt u reeds betaalde bedragen terug.

Ook geldt:
- Het bedrag is vrij te besteden. U kunt er bijvoorbeeld extra of meer luxe langdurige zorg (zoals professionele thuiszorgdiensten) mee inkopen, maar ook taxiritten, een maaltijdservice, een tuinman of schoonmaker mee betalen. U kunt het bedrag ook geven aan een persoon die u vrijwillig helpt of het besteden aan zaken zoals hobby's of reizen.
- Een onafhankelijke partij beoordeelt of u langdurige zorg nodig hebt en gebruikt hiervoor objectieve criteria. U hebt langdurige zorg nodig als u hulp nodig hebt bij **ten minste twee** van de volgende zes activiteiten:

  - Wassen
  - Aan- en uitkleden
  - Bewegen en lopen (op de begane grond)
  - Naar het toilet gaan
  - In een stoel gaan zitten en weer opstaan
  - Eten

- De getoonde bedragen zijn per persoon. Ga ervan uit dat de prijzen in de toekomst hetzelfde zijn als nu.
- Er is geen risico dat de financiële instelling waar u dit product aanschaft de financiële verplichtingen niet nakomt of de polisvoorwaarden later aanpast.

Figure A1: Description of the insurance product

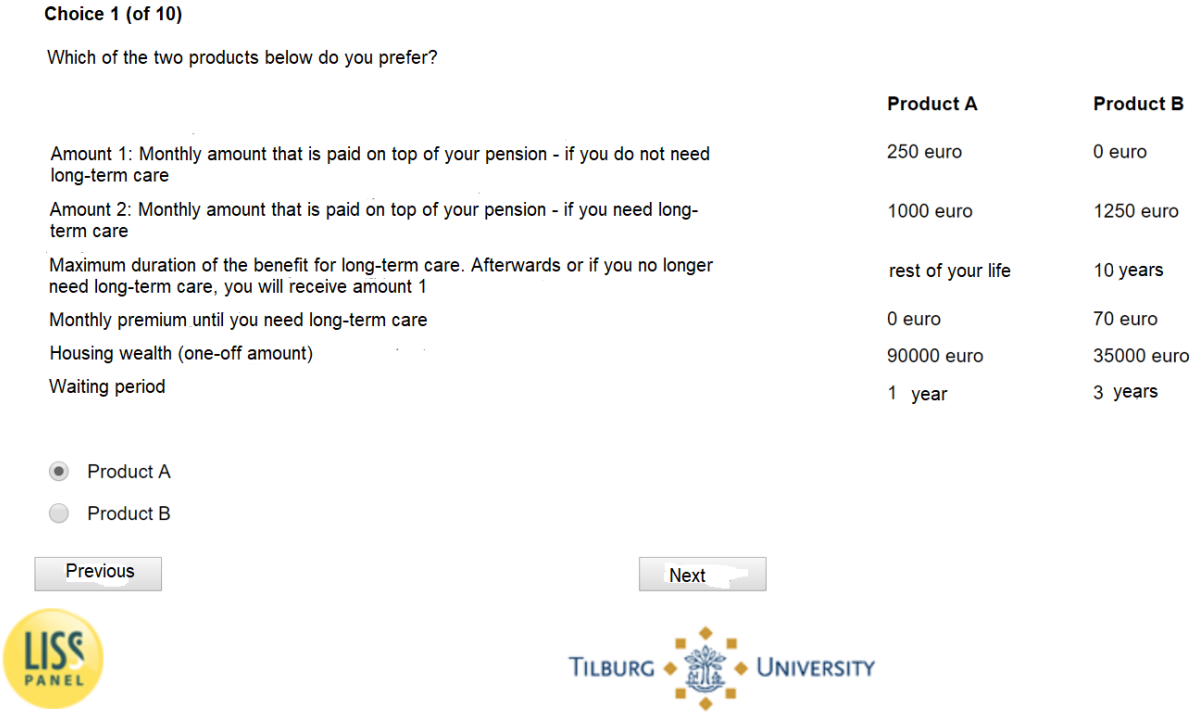


Figure A2: Example of a choice option

B Descriptive statistics

Table B1: Descriptive statistics of background variables (unweighted)

	Age 40-55		Age 56-66	
	Mean	(Std. dev.)	Mean	(Std. dev.)
Age	48.2	(4.5)	61.3	(3.2)
Female	0.53	(0.50)	0.51	(0.50)
Partner	0.74	(0.44)	0.73	(0.45)
Any kids in HH	0.62	(0.48)	0.22	(0.42)
Number of kids in HH	1.27	(1.18)	0.36	(0.76)
Civil status				
Married	0.61	(0.49)	0.67	(0.47)
Divorced/widowed	0.13	(0.34)	0.21	(0.41)
Never married	0.26	(0.44)	0.11	(0.31)
Education				
Low	0.18	(0.39)	0.28	(0.45)
Middle	0.42	(0.49)	0.33	(0.47)
High	0.38	(0.48)	0.36	(0.48)
Other	0.02	(0.14)	0.03	(0.17)
Most important activity				
Employee	0.71	(0.45)	0.44	(0.50)
Self-employed	0.10	(0.30)	0.08	(0.27)
Unemployed	0.03	(0.16)	0.06	(0.23)
Homemaker	0.08	(0.27)	0.11	(0.31)
Retired	0.00	(0.04)	0.15	(0.36)
Disabled	0.06	(0.24)	0.10	(0.30)
Other	0.03	(0.16)	0.06	(0.23)
N	799		843	

Table B2: Descriptive statistics of income and wealth (unweighted)

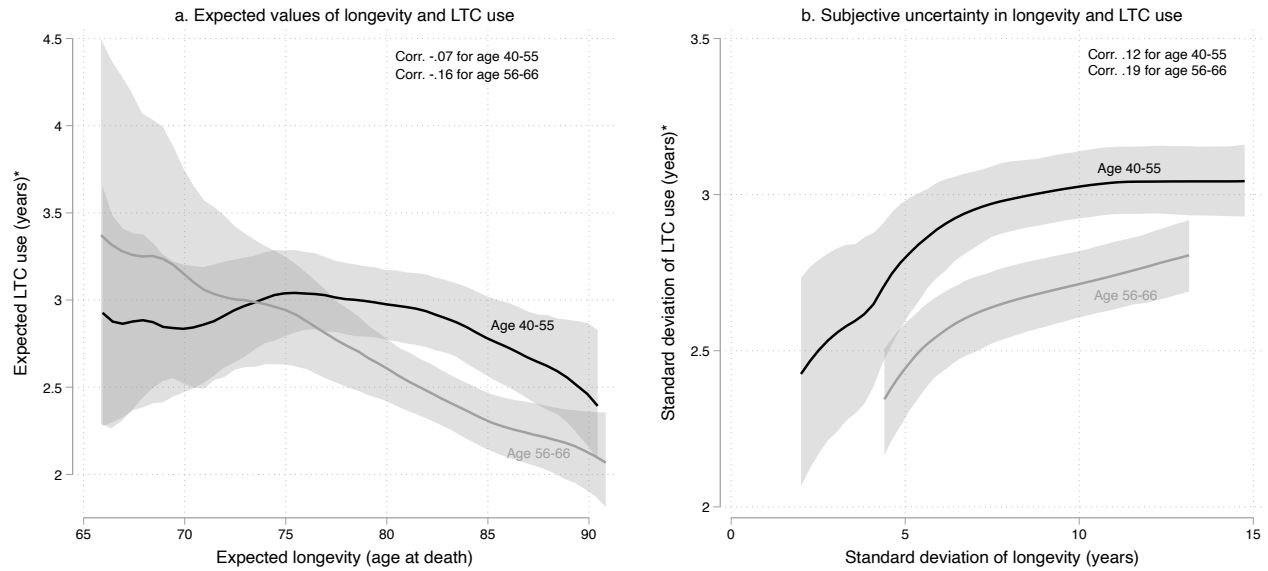
a. Age 40-55	N	Mean	Std. dev.	p25	p50	p75
Net income (euro/month)						
Personal	798	1844	1106	1100	1800	2412
Household	797	3469	1716	2225	3330	4420
Homeowner	799	0.78	0.41			
Wealth (1000s Euro)						
Home value[a]	587	306	152	200	270	350
Current mortgage debt[a]	566	204	176	117	175	250
Predicted mortgage at ret. age[a]	505	87	136	0	50	125
Current net home value[a]	559	104	185	34	90	175
Predicted net home value[a]	500	225	185	135	220	300
Net financial wealth[b]	129	17	65	0	2.5	7.5
b. Age 56-66	N	Mean	Std. dev.	p25	p50	p75
Net income (euro/month)						
Personal	843	1681	1153	935	1600	2260
Household	836	3190	1745	1906	2955	4120
Homeowner	843	0.77	0.42			
Wealth (1000s Euro)						
Home value[a]	624	313	204	200	273	363
Current mortgage debt[a]	604	107	109	3	88	160
Predicted mortgage at ret. age[a]	470	94	120	0	70	140
Current net home value[a]	598	208	210	90	179	290
Predicted net home value[a]	466	220	241	104	190	300
Net financial wealth[b]	165	26	61	0.4	4	24

[a] Only for homeowners (of which there are 623 and 648 in the age-based samples respectively).
[b] Only for non-homeowners (of which there are 176 and 195 in the age-based samples respectively).

Table B3: Descriptive statistics of relevant expectations and preferences (unweighted)

	Age 40-55			Age 56-66		
	N	Mean	(Std. dev.)	N	Mean	(Std. dev.)
Expected LTC use – expected value (yrs)[a]	791	2.9	(2.2)	838	2.5	(2.2)
Expected LTC use – standard dev. (yrs)[a]	791	3.0	(1.4)	838	2.7	(1.5)
Subj. longevity – expected age at death[b]	759	81.0	(5.3)	827	82.8	(5.0)
Sub. longevity – standard dev. (yrs)[b]	759	12.8	(2.8)	827	9.8	(2.0)
Availability informal care						
Available	799	0.34	(0.47)	843	0.29	(0.45)
Maybe	799	0.33	(0.47)	843	0.30	(0.46)
Not available	799	0.33	(0.47)	843	0.41	(0.49)
Has plan to finance LTC	799	0.34	(0.47)	843	0.46	(0.50)
Expected change in non-medical expenditures at onset of LTC requirement						
Decrease	799	0.39	(0.49)	843	0.36	(0.48)
Constant	799	0.30	(0.46)	843	0.30	(0.46)
Increase	799	0.31	(0.46)	843	0.34	(0.47)
Expected change in medical expenditures at onset of LTC requirement						
Constant	799	0.04	(0.20)	843	0.05	(0.22)
Increase/strong increase	799	0.62	(0.48)	834	0.69	(0.46)
Very strong/extreme increase	799	0.33	(0.47)	843	0.26	(0.44s)
Expected pension income (eu/month)	553	2160	(1173)	704	2326	(1146)
Preferences (scale 1-7)						
Risk aversion	799	4.6	(1.3)	843	4.6	(1.4)
Patience	799	4.7	(1.4)	843	4.9	(1.4)
Impulsiveness	799	2.9	(1.3)	843	2.7	(1.3)
Importance of bequests						
Not important (1-3 on 7-point scale)	799	0.40	(0.49)	843	0.51	(0.50)
Neutral (4 on 7-point scale)	799	0.25	(0.43)	843	0.19	(0.39)
Important (5-7 on 7-point scale)	799	0.35	(0.48)	843	0.30	(0.46)
Importance of inter-vivos transfers						
Not important (1-3 on 7-point scale)	799	0.36	(0.48)	843	0.41	(0.49)
Neutral (4 on 7-point scale)	799	0.25	(0.43)	843	0.22	(0.42)
Important (5-7 on 7-point scale)	799	0.39	(0.49)	843	0.37	(0.48)
Allocation of money to good-health states of the world (fraction out of 10k euro)						
$< 50\%$	791	0.27	(0.44)	838	0.29	(0.46)
50%	791	0.42	(0.49)	838	0.34	(0.47)
$> 50\%$	791	0.31	(0.46)	838	0.37	(0.48)

[a] Expectations regarding LTC use are constructed from six reported probabilities of needing LTC at all and requiring LTC for more than 1, 3, 5, 7, or 9 years. From these probabilities we construct a mixed discrete-continuous distribution of LTC use with a mass point at zero and a continuous distribution over positive durations, where the continuous part of the distribution uses piecewise linear interpolation between reported probabilities. We cap LTC use at 12 years and compute the expected value and standard deviation for each individual who reported probabilities. (All reported sequences satisfy monotonicity and are thus logically consistent though this was not enforced in the survey.) [b] Survival expectations were elicited in the core health survey of LISS in November/December 2017, about eight months prior to the main survey analyzed in this paper. Depending on the respondent's age at the time of the health survey we observe the probability of survival past the ages 75, 80, and/or 85 (current ages of at most 64 received target ages 75 and 80, current age 65 received all three target ages, and current age 66 received ages 80 and 85). Survival probabilities were reported on an 11-point scale from 0 to 10, which can be interpreted as probabilities rounded to multiples of 10 %-points (De Bresser, 2019). Survival is capped at age 100 and distributions are constructed by linear interpolation between reported probabilities. We calculate the expected value and standard deviation for each respondent from these piecewise linear distributions.



*Current age has been partialled out of subjective survival by means of a linear model with a quadratic in age.

Figure B1: Subjective expectations regarding utilization of LTC and survival

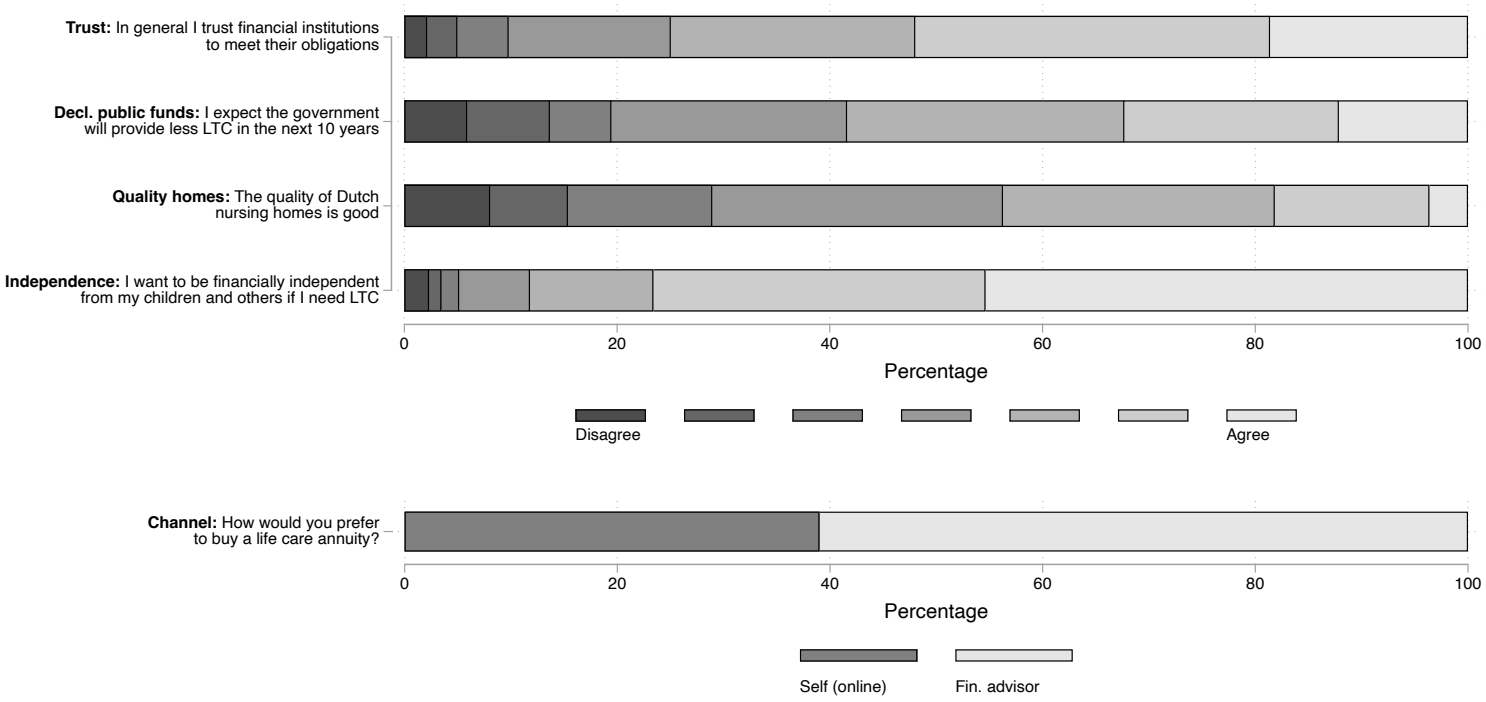


Figure B2: Opinions on LTC in the Netherlands and preferred purchasing channel (weighted using weights described in Appendix G)

C Data quality

This Appendix assesses data quality by means of response times and the evaluation questions included at the end of each survey fielded in the LISS panel. Average response times are longer for the forced choices between two insurance policies than for the opt outs: the medians are around 20 and 9 seconds per question, respectively (Table C1). This can be explained by the effort required to choose between two policies that vary on five attributes, trading off different attributes against each other, compared to the simpler choice whether to buy one policy that dominates the outside option on all features. Moreover, the products in the forced choices are new to the respondent while each opt out refers to the preferred and thus familiar option in a forced choice. The tenth percentiles of response time are 4-9 seconds per question, which indicates that few respondents raced through.

Analysis of time stamps by vignette number suggests that familiarization with the forced choice questions occurs during the first four vignettes as median response times decline from 33-41 seconds to 15-20 seconds and either stabilize (ages 40-55) or decline more slowly (ages 56-66) afterwards (Figure C1). Familiarization is more rapid for the opt outs with median response times dropping from 20-25 seconds for the first question to below 10 seconds for all later ones. Shrinking inter-quartile ranges indicate that response times for both types of choices also become less spread out as respondents familiarize themselves with the questions.

Response times can shed light on the quality of the reported probabilities equal to zero or fifty. It is a well-documented fact in psychology and economics that more difficult questions take longer to answer (the chronometric function e.g., Alós-Ferrer et al., 2021). In our context, choices between alternatives with similar utilities are more difficult for respondents and should have longer response times. If probabilities similarly reflect the size of utility contrasts, a central assumption of our analysis, we would thus expect response sequences that consist entirely of zeros to reflect larger utility contrasts and have shorter response times than sequences that contain fewer zeros. Moreover, sequences that consist entirely of fifties indicate that the respondent is indifferent between alternatives and should thus take longer than those which contain fewer fifties and those which consist entirely of zeros. Alternatively, if fifties reflect lack of understanding or inability to reason in terms of probabilities one may expect more fifties to be associated with shorter rather than longer response times as frustrated respondents click quickly through the items.

Figure C2 presents median average response times among those who answered zero or fifty to all ten opt outs, between one and nine of those questions, or not at all. For both age brackets we find clear evidence that sequences that consist only of zeros take shorter than those with fewer zeros: around 6 rather than 8-10 seconds per item. The data are less clear-cut for the number of fifties. While sequences with one to nine fifties

take 2 sec./item longer compared to zero fifties in the 56-66 age bracket, the difference is smaller and insignificant among 40-55 year-olds. Moreover, the median duration of sequences that contain only fifties is comparable to that of sequences with no fifties at all, so the overall pattern appears hump-shaped. Nonetheless, sequences that contain only fifties take about 2 sec./item longer at the median than sequences of zeros. Overall the time stamps support the notion that these probabilities express genuine uncertainty about choices and are not mere reporting anomalies.

Table C2 presents the answers to the self-evaluation questions. The self-evaluations at the end of the survey concern the questionnaire as a whole and thus also reflect the questions asked before and after the stated choice experiment. Nonetheless, the fact that these twenty choices account for a quarter of total response time at the median suggests that they carry substantial weight in the overall evaluations. From that perspective it is reassuring that three quarters of respondents found the questionnaire clear. About half found the survey questions difficult to answer and around 70% enjoyed participating. While perceived clarity of the survey questions significantly predicts response time to the stated choice experiment, greater clarity is associated with 30-50% longer response times, the largest difference occurs between the 7-10% who thought that the questions were "definitely not" clear and the rest.

Table C1: Average response times for forced choices and opt outs (averages by individual across 10 questions of each type)

a. Age 40-55							
	Mean	Std. dev.	p10	p25	p50	p75	p90
Forced choices (sec./item)	26	38	6	13	19	30	43
Opt outs (sec./item)	11	17	4	6	8	11	16
N	799						
Stated choice as frac. of survey	0.23	0.13	0.02	0.16	0.25	0.31	0.36
N	791						
b. Age 56-66							
	Mean	Std. dev.	p10	p25	p50	p75	p90
Forced choices (sec./item)	31	33	9	15	23	35	53
Opt outs (sec./item)	12	15	5	7	9	14	20
N	843						
Stated choice as frac. of survey	0.24	0.13	0.02	0.18	0.25	0.32	0.36
N	838						

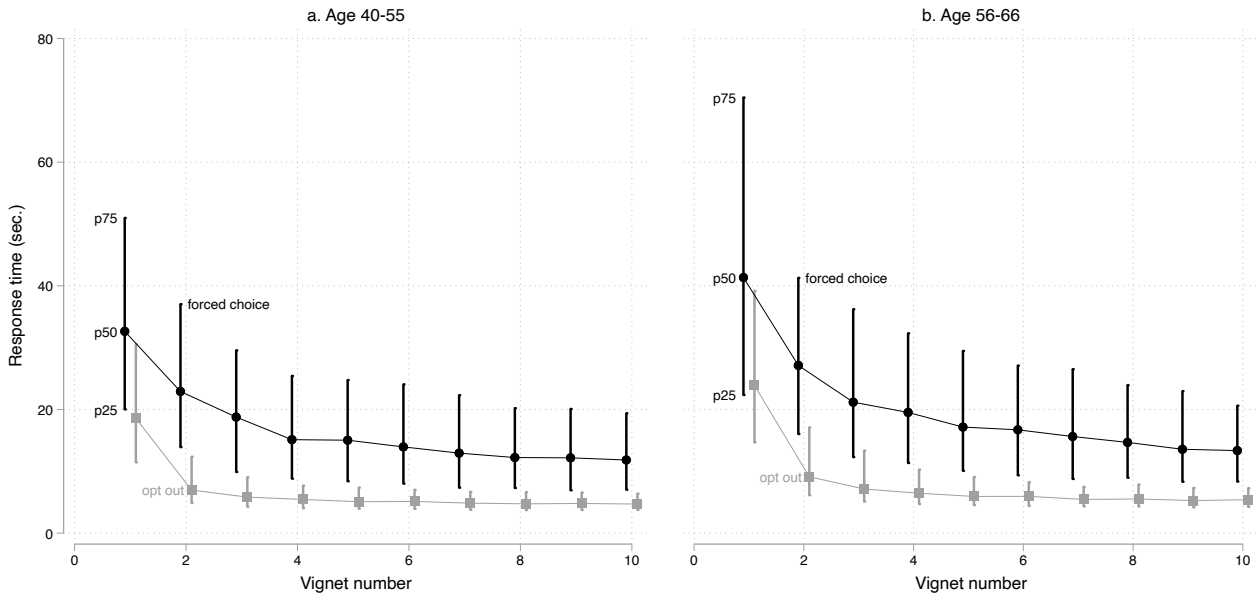


Figure C1: Response times by vignette number

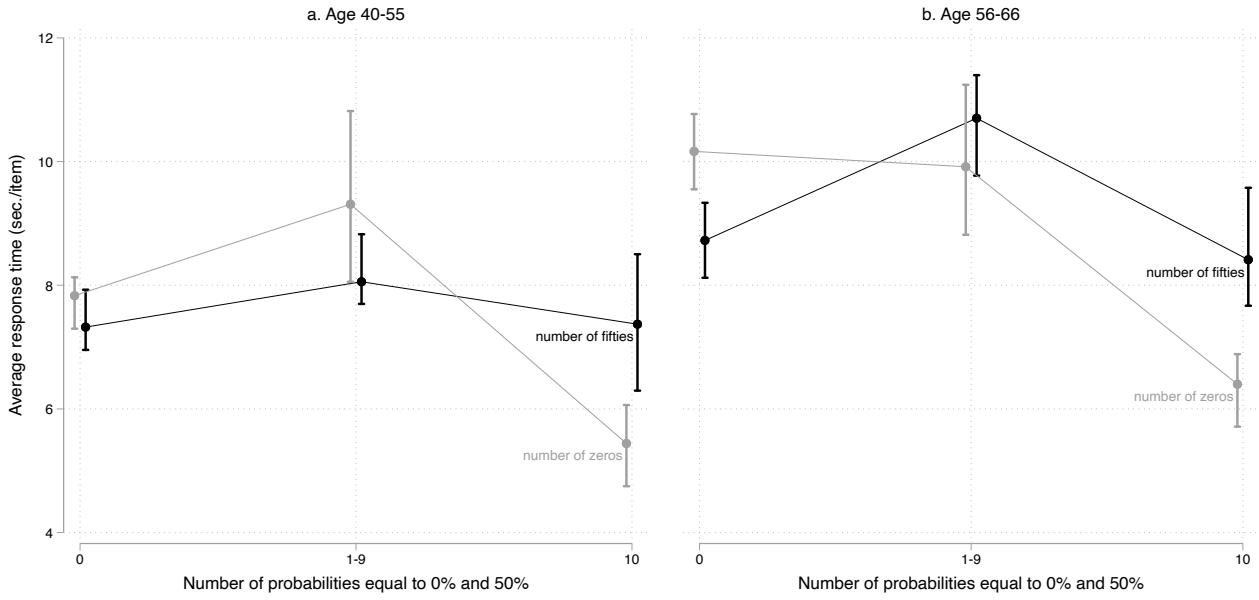


Figure C2: Median average response times to the probabilistic opt outs by number of reported probabilities equal to zero or fifty percent (bars are 95% CIs bootstrapped by 500 replications)

Table C2: Descriptive statistics of survey self-evaluations

a. Age 40-55

	Descriptives (fractions)				
	Difficult to answer	Questions clear	Made me think	Topic interesting	Enjoyed survey
1. Definitely not	0.21	0.07	0.15	0.15	0.15
2.	0.11	0.15	0.12	0.13	0.14
3.	0.16	0.29	0.29	0.30	0.33
4.	0.24	0.23	0.25	0.23	0.19
5. Definitely	0.26	0.26	0.19	0.19	0.18

	Regressions – dependent variable: log average total response time (forced choices and opt outs)				
	Difficult to answer	Questions clear	Made me think	Topic interesting	Enjoyed survey
Base: 1. Definitely not					
2.	0.155**	0.344***	0.142*	0.264***	0.205**
	(0.0693)	(0.111)	(0.0840)	(0.0820)	(0.0886)
3.	0.157*	0.463***	0.247***	0.408***	0.337***
	(0.0907)	(0.102)	(0.0793)	(0.0766)	(0.0817)
4.	0.281***	0.543***	0.368***	0.491***	0.352***
	(0.0690)	(0.104)	(0.0788)	(0.0781)	(0.0848)
5. Definitely	0.295***	0.395***	0.389***	0.416***	0.293***
	(0.0738)	(0.101)	(0.0884)	(0.0864)	(0.0937)
Constant	2.449***	2.225***	2.385***	2.292***	2.377***
	(0.0510)	(0.0895)	(0.0621)	(0.0601)	(0.0685)
R-squared	0.028	0.037	0.038	0.056	0.031
N	791	791	791	791	791

b. Age 56-66

	Descriptives (fractions)				
	Difficult to answer	Questions clear	Made one think	Topic interesting	Enjoyed survey
1. Definitely not	0.20	0.10	0.15	0.17	0.16
2.	0.11	0.15	0.12	0.12	0.15
3.	0.15	0.23	0.28	0.25	0.30
4.	0.22	0.24	0.23	0.24	0.20
5. Definitely	0.32	0.28	0.21	0.22	0.19

	Regressions – dependent variable: log average total response time (forced choices and opt outs)				
	Difficult to answer	Questions clear	Made me think	Topic interesting	Enjoyed survey
Base: 1. Definitely not					
2.	0.168**	0.195*	0.145*	0.243***	0.220***
	(0.0783)	(0.102)	(0.0878)	(0.0837)	(0.0799)
3.	0.164**	0.290***	0.317***	0.403***	0.288***
	(0.0734)	(0.0982)	(0.0781)	(0.0739)	(0.0747)
4.	0.257***	0.342***	0.390***	0.489***	0.396***
	(0.0613)	(0.0977)	(0.0768)	(0.0722)	(0.0804)
5. Definitely	0.182***	0.251***	0.524***	0.456***	0.263***
	(0.0603)	(0.0957)	(0.0814)	(0.0699)	(0.0757)
Constant	2.685***	2.595***	2.533***	2.493***	2.595***
	(0.0427)	(0.0876)	(0.0660)	(0.0567)	(0.0606)
R-squared	0.018	0.023	0.071	0.073	0.036
N	838	838	838	838	838

Standard errors in parentheses, clustered at household level (658 clusters for age 40-55, 709 clusters for age 56-66)
*** p<0.01, ** p<0.05, * p<0.10

D Estimates for age group 56-66

Table D1: Mixed logit model with resolvable uncertainty for ages 56–66

a. Preferences in WTP space

	Preferences[a]				Market premiums[d]	
	Mean		Standard deviation		Premium	Frac. WTP ≥ premium
Log-sensitivity to negative price	-5.712	(0.0508)	1.245	(0.0404)		
Non-care annuity (100s €/month)	2.482	(5.942)	136.809	(7.653)	143.17	0.15
Care annuity (100s €/month)	-0.157	(1.505)	48.592	(2.356)	36.79	0.22
Duration care annuity (baseline: 5 yrs)						
Duration: 10 yrs	-19.817	(11.737)	246.700	(16.715)	49.50	0.39
Duration: lifelong	89.711	(9.126)	239.608	(16.176)	78.85	0.52
Lump sum (1000s €)	-4.907	(0.409)	8.071	(0.413)	-12.74	0.83
ASC 1st option in forced choice[b]	35.855	(8.704)	–			
Interaction 1st option × opt-out[c]	-113.041	(9.882)	–			

b. Correlation matrix for preferences and rounding

	Log-premium sensitivity	Non-care annuity	Care annuity	Duration: 10 yrs	Duration: lifelong	Lump sum	Rounding
Log-sensitivity to negative premium	1						
Non-care annuity	-0.55***	1					
Care annuity	-0.44***	0.93***	1				
Duration: 10 yrs	-0.35***	0.77***	0.86***	1			
Duration: lifelong	-0.45***	0.93***	0.96***	0.93***	1		
Lump sum	0.09*	-0.72***	-0.61***	-0.44***	-0.54***	1	
Rounding	0.01	-0.01	-0.04***	0.12***	0.03*	-0.01	1

c. Reporting behavior

Log standard deviation recall error			Rounding model		
Forced, deterministic, choices	3.903	(0.0221)	τ_1	-10.716	(0.505)
Probabilistic opt outs	2.574	(0.00496)	τ_2	-4.001	(0.244)
			τ_3	3.200	(0.206)
			τ_4	5.229	(0.222)
			Std. dev. ind. effect	7.382	(0.333)
Individuals	843				
Log-likelihood[e]	-21,114.74				

[a] The preference for negative premiums follows a log-normal distribution, log-premium sensitivity and the other preferences follow a multivariate normal distribution.

[b] Alternative-Specific Constant (ASC): indicator for the first, left-most, alternative in a discrete, forced, choice scenario.

[c] Interaction of first alternative (opt in) with indicator for probabilistic opt out.

[d] Market premiums used in vignettes refer to age 60 and are obtained as slopes in the OLS regressions:
$premium = \beta_0 + \beta_1 non\text{-}careann + \beta_2 careann + \beta_3 \mathbb{I}\{\text{duration: 10 yrs}\} + \beta_4 \mathbb{I}\{\text{duration: life long}\} + \beta_5 lumpsum + \varepsilon$

[e] Likelihood simulated using 1000 Halton draws.

The data consist of 10 forced, discrete, choices between two life care annuities and 10 corresponding probabilistic choices between the preferred alternative and an opt-out for each respondent.

Standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10

Table D2: Sample average rounding probabilities at posterior means for the individual effect

	Age 40-55	Age 56-66
Average probability to round to multiples of...		
...1	0.03	0.00
...5	0.02	0.00
...10	0.92	0.96
...25	0.03	0.01
...50	0.00	0.03

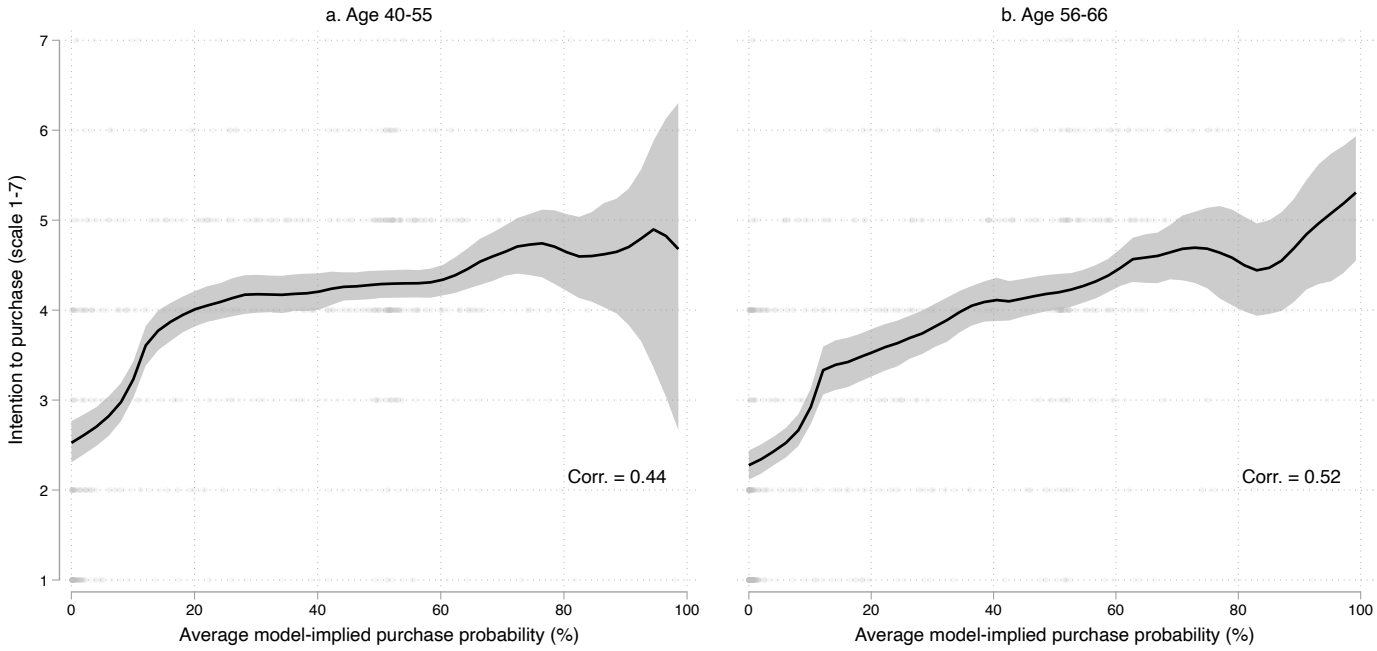


Figure D1: Out-of-sample prediction accuracy: individual average purchasing probabilities and purchase intentions on a 7-point scale

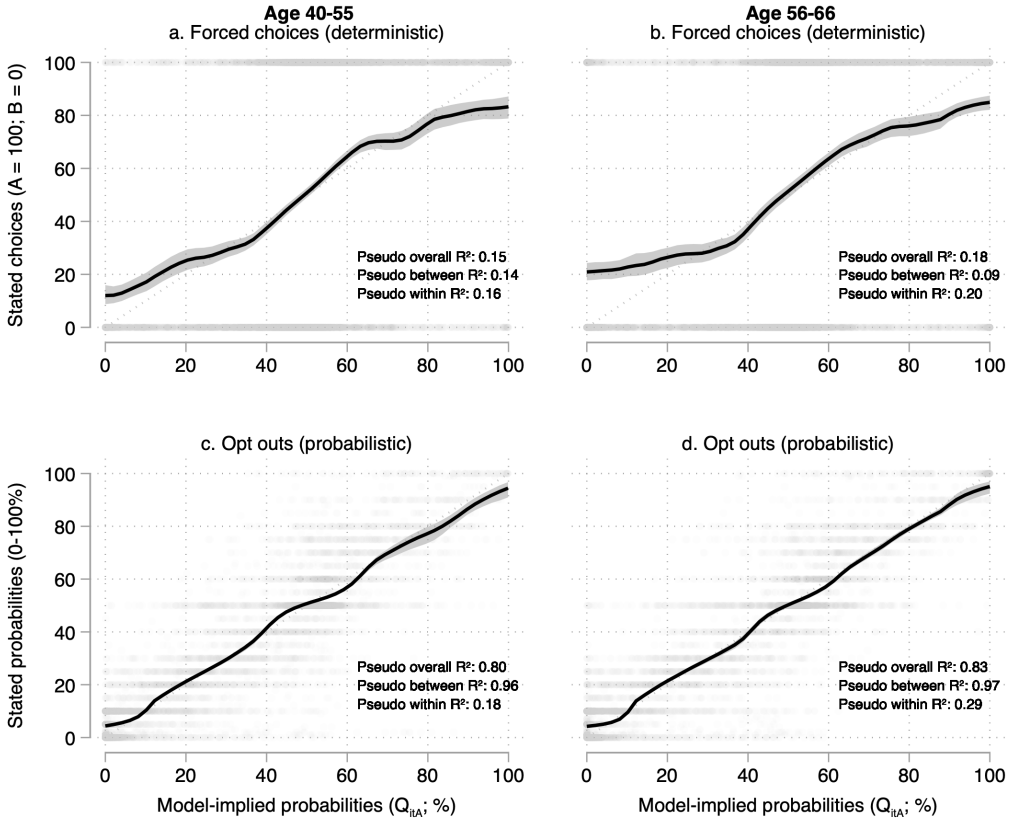


Figure E1: Model-predicted and reported choices (shaded areas are 95% confidence bands based on 500 bootstrap replications)

E Model fit

Figure E1 visualizes model fit by plotting observed choices against model-implied probabilities. Observed choices are either 0 or 100% for the forced choices between two life care annuities (panels a. and b.), or reported probabilities between 0 and 100% of buying an annuity (panels c. and d.). Model-implied probabilities are the Q_{itA} in equation 3 evaluated at individual-specific preference estimates. Individual preferences are approximated by the conditional means for price sensitivity $\check{\alpha}_i$ and WTP for attributes $\check{\boldsymbol{\gamma}}_i$ given the mixing distribution and observed choices.[6] These model-implied probabilities $\check{Q}_{itA}$ reflect preferences but not recall error or rounding. To facilitate interpretation we include a kernel regression of observed choices on model-implied probabilities that captures either the fraction of choices in which respondents choose option A (forced choices) or the average probability assigned to A (opt outs).[7]

Model fit is satisfactory for both types of choices. For the forced choices only 15-20% of the decisions in which the model assigns a zero probability to A deviate from that

[6]See Train (2003) for more information and a step-by-step description of the computational algorithm. Appendix F contains histograms and descriptives of the individual-specific preference estimates.

[7]The alternative-specific constants are included in $\check{Q}_{itA}$. They do not affect model fit as reported in Figure E1.

prediction. Similarly, 80-85% of decisions for which the model assigns a 100% probability to A are in line with the model. The fit is particularly good at intermediate values of the predicted probability: observed decisions are split exactly evenly for those choices where the predicted probability is 50%. The correspondence between data and model is even better for the opt outs, for which the average reported probability increases from 5% at a predicted probability of zero to 95% at one hundred.

In addition to the graphical summaries, Figure E1 also lists pseudo R-squares as quantitative measures of model fit. The overall R-square is defined as the squared correlation across individuals i and choices t between $\check{Q}_{itA}$ and P_{it} (choose A). Analogously, the between R-square is the squared correlation across individuals between the individual means $\bar{\check{Q}}_{iA}$ and $\bar{P}_i$ and the within R-square is the squared correlation between $\check{Q}_{itA} - \bar{\check{Q}}_{iA}$ and $P_{it} - \bar{P}_i$.

Overall fit is much better for the opt outs, with R-squares around 0.80, than for the forced choices, with R-squares around 0.15. This difference is not explained by fit for within-individual variation, since pseudo within R-squares range from 0.16 to 0.29. Instead, the large difference in overall fit is driven by the between R-squares, which are around 0.96 and 0.10 for the opt outs and forced choices respectively. The model thus captures differences between individuals in the average probability to buy insurance almost perfectly, while it struggles to fit differences in the fraction of forced choices for which a respondent chooses the first option. This pattern is understandable, since knowing that someone reports a 70% probability of buying insurance on average is more meaningful and informative for that person's preferences than the fact that she chooses alternative A exactly seven times out of ten. The latter may reflect either strong or weak preferences for annuities depending on the attribute levels of the options. The good fit for the opt outs is reassuring because it corresponds to the main goal of the analysis, which is to simulate demand for different products. In the next section we use the cross-section average probabilities of choosing different annuities over the outside option to approximate demand.

In addition to in-sample fit, we also check the model's ability to predict purchase intentions elicited immediately after the choice experiment. Specifically, we correlate individual average purchase probabilities with stated intentions to buy LTC insurance on a 7-point scale from "definitely not" to "definitely yes". Figure D1 in Appendix D shows that the average simulated purchase probability is highly predictive: the average intention increases from around 2.5 for probabilities below 10% to 5 for probabilities above 80%. Bivariate correlations are 0.44 and 0.52 for the younger and older sample respectively.

F Individual-specific preference estimates

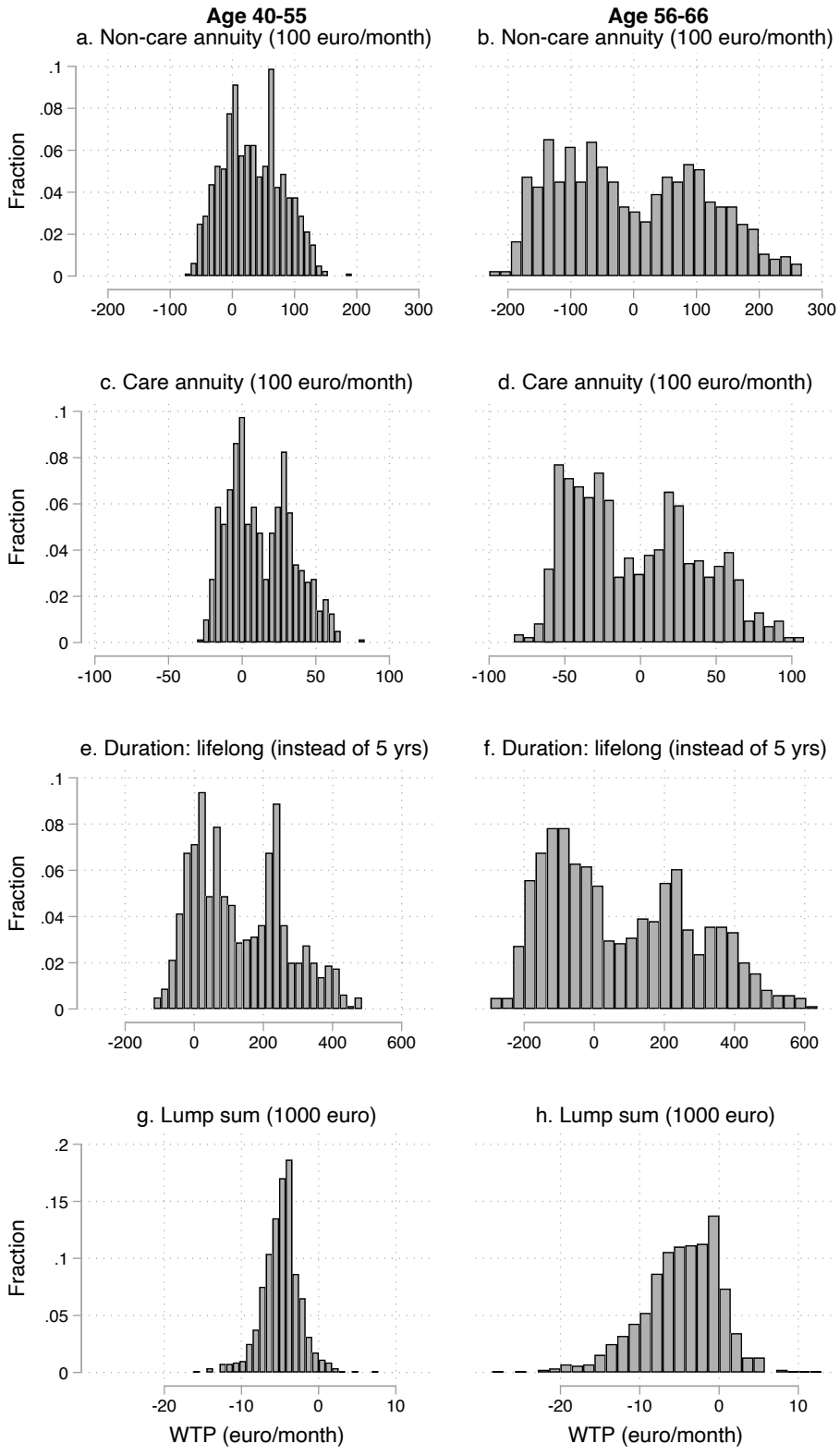


Figure F1: Individual-specific preference estimates – WTP for attributes

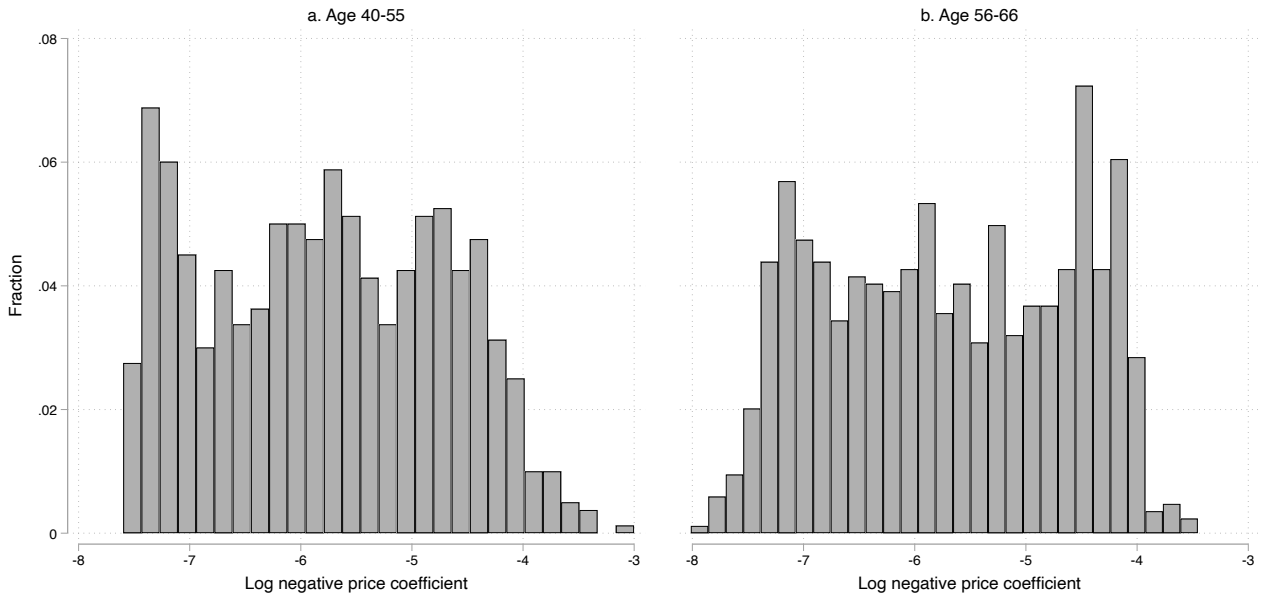


Figure F2: Individual-specific preference estimates – price sensitivity

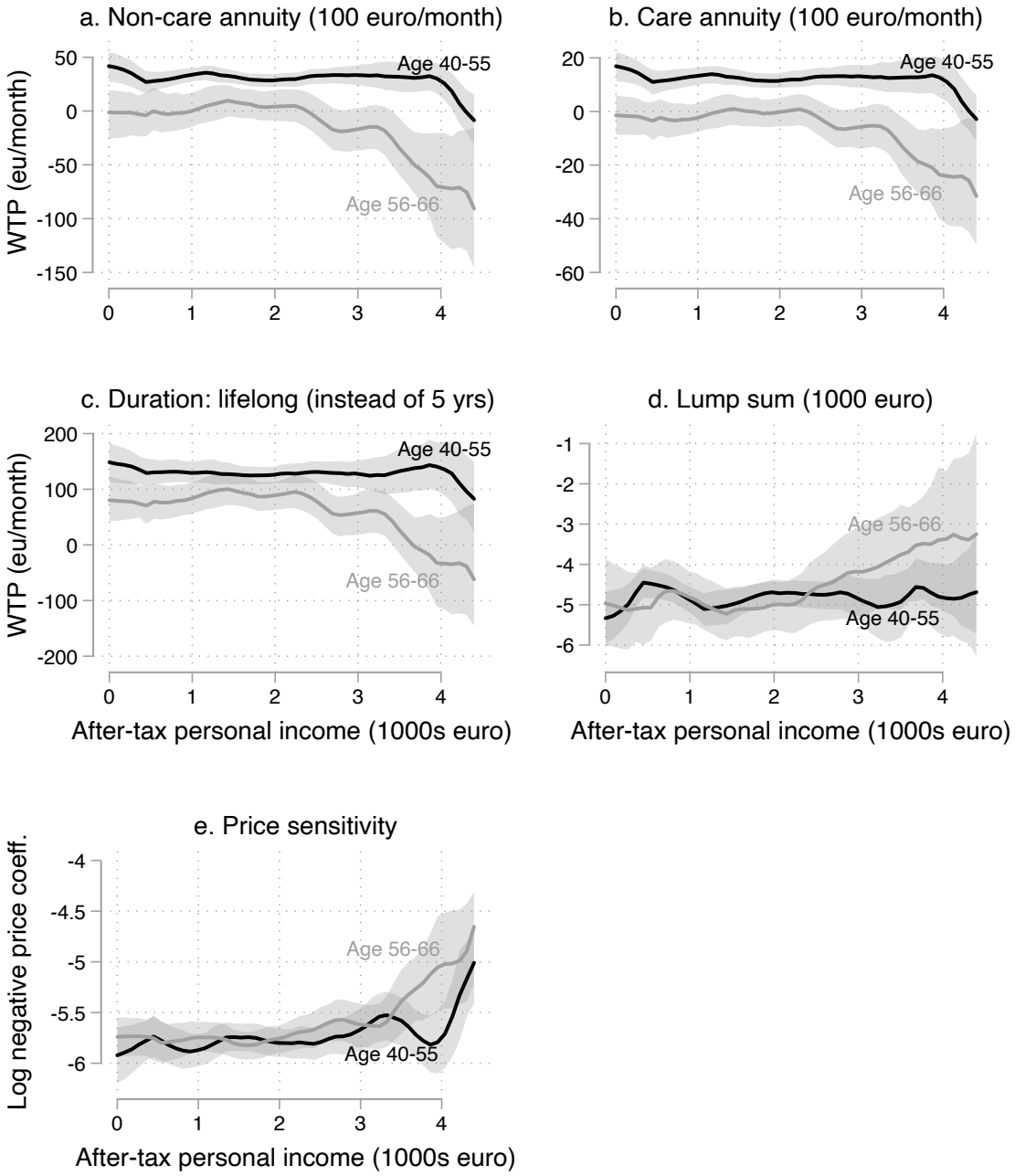


Figure F3: Kernel regressions of individual-specific preferences on income (bandwidth 200 eu/month; shaded areas are 95% CIs based on 500 bootstrap iterations)

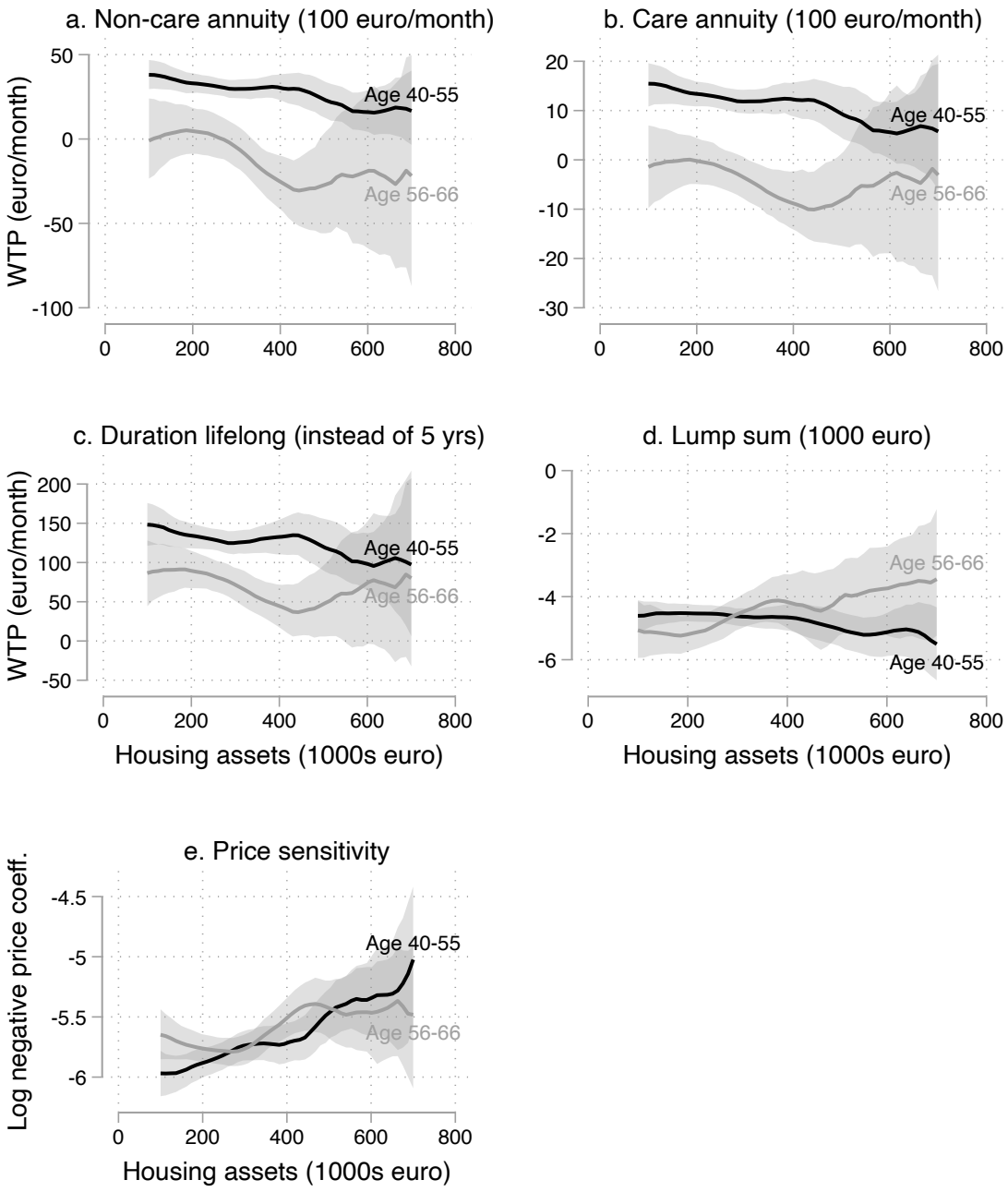


Figure F4: Kernel regressions of individual-specific preferences on housing assets (bandwidth 50k; shaded areas are 95% CIs based on 500 bootstrap iterations)

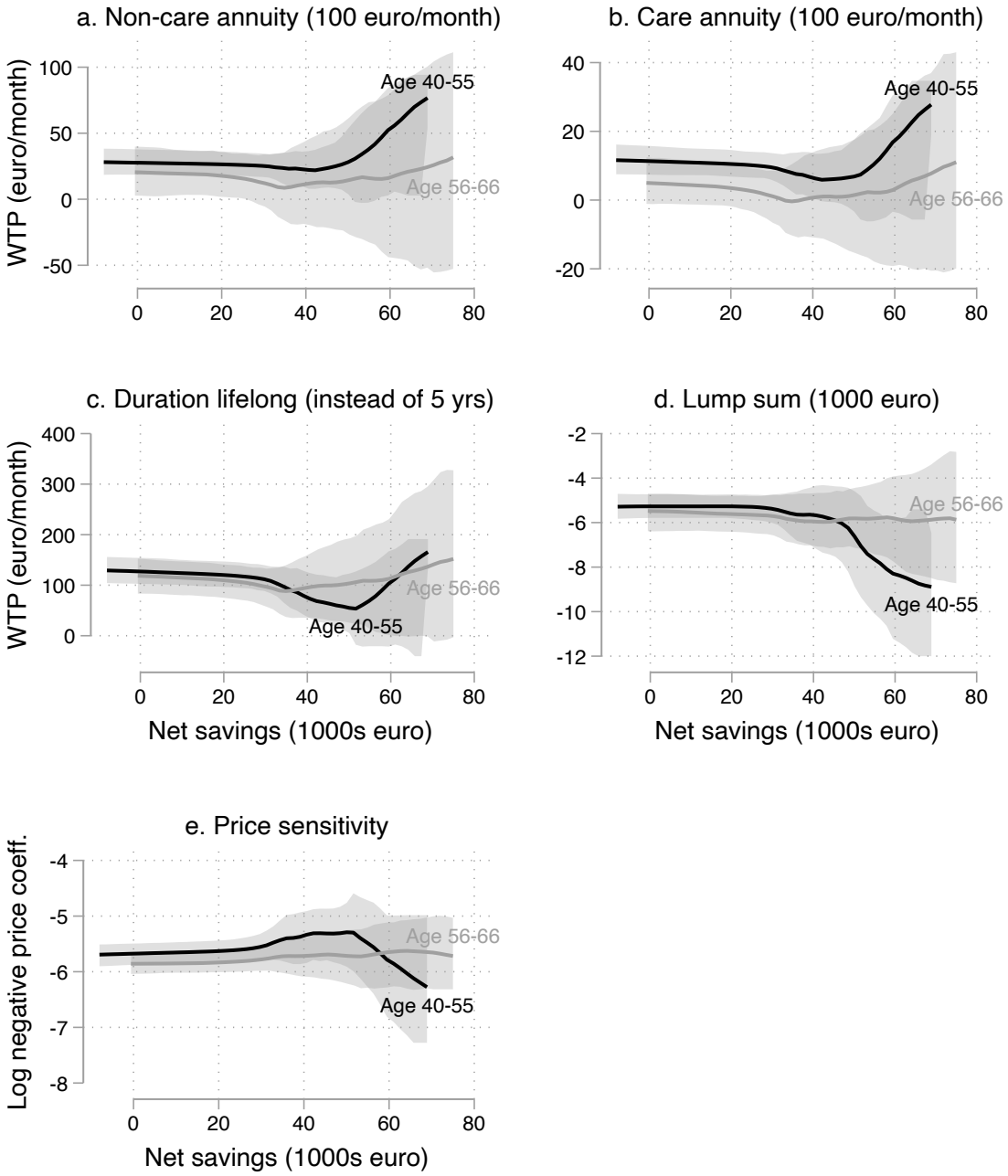


Figure F5: Kernel regressions of individual-specific preferences on savings (bandwidth 15k; shaded areas are 95% CIs based on 500 bootstrap iterations)

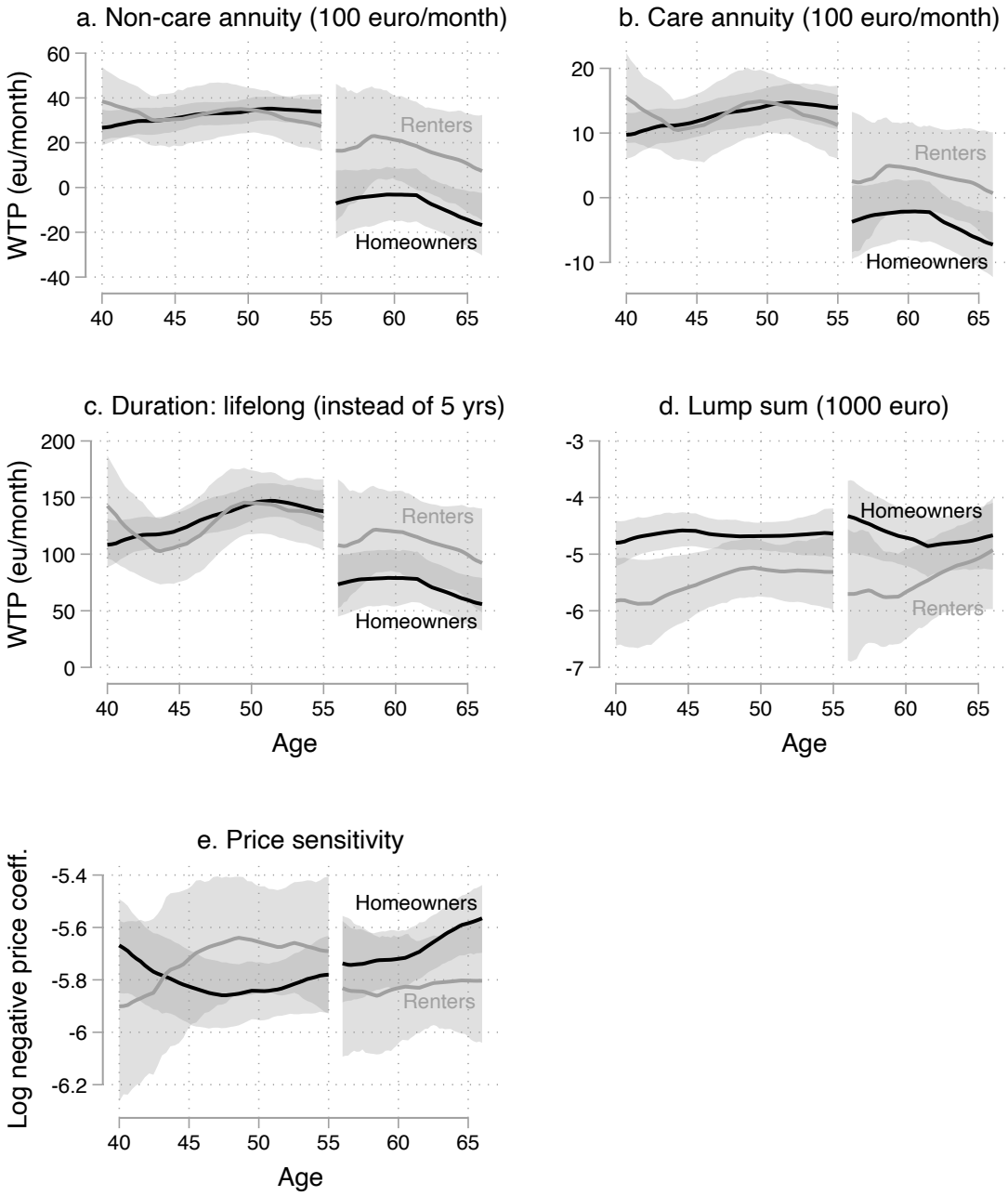


Figure F6: Kernel regressions of individual-specific preferences on age (bandwidth 2 years; shaded areas are 95% CIs based on 500 bootstrap iterations)

G Survey weights

Table G1: Target distributions derived from Statistics Netherlands microdata and distributions within the sample

a. Covariates

	Age 40-55				Age 56-66		
		Sample				Sample	
	Population	Raw	Weighted		Population	Raw	Weighted
Female	0.49	0.52	0.49		0.47	0.51	0.47
Partner	0.75	0.76	0.75		0.74	0.73	0.74
Gross personal income (euro/yr)							
1. ≤ 19,946	0.20	0.27	0.20	1. ≤ 16,280	0.20	0.29	0.20
2. 19,946 – 27,598	0.10	0.14	0.10	2. 16,280 – 22,203	0.10	0.12	0.10
3. 27,598 – 35,377	0.10	0.17	0.10	3. 22,203 – 28,988	0.10	0.13	0.10
4. 35,377 – 43,580	0.10	0.15	0.10	4. 28,988 – 36,268	0.10	0.15	0.10
5. 43,580 – 51,818	0.10	0.11	0.10	5. 36,268 – 44,525	0.10	0.11	0.10
6. 51,818 – 61,824	0.10	0.07	0.10	6. 44,525 – 53,641	0.10	0.07	0.10
7. > 61,824	0.30	0.09	0.30	7. > 53,641	0.30	0.14	0.30
Homeowner	0.73	0.82	0.74		0.70	0.79	0.70
N	3,516,327 (61%)	715 (48%)	917.26 (61%)		2,224,452 (39%)	789 (52%)	582.77 (39%)
Deciles housing value (homeowners, 1000s euro)							
1. ≤ 162	0.10	0.09	0.10	1. ≤ 166	0.10	0.11	0.10
2. 162 – 191	”	0.12	0.10	2. 166 – 195	”	0.10	0.10
3. 191 – 216	”	0.07	0.10	3. 195 – 219	”	0.08	0.10
4. 216 – 240	”	0.09	0.10	4. 219 – 243	”	0.09	0.10
5. 240 – 266	”	0.13	0.10	5. 243 – 268	”	0.11	0.10
6. 266 – 298	”	0.07	0.10	6. 268 – 300	”	0.14	0.10
7. 298 – 340	”	0.13	0.10	7. 300 – 342	”	0.05	0.10
8. 340 – 401	”	0.12	0.10	8. 342 – 401	”	0.15	0.10
9. 401 – 512	”	0.09	0.10	9. 401 – 504	”	0.08	0.10
10. > 512	0.10	0.09	0.10	10. > 504	0.10	0.09	0.10
N	2,581,845 (62%)	586 (48%)	676.41 (62%)		1,563,930 (38%)	624 (52%)	409.73 (38%)
Quintile savings (non-homeowners, 1000s euro)							
1. ≤ 0.4	0.20	0.33	0.20	1. ≤ 0.7	0.20	0.29	0.20
2. 0.4 – 1.5	”	0.07	0.19	2. 0.7 – 2.2	”	0.05	0.20
3. 1.5 – 4.4	”	0.26	0.20	3. 2.2 – 7.7	”	0.22	0.20
4. 4.4 – 15.9	”	0.16	0.20	4. 7.7 – 27.6	”	0.21	0.20
5. > 15.9	0.20	0.19	0.20	5. > 27.6	0.20	0.23	0.20
N	934,482 (59%)	129 (44%)	240.86 (58%)		660,522 (41%)	165 (56%)	173.05 (42%)

b. Summary statistics of the weights[a]

	Mean	Std. Dev.	Min	Max
Raked weights	1.00	1.12	0.20	5.00

[a] Survey weights are calculated using a raking algorithm using the Stata function `ipfraking`. Weights are trimmed at 0.2 and 5 following the guideline by the National Institute for Public Health and the Environment (RIVM) to safeguard robustness and mitigate the influence of individual observations.

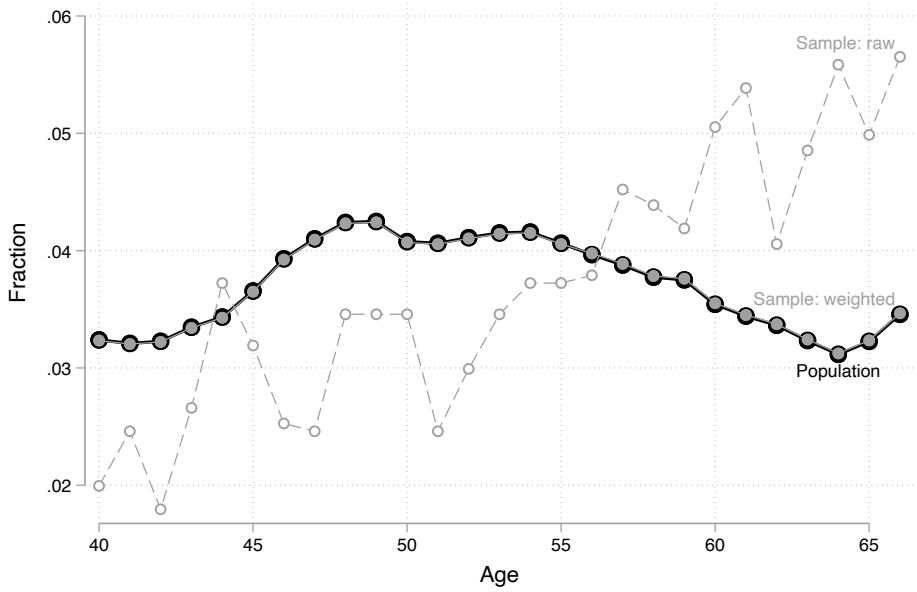


Figure G1: Distributions of age in the sample and in the population (population distribution derived from Statistics Netherlands microdata)

H Demand for life care annuities

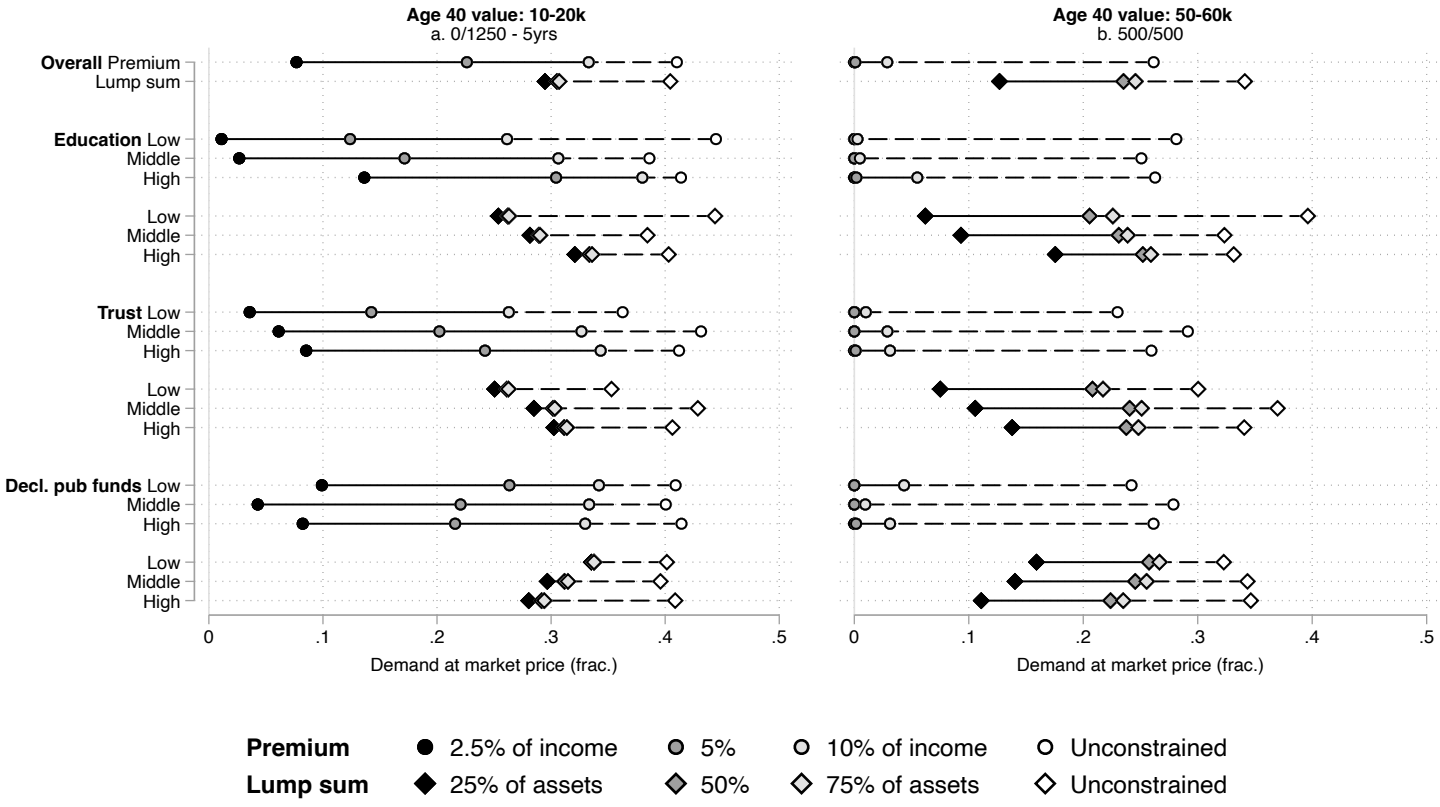


Figure H1: Heterogeneity in demand for life care annuities at market prices and different budget constraints

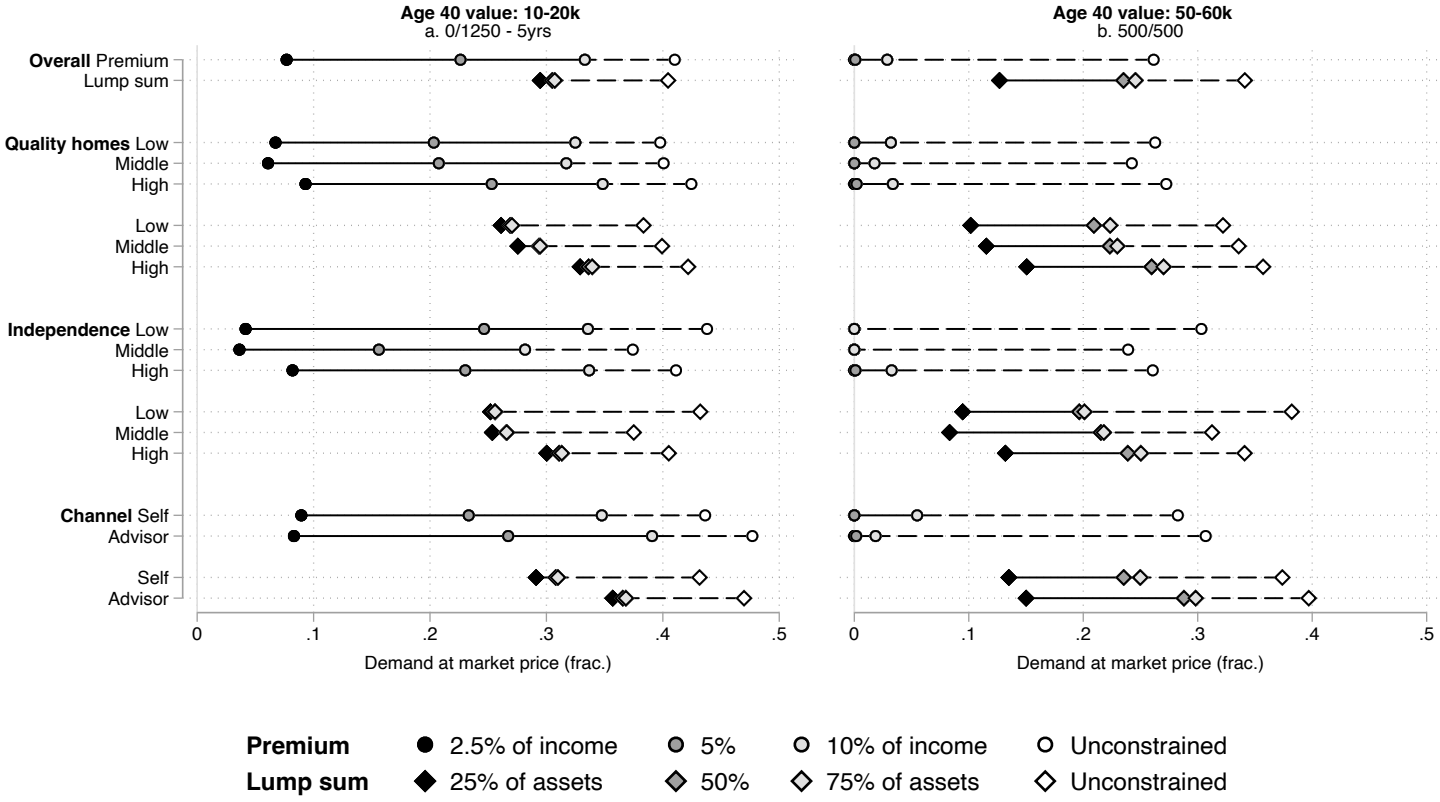


Figure H2: Heterogeneity in demand for life care annuities at market prices and different budget constraints (continued)

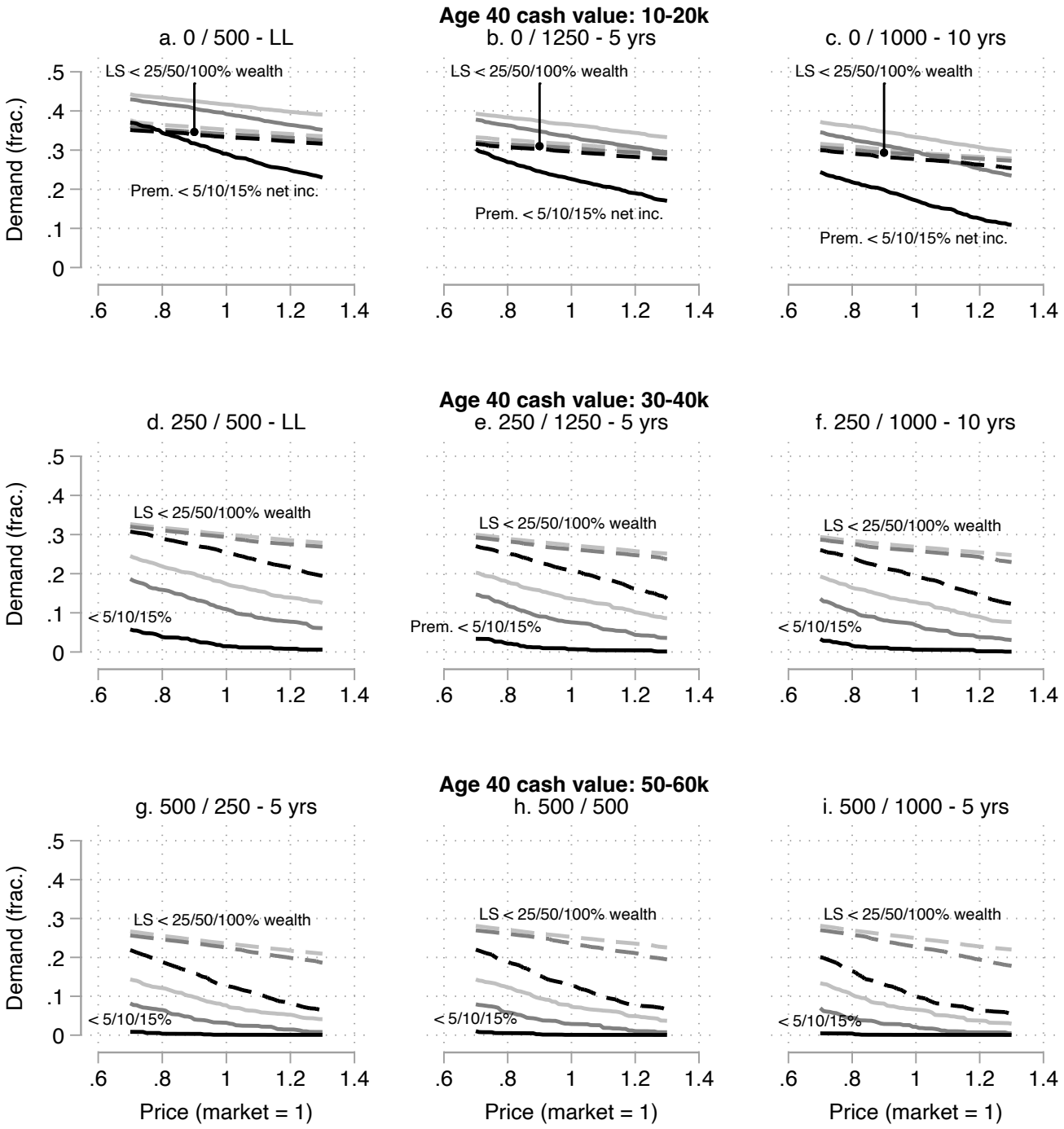
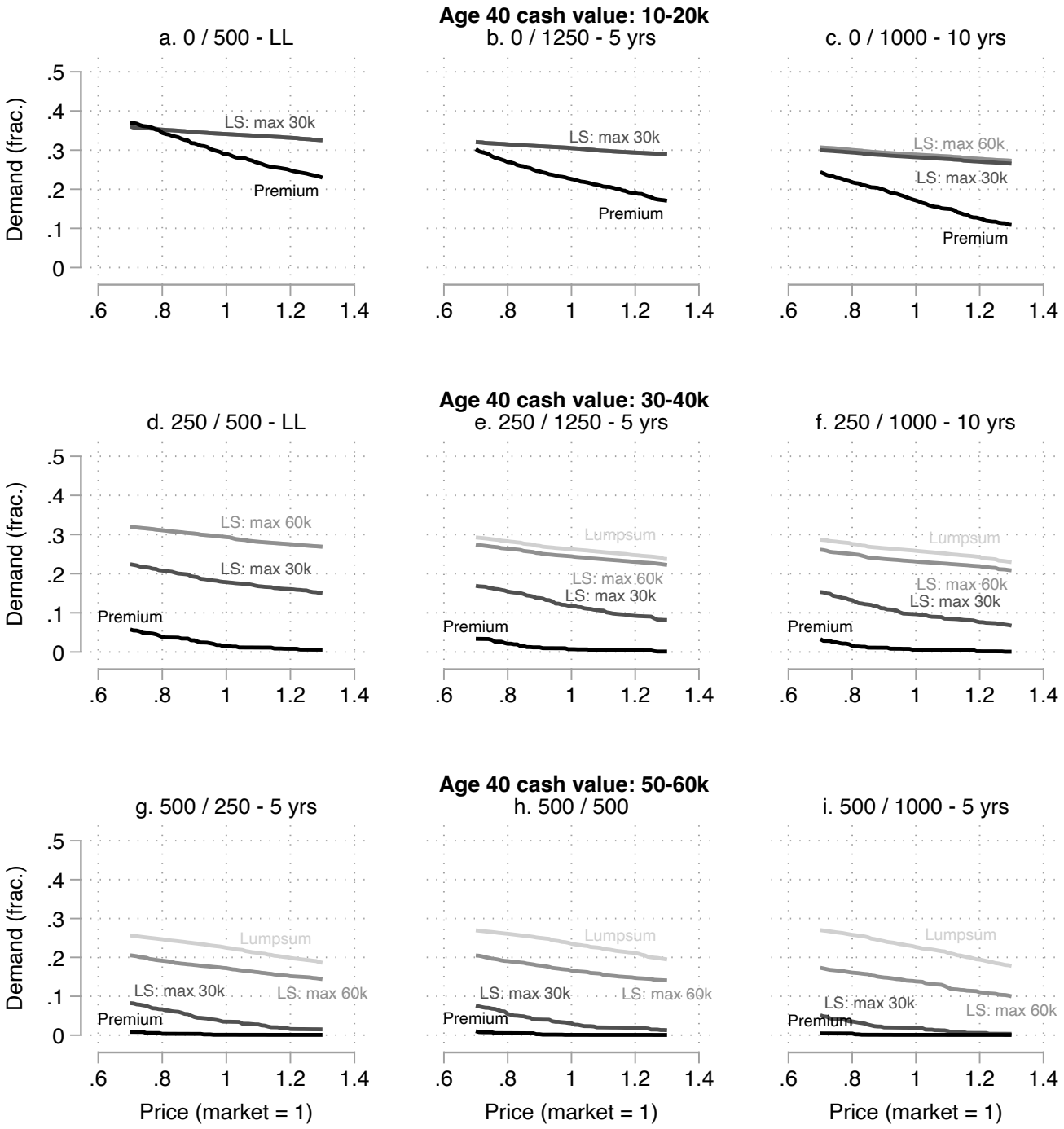
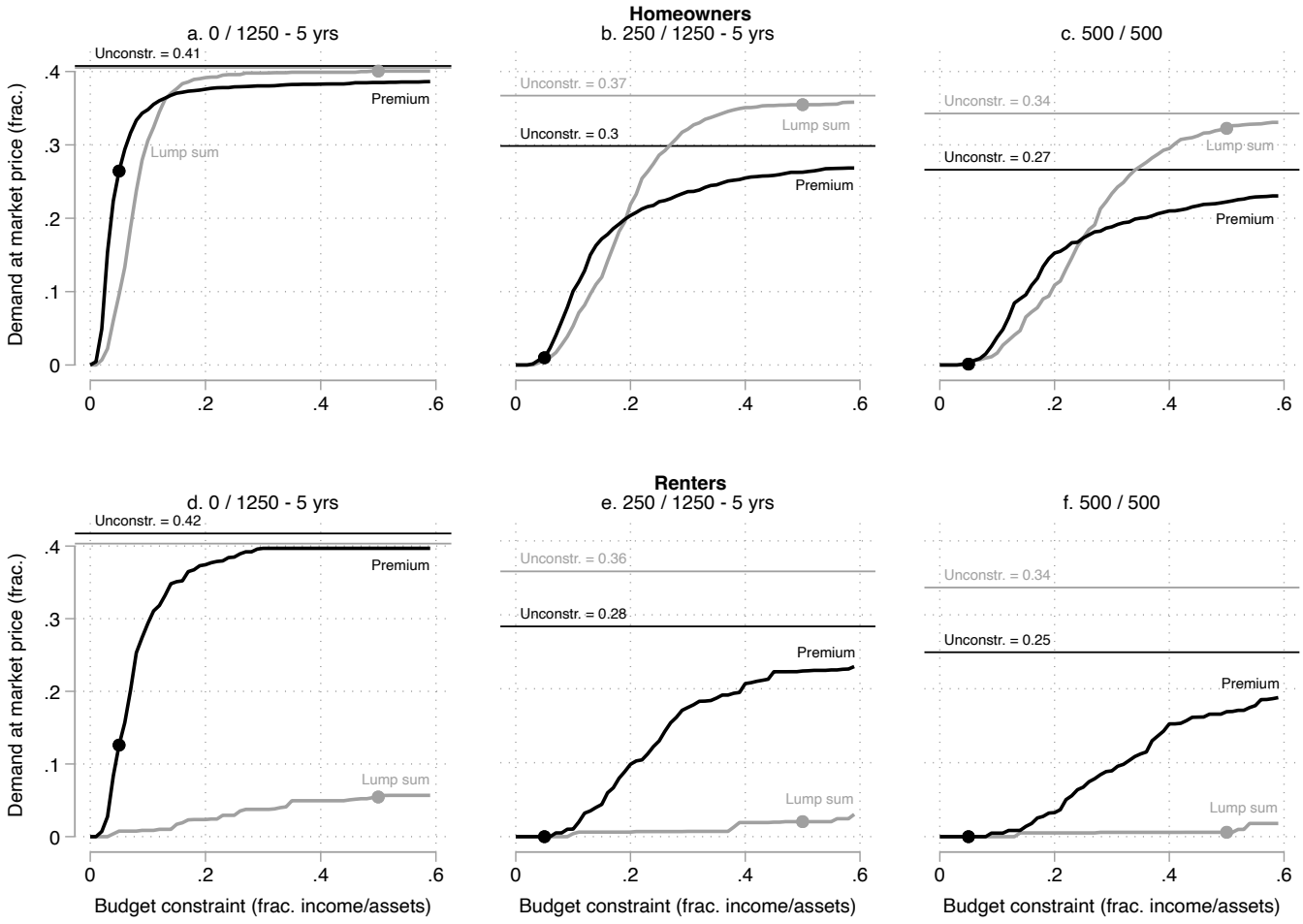


Figure H3: Constrained demand for life care annuities under different sets of budget constraints



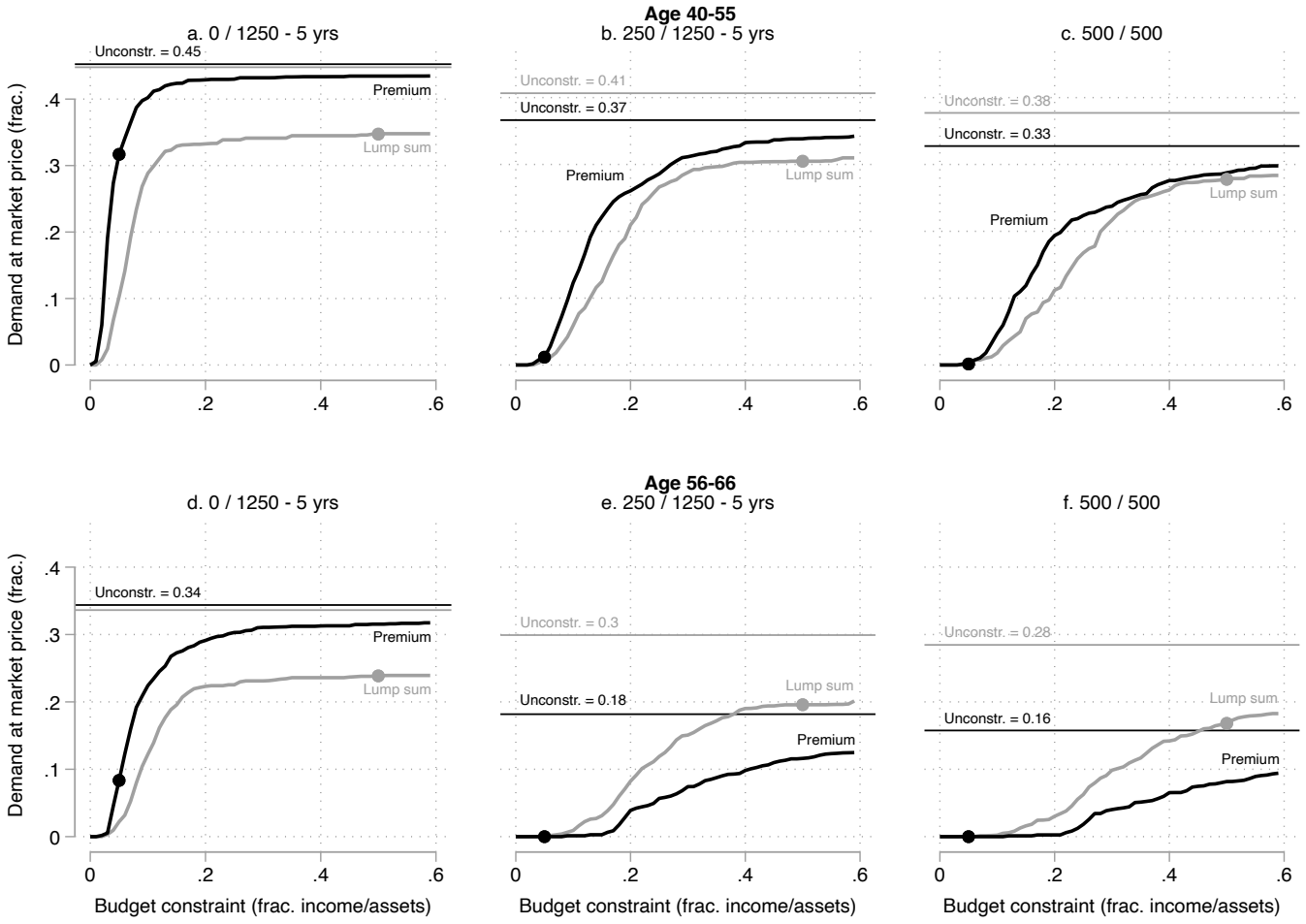
Products: [non-care annuity (eu/month)] / [care annuity (eu/month)] - [duration care annuity (LL = LifeLong)]

Figure H4: Constrained demand for life care annuities under different combinations of premium and lump sum (budget constraint: 5% of net personal income and 50% of value of assets)



Products: [non-care annuity (eu/month)] / [care annuity (eu/month)] - [duration care annuity (LL = LifeLong)]

Figure H5: Constrained demand for life care annuities at market prices as function of budget constraint – by homeownership



Products: [non-care annuity (eu/month)] / [care annuity (eu/month)] - [duration care annuity (LL = LifeLong)]

Figure H6: Constrained demand for life care annuities at market prices as function of budget constraint – by age group

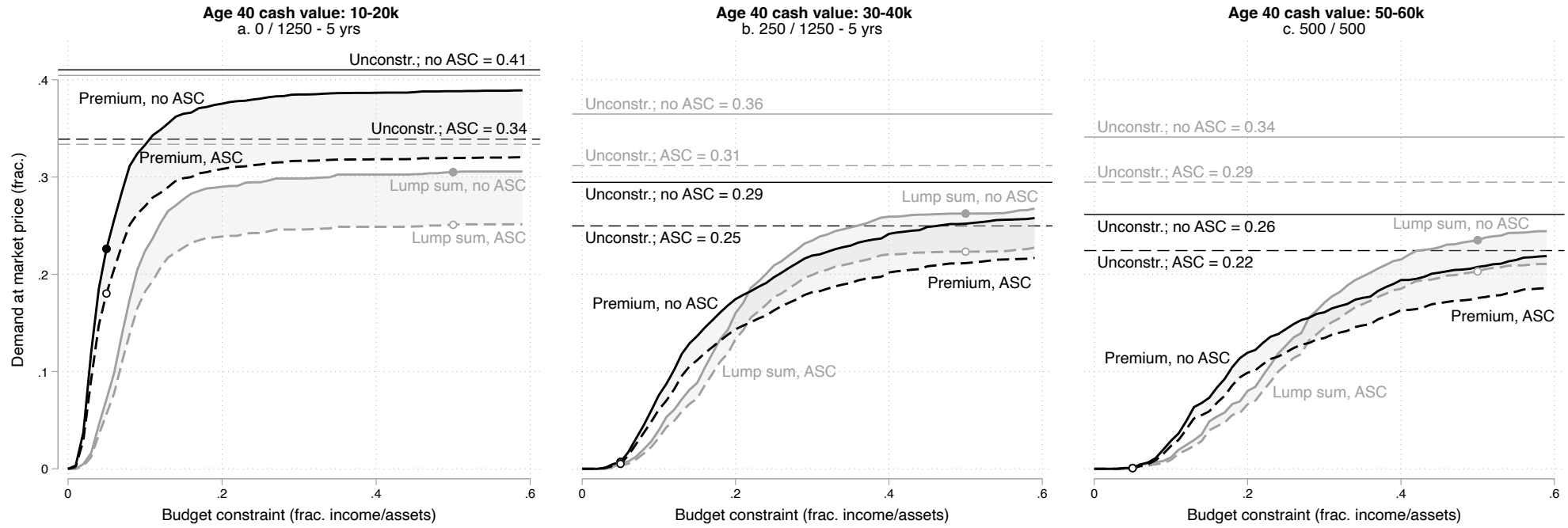


Figure H7: Constrained demand for life care annuities at market prices as function of budget constraint – with and without Alternative-Specific Constant (ASC)

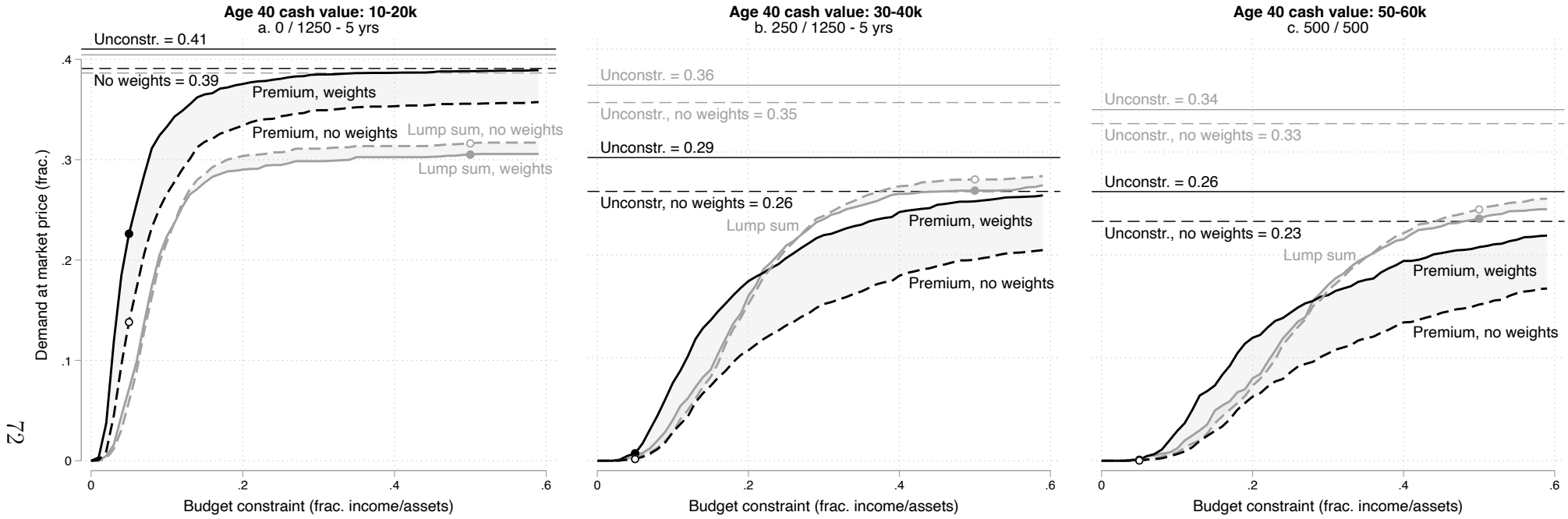


Figure H8: Constrained demand for life care annuities at market prices as function of budget constraint – with and without survey weights

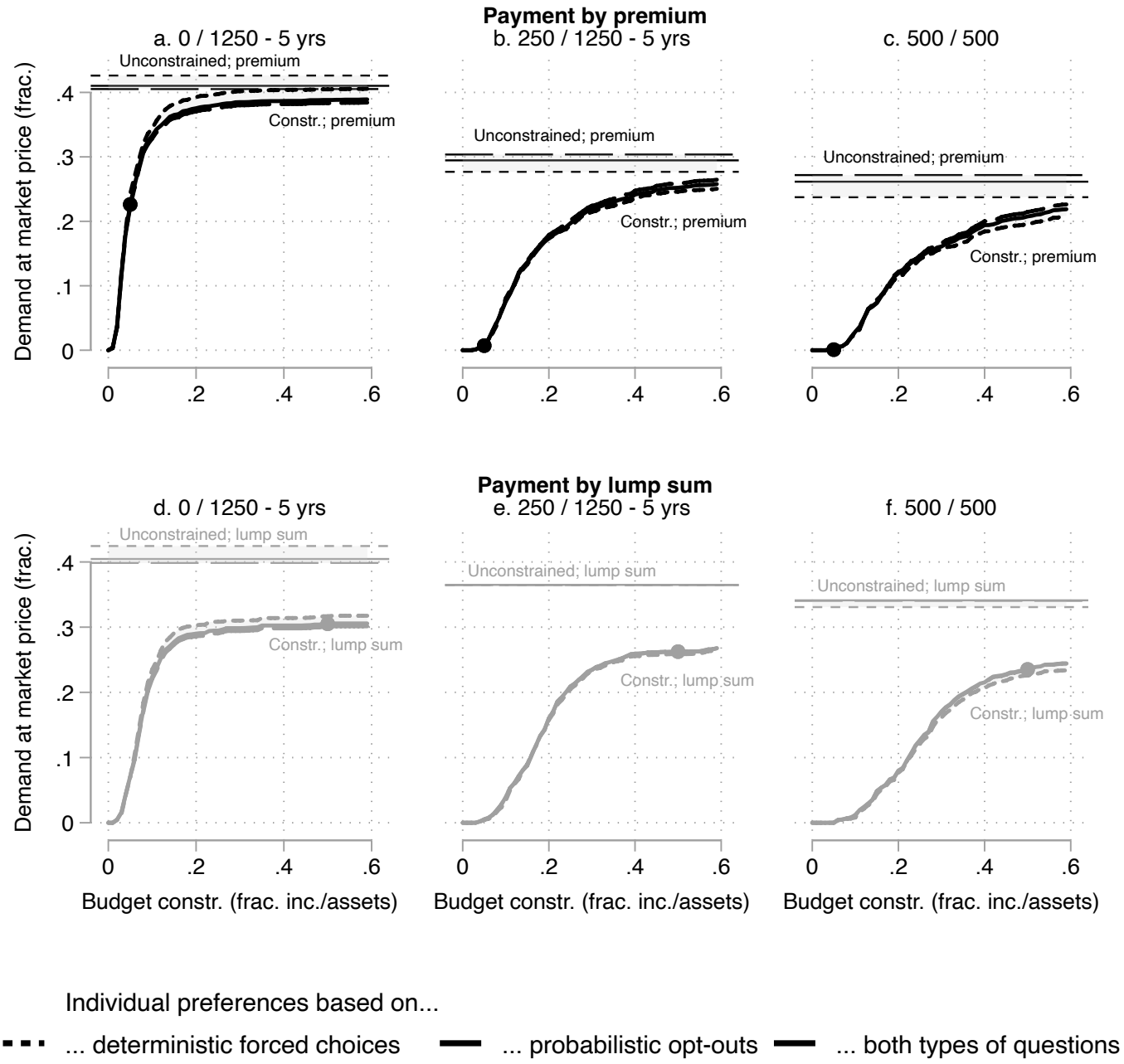


Figure H9: Constrained demand for life care annuities at market prices as function of budget constraint – separately for individual-specific estimates computed based only on forced (deterministic) choices; only (probabilistic) opt-outs; or both sets of questions

I Variation in individual-specific preference estimates

Table I1: Linear regression models of WTP for the attributes

	Non-care annuity (100 eu/month)		Care annuity (100 eu/month)		Duration: 10 years		Duration: life long	
	Age 40-55	Age 56-66	Age 40-55	Age 56-66	Age 40-55	Age 56-66	Age 40-55	Age 56-66
Female	-9.762**	-11.73	-5.332***	-4.582	-34.14***	-14.64	-36.69***	-22.85
	(4.358)	(8.944)	(1.968)	(3.305)	(10.48)	(16.04)	(12.24)	(16.26)
Partner	12.69*	-15.27	4.659	-5.696	3.845	-29.40	9.290	-30.22
	(6.914)	(11.98)	(3.142)	(4.561)	(16.68)	(22.70)	(19.49)	(22.56)
Number of children	-4.135*	0.740	-1.874*	-0.00635	-6.992	-5.099	-8.562	-1.426
	(2.143)	(7.316)	(0.960)	(2.648)	(5.117)	(12.33)	(5.850)	(13.14)
Age	0.370	-2.133	0.218	-0.695	1.426	-3.943	1.767	-3.940
	(0.496)	(1.911)	(0.224)	(0.689)	(1.167)	(3.371)	(1.360)	(3.465)
Education (base: primary/lower secondary)								
Higher secondary	-7.620	-25.28**	-3.551	-8.291*	-17.67	-40.16*	-21.88	-44.69**
	(6.999)	(11.86)	(3.115)	(4.331)	(15.03)	(20.88)	(17.72)	(21.47)
University	-6.079	-24.95*	-3.063	-8.764*	-16.07	-32.57	-22.85	-39.62*
	(7.741)	(12.72)	(3.452)	(4.635)	(16.25)	(22.30)	(19.42)	(22.87)
Other	-3.995	-31.71	-3.468	-10.98	-36.33	-39.80	-41.63	-41.50
	(20.29)	(27.98)	(8.773)	(10.79)	(34.44)	(55.42)	(47.54)	(53.36)
Net household income (base: < 1810 euro/month)								
1811 - 2670 euro/month	-4.383	-0.630	-1.119	0.138	2.053	-2.766	11.84	-1.488
	(8.831)	(15.29)	(4.083)	(5.731)	(21.57)	(28.21)	(25.13)	(28.44)
2671 - 3500 euro/month	-8.491	14.15	-2.808	4.065	-5.251	-5.619	1.017	11.86
	(10.22)	(16.50)	(4.696)	(6.138)	(24.32)	(30.33)	(28.56)	(30.50)
3501 - 4550 euro/month	-17.72	7.688	-6.459	3.165	-13.14	3.010	-15.83	6.849
	(10.83)	(18.48)	(4.955)	(6.880)	(25.95)	(34.77)	(30.25)	(34.32)
> 4500 euro/month	-10.42	13.67	-3.258	6.084	3.413	10.41	4.834	17.97
	(11.11)	(19.79)	(5.074)	(7.313)	(26.98)	(35.86)	(31.21)	(36.14)
Homeowner	-1.415	-13.22	-1.011	-4.049	-8.210	-9.506	-6.553	-18.33
	(7.061)	(12.04)	(3.245)	(4.466)	(16.40)	(22.30)	(19.32)	(22.50)
Most important activity (base: employed)								
Self-employed	-2.559	-1.054	-1.028	-0.234	-3.545	-1.712	-4.739	-3.454
	(6.888)	(16.96)	(3.143)	(6.162)	(16.22)	(28.70)	(18.85)	(29.76)
Unemployed	4.031	-16.39	1.584	-9.172	2.259	-46.30	3.706	-43.02
	(15.05)	(18.12)	(6.988)	(6.455)	(39.09)	(29.66)	(43.66)	(31.59)
Homemaker	-1.273	-3.591	0.888	-0.0556	21.19	4.465	20.06	-2.138
	(8.921)	(16.60)	(3.998)	(5.990)	(21.10)	(28.29)	(23.90)	(29.60)
Retired		-4.496		-1.464		7.610		-2.753
		(14.97)		(5.398)		(26.55)		(27.01)
Disabled	-10.86	42.19**	-4.900	14.53**	-6.803	60.48*	-16.04	68.35**
	(10.82)	(19.05)	(5.022)	(6.867)	(27.30)	(32.78)	(31.81)	(34.28)
Other	4.133	21.31	3.931	7.378	41.76	21.88	43.18	26.44
	(17.69)	(23.36)	(8.487)	(8.730)	(46.07)	(39.58)	(52.55)	(41.86)

– continued on next page –

Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10

Table H1 (continued): Linear regression models of WTP for the attributes

	Non-care annuity (100 eu/month)		Care annuity (100 eu/month)		Duration: 10 years		Duration: life long	
	Age 40-55	Age 56-66	Age 40-55	Age 56-66	Age 40-55	Age 56-66	Age 40-55	Age 56-66
– continued from previous page –								
Expected LTC use (years)								
Expectation	0.335	5.529**	0.126	2.615***	1.765	13.27***	1.382	12.57***
	(1.352)	(2.280)	(0.576)	(0.922)	(3.197)	(4.804)	(3.527)	(4.502)
Standard deviation	-0.962	0.849	-0.365	-0.514	-2.537	-4.580	-2.455	-2.362
	(2.187)	(3.773)	(0.970)	(1.440)	(5.348)	(7.156)	(5.974)	(7.061)
Subjective longevity								
Expected age at death	1.215**	0.898	0.544**	0.354	1.875	0.864	2.765**	1.590
	(0.474)	(0.950)	(0.216)	(0.342)	(1.156)	(1.608)	(1.317)	(1.655)
Standard deviation	1.034	-3.461	0.414	-0.791	0.321	-2.588	1.158	-3.611
	(0.946)	(2.531)	(0.437)	(0.924)	(2.472)	(4.483)	(2.769)	(4.545)
Availability of informal care (base: available/definitely available)								
May be available	-10.33	-8.940	-5.021	-2.840	-25.69	-7.613	-33.18*	-12.44
	(6.997)	(17.03)	(3.183)	(6.146)	(16.73)	(29.66)	(19.62)	(30.53)
Not/definitely not available	-17.14**	-41.69**	-8.515***	-13.06**	-40.23***	-48.03	-53.28***	-65.08**
	(6.815)	(17.33)	(3.000)	(6.223)	(15.54)	(29.65)	(17.89)	(30.93)
Has plan to deal with costs of LTC	-1.970	-32.55*	-1.321	-12.40*	-1.195	-51.21*	-8.095	-58.26*
	(7.306)	(17.75)	(3.330)	(6.351)	(18.28)	(30.51)	(21.07)	(31.77)
Has a plan × maybe informal care	17.48	-0.882	8.263	0.426	35.06	-7.440	49.31	-5.192
	(11.22)	(22.69)	(5.111)	(8.134)	(26.59)	(38.93)	(31.37)	(40.29)
Has a plan × no informal care	30.09***	45.81**	13.45***	16.26**	42.78	60.57	67.68**	77.94*
	(10.54)	(22.47)	(4.871)	(8.117)	(26.55)	(39.85)	(30.73)	(40.77)
Expected change in non-medical expenditures when in need of LTC (base: decrease)								
Non-medical exp. constant	-0.823	16.29	-1.049	3.919	-11.34	11.22	-8.423	20.16
	(5.577)	(11.45)	(2.495)	(4.112)	(12.39)	(19.81)	(14.61)	(20.34)
Non-medical exp. increase	10.26**	5.989	4.933**	0.993	14.76	-3.998	27.06*	3.813
	(4.959)	(9.660)	(2.284)	(3.546)	(12.24)	(17.31)	(14.26)	(17.54)
Expected change in medical expenditures when in need of LTC (base: increase/strong increase)								
Medical exp. constant	51.77***	18.86	21.92***	5.530	69.72*	19.77	97.56**	31.50
	(17.81)	(25.56)	(8.241)	(9.477)	(41.41)	(42.35)	(45.15)	(45.07)
Medical exp. extreme increase	-1.751	0.779	-0.656	-0.670	1.676	-0.179	-2.250	0.293
	(4.606)	(9.595)	(2.057)	(3.441)	(10.27)	(17.25)	(12.22)	(17.31)
Preferences								
Risk aversion	-0.617	0.225	0.0291	0.150	5.693	0.0235	4.772	-0.127
	(1.819)	(3.313)	(0.815)	(1.231)	(4.279)	(6.069)	(4.979)	(6.104)
Patience	-2.012	-2.437	-0.761	-0.956	-0.0304	-3.629	-2.016	-4.272
	(1.816)	(3.055)	(0.833)	(1.100)	(4.348)	(5.383)	(5.066)	(5.451)
Impulsiveness	4.024**	0.296	1.770*	0.222	6.652	0.434	8.722	1.146
	(1.962)	(3.647)	(0.910)	(1.326)	(4.770)	(6.283)	(5.598)	(6.486)
Expected pension (base: < 1750 euro/month)								
1751 - 2700 euro/month	-4.179	2.686	-1.687	2.026	4.946	11.63	0.741	7.577
	(5.945)	(12.48)	(2.692)	(4.580)	(13.77)	(22.25)	(16.28)	(22.86)
> 2700 euro/month	-9.995	-30.64**	-5.588*	-9.439*	-24.63*	-32.60	-33.91**	-45.90*
	(6.386)	(14.88)	(2.847)	(5.414)	(14.82)	(25.72)	(17.21)	(26.69)

– continued on next page –

Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10

Table H1 (continued): Linear regression models of WTP for the attributes

	Non-care annuity (100 eu/month)		Care annuity (100 eu/month)		Duration: 10 years		Duration: life long	
	Age 40-55	Age 56-66	Age 40-55	Age 56-66	Age 40-55	Age 56-66	Age 40-55	Age 56-66
– continued from previous page –								
Importance of bequests (base: not important)								
Neutral beq. motive	-4.861	21.42	-2.595	7.037	-15.91	42.71*	-15.20	39.60*
	(6.322)	(13.01)	(2.792)	(4.794)	(14.20)	(23.31)	(16.76)	(23.69)
Strong beq. motive	1.561	20.19*	0.431	6.349	-2.792	26.78	2.297	32.00
	(6.095)	(11.66)	(2.695)	(4.236)	(14.09)	(20.32)	(16.25)	(20.90)
Importance of inter-vivos transfers (base: not important)								
Neutral	3.677	7.319	1.213	3.578	-4.253	13.38	-3.016	16.56
	(6.615)	(13.73)	(2.937)	(5.004)	(15.19)	(24.09)	(17.60)	(24.80)
Important	12.90**	1.693	4.892*	0.244	9.947	-0.404	15.33	0.378
	(6.218)	(11.39)	(2.786)	(4.145)	(14.74)	(20.23)	(17.16)	(20.55)
Allocation of money to good-health states of the world (base: less than 50%)								
50%	-15.67***	-3.673	-7.547***	-3.677	-43.48***	-11.03	-49.11***	-11.66
	(5.194)	(11.24)	(2.429)	(4.071)	(13.64)	(19.54)	(15.53)	(20.04)
$>$ 50%	-9.027	-38.55***	-3.927	-15.18***	-16.46	-64.70***	-21.32	-69.03***
	(5.818)	(11.14)	(2.659)	(4.041)	(14.14)	(19.41)	(16.38)	(19.95)
Constant	-69.17	149.8	-34.07	42.71	-152.0	273.0	-136.1	345.1
	(57.36)	(151.8)	(26.22)	(54.46)	(141.0)	(265.2)	(160.6)	(269.8)
Observations	517	682	517	682	517	682	517	682
R-squared	0.166	0.136	0.164	0.126	0.124	0.108	0.142	0.124

Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10

Table H2: Linear regression models of WTP for the attributes

	Lump sum (1000 euro)		Price sensitivity	
	Age 40-55	Age 56-66	Age 40-55	Age 56-66
Female	0.201	0.569	0.0141	-0.0908
	(0.244)	(0.430)	(0.0965)	(0.0836)
Partner	-0.474	0.283	-0.0859	0.104
	(0.388)	(0.572)	(0.145)	(0.112)
Number of children	0.144	-0.142	0.0222	0.0200
	(0.121)	(0.356)	(0.0434)	(0.0662)
Age	0.00797	-0.0225	-0.00994	0.0361**
	(0.0305)	(0.0840)	(0.0107)	(0.0176)
Education (base: primary/lower secondary)				
Higher secondary	-0.348	0.189	0.108	0.309***
	(0.359)	(0.566)	(0.137)	(0.110)
University	-0.927**	0.756	0.236	0.222*
	(0.368)	(0.624)	(0.148)	(0.117)
Other	-0.398	1.844	0.178	0.326
	(1.144)	(1.224)	(0.461)	(0.234)
Net household income (base: $<$ 1810 euro/month)				
1811 - 2670 euro/month	0.309	-0.311	-0.401**	0.0917
	(0.532)	(0.738)	(0.182)	(0.132)
2671 - 3500 euro/month	0.712	-0.531	-0.321	-0.138
	(0.561)	(0.737)	(0.203)	(0.154)
3501 - 4550 euro/month	1.097*	-1.199	-0.0809	0.0887
	(0.613)	(0.867)	(0.211)	(0.168)
$>$ 4500 euro/month	0.629	-1.403	-0.156	0.0803
	(0.619)	(0.920)	(0.217)	(0.195)
Homeowner	1.030**	0.688	-0.105	0.0243
	(0.456)	(0.554)	(0.143)	(0.116)
Most important activity (base: employed)				
Self-employed	0.210	-0.0357	0.0138	-0.0346
	(0.363)	(0.719)	(0.143)	(0.156)
Unemployed	0.115	0.588	-0.0281	-0.102
	(0.757)	(0.897)	(0.321)	(0.181)
Homemaker	-0.148	-0.0606	0.0357	0.0598
	(0.487)	(0.798)	(0.191)	(0.153)
Retired		0.0148		0.0353
		(0.715)		(0.131)
Disabled	0.239	-1.849**	0.257	-0.240
	(0.589)	(0.879)	(0.239)	(0.154)
Other	1.534	-0.860	-0.0819	-0.299
	(1.308)	(0.997)	(0.266)	(0.212)

– continued on next page –

Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10

Table H2 (continued): Linear regression models of WTP for the attributes

	Lump sum (1000 euro)		Price sensitivity	
	Age 40-55	Age 56-66	Age 40-55	Age 56-66
– continued from previous page –				
Expected LTC use (years)				
Expectation	-0.0668	-0.246*	0.0194	0.0161
	(0.0931)	(0.127)	(0.0251)	(0.0213)
Standard deviation	0.103	0.177	-0.0143	-0.105***
	(0.129)	(0.195)	(0.0426)	(0.0351)
Subjective longevity				
Expected age at death	0.00869	-0.0633	-0.0236**	0.0106
	(0.0224)	(0.0474)	(0.0115)	(0.00929)
Standard deviation	-0.0141	0.0707	-0.0226	0.0723***
	(0.0523)	(0.124)	(0.0231)	(0.0230)
Availability of informal care (base: available/definitely available)				
May be available	0.746*	0.697	0.165	-0.0315
	(0.386)	(0.821)	(0.154)	(0.153)
Not/definitely not available	0.310	1.195	0.341**	0.317**
	(0.378)	(0.791)	(0.135)	(0.152)
Has plan to deal with costs of LTC	-0.0912	0.953	0.244*	0.196
	(0.405)	(0.782)	(0.148)	(0.155)
Has a plan × maybe informal care	-0.786	0.0232	-0.358	-0.0432
	(0.581)	(1.110)	(0.230)	(0.208)
Has a plan × no informal care	-0.326	-1.148	-0.674***	-0.297
	(0.564)	(0.978)	(0.213)	(0.202)
Expected change in non-medical expenditures when in need of LTC (base: decrease)				
Non-medical exp. constant	-0.508	-0.268	-0.0885	-0.247**
	(0.312)	(0.520)	(0.112)	(0.108)
Non-medical exp. increase	-0.207	-0.181	-0.365***	-0.0778
	(0.262)	(0.460)	(0.107)	(0.0936)
Expected change in medical expenditures when in need of LTC (base: increase/strong increase)				
Medical exp. constant	-0.466	-0.314	-0.611*	-0.0985
	(0.551)	(1.187)	(0.327)	(0.239)
Medical exp. extreme increase	-0.0963	0.0609	0.133	-0.0421
	(0.237)	(0.479)	(0.0976)	(0.0884)
Preferences				
Risk aversion	0.123	-0.303*	0.0247	0.0615*
	(0.106)	(0.157)	(0.0383)	(0.0318)
Patience	-0.0254	-0.0417	0.0587*	0.0418
	(0.0886)	(0.158)	(0.0351)	(0.0302)
Impulsiveness	-0.0990	0.0214	-0.0411	0.0107
	(0.102)	(0.176)	(0.0428)	(0.0346)
Expected pension (base: $<$ 1750 euro/month)				
1751 - 2700 euro/month	0.0500	0.322	0.126	-0.137
	(0.304)	(0.583)	(0.126)	(0.115)
$>$ 2700 euro/month	-0.420	1.175*	0.289**	0.183
	(0.360)	(0.681)	(0.132)	(0.137)
– continued on next page –				

Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10

Table H2 (continued): Linear regression models of WTP for the attributes

	Lump sum (1000 euro)		Price sensitivity	
	Age 40-55	Age 56-66	Age 40-55	Age 56-66
– continued from previous page –				
Importance of bequests (base: not important)				
Neutral beq. motive	-0.234	-0.0601	-0.0527	-0.335***
	(0.327)	(0.654)	(0.133)	(0.119)
Strong beq. motive	-0.0709	-0.427	-0.168	-0.225**
	(0.389)	(0.605)	(0.125)	(0.107)
Importance of inter-vivos transfers (base: not important)				
Neutral	-0.369	-0.570	-0.00446	0.139
	(0.375)	(0.690)	(0.137)	(0.110)
Important	-0.380	-0.267	-0.0829	0.00268
	(0.375)	(0.574)	(0.129)	(0.106)
Allocation of money to good-health states of the world (base: less than 50%)				
50%	0.462	0.208	0.0675	-0.0719
	(0.298)	(0.545)	(0.104)	(0.102)
> 50%	0.0201	1.167**	0.106	0.278***
	(0.317)	(0.536)	(0.117)	(0.0977)
Constant	-6.561**	0.640	-3.254**	-9.999***
	(2.802)	(7.305)	(1.396)	(1.411)
Observations	517	682	517	682
R-squared	0.103	0.074	0.148	0.152

Cluster-robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.10