**SERIES**

**ACADEMIC**

# Employees' Emotional, Evidence of Behavioural Life-Cycle Features in Spending Patterns after Retirement

Johan Bonekamp, Arthur van Soest

**NETSPAR**

# Evidence of Behavioural Life-Cycle Features in Spending Patterns after Retirement

Johan Bonekamp*

Arthur van Soest†

June 28, 2021

**Abstract**

Using data from a survey experiment on the decumulation of pension wealth after retirement, we estimate a stylized structural life-cycle model incorporating several behavioural features. In the experiment, pension income is in the form of a constant annuity, a "high-low" annuity that falls from a higher to a lower level five years into retirement, or a "low-high" annuity that does the reverse. This creates variation in liquid and illiquid wealth. Respondents are asked to choose among several expenditure patterns in the first ten years after retirement. We find that the respondents do not behave in the way the standard life-cycle model would predict. They respond to the variation in how they receive their income, and strongly undervalue illiquid wealth compared to liquid wealth at the ten years time horizon. Moreover, they have a tendency to follow the rule of thumb of going for the middle choice alternative.

# 1  Introduction

According to the standard life-cycle model, individuals and their households determine their consumption expenditures in a given period by maximizing expected discounted life-time utility under a life-time budget constraint. Many extensions have added empirically relevant features to the standard model, such as liquidity constraints, habit formation, a bequest motive, endogenous labour supply and retirement, etc. Still, there seems to be broad consensus in the literature that standard life-cycle models based upon expected utility maximization cannot explain several features of observed behaviour in economic experiments as well as observational data on actual consumption choices (Shefrin and Thaler, 1988; Levin, 1998). This has led to the introduction of behavioural life-cycle models, in which a traditional version of the life-cycle model is enriched with behavioural features that can explain deviations from optimal behaviour in the choices that agents make. Most of these studies use behavioural arguments to predict how observed behaviour differs from what the life-cycle model predicts and then present reduced form empirical evidence in line with the predictions. More structural models that incorporate the behavioural features into the empirical life-cycle model are scarce.

One of the most important reasons for saving and dissaving over the life-cycle is the change in income due to retirement. Even in countries like the Netherlands where most employees automatically accumulate pension wealth through a mandatory occupational pension, many retirees have to use private savings to meet their financial retirement goals (Knoef et al., 2016). The last few decades, research on the adequacy of retirement savings has focussed on explaining the discrepancy between predictions of life-cycle models and observed individual or household saving behaviour (Banks et al., 1998; Bernheim et al., 2001; De Nardi et al., 2010) and ways to increase individuals' voluntary pension contributions, exploiting insights from behavioural economics; see, e.g., Madrian and Shea (2001) and Hung et al. (2019).

More recent academic interest is not only in the accumulation of pension wealth before retirement, but also in the decumulation of pension wealth after retirement. An important question is why retired individuals hold on to their wealth. Some studies find that this can be partly explained by a bequest motive or uncertainty (De Nardi et al., 2016). Others focus on the decision to annuitize pension wealth. While this would be optimal from a standard life-cycle perspective (e.g., Davidoff et al., 2005), individuals who are given the choice between annuities or receiving a lump sum at retirement, often tend to choose a lump sum – in the literature this is commonly referred to as the annuitization-puzzle (e.g., Bütler and Teppa, 2007).

Insights from behavioural economics can be helpful to understand how individuals decumulate their pension wealth. For many individuals, making an optimal decision on how to spend down wealth during retirement is difficult. To prevent choices that could harm their income security during retirement, policy-makers and pension plan providers can assist through mandating (e.g. requiring full annuitization of wealth - as is current practice in the Netherlands for the second pillar of mandatory occupational pensions) or nudging individuals to make certain choices. An effective way seems to be setting a default (i.e., a predetermined outcome like full annuitization if no active choice is made). After retirement, defaults can explain the difference in take up rates of annu-

ities versus a lump sum (Bütler and Teppa, 2007). Framing also influences the take-up of life-long annuities. In a stated choice experiment, Brown et al. (2008) showed that framing the implications of a choice in terms of savings (using terms like investment and earnings) or consumption (using the terms spending and payment) has strong effects on the choices that individuals make. A minimum age-specific pension-wealth withdrawal rate set by the government also influences (stated) spending decisions (Alonso-García et al., 2021), even though the amount withdrawn from the pension wealth account can be saved instead of spent. Policy-makers and pension plan providers thus carry large responsibility in carefully designing defaults, framing and other nudges, as some designs may lead to suboptimal outcomes. This makes it important to understand how individuals select different wealth decumulation and consumption strategies.

This paper contributes to the literature on decumulation of pension wealth after retirement. Effectively, the default in the Netherlands is to transform accrued pension rights into a life-long flat-rate annuity. Individuals can deviate from the default at the start of retirement by choosing a high-low (or low-high) pension income, introduced with the goal to tailor pension benefits more to heterogeneous individual needs. This implies a higher (or lower) pension in the first years after retirement and a lower (higher) pension in later years, keeping the total expected net present value constant. Our first contribution is to investigate the behavioural implications of these alternative pension income schemes for expenditure choices, since the (exogenously given) income pattern may act as a frame for the (endogenous choice of) expenditure pattern. Our second contribution is to analyse the importance of (illiquid) net present value of the life-long annuity compared to liquid wealth. In the standard life-cycle model these are equally important, whereas in practice the complex setting of the life-cycle choice problem and the way it is presented to the individuals may make one form of wealth more salient than the other.

Our evidence is drawn from a stated preference (SP) experiment aimed at eliciting preferences for consumption in the context of a constant, high-low or low-high pension income stream. We investigate how respondents make the trade-off between higher consumption expenditures in the years immediately after retirement versus higher wealth 10 years into retirement. Since the constant, high-low and low-high annuity streams are approximately equivalent in terms of expected net present value and since respondents who smooth consumption will not face any liquidity constraints, we expect that most respondents who behave as expected utility maximizers in a standard life-cycle model will make similar choices in case they receive a pension as high-low, low-high, or a constant annuity; they can offset suboptimal outcomes by adjusting their (dis)saving.

Exploiting stated preference has become more common in the economics of ageing literature in recent years; see, e.g., Brown et al. (2008, 2017) for SP studies on heterogeneity in financial decision-making abilities regarding retirement pay outs. Brown et al. (2021) use SP data to analyse the effect of increasing complexity of the annuity choice in valuing annuities. Elsayed et al. (2018) apply stated preference to analyse preferences for gradual retirement and Michaud et al. (2020) extend their approach to understand joint retirement decisions. Stated preferences are particularly helpful for studying preferences for choice options that are not (yet) commonly known by individuals or are not widely available. This also applies to our setting: only few individuals currently choose to deviate from the flat-rate annuity (Lever et al., 2018). We show that most individuals are not aware of high-low and low-high pension arrangements. Consequently, analysing

revealed preferences would be confounded by individuals who were not aware of these possibilities at the start of retirement.

Our SP experiment was administered to a random sample of the non-retired Dutch population of ages 50-64. Individuals aged 50-64 are likely to already have thought at least somewhat about retirement (De Bresser and Knoef, 2015), mitigating the potential drawback that individuals might not be involved and thus would not evaluate the hypothetical consumption decisions during retirement as thoroughly as they would do in real-life decisions. This increases confidence that the systematic patterns in the stated choices resemble those in real-life choice situations.

The experiment consists of three descriptions of hypothetical recently retired households ("vignettes") that vary in the level of annual pension incomes in the years after retirement. The respondents were asked to advise the hypothetical household, based on their own preferences, how much to consume for the first ten years after retirement. We use the answers to the stated choice questions to estimate a stylized life-cycle model in which heterogeneous respondents choose expenditure levels based upon the trade-off between consumption in the first ten years after retirement versus remaining pension wealth at the end of this ten year period. The model accounts for several behavioural features. First, we allow for framing: even though the life-cycle budget constraint remains unchanged, individuals can make systematically different choices depending on whether and how pension income varies over time. Second, we allow for mental accounting (Levin, 1998), i.e. the possibility that individuals do not consider the two forms of pension wealth (the expected value of future annuity income ("illiquid wealth" and discretionary wealth and a lump sum paid at retirement ("liquid wealth") ten years into retirement as equally important, nudging individuals into different choices for different combinations of liquid and illiquid wealth that are equivalent from a standard life-cycle model point of view. Third, we account for the tendency to choose the middle option among the five consumption expenditure patterns in each choice set. This tendency not only plays a role in answering survey questions, but also in actual consumer choices (Simonson, 1989; Simonson and Tversky, 1992).

Our estimates imply large heterogeneity across individuals. For a large majority, behavioural features play an important role. First, their choices depend on how income is annuitized: most individuals value wealth ten years into retirement less (relative to consumption) if they get a high-low annuity than for a flat rate annuity (and the reverse for a low-high annuity). This implies that for a high-low pension income trajectory, most individuals want to consume more in the years shortly after retirement than for a constant annuity. Second, our results indicate that, in contrast to the prediction of the life-cycle model, liquid and illiquid wealth ten years into retirement affect chosen consumption patterns in very different ways. The former - probably more salient - plays a much larger role than the latter.

These findings suggest that most individuals do not behave as the standard life-cycle model would predict. They respond to the way in which the choice problem is framed and have different marginal propensities to consume from different types of pension wealth (annuities and lump sum). Policy makers should take this into account when designing choice architecture and communication on the decumulation of pension wealth. Our findings also may contribute to explaining several puzzles in the literature. First, there is an extensive literature that tries to explain why individuals hold on to, or

even increase, their wealth after retirement; see Love et al. (2009) for the US, Banks et al. (2010) for the UK, Asher et al. (2017) for Australia, and Van Ooijen et al. (2015) for the Netherlands. Some argue that this is the result of a intended bequest motive or uncertainty (De Nardi et al., 2010, 2016), whereas others argue that alternative saving motives play a role (Canova et al., 2005). Our findings suggest that individuals undervalue the illiquid wealth that comes in the form of life-time annuities, which substantially reduces their consumption expenditures in the first years after retirement.

Second, although our experiment takes annuitization and retirement income trajectories as exogenously given, our findings still help to explain the "annuity puzzle." According to standard models, it is optimal for individuals who do not desire to leave a bequest and only face longevity risk, to annuitize their pension wealth (e.g. Davidoff et al., 2005) . Nonetheless, the voluntary take-up of annuities in retirement is low. Researchers have given various explanations for this puzzle, such as uncertain medical expenses (Ameriks et al., 2011; Peijnenburg et al., 2017), bequests (Brown, 2001; Ameriks et al., 2011), or means-tested transfers (Bütler et al., 2017). Behavioural explanations have also been put forward, such as hyperbolic discounting (Schreiber and Weber, 2016), lack of cognitive skills in valuing complex annuities (Brown et al., 2021), framing (Agnew et al., 2008; Brown et al., 2008; Beshears et al., 2014), mental accounting (Levin, 1998) and anchoring (Hurwitz et al., 2020). Our findings suggest that individuals do not annuitize their pension wealth because they under value the illiquid wealth in the form of future annuities compared to the liquid wealth of a lump sum.

In the remainder of this paper we first briefly describe the relevant characteristics of the Dutch pension system at the time of the experiment. In Section 3, we introduce the stated preferences experiment and describe the data. We present the stylized model in Section 4. In Section 5, we present the estimation results and illustrate them with some simulations. Section 6 concludes.

## 2 The Dutch pension system

The Dutch pension system is a system in transition. We briefly describe the pension system as it was when the survey was fielded. Bovenberg and Nijman (2019) present a detailed overview of the current Dutch pension system and where it is heading.

The Dutch system is currently ranked as the best pension system in the world (Mercer, 2019). As many other pension systems, it is characterised by three pillars. The first pillar is a universal statutory pension income aimed at poverty alleviation and financed through a Pay-As-You-Go scheme. The current statutory retirement age is 66 years and 4 months. The second pillar is a funded occupational scheme for employees. Accrued pension rights are converted into a life-long pension income at the start of retirement. As a result of labour market agreements between trade unions and employers, almost all Dutch employees are covered. Individuals are not (yet) allowed to take part of their accruals out of the second pillar pension fund as a lump sum. The large majority of the self-employed are not covered by an occupational pension; they can make their own voluntary arrangements, the third pillar, covering voluntary pension saving and individual pension insurance.

In recent years, pension funds have introduced choice opportunities for their partici-

pants to tailor pension benefits to individuals' needs. One of the options that pension funds now often offer their participants is to vary the level of the pension benefit after retirement. Individuals can choose to have a higher (or lower) pension the first couple of years and a lower (or higher) pension during their remaining life-time, instead of a constant pension income during all post-retirement years. For fiscal reasons, the lower pension amount should be at least 75% of the high pension amount. The net present value of these varying levels of pension income streams are the same; they are calculated on the basis of, among other things, fund-specific survival rates. The decision for a high-low or low-high pension can only be made once (at retirement) and the maximum length of the first period is 10 years.

Van der Cruijsen and Jonker (2019), using survey responses in 2015 of a representative sample for the Dutch population aged 25 or older who have accrued pension rights, find that almost 20% prefer a high-low pension income over a constant pension income. Even though the Dutch Pension law allows for this type of variation over time in pension income levels since 2007, the actual interest in a high-low pension appears to be low. The largest two Dutch pension funds reported that roughly 9% and 4% of their members who retired at or after the statutory pension age opted for a high-low pension income at the statutory pension age in 2015 or 2016 (Lever et al., 2018). In our survey, we asked individuals from a representative sample of the Dutch population aged 50-65 who are not yet retired and who (have) accumulate(d) pension rights whether they have the possibility for a high-low pension according to their current (or former) occupational pension arrangement. 32% reported that this is possible and according to 8% of the respondents this is not possible. The majority, 60% of the respondents, did not know whether this possibility exists or not ($N = 1036$).

# 3 Vignette study

Our survey was included in the LISS and CentERpanel. These are two well-established household panels, administered by CentERdata, a data collection and research institute affiliated with Tilburg University. The panels are based upon a random sample of the non-institutionalized adult Dutch population. Household members regularly receive questionnaires on a variety of topics and are incentivised to complete questionnaires. Our survey was administered in October 2018. Individuals aged 50-65 who were not yet retired were invited to participate.Table 1 shows that approximately 30% of the respondents fall in the age 50-54 bracket. This age bracket appears to be slightly under represented in our final sample. We have more men than women in our sample and more than one third of the respondents have completed university or higher vocational education.

## 3.1 The experimental task

We focus on the questions about consumption preferences during retirement.Before the experimental task, respondents were categorized based on their (self-reported) gross household income. We do this to prevent alienation from the vignettes. We do not want someone who is barely able to make ends meet, to advise a vignette household in

Table 1: Background characteristics

| Covariate | Percent |
|---|---|
| female | 45.2 |
| partner | 69.9 |
| educational attainment: low (primary, lower vocational) | 26.9 |
| educational attainment: medium (intermediate general or vocational) | 35.8 |
| educational attainment: high (higher vocational, university) | 37.3 |
| income Q1: annual gross household income: < 32 500 | 25.9 |
| income Q2: an. gross household income: between 32 500 and 52 000 | 37.1 |
| income Q3: an. gross household income: between 52 000 and 73 500 | 22.2 |
| income Q4: an. gross household income: > 73 500 | 14.8 |
| homeowner | 75.7 |
| child(ren) | 76.3 |
| age 50-54 | 30.1 |
| age 55-59 | 35.6 |
| age 60-64 | 34.3 |

*Note:* 1271 respondents.

the highest income group. Each respondent is shown three different vignettes. For each vignette, the respondent is asked to advise the hypothetical household a spending plan for the first 10 years after retirement, based on their own preferences. For each of the three vignettes, the respondent can choose among the same five spending plans that differ in the consumption level and, accordingly, the speed at which the hypothetical household accumulates or decumulates wealth. Respondents are explicitly informed that prices are assumed not to change over time.

Each vignette describes a hypothetical household with two individuals aged 67 who just retired. Both are in good health and expect to stay so until at least the age of 72. They own the house they live in, without a mortgage, and do not have any plans to move or to sell the house. The main reason to describe hypothetical households instead of asking about the household's own situation is that this makes it easier to let individuals think about scenarios and situations that are not realistic for themselves. In earlier experiments with hypothetical scenarios for the respondents themselves, respondents often said they could not make a choice because the scenarios did not apply to them.

The hypothetical households differ only in their life-time income trajectories. For the first vignette, income is constant. The second vignette describes an otherwise similar household which will receive a higher income during the first five years after retirement, and a lower income for the remaining life-time (a "high – low" pension). See Figure 4 in the Appendix for a screenshot (in Dutch). The third vignette describes a similar household with a lower income the first five years after retirement, and a higher income for the remaining life-time ("low – high" pension). An overview of wealth at the start of retirement, yearly income, and consumption per spending plan and vignette for the hypothetical households, are presented in Table 2. Note that the hypothetical households can freely spend this wealth – it is liquid wealth. On the other hand, the net present value of their future annuity income can be seen as illiquid wealth.

In an introduction to the vignette questions, respondents were asked to fill in any information that was missing in the vignettes, e.g. about their children, based on their personal information. In each vignette, we tried to ensure that the consequences of advising a certain spending plan were clear. For instance, we informed the respondents about the yearly increase, or decrease, of the vignette household's wealth together with

Table 2: Vignette parameters (income, wealth and spending plan) per income group

| | | income till 72 | income from 72 | wealth at 67 | plan 1 (dissaving) | spending plan for first 10 years: 2 | 3 | 4 | plan 5 (saving) |
|---|---|---|---|---|---|---|---|---|---|
| vignette: | | annual gross household income: $< 32\,500$ | | | | | | | |
| 1 | income: constant | 21 000 | 21 000 | 5250 | 23 625 | 22 050 | 21 000 | 19 950 | 18 900 |
| 2 | income: high-low | 21 450 | 20 850 | ″ | ″ | ″ | ″ | ″ | ″ |
| 3 | income: low-high | 20 550 | 21 150 | ″ | ″ | ″ | ″ | ″ | ″ |
| | | an. gross household income: between $32\,500$ and $52\,000$ | | | | | | | |
| 1 | income: constant | 30 000 | 30 000 | 18 000 | 33 750 | 31 500 | 30 000 | 28 500 | 27 000 |
| 2 | income: high-low | 31 650 | 29 700 | ″ | ″ | ″ | ″ | ″ | ″ |
| 3 | income: low-high | 28 500 | 30 300 | ″ | ″ | ″ | ″ | ″ | ″ |
| | | an. gross household income: between $52\,000$ and $73\,500$ | | | | | | | |
| 1 | income: constant | 42 000 | 42 000 | 36 000 | 47 250 | 44 100 | 42 000 | 39 900 | 37 800 |
| 2 | income: high-low | 45 450 | 41 250 | ″ | ″ | ″ | ″ | ″ | ″ |
| 3 | income: low-high | 38 850 | 42 600 | ″ | ″ | ″ | ″ | ″ | ″ |
| | | an. gross household income: $> 73\,500$ | | | | | | | |
| 1 | income: constant | 63 000 | 63 000 | 67 500 | 70 875 | 66 150 | 63 000 | 59 850 | 56 700 |
| 2 | income: high-low | 69 450 | 61 650 | ″ | ″ | ″ | ″ | ″ | ″ |
| 3 | income: low-high | 57 300 | 64 200 | ″ | ″ | ″ | ″ | ″ | ″ |

*Note:* Ditto marks (″) indicate the repetition of the amount presented above it. If the hypothetical household runs out of wealth, spending will be adjusted accordingly.

available wealth at age 77. The hypothetical households could not acquire debt: once it runs out of wealth, the household must adjust spending accordingly. The amount of wealth at age 77 depends, by construction, on the vignette and the chosen spending plan; see Table 3. Consider, for example, a respondent whose annual gross household income is between 52 000 and 73 500 euro (i.e. third income group). If spending plan 5 (the lowest consumption expenditure which yields highest wealth at age 77) is advised for vignette 1 ("income: constant"), available liquid wealth at age 77 will be €78 000. In addition, since, independent of the advised spending plan, the constant pension annuity will continue after age 77, the hypothetical household will have expected net worth €840 000 of future pension income at age 77 (see Table 3, final column). We informed respondents about this annual pension income but did not explicitly give them the total net present value of these amounts.

## 3.2 Descriptives

Figure 1 summarizes the distribution of the advised spending plans per vignette (bars) and respondents' income group (sub-plots). Consumption patterns 1 and 2 with dissaving shortly after retirement were chosen more often than patterns with saving, in line with the finding of Asher et al. (2017) that individuals decumulate their wealth more quickly in the first years after retirement. The figure also reveals that the distribution differs between vignettes - especially for the highest two income groups. Consider, for example, the respondents whose annual gross household income is between 52 000 and 73 500 euro (lower-left panel). Compared to a constant pension income (vignette 1), respondents, on average, advise the hypothetical household to spend more if pension income is initially higher but decreases after five years (vignette 2: high-low). They advise the hypothetical household to spend less when they are confronted with a lower

8

Table 3: Wealth at the start of age 77 per spending plan, vignette and income group

| | | plan 1 (dissaving) | 2 | 3 | 4 | plan 5 (saving) | | value of (illiquid) future income (20x) |
|---|---|---|---|---|---|---|---|---|
| vignette: | | annual gross household income: $< 32\,500$ | | | |
| 1 | income: constant | 0 | 0 | 5250 | 15 750 | 26 250 | | 420 000 |
| 2 | income: high-low | 0 | 0 | 6750 | 17 250 | 27 750 | | 417 000 |
| 3 | income: low-high | 0 | 0 | 3750 | 14 250 | 24 750 | | 423 000 |
| | | an. gross household income: between $32\,500$ and $52\,000$ | | | |
| 1 | income: constant | 0 | 3000 | 18 000 | 33 000 | 48 000 | | 600 000 |
| 2 | income: high-low | 0 | 9750 | 24 750 | 39 750 | 54 750 | | 594 000 |
| 3 | income: low-high | 0 | 0 | 12 000 | 27 000 | 42 000 | | 606 000 |
| | | an. gross household income: between $52\,000$ and $73\,500$ | | | |
| 1 | income: constant | 0 | 15 000 | 36 000 | 57 000 | 78 000 | | 840 000 |
| 2 | income: high-low | 0 | 28 500 | 49 500 | 70 500 | 91 500 | | 825 000 |
| 3 | income: low-high | 0 | 2250 | 23 250 | 44 250 | 65 250 | | 852 000 |
| | | an. gross household income: $> 73\,500$ | | | |
| 1 | income: constant | 0 | 36 000 | 67 500 | 99 000 | 130 500 | | 1 260 000 |
| 2 | income: high-low | 14 250 | 61 500 | 93 000 | 124 500 | 156 000 | | 1 233 000 |
| 3 | income: low-high | 0 | 13 500 | 45 000 | 76 500 | 108 000 | | 1 284 000 |

*Left rotated label:* available liquid wealth (per spending plan). *Header:* spending plan for first 10 year after retirement:

*Note:* The value of (illiquid) future income is, contrary to the available liquid wealth, neither visible nor actively communicated to the respondent.

income the first years after retirement (vignette 3: low-high). Since the vignettes give approximately the same permanent income and liquidity constraints would only play a role if desired expenditures in some periods are much larger than in later periods, the standard model with consumption smoothing over the life-cycle cannot explain the difference between the distributions across vignettes.

# 4 Empirical model

We assume that total utility, $U_{is}^q$, of consumption and savings trajectory $q = 1, \ldots, 5$ in vignette $s = 1, \ldots, 3$ for individual $i = \ldots, I$ is of the following form:

$$U_{is}^q = \sum_{t=67}^{76} \rho^{(t-67)} U_{ist}^q + \psi_{is}^q, \tag{4.1}$$

where $\rho$ is the time preference parameter (i.e., the discount factor). The first part is fairly standard, reflecting the utility of consumption until age 77. $U_{ist}^q$, is assumed to follow a constant relative risk aversion (CRRA) specification:

$$U_{ist}^q = \frac{(C_{ist}^q)^{1-\gamma} - 1}{1 - \gamma}, \tag{4.2}$$

with risk preference parameter $\gamma$. If $\gamma = 1$, we have $U_{ist}^q = \ln(C_{ist}^q)$ – a log-utility specification.

The second part ($\psi_{is}^q$) can be seen as an approximation to the (indirect) utility of expected consumption after reaching age 77 and the possible utility of leaving a bequest.

Figure 1: Distribution of the advised spending plan per vignette per income group
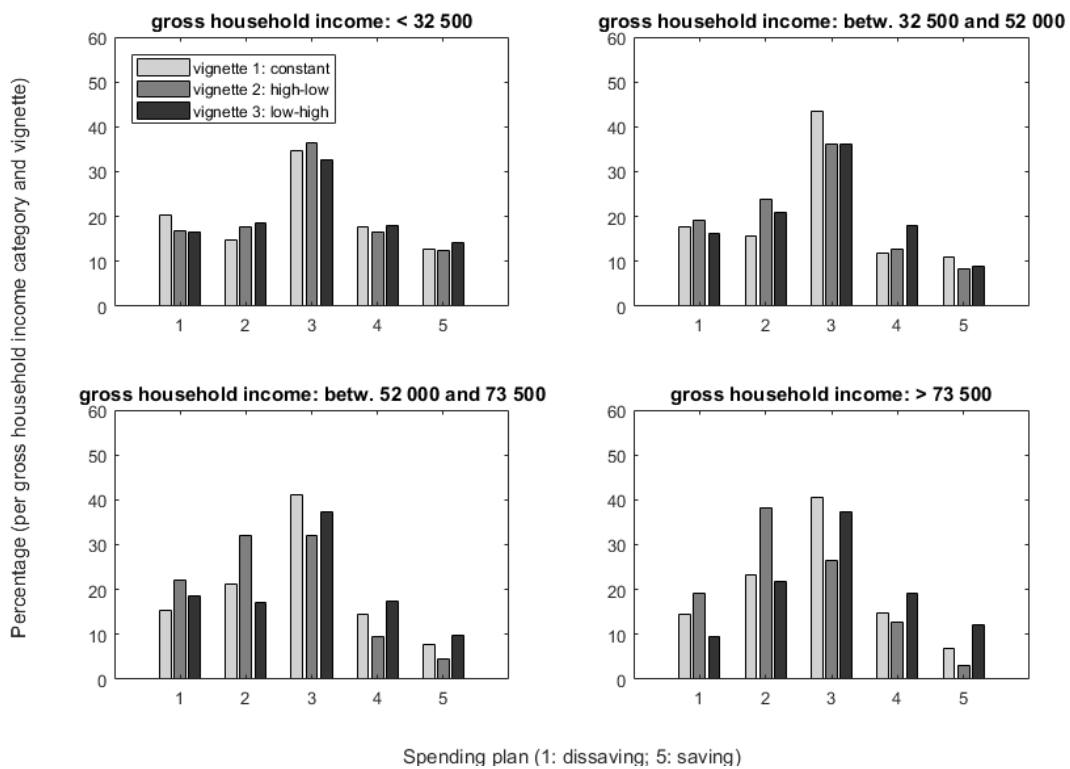


*Notes:* A Pearson $\chi^2$ test of independence for the difference in advised spending plan per vignette per income group yields the following $p$-values: 0.844 (upper-left panel; i.e. gross hhold. income: $<$ 32 500), 0.003 (upper-right), 0.000 (lower-left) and 0.000 (lower-right).

This will depend on (liquid) wealth at age 77 and the (illiquid) expected net present value of future income at that age:[1]

$$\psi_{is}^q = \theta_i \frac{(W_{is}^q)^{1-\gamma} - 1}{1 - \gamma}, \qquad (4.3)$$

where $W_{is}^q$ is "total wealth" when reaching age 77, consisting of two parts:

$$W_{is}^q = A_{is}^q + \omega \sum_{t=77}^{96} (1+r)^{-(t-77)} P_{t-77} Y_{ist}. \qquad (4.4)$$

The first part, $A_{is}^q$, indicates the amount of "liquid" wealth (discretionary and lump-sum pension wealth) and varies by income group, choice of spending plan and vignette. The second ("illiquid") part denotes the expected net present value of future pension annuities at $t = 77$. $r$ is the interest rate and $P_{t-77}$ denotes the probability of surviving for another $t-77$ years of someone aged 77. In the main analysis, we take $r = 0$ and we use the survival probabilities published by Statistics Netherlands for $P_{t-77}$.[2] $Y_{ist}$ differs across income groups and vignettes, but does not depend on the chosen consumption pattern. Moreover, $Y_{ist}$ remains constant after the high-low or low-high period of five years, so also from $t = 77$ until $t = 96$. All this implies that illiquid wealth can also be written as $(\sum_{t=77}^{96} P_{t-77}) Y_{is} = 11.4831 Y_{is,77}$. In the standard life-cycle model, liquid and illiquid wealth are equally important, so $\omega = 1$. This is what we impose in the benchmark model; in an extended model specification, we estimate $\omega$. There are several reasons why $\omega$ could be different from 1. Following the behavioural life-cycle model of Shefrin and Thaler (1988), different types of assets may not be fungible. Illiquidity may also prevent taking advantage of large unexpected consumption desires, and someone might simply derive utility from the freedom provided by liquid wealth. Moreover, liquid wealth can be used as a buffer against the risk of large unexpected expenses, e.g. due to a negative health shock. All these reasons might lead to a value of $\omega$ between 0 and 1, suggesting that illiquid wealth is valued less than liquid wealth.[3]

Note that without discounting total consumption up to age 76, $\sum_{t=67}^{76} C_{ist}^q$, together with liquid wealth at the end of age 76, $W_{is}^q$, is, by construction, the same irrespective of the spending plan for a given respondent and given vignette. Thus, $\sum_{t=67}^{76} C_{ist}^q + W_{is}^q$ does not differ for $q = 1, \ldots, 5$. If we assume that a hypothetical household will live up to age 96, adding the value of illiquid future income, $\sum_{t=77}^{96} Y_{ist}$ to the previous summation ensures that the outcomes are approximately the same irrespective of the three vignettes. Mathematically, $\sum_{t=67}^{76} C_{ist}^q + W_{is}^q + \sum_{t=77}^{96} Y_{ist}$ is similar for all choices of $q$ and $s$. The value of illiquid future income $\sum_{t=77}^{96} Y_{ist}$ varies across vignettes (see Table 3 - last column). It is lower in a high-low design than in a constant pension annuity design, since a high-low design implies lower annuities than a constant annuity design in all years after age 72. The reverse applies to a low-high design.

The marginal utility of wealth when reaching age 77 is determined by $\theta_i$. We call this *wealth preference* from now on. We allow this parameter to vary with observed and

---

[1]We use this approximation instead of explicitly incorporating consumption and bequest amounts because it matches the way in which the vignettes are formulated.

[2]See Table 6 in the Online Appendix; in Section B.1.1.

[3]We do not claim that other behavioural features such as hyperbolic discounting are less relevant in general, but our experiment is not designed to capture this.

unobserved characteristics of the individual and specify it as follows:[4]

$$\theta_i = x_i\beta + z_i\beta_i + \nu_i, \text{ where } (\nu_i, \beta_i | x_i, z_i) \sim N_3((0, \bar{\beta}), \Sigma_{\nu,\beta}). \tag{4.5}$$

Here $\Sigma_{\nu,\beta}$ is an arbitrary $3 \times 3$ covariance matrix, with parameters to be estimated; $x_i$ is a vector of observable characteristics and $z_i$ a vector of vignette dummies. The parameter $\theta_i$ depends on unobserved characteristics of individual $i$ through $\nu_i$ and $\beta_i$. The wealth preference parameter, $\theta_i$, is related to the strength of the bequest motive in the life-cycle literature. Still, here we look at remaining wealth at age 77, rather than remaining wealth at the time of death of the individual.

As described in Section 3, respondents choose, for each vignette, a preferred consumption path. We model the observed choices, $y_{is}$, as a (mixed) Multinomial Logit model. Introducing the random component of utility, $\varepsilon_{is}^q$, and scaling the error term using $\kappa$, we have

$$V_{is}^q = \kappa U_{is}^q + \varepsilon_{is}^q \tag{4.6}$$

$$y_{is} = q \Leftrightarrow V_{is}^q \geq V_{is}^p \text{ for all } q \neq p \tag{4.7}$$

$$\varepsilon_{is}^q \sim \text{ i.i.d. extreme value }; \varepsilon_{is}^q \text{ independent of } \nu_i, \beta_i, x_i, z_i. \tag{4.8}$$

We impose that the scale parameter $\kappa$ is positive. We estimate the mixed logit model using simulated maximum likelihood (see, e.g., Revelt and Train, 1998). The likelihood contribution for individual $i$ conditional on unobserved heterogeneity terms $(\nu_i, \beta_i)$, is the product of the probabilities of the observed outcome $y_{is}$ over the vignettes $s = 1, 2, 3$. Our model assumptions imply that these probabilities can be written as

$$P(y_{is} = q | (\nu_i, \beta_i) = \frac{\exp(\kappa U_{is}^q)}{\sum_p \exp(\kappa U_{is}^p)} \qquad q = 1, \dots, 5. \tag{4.9}$$

The unconditional likelihood contribution for individual $i$ can be written as

$$\iiint \prod_{s=1}^{3} \prod_{q=1}^{5} P(y_{is} = q | (\beta_i, \nu_i)^{I_{is}} f(\nu_i, \beta_i) d(\nu_i, \beta_i) \tag{4.10}$$

where $f$ denotes the density of the vector of random coefficients and $I_{is}$ equals 1 if $y_{is} = q$ and 0 otherwise. The density of $(\nu_i, \beta_i)$ is the product of three univariate normal densities, as specified earlier.

To approximate the integral, we make use of simulated likelihood using $D$ simulated values of the random coefficients, approximating the likelihood contribution of respondent $i$ with:

$$\frac{1}{D} \sum_{d=1}^{D} \prod_{s=1}^{3} \prod_{q=1}^{5} P(y_{is} = q | (\nu_i^d, \beta_i^d)^{I_{is}} \tag{4.11}$$

where $(\nu_i^d, \beta_i^d)$ are transformed draws from the three-dimensional standard normal distribution, using the covariance matrix $\Sigma_{\nu,\beta}$. We use $D = 100$ draws per individual, using Halton sequences with primes 3, 5, and 7 (Train, 2009).

---

[4]For computational feasibility, the other parameters are assumed to be the same for all individuals.

# 5  Estimation results

We discuss the estimation results for the model specification described in the previous section. First, we discuss the results under the standard life-cycle model in which liquid wealth and the (illiquid) net present value of future income are equally important. Second, we relax this assumption and estimate the importance of liquid wealth compared to the net present value of pension income. Third, we extend our model to explicitly take into account the middle response alternative. After all, the inclusion or exclusion of a middle alternative is known from the marketing and survey literature to influence findings. Finally, we assess how well the model predicts the observed spending plans and conduct a simulation exercise to better understand how these behavioural components affect preferred spending.

**Framing**

Specification (1) in Table 4 shows the estimation results for the model specification of the previous section.[5] In the standard life-cycle model, liquid wealth and the (illiquid) net present value of future income are equally important, so $\omega = 1$. We find that respondents attach, on average, less utility to wealth at age 77 if they receive a high-low annuity than for a constant life-time income, and the reverse result is found for a low-high annuity. Thus respondents want to consume more in the beginning of retirement when they receive a high-low annuity than when they get a constant life-time annual income.[6] Since the hypothetical households are not liquidity constrained in the first years after retirement and the net present value of both income trajectories is almost the same, we think the most plausible explanation of this is a framing effect, with individuals choosing an expenditure pattern that mimics their income path. It may reflect a rule of thumb or interpreting the income pattern as implicit advise of the pension fund on how much to spend.

We find no significant effects of gender, partnership status, educational attainment, income, home ownership, having children, or age. The significant estimate of $\sigma_\nu$ implies substantial heterogeneity in the marginal utility of wealth at age 77 that is not captured by observable characteristics. The estimated discount factor $\rho$ is slightly smaller than one. We have set $\gamma$ equal to 1 (i.e. log-utility) as estimation of the risk preference parameter does not lead to significant improvement of the log-likelihood.[7]

---

[5]We follow the approach in Revelt and Train (1998) and Train (2009), using the Cholesky decomposition, to estimate the variance-covariance structure. Estimation of a variance-covariance structure with $\sigma_\nu$, $\sigma_{\beta_{i1}}$, $\sigma_{\beta_{i2}}$ and $\sigma_{\beta_{i1}\beta_{i2}}$ leads to $\sigma_{\beta_{i2}}$ approaching zero. Therefore, we only present the results for a single random effect in $\theta_i$.

[6]Van der Cruijsen and Jonker (2019) found that approximately 30% of Dutch individuals prefer a non-flat pension income. This differs from findings for the U.S., where approximately 30% prefer a flat annuity (Beshears et al., 2014). Asked for their motivation, almost 80% indicated that they expect declining daily expenses and almost 50% wanted a higher income shortly after retirement because they expect to travel a lot.

[7]Even though the experiment is not designed to estimate the curvature of the utility function, we can still estimate $\gamma$. We find that for specification (1) $\gamma$ is 1.0674 (0.0570), for specification (2) 1.0382 (0.0555) and for specification (3) 1.0093 (0.0618). Full estimation results are available upon request.

Table 4: Estimation results for the main model specifications.

| | (1) $\theta_i$ | | (2) $\theta_i$ | | (3) $\theta_i$ | |
|---|---|---|---|---|---|---|
| | Coeff. | $t$-value | Coeff. | $t$-value | Coeff. | $t$-value |
| Const. | 11.7939 | 88.5254 | 4.7320 | 5.8629 | 4.9075 | 5.1448 |
| Female | 0.0097 | 0.1299 | −0.0114 | −0.2251 | −0.0047 | −0.0804 |
| Partner | −0.0452 | −0.5224 | 0.0372 | 0.6298 | 0.0265 | 0.3919 |
| Education medium | 0.0137 | 0.1471 | 0.0366 | 0.5805 | 0.0446 | 0.6189 |
| Education high | 0.0807 | 0.8800 | 0.1137 | 1.8299 | 0.1317 | 1.8425 |
| Homeowner | 0.0213 | 0.2291 | 0.0684 | 1.0702 | 0.0761 | 1.0485 |
| Children | −0.0480 | −0.5371 | −0.0196 | −0.3207 | −0.0218 | −0.3114 |
| Age 55-59 | −0.0508 | −0.5843 | −0.0428 | −0.7265 | −0.0471 | −0.6935 |
| Age 60-65 | −0.0257 | −0.2549 | −0.0362 | −0.5264 | −0.0392 | −0.4991 |
| $\beta_{i1}$: Vignette: High-low | −0.2303 | −7.2996 | −0.0394 | −1.2411 | −0.0591 | −1.5489 |
| $\beta_{i2}$: Vignette: Low-high | 0.0694 | 2.2952 | −0.0625 | −2.4886 | −0.0588 | −2.0038 |
| | | | | | | |
| $\delta$ | | | | | 0.0201 | 6.7844 |
| | | | | | | |
| | Coeff. | SE | Coeff. | SE | Coeff. | SE |
| $\sigma_\nu$ | 1.1837 | 0.0372 | 0.8053 | 0.0484 | 0.9198 | 0.0637 |
| $\kappa$ | 55.9867 | 1.4434 | 35.0126 | 4.0210 | 31.7270 | 4.1092 |
| $\rho$ (disc. factor) | 0.9942 | 0.0011 | 0.9962 | 0.0019 | 0.9948 | 0.0021 |
| $\omega$ (weight param.) | 1.0000 | | 0.3751 | 0.0715 | 0.3968 | 0.0853 |
| | | | | | | |
| Log-likelihood: | -4964.36 | | -4951.79 | | -4867.73 | |

*Notes:* Parameters are defined in Section 4.

## The importance of liquid wealth

In specification (1), we imposed that liquid wealth at age 77 and illiquid wealth in the form of the (expected) net present value of pension income after age 77 are equally important, in line with the standard life-cycle model without binding liquidity constraints. In other words, we set $\omega$, equal to 1. We now relax this assumption and estimate $\omega > 0$.

The estimate for $\omega$, Table 4 column (2), suggests that liquid wealth at age 77 is much more important for consumption expenditures than the net present value of pension income after reaching age 77. In terms of the behavioural life cycle model, it means that the marginal propensity to consume (MPC) out of liquid wealth is much higher than the MPC for illiquid wealth, suggesting that the two forms of wealth are different mental accounts (Levin, 1998).[8] There are several alternative explanations for this finding. Individuals may appreciate the freedom of liquid wealth, for example to have the opportunity to travel, to pay off their mortgage, to cover other large expenditures (possibly unexpected, due to e.g. negative health shocks). They may have a lack of confidence in the pension sector (i.e. whether future payments will be done at all), or perhaps they want to make substantial inter-vivos transfers or leave a bequest. Moreover, the choice questions make the trade-off between consumption between ages 67 and 77 and liquid wealth at age 77 very salient, whereas much less emphasis is given to the pension annuity as of age 77. They might also overestimate the value of their liquid wealth if they would use it to create their own annuity, since the vignettes do not provide this information.

---

[8]This finding holds for different values of $\alpha$. For instance, assuming a one-year mortality rate of 0.10 (0.05) implies an $\alpha$ equal to 0.4392 (0.6415) - see Table 6 in the Online Appendix - and an estimated importance of illiquid wealth, $\omega$, of 0.5188 (0.3552).

Note that the estimates for the mean coefficients on the low-high and high-low vignettes change substantially, because the different vignettes imply different shares of liquid and illiquid wealth. They remain jointly significant, however, showing that allowing $\omega \neq 1$ does not completely remove the framing effect. The estimated discount factor $\rho$ is slightly smaller than one. We find no significant effects of gender, partnership status, home ownership, having children, or age. We do find a strong association with educational attainment. Compared to the group with the lowest education, the group with the highest education have significantly higher marginal utility of wealth at age 77.

We again find that, ceteris paribus, respondents attach, on average, less utility to wealth at age 77 for a high-low annuity compared to a constant life-time income. This estimate is, however, no longer significant. For the low-high annuity we have the exact opposite signs - see column (1). We now have that, ceteris paribus, respondents attach, on average, less utility to wealth at age 77 for a low-high annuity compared to a constant life-time income. The implications for the chosen consumption pattern, however, remain unchanged: low-high annuities still raise the probability to choose low spending and high liquid wealth at age 77. The reason is that first, wealth preference is largely driven by available liquid wealth, as opposed to the combination of liquid wealth and illiquid future income. Second, the amount of liquid wealth at age 77 is, irrespective of the spending plan, smaller for the low-high vignette than for the flat annuity vignette - see Table 3. Third, the respondents are risk averse, so utility is concave in liquid wealth ($\gamma > 0$). Consequently, with less liquid wealth at age 77 due to the low-high design, liquid wealth is valued more and the respondent will spend less than in the flat annuity design. This effect dominates the negative average value of $\beta_{i2}$. Heterogeneity between respondents remains present. The variation in $\nu_i$ largely explains why there is a large minority of respondents that choose a conservative consumption pattern for each of the three vignettes. For this group, we expect that beliefs on health related costs that increase with age and the desire to leave a bequest are important factors (De Nardi et al., 2016).

**The middle response alternative**

Including a middle alternative or not may influence findings. Some respondents might select the middle alternative to express social desirability, to minimize the cognitive burden, or to indicate that they have "no opinion" (Krosnick, 1991).[9] To account for this, we add $1(y_{is} = 3)\delta$ in our expression for total utility - see equation (4.1). In other words, we include a dummy variable that equals one if the respondent advised the middle alternative (spending plan 3) and zero otherwise.[10] Formally,

$$U_{is}^q = \sum_{t=67}^{76} \rho^{(t-67)} U_{ist}^q + \psi_{is}^q + \delta 1(y_{is} = 3), \tag{5.1}$$

---

[9]We find that 16.8% of the respondents select the middle response alternative for all three vignettes.

[10]Alternatively, we could allow for a non-linear effect of the middle alternative and instead include four dummy variables - with advising spending plan 3 as the reference category. The inclusion of four, instead of one, dummy variables does not lead to a significant improvement of the log-likelihood or any other new insights. The estimation results are available upon request.

where $1(\cdot)$ denotes the indicator function.

Specification (3) in Table 4 presents the results where we simultaneously estimate the importance of liquid wealth and the middle response alternative. The estimate for $\delta$ is statistically significant and of the expected sign. Our estimate for the discount factor $\rho$ is slightly smaller than one. We again find no significant effects of gender, partnership status, home ownership, or having children. Similar to the estimation results of specification (2), we have that respondent attach, on average, less utility to wealth at age 77 for a low-high annuity compared to a constant life-time income.

## 5.1 Model predictions

To assess how well our model fits the data, we compare the relative frequency distribution of the advised spending plan per vignette in the data (see Figure 2 upper left panel) with the advised spending plan per vignette based upon our model estimates.[11] Here, we have used the estimates of the three models in Table 4 to predict, per respondent and simulation draw, the probabilities for each of the five spending plans. We then average these predicted probabilities over all 100 simulation draws and all respondents.

While a reduced form multinomial logit model would almost automatically lead to a perfect fit of the observed sample distribution, this is not the case for the models in Table 4 that impose more structure. From Figure 2 we conclude that our models without the middle response alternative underestimate the likelihood of advising spending plan 3, whereas it overestimates the likelihood of advising spending plan 2 and 4. The inclusion of a middle response alternative visually improves our model fit, as we would expect (Figure 2 lower right panel). For vignette 1 we still tend to slightly underestimate the likelihood of advising spending plan 3 while still overestimating the likelihood of advising plan 2 or 4. Moreover, for vignette 2 we now underestimate the likelihood of advising spending plan 2 and overestimate the likelihood of preferring spending plan 1. Nonetheless, our model specification in which we simultaneously estimate the importance of liquid wealth and the middle response alternative fits our data best based upon the model predictions, as well as the log-likelihood.

## 5.2 The importance of illiquid wealth and the tendency to choose the middle response

To better understand how the importance of illiquid wealth and the tendency to choose the middle response alternative affect chosen spending patterns, we conducted a simulation exercise. We use the estimation results of specification (3) in Table 4 to predict, per respondent and simulation draw, the probabilities for the five spending plans. We then average these probabilities over all 100 simulation draws and all respondents - see Figure 3 panel (a), or Figure 2 panel (d). Next, we make illiquid wealth in the form of the (expected) net present value of pension income after age 77 more important (see Figure 3 lower panels) and take out the special role of the middle alternative (see Figure 3 panels at the right). Formally, we use the estimates of specification (3), but set the

---

[11]The distribution of advised spending plans for all three vignettes together, can be found in the Online Appendix; in Section B.2.

Figure 2: Predicted advised spending plan per vignette.
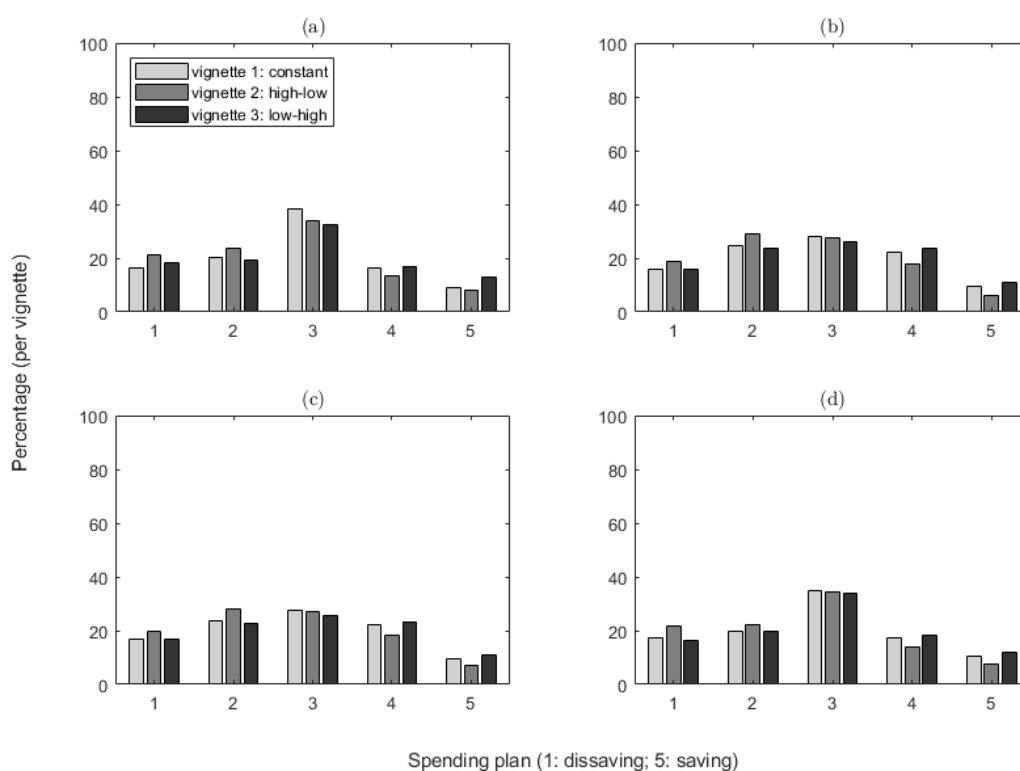
*Notes:* (a): Data summary. (b): Standard life-cycle model - i.e. specification (1) in Table 4. (c): Importance of illiquid wealth - specification (2). (d): Middle response alternative - specification (3).

value of $\omega$ equal to 0.5 (instead of the estimated value of 0.3986) and of $\delta$ to 0 (instead of 0.0201). The idea here is that the tendency to choose the middle alternative is a behavioral bias that we remove in the counterfactual simulation. Moreover, the low estimated value of $\omega$ may also reflect a behavioural bias, so we also check what happens if we use a higher value of $\omega$ ($\omega = 1$ would be the extreme case, but as argued above, there are also non-behavioural arguments why $\omega < 1$).

Setting $\delta$ to 0 leads to modest changes in the distribution of predicted advised spending plans. The likelihood of advising spending plan 3 falls by approximately 10 percentage points whereas the probabilities to advise spending plans 2 and 4 both increase by approximately 4 percentage points (compare the upper panels in Figure 3). The effect of setting $\omega$ to 0.5, bringing the importance of liquid and illiquid wealth at age 77 somewhat closer to each other than it is according to the estimates, is much larger (compare the upper left panel with lower left panel in Figure 3). The simulated distribution of spending plans appears to be quite sensitive to the value of $\omega$.[12] Because utility is a concave function of the sum of liquid and illiquid wealth weighted by $\omega$, a higher $\omega$ means that the marginal utility of liquid and total wealth will fall and respondents will consume more.

The results suggest that individuals would prefer a spending plan leading to much less liquid wealth at age 77 (see Table 3) once illiquid wealth is valued more, so that respondents would behave more in line with what a standard life-cycle model predicts. This result provides a potential explanation for the stylized fact that retirees hold on to, or even increase, their wealth after retirement – illiquid wealth in the form of a life-long income stream is perceived and valued differently from money on the bank. This finding is partly in line with the reduced form empirical evidence of Levin (1998) for the behavioural life-cycle model. He shows that for individuals at or near retirement, spending on several consumption categories is very sensitive to changes in (liquid) current income, less sensitive to changes in liquid assets, somewhat less sensitive to changes in social security wealth, and insensitive to changes in housing wealth, the most illiquid form of wealth considered. The difference between the importance of liquid wealth and illiquid wealth in the form of future pension annuities is much larger in our case than the difference between the marginal propensity to consume out of liquid and future (social security) wealth in Levin (1998). Possibly this is because in Levin's context, the value of social security wealth was rapidly increasing, inducing confidence that social security wealth would continue to rise in the future, while in our context sustainability of the pension system is under pressure and many people expect pension annuities to become less generous.

Our findings also add to the literature that examines the role of framing in valuing annuities - see, for example, Brown et al. (2008) and Brown et al. (2021). Presenting the income trajectories in a different way, with more emphasis on the importance of the continuous income stream provided by an annuity, may bring the individuals' decisions closer to expected utility maximizing behaviour.

---

[12]See also Table 7 in the Online Appendix.

Figure 3: Predicted advised spending plan per vignette for different behavioural life-cycle features.
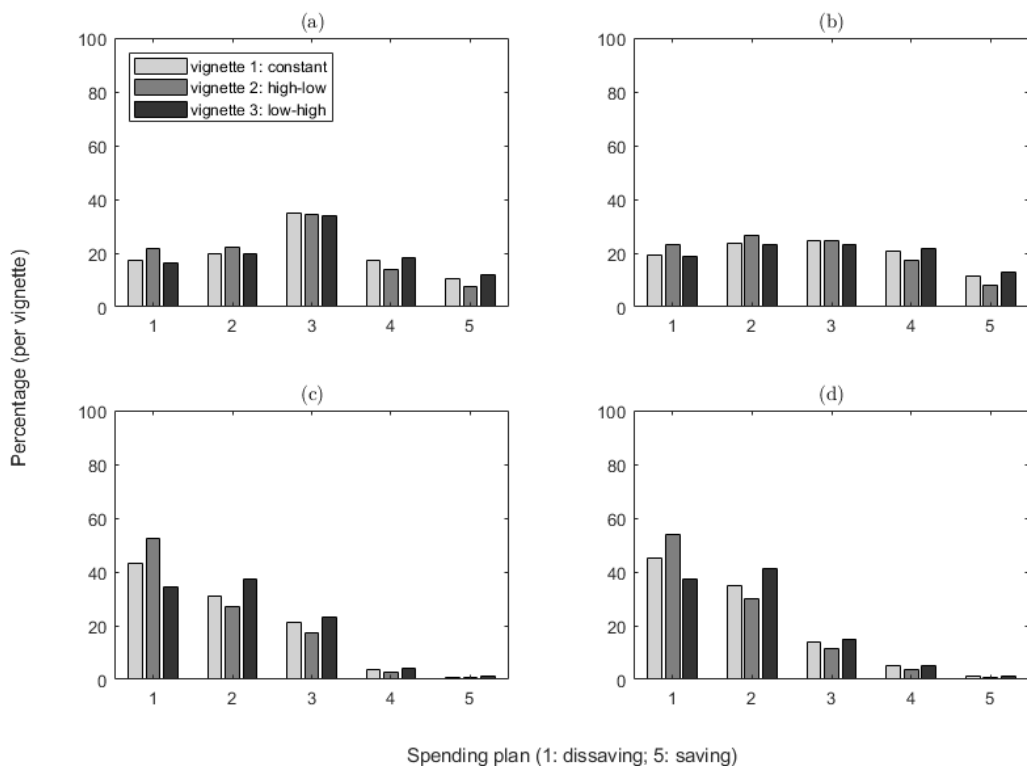


*Notes:* (a): Simulated distribution of the spending plans using the estimation results of specification (3) in Table 4. (b): Similar to (a), but with $\delta$, importance of the middle response, set equal to 0. (c): Similar to (a), but with $\omega$, the importance of illiquid wealth, set to 0.5. (d): Similar to (a), but with $\delta = 0$ and $\omega = 0.5$.

# 6    Conclusion

In this paper we have analysed stated preferences on preferred spending during the first ten years after retirement for a representative sample of Dutch individuals aged 50-65 who are not yet retired. In an experimental survey, respondents evaluated three hypothetical, but realistic, retirement scenarios. The scenarios varied in pension income, based on a high-low, a low-high and a flat-rate annuity design. We use the responses to investigate the behavioural implications of these different plans using a stylized model based upon life-cycle utility maximization with some behavioural features. Utility is the discounted sum of (CRRA) within-period utilities that depend on consumption and an end-of-period utility component for liquid and illiquid wealth ten years into retirement, summarizing consumption opportunities and a possible bequest motive after age 77.

An advantage of our SP approach is that individuals do not have to be aware of the actual plans available at the start of retirement. In fact, even though available at most pension funds, approximately 60% of the respondents who indicate that they (have) accrue(d) pension rights, are not aware of the possibility to choose a high-low pension profile. As deviating from the flat-rate annuity (up to ten years) in the Netherlands is only possible once and only at the start of retirement, analysing revealed preferences on a sample of retirees is bound to be confounded by individuals unaware of the different options and choosing the default. If respondents react differently to various pension profiles, pension funds might want to more actively communicate towards their participants about the possibilities at retirement. Alternatively, if policy makers belief that for instance increased consumption during retirement is welfare improving, the government might want to change the default option of a flat-rate annuity. Also for countries where the life-long annuity take up is low, this policy might be of interest as a (new) option for the decumulation of pension wealth.

Our main findings are twofold. First, although we find substantial heterogeneity across respondents in this respect, the marginal utility of a given amount of wealth at age 77 tends to be lower for respondents given a high-low annuity than for a flat-rate annuity (and, accordingly, the reverse holds for a low-high annuity). This suggests that for a high-low pension income respondents, on average, prefer to consume more at the start of retirement. A possible explanation might be that a high-low pension income better matches (ex-ante) preferred consumption during retirement. This result is in line with the common finding that consumption often follows changes in (transitory) consumption; see, e.g., Hall and Mishkin (1982) and Campbell and Mankiw (1990). It should be noted that the variation of income over time is rather small, and we do not know whether we would find a similarly strong relative response to the income change if the income variation were more substantial.

Second, liquid pension wealth ten years into retirement appears to be much more important for our respondents' choices than the net present value of (illiquid) future pension income at that point in time. There are several traditional and behavioural explanations for this finding, such as a bequest motive, the notion that individuals value the freedom of liquid wealth, the idea that they can use liquid wealth to cover large unexpected expenses, or a lack of financial skills making it hard to compare an annuity with a lump-sum. Unfortunately, our experiment cannot disentangle these different explanations. Our counterfactual simulation where illiquid wealth gets a higher weight

than in the estimates, makes individuals choose spending plans that lead to dissaving and much less liquid wealth at age 77. Based on these results, an explanation for the stylized fact that retirees hold on to, or even increase, their wealth after retirement is that illiquid wealth in the form of a life-long income stream is perceived and valued differently from money on the bank. All in all, varying pension income profiles seems a promising policy instrument for decumulation of pension wealth. Not only in the Netherlands where it already is available, but also in other countries that continue to improve the decumulation phase of their retirement scheme.

Several directions for future work remain. We could test, in an experimental set-up as well as using administrative data, our conjecture that a high-low pension income more closely matches (ex-ante) preferred spending during retirement. In addition, our model is flexible enough to be enriched with additional vignettes that differ, for instance, in durations of the high-income spells or other beliefs upon future health status. From a communication perspective, it would be interesting to investigate whether the stated spending preferences are affected by explicitly presenting the net present value of future (illiquid) pension wealth. Similar experiments could use more various income and expenditure patterns, making it possible to analyse the relevance of other extensions of the life-cycle model, such as habit formation or hyperbolic discounting.

# References

Agnew, J. R., Anderson, L. R., Gerlach, J. R., and Szykman, L. R. (2008). Who Chooses Annuities? An Experimental Investigation of the Role of Gender, Framing, and Defaults. *American Economic Review*, 98(2):418–422.

Alonso-García, J., Bateman, H., Bonekamp, J., and Stevens, R. (2021). Spending from regulated retirement drawdowns: The role of implied endorsement. *The Scandinavian Journal of Economics*. Advance online publication. Available at: https://doi.org/10.1111/sjoe.12437.

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.

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

Banks, J., Blundell, R., and Tanner, S. (1998). Is There a Retirement-Savings Puzzle? *American Economic Review*, 88(4):769–788.

Banks, J., o'Dea, C., and Oldfield, Z. (2010). Cognitive function, numeracy and retirement saving trajectories. *The Economic Journal*, 120(548):F381–F410.

Bernheim, B. D., Skinner, J., and Weinberg, S. (2001). What Accounts for the Variation in Retirement Wealth among U.S. Households? *American Economic Review*, 91(4):832–857.

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

Bovenberg, L. and Nijman, T. (2019). New Dutch pension contracts and lessons for other countries. *Journal of Pension Economics & Finance*, 18(3):331–346.

Brown, J. R. (2001). Private pensions, mortality risk, and the decision to annuitize. *Journal of Public Economics*, 82(1):29–62.

Brown, J. R., Kapteyn, A., Luttmer, E. F., and Mitchell, O. S. (2017). Cognitive constraints on valuing annuities. *Journal of the European Economic Association*, 15(2):429–462.

Brown, J. R., Kapteyn, A., Luttmer, E. F., Mitchell, O. S., and Samek, A. (2021). Behavioral Impediments to Valuing Annuities: Complexity and Choice Bracketing. *Review of Economics and Statistics*, 103(3):1–14.

Brown, J. R., Kling, J. R., Mullainathan, S., and Wrobel, M. V. (2008). Why Don't People Insure Late-Life Consumption? A Framing Explanation of the Under-Annuitization Puzzle. *American Economic Review*, 98(2):304–309.

Bütler, M., Peijnenburg, K., and Staubli, S. (2017). How much do means-tested benefits reduce the demand for annuities? *Journal of Pension Economics & Finance*, 16(4):419–449.

Bütler, M. and Teppa, F. (2007). The choice between an annuity and a lump sum: Results from swiss pension funds. *Journal of Public Economics*, 91(10):1944–1966.

Campbell, J. Y. and Mankiw, N. G. (1990). Permanent Income, Current Income, and Consumption. *Journal of Business & Economic Statistics*, 8(3):265–279.

Canova, L., Rattazzi, A. M. M., and Webley, P. (2005). The hierarchical structure of saving motives. *Journal of Economic Psychology*, 26(1):21–34.

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

De Bresser, J. and Knoef, M. (2015). Can the Dutch meet their own retirement expenditure goals? *Labour Economics*, 34:100–117.

De Nardi, M., French, E., and Jones, J. B. (2010). Why Do the Elderly Save? The Role of Medical Expenses. *Journal of Political Economy*, 118(1):39–75.

De Nardi, M., French, E., and Jones, J. B. (2016). Savings After Retirement: A Survey. *Annual Review of Economics*, 8(1):177–204.

Elsayed, A., de Grip, A., Fouarge, D., and Montizaan, R. (2018). Gradual retirement, financial incentives, and labour supply of older workers: evidence from a stated preference analysis. *Journal of Economic Behavior & Organization*, 150:277–294.

Hall, R. E. and Mishkin, F. S. (1982). The Sensitivity of Consumption to Transitory Income: Estimates from Panel Data on Households. *Econometrica*, 50(2):461–481.

Hung, A. A., Luoto, J., Burke, J., Utkus, S. P., and Young, J. A. (2019). Automatic enrollment and job market turnover. *Journal of Pension Economics & Finance*. Advance online publication. Available at: https://doi.org/10.1017/S1474747219000076.

Hurwitz, A., Sade, O., and Winter, E. (2020). Unintended consequences of minimum annuity laws: An experimental study. *Journal of Economic Behavior & Organization*, 169:208–222.

Knoef, M., Been, J., Alessie, R., Caminada, K., Goudswaard, K., and Kalwij, A. (2016). Measuring retirement savings adequacy: developing a multi-pillar approach in the Netherlands. *Journal of Pension Economics & Finance*, 15(1):55–89.

Krosnick, J. A. (1991). Response strategies for coping with the cognitive demands of attitude measures in surveys. *Applied Cognitive Psychology*, 5(3):213–236.

Lever, M., Ponds, E., Dillingh, R., and Stevens, R. (2018). *Keuzevrijheid in de uitkeringsfase: internationale ervaringen*. (CPB Achtergronddocument). Available at CPB: https://www.cpb.nl/publicatie/keuzevrijheid-in-de-uitkeringsfase-internationale-ervaringen.

Levin, L. (1998). Are assets fungible? Testing the behavioral theory of life-cycle savings. *Journal of Economic Behavior & Organization*, 36(1):59–83.

Love, D. A., Palumbo, M. G., and Smith, P. A. (2009). The trajectory of wealth in retirement. *Journal of Public Economics*, 93(1-2):191–208.

Madrian, B. C. and Shea, D. F. (2001). The power of suggestion: Inertia in 401(k) participation and savings behavior. *The Quarterly Journal of Economics*, 116(4):1149–1187.

Mercer (2019). *Melbourne Mercer Global Pension Index*. Australian Centre for Financial Studies, Melbourne.

Michaud, P.-C., Van Soest, A., and Bissonnette, L. (2020). Understanding joint retirement. *Journal of Economic Behavior & Organization*, 173:386–401.

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

Revelt, D. and Train, K. (1998). Mixed Logit with Repeated Choices: Households' Choices of Appliance Efficiency Level. *Review of Economics and Statistics*, 80(4):647–657.

Schreiber, P. and Weber, M. (2016). Time inconsistent preferences and the annuitization decision. *Journal of Economic Behavior & Organization*, 129:37–55.

Shefrin, H. M. and Thaler, R. H. (1988). The behavioral life-cycle hypothesis. *Economic Inquiry*, 26(4):609–643.

Simonson, I. (1989). Choice based on reasons: The case of attraction and compromise effects. *Journal of Consumer Research*, 16(2):158–174.

Simonson, I. and Tversky, A. (1992). Choice in context: Tradeoff contrast and extremeness aversion. *Journal of Marketing Research*, 29(3):281–295.

Train, K. E. (2009). *Discrete Choice Methods with Simulation*. Cambridge University Press.

Van der Cruijsen, C. and Jonker, N. (2019). Pension profile preferences: the influence of trust and expected expenses. *Applied Economics*, 51(12):1212–1231.

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

# Appendix A

## A.1 Screenshot of the vignettes

A screenshot of the choices for the respondent for the high-low pension income vignette (in Dutch) is presented in Figure 4. The English translation can be found in Table 5.

Figure 4: Screenshot (in Dutch) for the high-low pension income vignette for a respondent with gross household income between 52 000 and 73 500.

Denkt u nu aan een huishouden dat bestaat uit twee personen van 67 jaar oud die net met pensioen zijn gegaan. Beiden zijn in goede gezondheid en verwachten dat in ieder geval te blijven totdat ze 72 jaar oud zijn.

**Het huishouden heeft de eerste vijf jaar een netto inkomen van €45.450 (€3.788 per maand) en daarna zolang ze leven een netto inkomen van €41.250 (€3.438 per maand) en een (financieel) vermogen van €36.000. De hypotheek van het huis is volledig afgelost. Ze willen niet verhuizen en hun huis niet verkopen. Als een van beiden komt te overlijden, dan zal de achterblijvende partner minder inkomen ontvangen, maar ook minder uitgaven hebben. De verlaging in inkomen is dan ongeveer net zo groot als de verlaging in uitgaven.**

Op hun pensioenleeftijd (67 jaar) maakt het huishouden een plan hoeveel ze jaarlijks denken te gaan sparen en uit te geven. Dit doen ze op basis van hun vermogen op dat moment en hun toekomstig inkomen. Ze doen dit in twee stappen. Eerst tot ze 77 jaar oud zijn, en daarna vanaf hun 77e.

U ziet vijf verschillende uitgavenpatronen en het verloop van het vermogen (ervan uitgaande dat beide personen dan nog leven). Als het vermogen op is, moet het huishouden de uitgaven aanpassen aan het inkomen.

U mag ervan uitgaan dat de prijzen in de toekomst **niet** veranderen.

**Welk van de volgende uitgavenpatronen zou u, op basis van uw eigen voorkeuren, dit huishouden adviseren te kiezen tot leeftijd 77?**

**Uitgavenpatronen:**

○ Uitgavenpatroon 1: €47.250 per jaar (€3.938 per maand) van leeftijd 67 tot 76.
Daarna (vanaf leeftijd 76) is het vermogen op en zijn de uitgaven gelijk aan het inkomen (€41.250 per jaar; €3.438 per maand).

○ Uitgavenpatroon 2: €44.100 per jaar (€3.675 per maand) van leeftijd 67 tot 77.
Het vermogen stijgt met €1.350 per jaar tot leeftijd 72. Vanaf leeftijd 72 daalt het vermogen met €2.850 per jaar, tot bijvoorbeeld €28.500 op leeftijd 77.

○ Uitgavenpatroon 3: €42.000 per jaar (€3.500 per maand) van leeftijd 67 tot 77.
Het vermogen stijgt met €3.450 per jaar tot leeftijd 72. Vanaf leeftijd 72 daalt het vermogen met €750 per jaar, tot €49.500 op leeftijd 77.

○ Uitgavenpatroon 4: €39.900 per jaar (€3.325 per maand) van leeftijd 67 tot 77.
Het vermogen stijgt met €5.550 per jaar tot leeftijd 72. Vanaf leeftijd 72 stijgt het vermogen met €1.350 per jaar, tot €70.500 op leeftijd 77.

○ Uitgavenpatroon 5: €37.800 per jaar (€3.150 per maand) van leeftijd 67 tot 77.
Het vermogen stijgt met €7.650 per jaar tot leeftijd 72. Vanaf leeftijd 72 stijgt het vermogen met €3.450 per jaar, tot €91.500 op leeftijd 77.

| Vorige | | Verder |

Table 5: Translation of Figure 4.

Think of a household that consists of two individuals of 67 years old who have just retired. Both are in good health and expect to stay so at least till they reach the age of 72.

**The household has the first five years after retirement a net of tax income of €45 450 (€3788 monthly) and afterwards a life-time income of €41 250 (€3438 monthly)** and (financial) wealth of €36 000. They own the house they live, without a mortgage. They don't want to move or sell their house. If one member of the household dies, the survivor will receive less income but also spend less. The reduction in income is roughly equivalent to the reduction in spending.

At their statutory retirement age (67 year) the household has to plan how much they expect to save and spend, based on their current wealth and future income. They do this in two steps. First till they reach the age of 77, and second starting from the age of 77.

Below we have listed five different spending plans together with the development of wealth (if both members of the household survive). If their wealth is exhausted then the household has to adapt their spending to their income.

You can assume that prices do not change over time.

What spending plan do you, based on your own preferences, advise the household to choose **till age 77?**

**Spending plans**

- Spending plan 1: €47 250 yearly (€3983 monthly) from age 67 till 76.
  Afterwards (starting from age 76) wealth is exhausted and spending equals income (€41 250 yearly; €3438 monthly).

- Spending plan 2: €44 100 yearly (€3675 monthly) from age 67 till 77.
  Wealth increases by €1350 yearly till age 72. Starting from age 72, wealth decreases by €2850 yearly, to €28 500 at age 77.

- Spending plan 3: €42 000 yearly (€3500 monthly) from age 67 till 77.
  Wealth increases by €3450 yearly till age 72. Starting from age 72, wealth decreases by €750 yearly, to €49 500 at age 77.

- Spending plan 4: €39 900 yearly (€3325 monthly) from age 67 till 77.
  Wealth increases by €5550 yearly till age 72. Starting from age 72, wealth increases by €1350 yearly, to €70 500 at age 77.

- Spending plan 5: €37 800 yearly (€3150 monthly) from age 67 till 77.
  Wealth increases by €7650 yearly till age 72. Starting from age 72, wealth increases by €3450 yearly, to €91 500 at age 77.

# Appendix B   Online

## B.1   Additional tables

### B.1.1   Survival probabilities

The probability of surviving for another $x \in [0, 19]$ years of someone aged 77 can be found in column (1) of Table 6. These are taken from Statistics Netherlands[13] and are based upon the combined survival rates of males and females. Consequently, the likelihood of surviving for males (females) is overestimated (underestimated). In column (2) and (3) we have used a constant survival rate of 0.90, respectively 0.95.

Table 6: Probability of surviving for another $x \in [0, 19]$ years for a 77 years old.

|          | (1)    | (2)    | (3)    |
|----------|--------|--------|--------|
| $P_0$    | 1.0000 | 1.0000 | 1.0000 |
| $P_1$    | 0.9702 | 0.9000 | 0.9500 |
| $P_2$    | 0.9383 | 0.8100 | 0.9025 |
| $P_3$    | 0.9038 | 0.7290 | 0.8574 |
| $P_4$    | 0.8657 | 0.6561 | 0.8145 |
| $P_5$    | 0.8258 | 0.5905 | 0.7738 |
| $P_6$    | 0.7807 | 0.5314 | 0.7351 |
| $P_7$    | 0.7324 | 0.4783 | 0.6983 |
| $P_8$    | 0.6820 | 0.4305 | 0.6634 |
| $P_9$    | 0.6281 | 0.3874 | 0.6302 |
| $P_{10}$ | 0.5696 | 0.3487 | 0.5987 |
| $P_{11}$ | 0.5100 | 0.3138 | 0.5688 |
| $P_{12}$ | 0.4498 | 0.2824 | 0.5404 |
| $P_{13}$ | 0.3885 | 0.2542 | 0.5133 |
| $P_{14}$ | 0.3303 | 0.2288 | 0.4877 |
| $P_{15}$ | 0.2745 | 0.2059 | 0.4633 |
| $P_{16}$ | 0.2227 | 0.1853 | 0.4401 |
| $P_{17}$ | 0.1758 | 0.1668 | 0.4181 |
| $P_{18}$ | 0.1349 | 0.1501 | 0.3972 |
| $P_{19}$ | 0.1000 | 0.1351 | 0.3774 |
|          |        |        |        |
| $\alpha$ | 0.5742 | 0.4392 | 0.6415 |

Notes: $\alpha = \frac{1}{20} \sum_{t=77}^{96} P_{t-77}$.

---

[13]https://opendata.cbs.nl/statline/#/CBS/nl/dataset/70701ned/table?dl=3E0E2

## B.1.2  Sensitivity to the importance of illiquid wealth parameter

Table 7: Predicted advised spending plan per vignette for different varying importance of illiquid wealth.

| $\omega =$ | plan 1 (dissaving) | 2 | 3 | 4 | plan 5 (saving) |
|---|---|---|---|---|---|
| | spending plan for first 10 years: | | | | |
| 0.01 | 0.0000 | 0.0000 | 0.0000 | 0.0004 | 0.9995 |
| 0.10 | 0.0000 | 0.0002 | 0.0024 | 0.0115 | 0.9859 |
| 0.20 | 0.0021 | 0.0059 | 0.0452 | 0.1081 | 0.8387 |
| 0.30 | 0.0364 | 0.0618 | 0.2262 | 0.2476 | 0.4280 |
| 0.35 | 0.0947 | 0.1294 | 0.3194 | 0.2299 | 0.2266 |
| 0.38 | 0.1483 | 0.1784 | 0.3439 | 0.1907 | 0.1387 |
| 0.39 | 0.1690 | 0.1949 | 0.3453 | 0.1752 | 0.1156 |
| $\widehat{\omega}$ | 0.1839 | 0.2061 | 0.3443 | 0.1643 | 0.1015 |
| 0.41 | 0.2139 | 0.2268 | 0.3381 | 0.1431 | 0.0781 |
| 0.42 | 0.2377 | 0.2417 | 0.3300 | 0.1273 | 0.0633 |
| 0.45 | 0.3121 | 0.2801 | 0.2915 | 0.0843 | 0.0319 |
| 0.50 | 0.4328 | 0.3182 | 0.2052 | 0.0354 | 0.0085 |
| 0.60 | 0.6016 | 0.3196 | 0.0747 | 0.0037 | 0.0003 |
| 0.70 | 0.6744 | 0.2967 | 0.0286 | 0.0003 | 0.0000 |
| 0.80 | 0.7034 | 0.2819 | 0.0146 | 0.0000 | 0.0000 |
| 0.90 | 0.7176 | 0.2732 | 0.0092 | 0.0000 | 0.0000 |
| 1.00 | 0.7260 | 0.2675 | 0.0065 | 0.0000 | 0.0000 |

*Notes:* As input we use the estimation results of specification (3) in Table 4 for which we vary $\omega$.

## B.2 Additional figures

Figure 5 presents the relative frequency distribution of the advised spending plan in the data, panel (a), with the advised spending plan per vignette based upon our model estimates. More details can be found in Section 5.1.
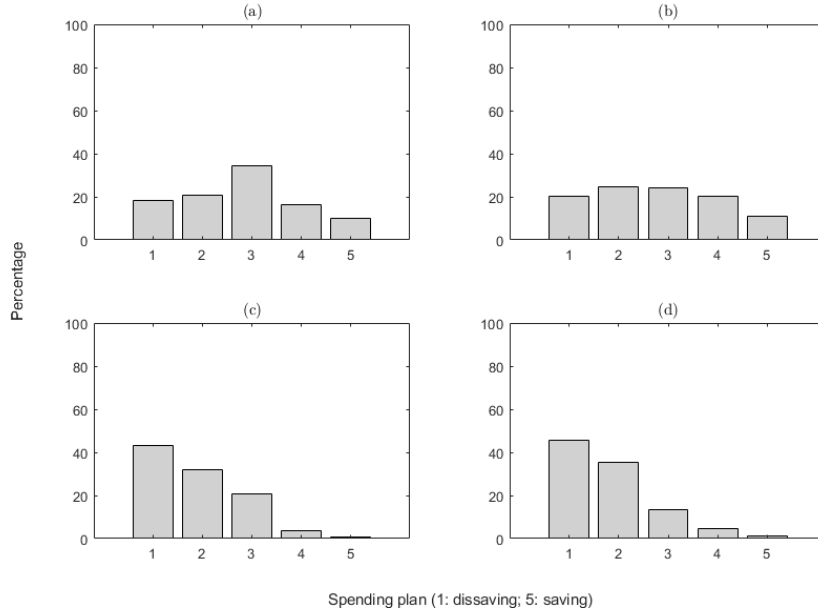
Figure 5: Predicted advised spending plan per vignette.
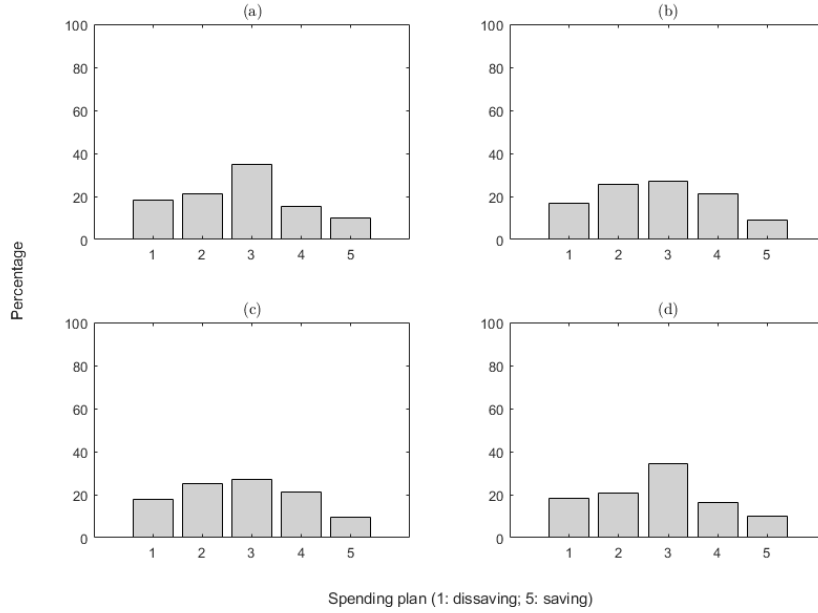


*Notes:* (a): Data summary. (b): Standard life-cycle model - i.e. specification (1) in Table 4. (c): Importance of illiquid wealth - specification (2). (d): Middle response alternative - specification (3).

For Figure 6, we use the estimation results of specification (3) in Table 4 to calculate, per respondent and simulation draw, the predicted probabilities for each of the five spending plans for different behavioural components. More details can be found in Section 5.1.

Figure 6: Predicted advised spending plan per vignette for different behavioural life-cycle features.



*Notes:* (a): Simulated distribution of the spending plans using the estimation results of specification (3) in Table 4. (b): Similar to (a), but with $\delta$, importance of the middle response, set equal to 0. (c): Similar to (a), but with $\omega$, the importance of illiquid wealth, set to 0.5. (d): Similar to (a), but with $\delta = 0$ and $\omega = 0.5$.