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I know (and) I can and I do? The role of Multi-dimensional financial literacy in explaining pension information behavior

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Milena Dinkova



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The role of Multi-dimensional financial literacy in explaining pension information behavior

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Abstract

This paper assesses whether financial literacy can explain the likelihood of people delving into their pension situation. I suggest to use a financial literacy construct that, next to the usual financial literacy questions assessing numeracy and knowledge of financial concepts, also includes perceived financial knowledge, questions on pension-specific knowledge and a vocabulary test. A survey was distributed amongst employees and customers of a large insurance company in order to elicit participants' financial literacy level, some relevant behavioural factors and demographics. I linked participants' login behaviour in their respective digital pension environment (DPE) to their financial literacy level and behavioural factors including attitudes towards pension information, need for cognition and future time perspective. People with higher pension knowledge and knowledge about the concept of interest compounding were more likely to log in to the DPE. Attitudes, need for cognition and future time perspective are directly related with login behaviour. The relationship between financial literacy and login behaviour is not affected by behavioural factors.

Keywords: pension communication, pension information, tailoring, financial literacy, pension attitudes, cognitive factors

JEL classification: D14, D83, D91, G41, J32

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Comments welcomed to: m.dinkova@uu.nl

1. Introduction

In the Netherlands, there is a discussion going on about providing more freedom of choice to pension plan participants. More freedom of choice implies that the responsibility for making optimal pension decisions shifts to the participants. Many efforts have been made in the pension industry to provide transparent and user-friendly pension information that can help individuals to ensure a carefree (at least moneywise) old age. The main challenge in the pension communication sector is how to get people to log in to their digital pension environment (DPE) in the first place. What are the underlying factors that drive people to or deter people from looking into their pension situation? Financial literacy is a factor that has been mentioned often in relation to optimal financial planning. For instance, Lusardi and Mitchell (2011) and Van Rooij et al. (2011a) confirm that more sophisticated and financially literate people are more likely to engage in financial planning. Arguably, financially literate individuals are aware of the importance and urgency to start planning for retirement if they have not done so already. Is being financially literate enough for people to motivate themselves to sit down, switch on their (smart) device and log in to their DPE?

In this study, I investigate the role of financial literacy in explaining the likelihood to look into one's personal pension situation (pension information behaviour) and the extent to which the effect of financial literacy is influenced by behavioural factors such as attitudes, need for cognition and future time perspective. To study this issue, I use data containing login information of 1) employees and 2) new customers of a large insurance company who were asked by means of an invitation letter to log in to their digital pension environment in order to take a closer look at their pension situation. See Dinkova et al. (2018a, 2018b) for more details on how the login data has been obtained. Every participant was invited to fill in a survey including questions measuring the financial literacy level of the participants and the behavioural factors mentioned further up in the paragraph.

To the best of my knowledge, the only study that provides experimental evidence on real login behaviour of pension participants in the Netherlands is a study by Bauer, Eberhardt and Smeets (2017). They conducted a field experiment on retirement information search amongst pension fund participants. They observe, amongst others, that participants who logged in are more likely to be male, older, earn more and have a partner.

Many studies on financial literacy focus on the impact of financial literacy on savings behaviour and stock market participation (Deuflhard, Georgarakos, & Inderst, 2017; van Rooij,

Lusardi, & Alessie, 2011b) and on retirement planning (Bucher-Koenen & Lusardi, 2011; Lusardi & Mitchell, 2007c; van Rooij et al., 2011a). Those studies predominantly used a basic concept of financial literacy comprising numeracy and knowledge of basic financial concepts like interest compounding, inflation and risk diversification.

However, financial literacy has more facets, especially when we want to study retirement planning. Retirement planning undoubtedly requires financial knowledge and skills. Sound retirement planning though also requires confidence in one's knowledge, the ability to read complex texts (pension documents are not written in the easiest language) and a fair share of basic knowledge about pensions. Financial literacy has been defined by Huston (2010) as “measuring how well an individual can understand and use personal finance-related information” (p.306) – a clear and simple definition. Remund (2010) presents a more multi-dimensional approach of financial literacy as a construct that does not only comprise knowledge of financial concepts but also the skill to use that knowledge for financial planning.

Using insights from linguistics and communication science (Lentz & Pander Maat, 2013; Nell, Lentz, & Pander Maat, 2016), I propose a comprehensive financial literacy construct that consists of numeracy, knowledge of financial concepts, topic-specific knowledge (pensions in this case), literacy in its original sense and one's self-assessment regarding financial knowledge. With this extension, I follow Remund's approach towards financial literacy (2010). Furthermore, this study contributes to the literature on retirement planning by linking financial literacy and other relevant behavioural factors to real behaviour¹ rather than behavioural intention as had been done by recent relevant studies (such as Eberhardt, Brüggem, Post, & Hoet, 2016). By following Eberhardt et al. (2016) and including behavioural factors like attitudes towards pension information, need for cognition and time preferences, the importance of intrinsic motivation in explaining people's pension information behaviour is addressed.

Next to financial literacy, it is important to consider several factors that might capture heterogeneity in (time) preferences²: people value current consumption more than future consumption, or people do not like to think about serious issues in general (or related to their pension) and consider everything related with pensions to be dull and difficult to digest. Future time perspective refers to how important the future is to people and to what degree they like to

¹ With the notable exception of Bauer et al. (2017)

² As including attitudes, need for cognition and future time perspective are not typical concepts used in economic literature, we chose to provide a more detailed background of those concepts in the main text.

engage in (long-term) planning rather than valuing present consumption. Carstensen et al. (1999) suggest that assessment of time is crucial “in the ranking and execution of social goals” (p.175). Although Zimbardo & Boyd (2015) are entirely correct about the need to consider a multi-dimensional time perspective (considering past, future and even perception about the beyond) when explaining present behaviour for most people, this study focusses on the future. After all, pension lies in the near or far future. I posit that future time perspective has an influence on the motivation of people to delve into their pension information. If for instance people tend to procrastinate, as they might value present benefits more than spending time on future benefits, the likelihood that they would delve into their pension information is smaller. Possibly this is even the case for people with a high financial literacy level, hence future time perspective may have a moderating effect on the relationship between financial literacy and login behaviour.

Finally, I believe that two additional factors that influence the motivation to look into one’s pension information are attitudes towards pension information and need for cognition. With attitudes I mean attitudes that are “expressed by evaluating a particular entity [pension information] with some degree of favour or disfavour” (Eagly & Chaiken, 1993, p. 1). When measuring attitudes towards pension information, particular adjectives are used enabling respondents to clearly state their (dis)liking of pension information. The last element in this conceptual framework is need for cognition. The oldest definition of need for cognition is provided by Cohen, Stotland & Wolfe (1955): “[the] need to structure relevant situations in meaningful, integrated ways [and] the need to understand and make reasonable the experiential world” (p.291). Cacioppo et al. (1986) extend this concept by emphasising that the dominant factor of this construct is that individuals “engage in and enjoy effortful cognitive endeavors” (p.1033). Using the latter view, one can set up the link to the pension context. General need for cognition should still be seen separately from the need to be informed about one’s pension. There are individuals after all who dearly like to solve puzzles but yet, they prefer not to focus their cognitive efforts towards pension information.

With this study I want to advocate the use of behavioural variables, next to the usual economic variables (wealth, income, household assets) and demographics, in enriching economic models. This way, insights from other disciplines (communication science, linguistics and social psychology) can complement already established findings in economics and help to answer the economic question of how consumers can be incentivised in optimal financial planning. More

knowledge about people's attitudes and need to be informed can help policy makers and financial institutions to assist people in making the right financial decision at the right time.

This paper is organised as follows: section two describes the methodology used to elicit login behaviour, the constructs measured in the survey and a schematic overview of how the constructs relate to each other. The third section describes the data, the fourth section contains estimation procedure and section five— the estimation results. The sixth and final section concludes and briefly discusses the results.

2. Methodology

In this section I first briefly describe how the dependent variable— login behaviour into one's digital pension environment— is constructed. Then, I provide more information on the survey methodology and which constructs were measured. Lastly, I outline how financial literacy is defined and which relations are examined in particular.

2.1 Constructing the dependent variable – login behaviour

The data on login behaviour to a digital pension environment has been obtained during a field experiment - see Dinkova et al. (2018a, 2018b) for more details. There were two different research populations: The first research population comprised employees of a large insurance company (data collection in winter 2016) and the second research population— customers who enrolled into a new workplace pension scheme with the aforementioned insurance company (data collection in the first half of 2017). From here onwards, I will refer to the first group as the employee subsample and to the second group as the customer subsample. All participants had to log in to their digital pension environment using the Digital Identification (DigID). Two weeks after having received the invitation to login to their digital pension environment, the participants received a survey eliciting financial literacy and several psychometric concepts³.

³ Note that the data for the employee subsample has been collected during one wave. Regarding the second subsample, data has been collected in multiple waves for a total duration of six months. The timing of the waves depended on how many new customers got enrolled into the workplace scheme. The invitation to fill in the survey always succeeded the invitation to log in by two weeks.

2.2 Survey Methodology

The survey contained questions on financial literacy (comprising self-assessed financial literacy, questions testing numeracy and knowledge of financial concepts, a vocabulary test and a pension knowledge test), need for cognition (general and pension-related), attitudes related to pension information and relevant demographics. Please refer to Appendix C for the exact wording of all survey questions.

Financial literacy

Nell, Lentz & Pander Maat (2016) and Nell (2017) used a financial knowledge test of 11 questions based on Lusardi (2015) and Lusardi & Mitchell (2011) and found that topic-specific knowledge is an important predictor (after language skill) for readers' performance in understanding financial documents. Combining those insights with Remund's view on financial literacy, we end up with the following constituent parts of financial literacy: Numeracy and knowledge of financial concepts (the classical approach in economic literature so far), topic knowledge (in this case pension knowledge), self-assessed financial knowledge and literacy in its original sense.

Numeracy and knowledge of financial concepts. The survey also takes into account the classical approach adopted in financial literacy literature which essentially measures numeracy and knowledge of financial concepts. Lusardi and her colleagues implemented a set of financial literacy questions in various (inter)national surveys such as the RAND American Life Panel (Lusardi & Mitchell, 2007c b), the Survey of Health Ageing and Retirement in Europe (SHARE) (Christelis, Jappelli, & Padula, 2010), the Dutch DNB Household survey (DHS) (van Rooij et al., 2011a) and the LISS panel. This classical approach uses four multiple-choice questions that test the following financial concepts: interest compounding, inflation, risk diversification and the relationship between bond prices and interest rate. Here, the "don't know" option is included as well. See Lusardi and Mitchell (2011) for more details on those questions.

Topic knowledge. Based on Lentz & Pander Maat (2013) and Nell *et al.* (2016), we asked the respondents four questions in order to test their pension knowledge. The topics covered are workplace pension schemes (*werkgeverspensioen* in Dutch), basic state pension (*AOW*), life events that can impact one's pension and the investment behaviour of pension funds. When assessing topic knowledge, two alternative grading systems are applied— a strict and a lenient one. Concerning the strict grading, it is assessed how many out of the four pension knowledge questions

were answered completely correct implying that for a question with multiple correct answers, *all* correct answers had to be ticked. This resulted in a scale from 0-4. The lenient grading applied a different scale (0-7) and counted the total number of correct responses for all questions: hence 7 correct answers in total for 4 questions. With the lenient grading scheme, scoring 0 or 1 becomes less likely compared to the strict grading scheme. For the main analysis of this paper, the strict grading scheme applies. The lenient scheme is used to check the sensitivity of the estimation results.

Self-assessed financial knowledge. As people's behaviour is not only driven by one's skills and knowledge but also by the own perception of one's knowledge, respondents were asked to indicate on a 7-point Likert scale how they would assess their own financial knowledge. Van Rooij, Lusardi & Alessie (2011b) also included self-assessed financial knowledge in their analysis in order to capture people's confidence in dealing with financial matters.

Vocabulary. Nell and her colleagues (2016) found that language skill was the most important predictor for readers' performance in finding and understanding information in financial documents. A shortened version of the vocabulary test that they used in their study has been included in the present survey. Respondents were asked to identify the correct meaning of a complex word embedded in a specific context in a multiple-choice setting (four possibilities). The words were general words that could be encountered in newspapers, books or discussions: demagogue, segregation, philanthropist or megalomaniac. Additionally, to avoid gambling (van Rooij et al., 2011b; van Rooij, Lusardi, & Alessie, 2012), the "don't know" option has been added to every question (see for instance van Rooij, Lusardi & Alessie (2012) and van Rooij et al. (2011b)).

Need for cognition

Need for cognition (NFC) also appears in two variations in the survey: general NFC and topic NFC. General NFC consists of four items that aim at identifying the extent to which the respondent enjoys being confronted with situations that require some cognitive effort. For the purpose of this study, a shortened version has been constructed based on Cacioppo et al. (1986) and Pieters et al. (1987). Three additional items were included in the survey to measure topic NFC. In particular, respondents were asked to indicate the extent to which they wished to be informed about their pension and in how far they liked to look into it themselves. NFC is different from behavioural

intention in that it relates to affection/aversion towards a certain topic and behavioural intention refers to a stated intention to look into one's pension situation within a given timeframe.

Future time perspective

As the goal of saving for pension lies in the near or far future, time preferences can be an important factor in explaining pension information behaviour. Zimbardo (2015) proposed three statements measuring future time perspective that should be evaluated on a 5-point Likert scale. Those three statements have been included in this survey as well. For instance, one statement was about to what extent respondents agree that they prefer to spend money now on nice things rather than saving for later.

Attitudes towards pension information

Another construct that is needed to explain behaviour, are attitudes towards this particular behaviour (see Ajzen, 1991; Eagly & Chaiken, 1993; Yzer, 2012). In this context, it is more sensible to measure attitudes towards pension information (rather than attitudes towards login behaviour) as people know that the goal of logging in is to eventually look into their *pension information*. Respondents were asked to assess their attitudes regarding pension information by ranking six characteristics respectively on a 5-point Likert scale. In particular, respondents had to indicate how unimportant/important, interesting/uninteresting, difficult/easy, reliable/unreliable, unclear/clear and useful/not useful they considered pension information to be. To avoid mechanical answers, the scales were alternating from positive to negative and vice versa.

Demographics

The survey also contained questions on demographics: date of birth, gender, and household composition, number of children, monthly net household income and education level. Respondents could choose from dropdown income categories as suggested by Statistics Netherlands (CBS).

2.3 The financial literacy construct in relation to behavioural factors

Figure 1 presents the composition of the financial literacy construct I propose to use. Financial literacy can be dissected in two parts: the concept of financial knowledge which consists of numeracy and knowledge of financial concepts, topic-specific knowledge and perceived financial knowledge on the one hand, and the concept of literacy which refers to literacy in its original sense on the other hand. Note that this does not imply that the constituent parts should be aggregated to

one single financial literacy construct as it is the multi-dimensionality of financial literacy that makes it an interesting subject.

Having visualised what financial literacy is, we move on to setting the links between login behaviour and specifying the role of the behavioural factors. Firstly, we are interested in examining the relationship between financial literacy and login behaviour— this is the main research question of this study. Secondly, we will examine whether the behavioural factors need for cognition, attitudes towards pension information and future time perspective affect the relationship between financial literacy and login behaviour. In other words, we will investigate whether there are interaction effects between the behavioural factors and financial literacy. A schematic visualisation of the associations that are examined in this study can be found in the Appendix (Figure A-1).

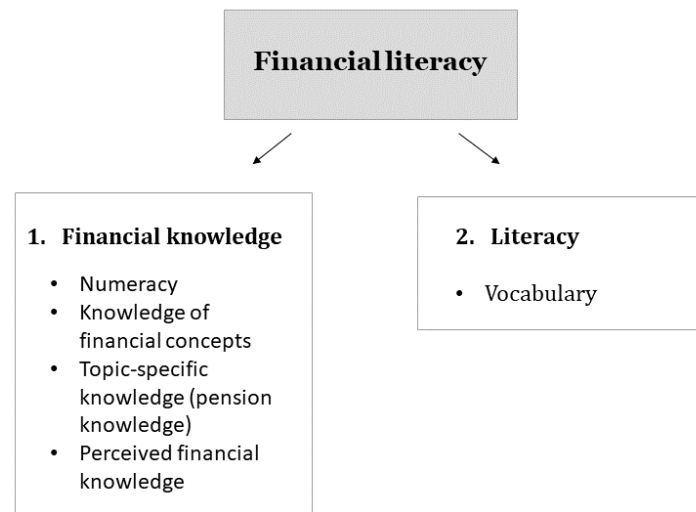


Figure 1: Composition of financial literacy construct

3. Data description

3.1 Summary statistics

The research populations from both subsamples summed up to 11,797 (3,159 for the first experiment and 8,638 for the second experiment embodying the gross employee and customer subsample respectively). Login behaviour could only be linked to the participants' financial literacy level and the other factors provided that they also answered the survey. The overlap between the survey responses and the behaviour measured is 980 participants for the first (employee) sub-group

and 613 participants for the second (customer) sub-group. Additionally, 10% of the observations had to be dropped as they did not agree for their survey responses to be linked to their online behaviour. This leaves us with a final sample of 1,351 participants (where 62% belong to the first sub-sample and the remaining share— to the second sub-sample). See table A1 in the appendix for summary statistics of all variables included in this analysis.

The share of participants who logged in is quite high: On average, 19% of the participants who received an invitation to login have logged in at least once. Table 1 breaks down the login share and other key variables into the subsamples. For the employee subsample, the login share (conditional on having filled in the survey) was 23% and for the customers subsample, the share was 12%. A keen reader might think that the research questions have been already answered with table 1. It is true that the employee subsample is comprised of intrinsically more motivated individuals who self-selected into filling in the survey. However, I will confirm later in this study (in the Appendix), that when the results for both subsamples are estimated separately, there is still heterogeneity in login behaviour related to attitudes towards pension information and future time perspective. In the next subsection, I will discuss the graveness of self-selection and its implications for the interpretation of our results.

Table 2 displays the mean values for all financial literacy variables for participants who logged in and did not log in respectively. Considering the total sample, participants who logged in are, on average, more confident about their financial knowledge (higher mean of self-assessed financial knowledge), they score higher on the classic financial literacy questions and know more about their pension. The average score in the vocabulary test did not differ for participants who logged in to their DPE and those who did not log in. The general score in the vocabulary test was quite high: the average participants answered at least 6 out of 9 questions correctly.

Table 1: Mean values of some key variables by subsample

| <i>Variable</i> | Employee subsample | Customer subsample | $\Pr(T > t)^*$ |
|---|--------------------|--------------------|--------------------|
| Logged in | 0.23 | 0.12 | 0.000 |
| Self-assessed financial knowledge (1-7) | 5.39 | 4.62 | 0.000 |
| Score on classic financial literacy questions (0-4) | 3.31 | 2.95 | 0.000 |
| Score Vocabulary test (0-9) | 6.99 | 5.95 | 0.000 |
| Score Pension knowledge (0-4) | 2.55 | 2.24 | 0.000 |
| Attitudes PIB - negative to positive | 3.43 | 3.19 | 0.000 |
| NFC General | 3.68 | 3.59 | 0.008 |
| NFC Pension information | 3.47 | 3.37 | 0.012 |
| Future time perspective | 3.45 | 3.39 | 0.087 |
| Age (in years) | 46.73 | 43.69 | 0.000 |
| Low education dummy | 0.09 | 0.12 | 0.129 |
| High education dummy | 0.60 | 0.52 | 0.004 |
| Male (=1) | 0.67 | 0.70 | 0.180 |
| Number of observations | 840 | 511 | |

Notes: $\Pr(|T| > |t|)$ returns the p-value of a two-sided t-test comparing means testing the zero hypothesis $H_0: \mu_{Employee} = \mu_{Customer}$ where $\mu_{Employee}$ and $\mu_{Customer}$ are the population means of the employee subsample and of the customer subsample respectively. SAFL is self-assessed financial literacy measured on a 7-point scale.

Table 2: Mean values for all measured financial literacy concepts for participants who have logged in to the Digital Pension Environment and participants who did not log in (n=1,351)

| <i>Variable</i> | Logged in? | | |
|---|------------|------|--------------------|
| | Yes | No | $\Pr(T > t)^*$ |
| Self-assessed financial knowledge (1-7) | 5.35 | 5.04 | 0.00 |
| Score on classic financial literacy questions (0-4) | 3.30 | 3.14 | 0.00 |
| Score Pension knowledge (0-4) | 2.58 | 2.40 | 0.00 |
| Score Vocabulary test (0-9) | 6.80 | 6.55 | 0.14 |

Notes: $\Pr(|T| > |t|)$ returns the p-value of a two-sided t-test comparing means testing the zero hypothesis $H_0: \mu_{Yes} = \mu_{No}$ where μ_{Yes} and μ_{No} are the population means of the group that has logged in to the DPE and of the group that has not logged in respectively.

Table 3: Percentage share per type of answer for the Numeracy and financial knowledge questions, Pension knowledge and Vocabulary questions (n=1,351)

| <i>A. Classical FL questions</i> | | Q1: Interest | Q2: Inflation | Q3: Risk | Q4: Bonds | | | | | | |
|--------------------------------------|-----------|-----------------------|-------------------|------------------------------|-------------------|-------|-------|-------|-------|-------|--|
| | Correct | 96.52 | 92.30 | 87.70 | 40.67 | | | | | | |
| | Incorrect | 2.52 | 4.22 | 2.37 | 26.59 | | | | | | |
| | DK | 0.96 | 3.48 | 9.93 | 32.74 | | | | | | |
| <i>B. Pension knowledge (strict)</i> | | Q1: Workplace pension | Q2: State pension | Q3: Life changes and pension | Q4: Pension funds | | | | | | |
| | Correct | 71.13 | 77.65 | 2.59 | 91.86 | | | | | | |
| | Incorrect | 28.87 | 8.22 | 97.41 | 1.78 | | | | | | |
| | DK | N/A | 14.14 | N/A | 6.37 | | | | | | |
| <i>C. Vocabulary</i> | | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 | |
| | Correct | 75.35 | 86.01 | 49.26 | 78.67 | 84.96 | 87.18 | 61.87 | 69.99 | 67.56 | |
| | Incorrect | 13.92 | 8.59 | 12.15 | 5.63 | 12.52 | 9.12 | 4.97 | 9.51 | 5.27 | |
| | DK | 10.73 | 5.40 | 38.59 | 15.70 | 2.52 | 3.71 | 33.16 | 20.51 | 27.17 | |

Notes: For the precise wording of the questions refer to the Appendix. Note also the following about the pension knowledge questions: Question 1 contained two correct answers (referred to as Q1.1 and Q1.2), question 2 and 4 had only one possible correct answer and question 3 had three correct answers (referred to as Q3.1, Q3.2 and Q3.3 respectively in panel C). Questions 2 and 4 contained the don't know option.

In table 3, I computed the percentage share of correct, incorrect and don't know answers for every question for the classical financial literacy questions (panel A), the pension knowledge questions (panel B) and the vocabulary test (panel C). Regarding the classical financial literacy questions, the share of correct answers for the first three questions is extremely high. A possible explanation is that the majority of the respondents (who are part of the employee sample) have an affinity towards financial issues due to their work.

The questions on pension knowledge with multiple correct answers (questions 1 and 3), were considered more difficult than questions 2 and 4. The share of correct answers for the question of life-events is strikingly low: to answer this question entirely correctly, participants had to get all three correct sub-answers correct. The share of correct answers for the vocabulary test is quite high – for every question, the share is not lower than 60% with the single exception of question 3 (the question on what a demagogue is) that had the lowest share of correct answers. As in table 3 we could detect differences in the difficulty of questions, we should take this into account when conducting our empirical analysis. Including dummy variables for every question separately rather than the scores of the respective knowledge tests accounts for the differences in difficulty of the questions.

3.2 Sample selection and representativeness

To assess how far we can go in the inference of the estimation results, I compared the sub-sample of individuals who filled in the survey— and hence became part of our final sample— with the remainder of the gross sample consisting of individuals who did not fill in the survey. Next to login behaviour for the gross sample, there is also information available about age and gender of the research population. The mean values of login behaviour, age and gender who filled in the survey (and who did not) are presented in table 4. The most concerning statistics of table 4 are the means for login behaviour: 18.8 percent of the individuals who filled in the survey logged in to the DPE compared to 5.2 percent who did not fill in the survey. When digesting the estimation results in section 5, we should keep in mind that we are analysing a selective sub-sample and that the results we find are correlations.

Table 4: Mean values of login behaviour, age and gender of participants who filled in the survey and participants who did not fill it in

| | Filled in survey? | | Pr(T > t)* |
|---------------------|-------------------|--------|--------------|
| | Yes | No | |
| <i>Variable</i> | | | |
| Logged in (=1) | 0.188 | 0.052 | 0.000 |
| Age (in years) | 45.580 | 43.317 | 0.000 |
| Male (=1) | 0.679 | 0.697 | 0.179 |
| Nr. of observations | 1,351 | 10,401 | |

Notes: *Pr(|T| > |t|) returns the p-value of a two-sided t-test comparing means testing the zero hypothesis $H_0: \mu_{Survey} = \mu_{No Survey}$ where μ_{Survey} and $\mu_{No Survey}$ are the population means of the group that has filled in the survey and of the group that has not filled in the survey respectively.

4. Estimation procedure

4.1 Financial literacy and login behaviour

In order to investigate the answer to the first research question, I use a linear probability model⁴ to estimate the probability to log in to the digital pension environment with clustered standard errors at the employer level. I estimated models for the total sample— employee and customer subsamples altogether⁵. The estimation equation is given by (4.1) with $login_i$ being a binary dependent variable equal to 1 if an individual has logged in and 0 if otherwise, $NumFin_i$, PK_i , $Vocabulary_i$ and $SAFL_i$ denoting numeracy and knowledge of financial concepts (the questions developed by Lusardi and Mitchell), pension knowledge, vocabulary and self-assessed financial literacy respectively. Vocabulary is measured on a scale from 0-9, based on the number of correct answers given regarding the nine questions testing the participants' literacy. Self-assessed financial literacy is measured by one question on a 7-point Likert scale.

$$login_i = \beta_0 + \beta_1 NumFin_i + \beta_2 PK_i + \beta_3 Vocabulary_i + \beta_4 SAFL_i + \sum_{j=1}^4 \gamma_j B_{ji} + \delta' Z_i + \epsilon_i \quad (4.1)$$

⁴ Please note that I also estimated alternative non-linear specifications (probit and logit). The average marginal effects and standard errors are very similar to the estimations of the linear probability model, hence the choice to present the estimations of the linear probability model.

⁵The Chow-statistic of 45.26 is fairly high suggesting that the model could be estimated separately for the employee and customers subsample. Those results are reported in the Appendix. However, it is still more sensible to focus on the results of the total sample as reported in the main text for the sample size is still too small for examining the separate cells of the interaction terms in the unrestricted model.

I implement $NumFin_i$ and PK_i by 1) using a simple scale consisting of the number of correct answers respectively, where for pension knowledge I use the strict grading scale (as described in section 2) and 2) by including dummies for every question in a different specification. I also conducted sensitivity checks using the lenient grading scale of the pension knowledge questions. The decision to use two approaches to measure numeracy and knowledge of financial concepts on the one hand and pension knowledge on the other hand is based on the rationale that those concepts are already multi-dimensional by nature. The first two questions by Lusardi and Mitchell arguably test numeracy, the last two questions test general financial knowledge and pension knowledge is about knowing what someone is entitled to and which choices are available depending on life events. B_{ji} in equation (4.1) captures the behavioural constructs of interest: attitudes towards pension information (we aggregated the answers to the six questions on attitudes by computing the mean), general (aggregated four questions) and pension-related need for cognition (aggregated three questions) and future time perspective (aggregated three questions). At last, Z_i is a vector including the following control variables: gender, age, education level, household situation, children in the household (dummy).

For all constructs that involved more than one question, I computed the coefficient alpha— an indicator that has been widely used (and admittedly overused) in the psychology literature — to get an idea about the interim correlations between the items supposed to measure one concept. See Cronbach (1951) for more details on the coefficient alpha and Cortina (1993), Rodriguez and Maeda (2006) for a discussion of the coefficient and Raykov (2001), Schmitt (1996) and Sijtsma (2008) for a more critical discussion. Appendix D contains a short discussion of the literature surrounding the coefficient alpha and the computations for the financial literacy and behavioural constructs. I loosely based the decision how to implement the respective concepts into our empirical strategy on those results. For instance, regarding vocabulary, need for cognition (general and pension-related) and attitudes towards pension information, the alpha was 0.82, 0.68, 0.713 and 0.73 respectively. Following a rule of thumb that an alpha of 0.7 is an acceptable value, this is an indication that we could aggregate the questions without claiming uni-dimensionality. Note that for the numeracy, general financial knowledge and pension knowledge questions, the coefficient alpha was substantially lower and therefore encouraging the reporting of several specifications.

4.2 Financial literacy, behavioural factors and login behaviour

Next, we turn to the specification testing whether there are interactions between the financial literacy constituent variables and the behavioural concept. The estimation equation is given by (4.2) where again the linear probability model with clustered standard errors is used to obtain the estimates. The dependent variable and the set of covariates is unchanged with respect to equation (4.1). Fl_{ji} captures all financial literacy variables (still estimated separately) and B_{ji} refers to the behavioural variables which are now a set of the following dummy variables in order to facilitate the interpretation of the interactions: positive attitude towards pension information (equal to 1 if the aggregated attitudes are above the median), high need for cognition (all seven questions pooled and equal to 1 if the aggregated need for cognition is above the median) and high future time perspective implying that the individual is forward-looking (rather than being short-sighted).

$$\text{login}_i = \alpha_0 + \sum_{j=1}^4 \alpha_j Fl_{ji} + \sum_{j=1}^3 \theta_j B_{ji} + \sum_{j=1}^3 \mu_j Fl_{ji} * B_{ji} + \tau' Z_i + \epsilon_i \quad (4.2)$$

$Fl_{ji} * B_{ji}$ refers to the set of interaction terms where each financial literacy concept (aggregated to a score) is multiplied with each behavioural dummy. Consequently, μ_j is the difference in the probability to login between individuals with a positive attitude (high need for cognition, high future time perspective) relative to individuals with a negative attitude (low need for cognition, low future time perspective) for a given level of the financial literacy variables.

5 Empirical results

In this section, two sets of results are presented: firstly, I investigate the role of financial literacy in predicting participants' probability to log in (see equation 4.1) and secondly, I explore whether behavioural factors (attitudes, need for cognition and future time perspective) affect the relationship between financial literacy and the probability to log in (see equation 4.2). Additionally, I also present a set of sensitivity checks.

5.1 Financial literacy and login behaviour

Table 5 displays the estimation results when including the scores based on the number of correct answers respondents provided for each of the financial literacy concepts (and self-assessed financial literacy being a scale variable): the score on the numeracy and financial knowledge questions, the score in the Vocabulary test and the score on the Pension knowledge test. The

coefficients of the pension knowledge variables were estimated using strict grading— a question was either entirely correct or not at all.

Participants who scored one point higher on the pension knowledge test, have a predicted probability of 2.7 percentage points to log in to their DPE. Regarding the other financial literacy concepts, there were no differences in login behaviour for different scores on the vocabulary test, numeracy and financial knowledge questions or for differences in self-assessed financial literacy. All financial literacy constructs are jointly significant at the 1%-level. Regarding the behavioural factors, a more positive attitude towards pension information and higher pension-related need for cognition was associated with an estimated login probability of 4.7 percentage points and 2.3 percentage points respectively. Surprisingly, participants who are more forward-looking, were 3.3 percentage points less likely to log in. Re-estimating the model for different age groups might shed more light on the negative coefficient of future time perspective. Considering demographic factors, the estimated login probability differed only marginally for different age. Furthermore, participants with a low education level were less likely to log in (8.2 percentage points) than participants with a medium education level. I did not find any differences in login probabilities between participants with medium and high education levels. As the summary statistics in section 3 already have suggested, men were more likely to log in than women (6.2 percentage points). Additionally, there is evidence that younger participants were more likely to login than older participants⁶. The findings regarding the demographics are in line with Bauer et al. (2017).

Table 6 presents the estimated coefficients when including each numeracy, financial knowledge and pension knowledge question rather than counting the number of correct answers. Participants who answered the question on interest rates correctly (the first in the set of questions of Lusardi and Mitchell), were 9.7 percentage points more likely to log in than participants who did not know the answer or gave an incorrect answer. Furthermore, participants who answered the first and fourth pension knowledge question correctly (factors influencing the workplace pension scheme and why pension funds invest money in shares) were more likely to log in than participants who did not answer those questions correctly. The numeracy and financial knowledge questions, the pension knowledge questions and all variables measuring financial literacy are jointly significant (see F-tests at the bottom of table 6).

⁶ Note that the coefficient of the square is only statistically significant at the 10% level, suggesting that the probability of logging in is (linearly) decreasing in age. See figure A-5 in the Appendix for a density plot of the age distribution of participants by login behaviour.

The coefficients of the behavioural factors and demographic variables have a similar magnitude and standard errors as in table 3— coefficients are reported in Appendix B. So far, we have seen that from the financial literacy variables, pension knowledge and to a certain extent numeracy can be important determinants—next to behavioural characteristics like attitudes towards pension information— of characterising the individuals who are more likely to log in and to take a look at their pension information.

Table 5: Estimation results of login behaviour (total sample)

| | (1) Probability of logging in | (2) se |
|---|-------------------------------------|-----------|
| Self-assessed financial knowledge (1-7) | 0.001 | (0.010) |
| Score on Numeracy and financial knowledge questions (0-4) | 0.005 | (0.014) |
| Score Vocabulary test (0-9) | -0.004 | (0.003) |
| Score Pension knowledge, strict grading (0-4) | 0.027*** | (0.009) |
| Attitudes PIB - negative to positive | 0.047*** | (0.013) |
| NFC General- low to high | 0.014 | (0.011) |
| NFC Pension information - low to high | 0.023** | (0.010) |
| Future time perspective - low to high | -0.033** | (0.015) |
| Age (in years) | -0.011** | (0.005) |
| Age (squared) | 0.000* | (0.000) |
| Low education dummy | -0.082*** | (0.020) |
| High education dummy | -0.009 | (0.020) |
| Male (=1) | 0.062*** | (0.018) |
| Observations | 1,351 | |
| R-squared | 0.052 | |
| F-test FL variables (p-value) | 0.004 | |
| F-test NFC variables (p-value) | 0.033 | |
| F-test all beh. vars (p-value) | 0.001 | |
| F-test age variables (p-value) | 0.006 | |

Notes: *** p<0.01, ** p<0.05, * p<0.1. Those are the estimates for the total sample. Estimates for the employee and customers subsamples can be found in the Appendix. Clustered standard errors in parentheses (at the level of the employer of the participants). FL index is a simple measure of the number of the classic financial literacy questions answered correctly (0-4). Additional covariates are: attitudes towards pension information, need for cognition (NFC general and pension-related), and future time perspective (FTP). Furthermore, I controlled for: gender, age and its square, education level, household net income level, household type, whether there are children living at home and whether the respondent is part of the customer subsample. Medium education level and median income level (between 3,001 and 3,500 EUR) are the reference group. Note also that pooling NFC general and pension-related NFC does not change our estimates. Ho of the F-tests is respectively whether all coefficients of the mentioned group are equal to zero.

Table 6: Estimation results of login behaviour (total sample), numeracy and financial and pension knowledge questions included separately

| | (1) | (2) |
|--|-----|-----|
|--|-----|-----|

| | Probability of logging in | se |
|--|------------------------------|---------|
| Self-assessed financial knowlegde (1-7) | 0.002 | (0.010) |
| Interest question correct (=1) | 0.097*** | (0.029) |
| Inflation question correct (=1) | -0.018 | (0.040) |
| Risk div. question correct (=1) | 0.019 | (0.022) |
| Bond pricing question correct (=1) | -0.017 | (0.023) |
| PK Q1 correct (strict) | 0.032** | (0.015) |
| PK Q2 correct (strict) | 0.011 | (0.023) |
| PK Q3 correct (strict) | -0.038 | (0.033) |
| PK Q4 correct (strict) | 0.055*** | (0.020) |
| Score Vocabulary test (0-9) | -0.004* | (0.003) |
| Age (in years) | -0.010** | (0.005) |
| Age (squared) | 0.000* | (0.000) |
| Low education dummy | -0.081*** | (0.019) |
| High education dummy | -0.008 | (0.019) |
| Male (=1) | 0.062*** | (0.019) |
| Observations | 1,351 | |
| R-squared | 0.055 | |
| F-test Numeracy and fin. knowledge questions (p-value) | 0.000 | |
| F-test Pension knowledge questions (p-value) | 0.001 | |
| F-test FL variables (p-value) | 0.000 | |
| F-test NFC variables (p-value) | 0.004 | |
| F-test all beh. vars (p-value) | 0.000 | |
| F-test age variables (p-value) | 0.003 | |

Notes: *** p<0.01, ** p<0.05, * p<0.1. Those are the estimates for the total sample. Estimates for the employee and customers subsamples can be found in the Appendix. Clustered standard errors in parentheses (at the level of the employer of the participants). Interest, inflation, risk diversification and bond prices refer to the questions developed by Lusardi and Mitchell. The same covariates and reference categories are used as in previous analyses. Ho of the F-tests is respectively whether all coefficients of the mentioned group are equal to zero.

5.2 Interacting financial literacy with behavioural factors

In order to explore whether attitudes towards pension information, need for cognition and future time perspective have an impact on the relationship between financial literacy and login behaviour, equation (4.2) has been estimated. Table 7 presents the estimation results with the first three columns including interaction terms of each financial literacy concept with attitudes, need for cognition and future time perspective respectively. The last column contains a model including all three sets of interactions. As already noted in section 4, I multiplied the financial literacy variable with a binary behavioural variable in order to facilitate an easy to grasp interpretation. For the first three models, all interaction terms (with a single exception) are not statistically significant (neither marginally nor jointly), implying that there is no evidence that attitudes, need for cognition and future time perspective have an impact on the association between financial literacy and log in. The same holds for the specification with interactions with all three behavioural factors.

Table 7: Estimation results with interactions between financial literacy variables and behavioural factors

| | (1) Probability of logging in - attitudes IT | (2) Probability of logging in - NFC IT | (3) Probability of logging in - FTP IT | (4) Probability of logging in - All IT |
|-----------------------------------|---|---|---|---|
| SAFL*attitude | 0.003 (0.016) | | | -0.000 (0.019) |
| NumFin*attitude | 0.015 (0.024) | | | 0.016 (0.031) |
| Vocabulary*attitude | 0.004 (0.007) | | | -0.002 (0.007) |
| PK*attitude | -0.013 (0.016) | | | -0.012 (0.022) |
| SAFL*NFC | | 0.009 (0.013) | | 0.013 (0.014) |
| NumFin*NFC | | -0.004 (0.017) | | -0.012 (0.020) |
| Vocabulary*NFC | | 0.015** (0.007) | | 0.014* (0.008) |
| PK*NFC | | -0.012 (0.030) | | -0.017 (0.040) |
| SAFL*FTP | | | -0.011 (0.010) | -0.015 (0.010) |
| NumFin*FTP | | | 0.008 (0.019) | 0.009 (0.018) |
| Vocabulary*FTP | | | 0.006 (0.007) | 0.002 (0.008) |
| PK*FTP | | | 0.027 (0.028) | 0.032 (0.034) |
| Observations | 1,351 | 1,351 | 1,351 | 1,351 |
| R-squared | 0.049 | 0.051 | 0.050 | 0.052 |
| F-test all beh. vars (p-value) | 0.629 | 0.000 | 0.000 | 0.463 |
| F-test all attitudes IT (p-value) | 0.575 | | | 0.945 |
| F-test all FL (p-value) | 0.005 | 0.000 | 0.000 | 0.000 |
| F-test all NFC IT (p-value) | | 0.126 | | 0.218 |
| F-test all FTP IT (p-value) | | | 0.149 | 0.290 |

Notes: *** p<0.01, ** p<0.05, * p<0.1. SAFL, NFC, PK, FTP and IT refer to self-assessed financial knowledge, need for cognition, pension knowledge, future time perspective and interaction term respectively. Clustered standard errors in parentheses (at the employer level). The covariates are identical to previous analyses. See Appendix B for all estimated coefficients.

5.3 Sensitivity checks

Lenient scale pension knowledge

As a first sensitivity check of the estimation results, the results from section 5.1 were re-estimated using an alternative scale to measure pension knowledge. See table 8 for the estimation results. I broke down how many of the possible correct answers have been chosen: there were four questions testing pension knowledge with some questions having multiple correct answers resulting in a total

of seven possible correct answers. This resulted in a scale from 0-7. The coefficients of this specification are reported in column 1 of table 8.

Regarding the specification with dummies for each numeracy/financial knowledge and pension knowledge question (column 3 in table 8), a strong association can be found between knowing how interest compounding works and the probability to log in to the DPE. Regarding pension knowledge, participants who knew that the amount of years they have worked until retirement influence the workplace pension (Q1.2) and participants who knew that pension funds invest in shares in order to obtain a larger return in the long run (Q.4) were more likely to log in by 10.4 and 5.1 percentage points respectively. Additionally, participants who knew that if their partner stopped with working, their future pension could be affected, had a lower estimated probability (3.7 percentage points) to log in than participants who did not know this.

Differences in login behaviour by age categories

As people's preferences to the extent to which they wish to be informed about their pension and people's time preference can differ by age, estimating the probability to log in separately for different age groups can give more sensible results which also might explain the estimation results from the previous sub-sections. The estimation results are shown in table 9. The division of the age categories correspond with the age categories used in the field experiments that generated the data of this study (see Dinkova et al., 2018a, 2018b). The sample is divided in three age categories: young (18-34 years), middle (35-54 years) and senior (55-65 years).

For young participants, there were no differences in login behaviour due to differences in financial literacy levels. From the behavioural factors, only the coefficient of future time perspective is statistically significant. As in section 5.1, the association between the estimated probability to log in and future time perspective is negative, implying that young participants with stronger preferences for present benefits rather than future benefits logged in more often.

Zooming in on the middle-aged participants gives a different picture: Participants with higher self-assessed financial knowledge, higher pension knowledge and a lower vocabulary score (though the coefficient is close to zero) were more likely to log in. Regarding the behavioural factors, middle-aged participants who had a higher need to be informed about pensions (pension-related NFC) and who valued present benefits more than future benefits logged in more often.

Concerning the senior age group, participants with a higher self-assessed financial knowledge were less likely to log in. At the same time, senior participants with more positive attitudes towards pension information and who had a stated preference for future benefits rather than present benefits

were more likely to log in. Note that the standard errors of all coefficients for the model for the middle-aged group are smaller than the model for the young and senior group as 57% of the total sample belong to the middle-aged group. Summing up, we can observe that financial literacy appears to be more relevant for middle-aged and senior participants. Furthermore, future time perspective is relevant for all three age groups implying that young and middle-aged participants who log in are typically more impatient compared to young and middle-aged participants who did not log in; senior participants who logged in were, on average, more patient.

Table 8: Estimation results using lenient grading (pension knowledge)

| | (1) Probability of logging in | (2) se | (3) Probability of logging in | (4) se |
|--|--|-----------|--|-----------|
| Self-assessed financial knowledge (1-7) | 0.003 | (0.010) | 0.002 | (0.010) |
| Score on classic financial literacy questions (0-4) | 0.009 | (0.014) | | |
| Interest question correct (=1) | | | 0.094*** | (0.034) |
| Inflation question correct (=1) | | | -0.023 | (0.040) |
| Risk div. question correct (=1) | | | 0.027 | (0.022) |
| Bond pricing question correct (=1) | | | -0.018 | (0.024) |
| Score Pension knowledge, lenient grading (0-7) | 0.008 | (0.005) | | |
| PK Q1.1 correct (lenient) | | | -0.021 | (0.017) |
| PK Q1.2 correct (lenient) | | | 0.104*** | (0.025) |
| PK Q2 correct (lenient) | | | 0.009 | (0.021) |
| PK Q3.1 correct (lenient) | | | -0.037*** | (0.013) |
| PK Q3.2 correct (lenient) | | | -0.000 | (0.015) |
| PK Q3.3 correct (lenient) | | | 0.028 | (0.036) |
| PK Q4 correct (lenient) | | | 0.051** | (0.022) |
| Score Vocabulary test (0-9) | -0.004 | (0.003) | -0.006** | (0.003) |
| Attitudes PIB - negative to positive | 0.048*** | (0.013) | 0.047*** | (0.013) |
| NFC General | 0.014 | (0.011) | 0.012 | (0.013) |
| NFC Pension information | 0.024** | (0.010) | 0.026*** | (0.008) |
| Future time perspective | -0.032** | (0.015) | -0.032** | (0.015) |
| Age (in years) | -0.010* | (0.005) | -0.008* | (0.005) |
| Age (squared) | 0.000 | (0.000) | 0.000 | (0.000) |
| Low education dummy | -0.081*** | (0.020) | -0.086*** | (0.019) |
| High education dummy | -0.010 | (0.020) | -0.001 | (0.018) |
| Male (=1) | 0.062*** | (0.018) | 0.062*** | (0.019) |
| Observations | 1,351 | | 1,351 | |
| R-squared | 0.050 | | 0.059 | |
| F-test FL variables (p-value) | 0.121 | | 0.000 | |
| F-test NFC variables (p-value) | 0.023 | | 0.004 | |
| F-test all beh. vars (p-value) | 0.002 | | 0.000 | |
| F-test age variables (p-value) | 0.016 | | 0.001 | |
| F-test Numeracy and fin. knowledge questions (p-value) | | | 0.000 | |
| F-test Pension knowledge questions (p-value) | | | 0.000 | |

Notes: *** p<0.01, ** p<0.05, * p<0.1. Estimates are for the total sample. Clustered standard errors in parentheses (at the level of the employer of the participants). The first two columns are the estimation results for the specification including the scores of the financial literacy constructs and the corresponding standard errors respectively. The last two columns are the estimation results for the specification including dummies per numeracy/financial knowledge and pension knowledge question. The same set of covariates has been included as in previous analyses (with the same reference categories). Estimation results per sub-sample and including all covariates are in the Appendix.

Table 9: Estimation results by age category

| | Age ∈ [18, 34] | | Age ∈ [35, 54] | | Age ∈ [55, 65] | |
|---|---------------------------------|---------|---------------------------------|---------|---------------------------------|---------|
| | (1) | (2) | (3) | (4) | (5) | (6) |
| | Probability of logging in | se | Probability of logging in | se | Probability of logging in | se |
| Self-assessed financial knowledge (1-7) | 0.001 | (0.028) | 0.021*** | (0.007) | -0.048*** | (0.012) |
| Score on classic financial literacy questions (0-4) | -0.012 | (0.017) | 0.013 | (0.018) | -0.006 | (0.015) |
| Score Pension knowledge, strict grading (0-4) | 0.039* | (0.020) | 0.023** | (0.011) | 0.006 | (0.015) |
| Score Vocabulary test (0-9) | 0.009 | (0.009) | -0.007** | (0.003) | -0.001 | (0.006) |
| Attitudes PIB - negative to positive | 0.106* | (0.059) | 0.017 | (0.012) | 0.080*** | (0.017) |
| NFC General | 0.013 | (0.054) | 0.002 | (0.011) | 0.054* | (0.028) |
| NFC Pension information | 0.048 | (0.032) | 0.026** | (0.011) | -0.012 | (0.023) |
| Future time perspective | -0.113*** | (0.041) | -0.051** | (0.021) | 0.091*** | (0.025) |
| Age (in years) | 0.134 | (0.101) | -0.035 | (0.023) | 0.161 | (0.147) |
| Age (squared) | -0.002 | (0.002) | 0.000 | (0.000) | -0.001 | (0.001) |
| Low education dummy | -0.087 | (0.097) | -0.111*** | (0.032) | -0.042* | (0.023) |
| High education dummy | 0.043 | (0.044) | -0.033 | (0.022) | -0.029 | (0.031) |
| Male (=1) | 0.024 | (0.043) | 0.076*** | (0.015) | 0.036 | (0.028) |
| Observations | 239 | | 779 | | 333 | |
| R-squared | 0.105 | | 0.068 | | 0.115 | |
| F-test FL variables (p-value) | 0.335 | | 0.000 | | 0.004 | |
| F-test NFC variables (p-value) | 0.293 | | 0.007 | | 0.164 | |
| F-test all beh. vars (p-value) | 0.017 | | 0.003 | | 0.000 | |
| F-test age variables (p-value) | 0.417 | | 0.215 | | 0.544 | |

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors in parentheses (at the level of the employer of the participants). The same set of covariates has been included as in previous analyses (with the same reference categories). Estimation results per sub-sample and including all covariates are in the Appendix.

6 Discussion and conclusion

With this study I sought to investigate whether multi-dimensional financial literacy (extended by a pension knowledge and vocabulary test) can explain the login behaviour of people to their digital pension environment, next to behavioural factors like attitudes towards pension information, need for cognition and future time perspective. I combined data on login behaviour of participants into a digital environment with survey data measuring financial literacy constructs, behavioural constructs and demographics. A financial literacy construct has been proposed consisting of numeracy and financial knowledge, pension knowledge, literacy in its original sense and perceived financial knowledge. People with higher pension knowledge and knowledge about the concept of interest compounding were more likely to log in to the DPE. Attitudes, need for cognition and future time perspective are directly related with login behaviour. The relationship between financial literacy and login behaviour is not affected by behavioural factors.

There are several limitations that should be considered: Firstly, as only the behaviour of participants who completed the survey could be analysed, the sample is not representative (not even for the population of pension plan participants). Hence, the estimated results are associations. Secondly, the employee sub-sample, which is larger than the customers sub-sample, is a selection of people who already have a higher affinity with the financial sector than the average Dutch individual. This implies that the variation of the individual characteristics within the sample might not be large enough in order to explain differences in login behaviour. The customer sub-sample, although being more representative as those participants worked for many different companies, is considerably smaller than the employee sample. By pooling the employee and customer subsample, the mass and variation has been increased.

Nonetheless, there are two main contributions that crystallise: Firstly, this study linked real behaviour (login behaviour) with financial literacy and other behavioural characteristics and secondly, a concept of financial literacy has been proposed using insights from other disciplines. The value added of including psychological factors when explaining economic decision making has been demonstrated in this study: attitudes towards pension information and need for cognition are related to login behaviour. Taking the aforementioned psychological factors into account when analysing pension information behaviour can (at least partially) capture unobserved heterogeneity due to the (lack of) motivation of people to delve into their pension information. More empirical work with larger (representative) samples linking real behaviour and eliciting knowledge, attitudes and preferences towards pensions and pension information is needed to understand what pushes

and pulls people to delve into their pension situation. Lab experiments can also be very useful in this area, as then researchers could get more insights into what goes through the participants' head when they are confronted with a set of questions or a digital portal they are asked to enter. This would be particularly useful when understanding the rationale of participants regarding time preferences, attitudes or need for cognition.

Going one step further, one could argue that providing only financial education in the classical sense is not enough, but it should be designed to create an affinity with the topic. Although not exactly in the pension context, an example of how one can increase people's knowledge about a topic on the one hand and motivation to deal with it at the other is the Money Week organised by the Money Wise Platform in the Netherlands. During this week, many financial institutions are involved in for instance visiting schools and teaching children in game-like situations how to deal with money. A game developed especially for the Money Week, the Cash quiz, is a good example of a tool that conveys knowledge and at the same time— as it is a game— tickles the competitive nature of (very young) individuals to increase their motivation to deal with money. Developing a pension game is probably not an easy task, but a first step could be for pension plan providers to offer a short quiz about testing one's pension knowledge before one logs in to the digital pension environment. Alternatively, employers could take the responsibility and offer once in a while a question on pensions before people log in to their workplace and subsequently provide the correct answer.

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8 Appendices

A. A schematic overview of the tested hypotheses and Additional descriptive statistics

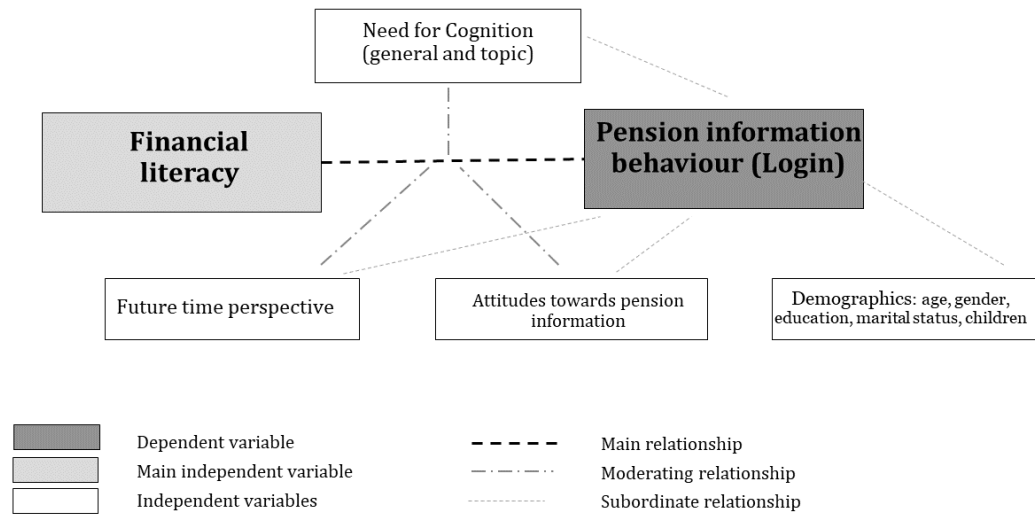


Figure A- 1: Schematic visualisation of the relation between constructs

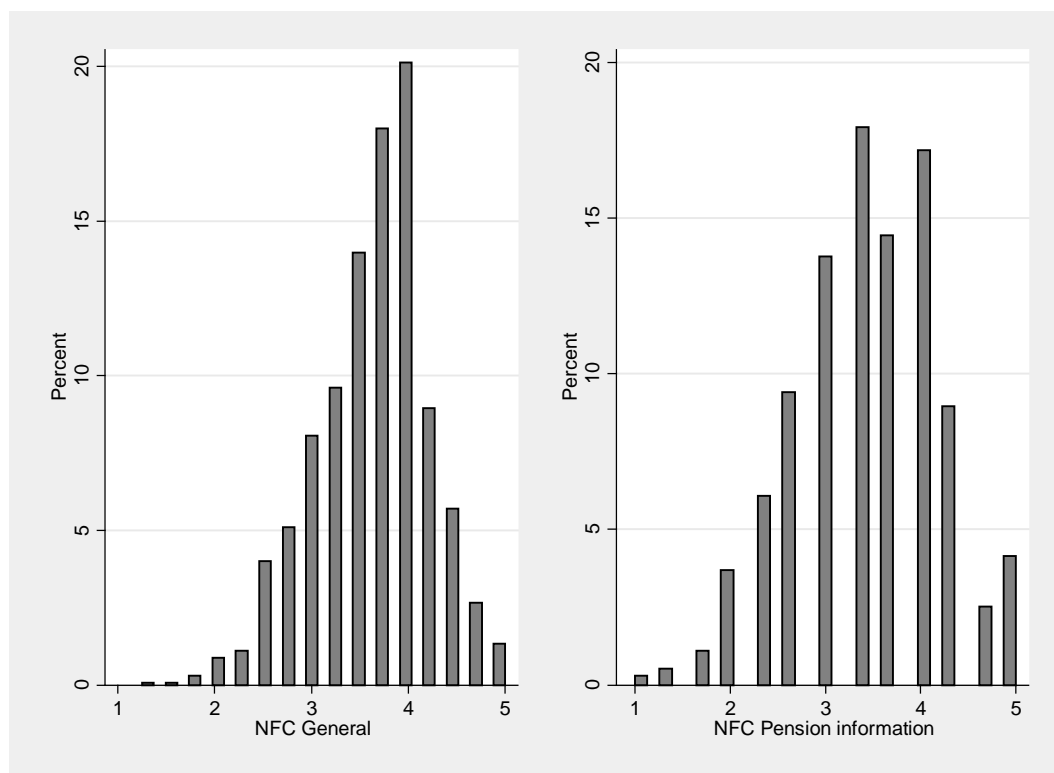


Figure A- 2: Histogram for general and pension-related need for cognition

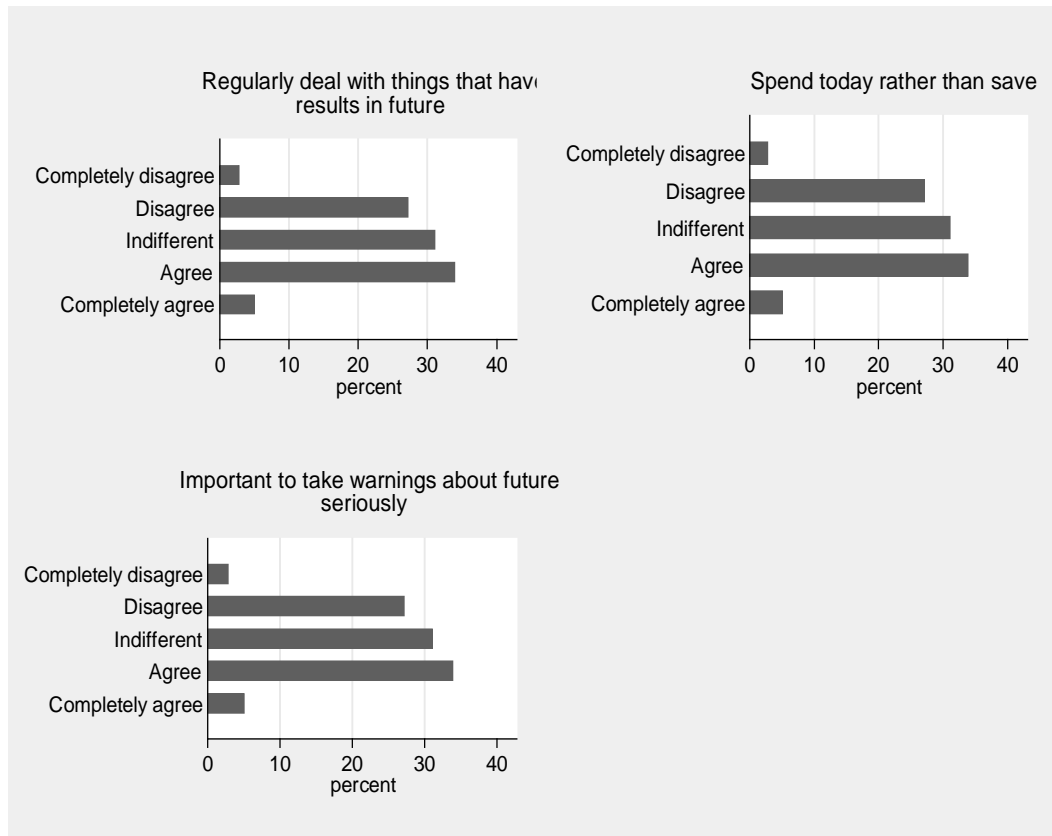


Figure A- 3: Distribution of answers to questions on future time perspective (in percentages)

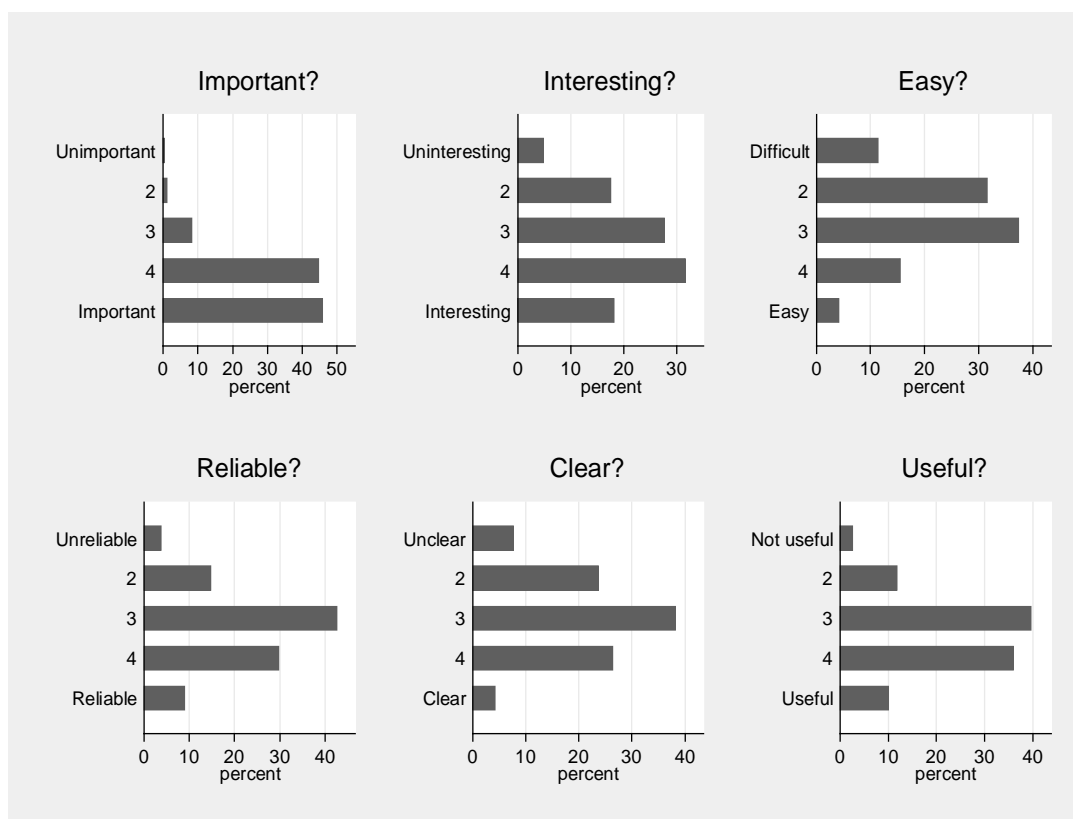


Figure A- 4: Distribution of answers to questions about attitudes towards pension information (in percentages)

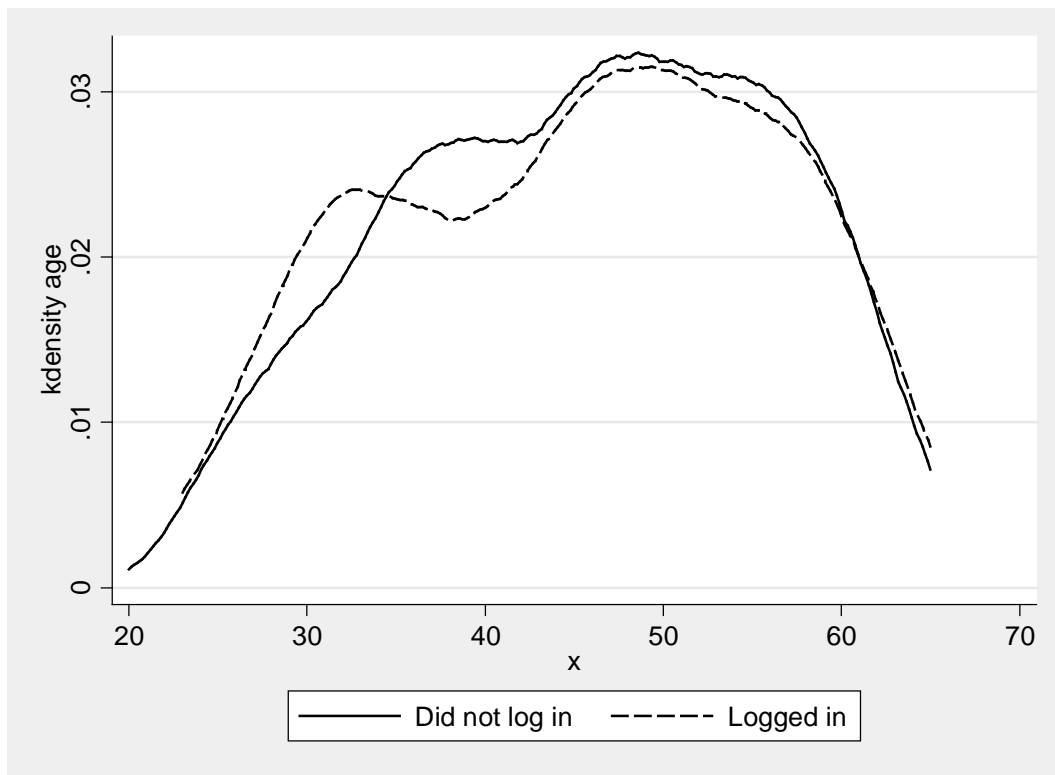


Figure A- 5: Density plot of age (in years) by login behaviour

Table A 1: Summary statistics of all covariates (dummies per Numeracy and Financial knowledge questions and Pension knowledge)

| Variable | Observations | Mean | Sd | Min | Max |
|---|--------------|-------|-------|------|-----|
| Logged in (dummy) | 1,351 | 0.19 | 0.39 | 0 | 1 |
| Self-assessed financial knowledge (1-7) | 1,351 | 5.09 | 1.18 | 1 | 7 |
| Score on classic financial literacy questions (0-4) | 1,351 | 3.17 | 0.80 | 0 | 4 |
| Score Vocabulary test (0-9) | 1,351 | 6.60 | 2.39 | 0 | 9 |
| Score Pension knowledge, strict grading (0-4) | 1,351 | 2.43 | 0.81 | 0 | 4 |
| Score Pension knowledge, lenient grading (0-7) | 1,351 | 5.50 | 1.24 | 0 | 7 |
| Attitudes PIB - negative to positive | 1,351 | 3.34 | 0.62 | 1.33 | 5 |
| NFC General | 1,351 | 3.64 | 0.61 | 1.25 | 5 |
| NFC Pension information | 1,351 | 3.43 | 0.76 | 1 | 5 |
| Future time perspective | 1,351 | 3.43 | 0.58 | 1.33 | 5 |
| Age (in years) | 1,351 | 45.58 | 10.48 | 20 | 65 |
| Low education dummy (=1) | 1,351 | 0.10 | 0.30 | 0 | 1 |
| High education dummy (=1) | 1,351 | 0.57 | 0.49 | 0 | 1 |
| Male (=1) | 1,351 | 0.68 | 0.47 | 0 | 1 |
| Income category: <2,000 | 1,351 | 0.13 | 0.33 | 0 | 1 |
| Income category: EUR 2,001 - EUR 2,500 | 1,351 | 0.11 | 0.32 | 0 | 1 |
| Income category: EUR 2,501 - EUR 3,000 | 1,351 | 0.12 | 0.33 | 0 | 1 |
| Income category: EUR 3,501 - EUR 4,000 | 1,351 | 0.12 | 0.33 | 0 | 1 |
| Income category: EUR 4,001 - EUR 4,500 | 1,351 | 0.12 | 0.32 | 0 | 1 |
| Income category: EUR 4,501 - EUR 5,000 | 1,351 | 0.12 | 0.32 | 0 | 1 |
| Income category: > EUR 7,500 | 1,351 | 0.02 | 0.14 | 0 | 1 |
| Single household (=1) | 1,351 | 0.20 | 0.40 | 0 | 1 |
| Other household (=1) | 1,351 | 0.00 | 0.05 | 0 | 1 |
| Children living at home (=1) | 1,351 | 0.55 | 0.50 | 0 | 1 |
| Part of customer subsample (=1) | 1,351 | 0.38 | 0.49 | 0 | 1 |

Table A 2: Percentage share per type of answer for the pension knowledge questions (lenient grading scheme)

| | Q1: Workplace pension | | Q2: State pension | Q3: Life changes and pension | | | Q4: Pension funds |
|------------------------------------|-----------------------|-------|-------------------|------------------------------|-------|-------|-------------------|
| <i>Pension knowledge (lenient)</i> | Q1.1 | Q1.2 | Q2 | Q3.1 | Q3.2 | Q3.3 | Q4 |
| Correct | 81.87 | 94.23 | 77.65 | 33.60 | 75.50 | 95.34 | 91.86 |
| Incorrect | 18.13 | 5.77 | 8.22 | 66.40 | 24.50 | 4.66 | 1.78 |
| DK | N/A | N/A | 14.14 | N/A | N/A | N/A | 6.37 |

Notes: There were seven possible correct answers in four questions. The means are computed whether the respective answer has been given (=correct) or not given (=incorrect) or, for questions 2 and 4, the don't know option has been chosen.

B. Empirical results

Table B 1: Complete estimation results (total sample, scores of FL variables)

| | (1) Total | (2) se | (3) Total | (4) se |
|---|--------------|-----------|--------------|-----------|
| SAFL (1-7) | 0.001 | (0.010) | 0.003 | (0.010) |
| Score on classic financial literacy questions (0-4) | 0.005 | (0.014) | 0.009 | (0.014) |
| Score Vocabulary test (0-9) | -0.004 | (0.003) | -0.004 | (0.003) |
| Score Pension knowledge, strict grading (0-4) | 0.027*** | (0.009) | | |
| Score Pension knowledge, lenient grading (0-7) | | | 0.008 | (0.005) |
| Attitudes PIB - negative to positive | 0.047*** | (0.013) | 0.048*** | (0.013) |
| NFC General | 0.014 | (0.011) | 0.014 | (0.011) |
| NFC Pension information | 0.023** | (0.010) | 0.024** | (0.010) |
| Future time perspective | -0.033** | (0.015) | -0.032** | (0.015) |
| Age (in years) | -0.011** | (0.005) | -0.010* | (0.005) |
| Age (squared) | 0.000* | (0.000) | 0.000 | (0.000) |
| Low education dummy | -0.082*** | (0.020) | -0.081*** | (0.020) |
| High education dummy | -0.009 | (0.020) | -0.010 | (0.020) |
| Male (=1) | 0.062*** | (0.018) | 0.062*** | (0.018) |
| Income category: <2,000 | 0.053* | (0.031) | 0.049 | (0.031) |
| Income category: EUR 2,001 - EUR 2,500 | 0.086*** | (0.027) | 0.084*** | (0.027) |
| Income category: EUR 2,501 - EUR 3,000 | 0.009 | (0.018) | 0.007 | (0.018) |
| Income category: EUR 3,501 - EUR 4,000 | 0.031* | (0.017) | 0.031* | (0.017) |
| Income category: EUR 4,001 - EUR 4,500 | 0.059** | (0.022) | 0.058** | (0.022) |
| Income category: EUR 4,501 - EUR 5,000 | 0.057*** | (0.018) | 0.055*** | (0.018) |
| Income category: > EUR 7,500 | -0.031*** | (0.008) | -0.034*** | (0.008) |
| Single household (=1) | -0.046** | (0.020) | -0.045** | (0.020) |
| Other household (=1) | -0.021 | (0.156) | -0.022 | (0.144) |
| Children living at home (=1) | -0.007 | (0.013) | -0.006 | (0.014) |
| Participated in experiment 2(=1) | -0.107*** | (0.021) | -0.107*** | (0.021) |
| Observations | 1,351 | | 1,351 | |
| R-squared | 0.052 | | 0.050 | |
| F-test FL variables (p-value) | 0.004 | | 0.121 | |
| F-test NFC variables (p-value) | 0.033 | | 0.023 | |
| F-test all beh. vars (p-value) | 0.001 | | 0.002 | |
| F-test age variables (p-value) | 0.006 | | 0.016 | |

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors in parentheses (at the level of the employer of the participants). Medium education level and median income level (between 3,001 and 3,500 EUR) are the reference group. Note also that pooling NFC general and pension-related NFC does not change our estimates.

Table B 2: Estimation results by subsample

| | (1) Employee subsample | (2) se | (3) Customer subsample | (4) se | (5) Employee subsample | (6) se | (7) Customer subsample | (8) se |
|---|------------------------------|-----------|------------------------------|-----------|------------------------------|-----------|------------------------------|-----------|
| SAFL (1-7) | -0.012 | (0.016) | 0.019 | (0.014) | -0.011 | (0.016) | 0.021 | (0.013) |
| Score on classic financial literacy questions (0-4) | 0.022 | (0.021) | -0.019 | (0.020) | 0.026 | (0.021) | -0.016 | (0.019) |
| Score Vocabulary test (0-9) | -0.004 | (0.008) | -0.005 | (0.006) | -0.004 | (0.008) | -0.005 | (0.006) |
| Score Pension knowledge, strict grading (0-4) | 0.031 | (0.019) | 0.023 | (0.019) | | | | |
| Score Pension knowledge, lenient grading (0-7) | | | | | 0.006 | (0.013) | 0.009 | (0.010) |
| Attitudes PIB - negative to positive | 0.057* | (0.030) | 0.025 | (0.032) | 0.059** | (0.030) | 0.024 | (0.032) |
| NFC General | 0.023 | (0.028) | -0.003 | (0.023) | 0.022 | (0.028) | -0.001 | (0.023) |
| NFC Pension information | 0.030 | (0.025) | 0.012 | (0.025) | 0.030 | (0.025) | 0.013 | (0.025) |
| Future time perspective | -0.048* | (0.028) | 0.001 | (0.026) | -0.047* | (0.028) | 0.003 | (0.026) |
| Age (in years) | -0.009 | (0.014) | -0.012 | (0.012) | -0.008 | (0.014) | -0.012 | (0.012) |
| Age (squared) | 0.000 | (0.000) | 0.000 | (0.000) | 0.000 | (0.000) | 0.000 | (0.000) |
| Low education dummy | -0.075 | (0.051) | -0.080* | (0.045) | -0.077 | (0.051) | -0.076* | (0.046) |
| High education dummy | 0.017 | (0.035) | -0.039 | (0.036) | 0.017 | (0.035) | -0.041 | (0.036) |
| Male (=1) | 0.082** | (0.034) | 0.023 | (0.028) | 0.083** | (0.034) | 0.022 | (0.028) |
| Income category: <2,000 | 0.045 | (0.078) | 0.055 | (0.059) | 0.042 | (0.078) | 0.052 | (0.058) |
| Income category: EUR 2,001 - EUR 2,500 | 0.069 | (0.059) | 0.108* | (0.056) | 0.066 | (0.059) | 0.106* | (0.057) |
| Income category: EUR 2,501 - EUR 3,000 | -0.000 | (0.050) | 0.015 | (0.051) | -0.004 | (0.050) | 0.014 | (0.050) |
| Income category: EUR 3,501 - EUR 4,000 | 0.040 | (0.047) | 0.036 | (0.055) | 0.041 | (0.048) | 0.034 | (0.056) |
| Income category: EUR 4,001 - EUR 4,500 | 0.078 | (0.050) | 0.040 | (0.066) | 0.076 | (0.050) | 0.042 | (0.067) |
| Income category: EUR 4,501 - EUR 5,000 | 0.071 | (0.051) | 0.049 | (0.054) | 0.069 | (0.051) | 0.047 | (0.054) |
| Income category: > EUR 7,500 | -0.033 | (0.077) | | | -0.036 | (0.077) | | |
| Single household (=1) | -0.026 | (0.045) | -0.058 | (0.045) | -0.025 | (0.045) | -0.057 | (0.045) |
| Other household (=1) | 0.202 | (0.365) | -0.287*** | (0.062) | 0.175 | (0.358) | -0.276*** | (0.060) |
| Children living at home (=1) | -0.009 | (0.034) | 0.003 | (0.038) | -0.009 | (0.034) | 0.005 | (0.038) |
| Observations | 840 | | 511 | | 840 | | 511 | |
| R-squared | 0.044 | | 0.044 | | 0.042 | | 0.042 | |
| F-test FL variables (p-value) | 0.245 | | 0.252 | | 0.635 | | 0.304 | |
| F-test NFC variables (p-value) | 0.306 | | 0.892 | | 0.315 | | 0.871 | |
| F-test all beh. vars (p-value) | 0.022 | | 0.808 | | 0.019 | | 0.793 | |
| F-test age variables (p-value) | 0.527 | | 0.112 | | 0.656 | | 0.136 | |

Notes: *** p<0.01, ** p<0.05, * p<0.1. For the specification for the employee subsample, we computed heteroskedasticity-robust standard errors and for the specification for the customer subsample, we clustered the standard errors at the employer level. Medium education level and median income level (between 3,001 and 3,500 EUR) are the reference group. Note also that pooling NFC general and pension-related NFC does not change our estimates.

Table B 3: Estimation results (all covariates) when including dummy per numeracy, financial and pension knowledge questions – total sample

| | (1) Probability of logging in | (2) se | (3) Probability of logging in | (4) se |
|--|-------------------------------------|-----------|-------------------------------------|-----------|
| SAFL (1-7) | 0.002 | (0.010) | 0.002 | (0.010) |
| Interest question correct (=1) | 0.097*** | (0.029) | 0.094*** | (0.034) |
| Inflation question correct (=1) | -0.018 | (0.040) | -0.023 | (0.040) |
| Risk div. question correct (=1) | 0.019 | (0.022) | 0.027 | (0.022) |
| Bond pricing question correct (=1) | -0.017 | (0.023) | -0.018 | (0.024) |
| PK Q1 correct (strict) | 0.032** | (0.015) | | |
| PK Q2 correct (strict) | 0.011 | (0.023) | | |
| PK Q3 correct (strict) | -0.038 | (0.033) | | |
| PK Q4 correct (strict) | 0.055*** | (0.020) | | |
| PK Q1.1 correct (lenient) | | | -0.021 | (0.017) |
| PK Q1.2 correct (lenient) | | | 0.104*** | (0.025) |
| PK Q2 correct (lenient) | | | 0.009 | (0.021) |
| PK Q3.1 correct (lenient) | | | -0.037*** | (0.013) |
| PK Q3.2 correct (lenient) | | | -0.000 | (0.015) |
| PK Q3.3 correct (lenient) | | | 0.028 | (0.036) |
| PK Q4 correct (lenient) | | | 0.051** | (0.022) |
| Score Vocabulary test (0-9) | -0.004* | (0.003) | -0.006** | (0.003) |
| Attitudes PIB - negative to positive | 0.047*** | (0.014) | 0.047*** | (0.013) |
| NFC General | 0.010 | (0.012) | 0.012 | (0.013) |
| NFC Pension information | 0.026*** | (0.008) | 0.026*** | (0.008) |
| Future time perspective | -0.033** | (0.015) | -0.032** | (0.015) |
| Age (in years) | -0.010** | (0.005) | -0.008* | (0.005) |
| Age (squared) | 0.000* | (0.000) | 0.000 | (0.000) |
| Low education dummy | -0.081*** | (0.019) | -0.086*** | (0.019) |
| High education dummy | -0.008 | (0.019) | -0.001 | (0.018) |
| Male (=1) | 0.062*** | (0.019) | 0.062*** | (0.019) |
| Income category: <2,000 | 0.063* | (0.032) | 0.066** | (0.032) |
| Income category: EUR 2,001 - EUR 2,500 | 0.085*** | (0.026) | 0.084*** | (0.026) |
| Income category: EUR 2,501 - EUR 3,000 | 0.008 | (0.018) | 0.008 | (0.018) |
| Income category: EUR 3,501 - EUR 4,000 | 0.030 | (0.018) | 0.035** | (0.017) |
| Income category: EUR 4,001 - EUR 4,500 | 0.062*** | (0.022) | 0.066*** | (0.020) |
| Income category: EUR 4,501 - EUR 5,000 | 0.057*** | (0.017) | 0.057*** | (0.017) |
| Income category: > EUR 7,500 | -0.026*** | (0.009) | -0.028*** | (0.009) |
| Single household (=1) | -0.044** | (0.020) | -0.045** | (0.019) |
| Other household (=1) | -0.006 | (0.146) | 0.005 | (0.131) |
| Children living at home (=1) | -0.011 | (0.014) | -0.013 | (0.014) |
| Participated in experiment 2(=1) | -0.110*** | (0.021) | -0.108*** | (0.022) |
| Observations | 1,351 | | 1,351 | |
| R-squared | 0.055 | | 0.059 | |
| F-test Numeracy and fin. knowledge questions (p-value) | 0.000 | | 0.000 | |
| F-test Pension knowledge questions (p-value) | 0.001 | | 0.000 | |
| F-test FL variables (p-value) | 0.000 | | 0.000 | |
| F-test NFC variables (p-value) | 0.004 | | 0.004 | |
| F-test all beh. vars (p-value) | 0.000 | | 0.000 | |
| F-test age variables (p-value) | 0.003 | | 0.001 | |

Notes: *** p<0.01, ** p<0.05, * p<0.1. Those are the estimates for the total sample. Clustered standard errors in parentheses (at the level of the employer of the participants). Interest, inflation, risk diversification and bond prices refer to the questions developed by Lusardi and Mitchell. SAFL refers to self-assessed financial literacy (on a 7-point Likert scale). PK refer to the pension knowledge questions. I controlled for attitudes towards pension information, need for cognition (NFC general and pension-related), and future time perspective (FTP). Note also that pooling NFC general and pension-related NFC does not change the estimates.

Table B 4: Estimation results (all covariates) when including dummy per numeracy, financial and pension knowledge questions – per subsample

| | (1) Employee subsample | (2) se | (3) Customer subsample | (4) se | (5) Employee subsample | (6) se | (7) Customer subsample | (8) se |
|--|------------------------------|-----------|------------------------------|-----------|------------------------------|-----------|------------------------------|-----------|
| SAFL (1-7) | -0.012 | (0.016) | 0.020 | (0.013) | -0.012 | (0.016) | 0.021 | (0.014) |
| Interest question correct (=1) | 0.035 | (0.078) | 0.128*** | (0.032) | 0.014 | (0.080) | 0.134*** | (0.032) |
| Inflation question correct (=1) | 0.051 | (0.050) | -0.067 | (0.052) | 0.049 | (0.050) | -0.070 | (0.051) |
| Risk div. question correct (=1) | 0.006 | (0.049) | 0.027 | (0.045) | 0.017 | (0.050) | 0.037 | (0.045) |
| Bond pricing question correct (=1) | 0.011 | (0.030) | -0.082** | (0.032) | 0.013 | (0.030) | -0.085*** | (0.031) |
| Score Vocabulary test (0-9) | -0.004 | (0.008) | -0.005 | (0.006) | -0.006 | (0.008) | -0.006 | (0.006) |
| PK Q1 correct (strict) | 0.020 | (0.035) | 0.038 | (0.033) | | | | |
| PK Q2 correct (strict) | 0.048 | (0.040) | -0.019 | (0.037) | | | | |
| PK Q3 correct (strict) | -0.047 | (0.093) | -0.045 | (0.061) | | | | |
| PK Q4 correct (strict) | 0.045 | (0.058) | 0.070* | (0.037) | | | | |
| PK Q1.1 correct (lenient) | | | | | -0.035 | (0.045) | -0.025 | (0.040) |
| PK Q1.2 correct (lenient) | | | | | 0.115 | (0.074) | 0.094** | (0.038) |
| PK Q2 correct (lenient) | | | | | 0.040 | (0.039) | -0.015 | (0.037) |
| PK Q3.1 correct (lenient) | | | | | -0.040 | (0.032) | -0.019 | (0.028) |
| PK Q3.2 correct (lenient) | | | | | -0.009 | (0.042) | -0.002 | (0.032) |
| PK Q3.3 correct (lenient) | | | | | 0.073 | (0.063) | 0.003 | (0.051) |
| PK Q4 correct (lenient) | | | | | 0.034 | (0.060) | 0.073* | (0.040) |
| Attitudes PIB - negative to positive | 0.058* | (0.030) | 0.017 | (0.032) | 0.057* | (0.030) | 0.019 | (0.030) |
| NFC General | 0.022 | (0.029) | -0.008 | (0.024) | 0.026 | (0.029) | -0.009 | (0.026) |
| NFC Pension information | 0.030 | (0.025) | 0.026 | (0.021) | 0.028 | (0.025) | 0.027 | (0.022) |
| Future time perspective | -0.047* | (0.028) | 0.006 | (0.026) | -0.045* | (0.027) | 0.005 | (0.027) |
| Age (in years) | -0.008 | (0.014) | -0.011 | (0.012) | -0.007 | (0.014) | -0.009 | (0.012) |
| Age (squared) | 0.000 | (0.000) | 0.000 | (0.000) | 0.000 | (0.000) | 0.000 | (0.000) |
| Low education dummy | -0.072 | (0.051) | -0.074* | (0.042) | -0.082 | (0.052) | -0.080* | (0.043) |
| High education dummy | 0.016 | (0.036) | -0.038 | (0.036) | 0.021 | (0.036) | -0.028 | (0.036) |
| Male (=1) | 0.083** | (0.034) | 0.021 | (0.028) | 0.084** | (0.034) | 0.020 | (0.028) |
| Income category: <2,000 | 0.048 | (0.082) | 0.073 | (0.058) | 0.041 | (0.082) | 0.083 | (0.056) |
| Income category: EUR 2,001 - EUR 2,500 | 0.068 | (0.059) | 0.107** | (0.053) | 0.067 | (0.059) | 0.117** | (0.053) |
| Income category: EUR 2,501 - EUR 3,000 | 0.043 | (0.048) | 0.024 | (0.057) | 0.046 | (0.048) | 0.035 | (0.054) |
| Income category: EUR 3,501 - EUR 4,000 | 0.082 | (0.050) | 0.054 | (0.066) | 0.081 | (0.050) | 0.067 | (0.066) |
| Income category: EUR 4,001 - EUR 4,500 | 0.069 | (0.051) | 0.058 | (0.053) | 0.070 | (0.051) | 0.061 | (0.051) |
| Income category: EUR 4,501 - EUR 5,000 | -0.032 | (0.077) | | | -0.038 | (0.078) | | |
| Single household (=1) | -0.023 | (0.045) | -0.057 | (0.045) | -0.026 | (0.045) | -0.056 | (0.045) |
| Other household (=1) | 0.225 | (0.368) | -0.228*** | (0.056) | 0.211 | (0.370) | -0.186*** | (0.058) |
| Children living at home (=1) | -0.013 | (0.035) | -0.007 | (0.039) | -0.015 | (0.035) | -0.007 | (0.040) |

Table B4 (continued)

| | | | | |
|--|-------|-------|-------|-------|
| Observations | 840 | 511 | 840 | 511 |
| R-squared | 0.046 | 0.067 | 0.050 | 0.072 |
| F-test Numeracy and fin. knowledge questions (p-value) | 0.827 | 0.002 | 0.857 | 0.001 |
| F-test Pension knowledge questions (p-value) | 0.518 | 0.160 | 0.364 | 0.065 |
| F-test FL variables (p-value) | 0.561 | 0.001 | 0.316 | 0.000 |
| F-test NFC variables (p-value) | 0.331 | 0.476 | 0.303 | 0.461 |
| F-test all beh. vars (p-value) | 0.023 | 0.535 | 0.024 | 0.513 |
| F-test age variables (p-value) | 0.488 | 0.120 | 0.400 | 0.093 |

Notes: *** p<0.01, ** p<0.05, * p<0.1. For the specification for the employee subsample, I computed heteroskedasticity-robust standard errors and for the specification for the customer subsample, I clustered the standard errors at the employer level. Medium education level and median income level (between 3,001 and 3,500 EUR) are the reference group. Note also that pooling NFC general and pension-related NFC does not change our estimates.

Table B 5: Estimation results (all covariates)- interaction terms, total sample

| | (1) Probability of logging in - attitudes IT | (2) Probability of logging in - NFC IT | (3) Probability of logging in - FTP IT | (4) Probability of logging in - All IT |
|---|---|---|---|---|
| SAFL (1-7) | 0.003 (0.013) | -0.000 (0.009) | 0.008 (0.008) | 0.005 (0.010) |
| Score on classic financial literacy questions (0-4) | -0.002 (0.020) | 0.006 (0.013) | 0.001 (0.013) | -0.001 (0.017) |
| Score Vocabulary test (0-9) | -0.006* (0.003) | -0.010*** (0.004) | -0.006 (0.004) | -0.010** (0.004) |
| Score Pension knowledge, strict grading (0-4) | 0.032*** (0.010) | 0.033** (0.015) | 0.018 (0.014) | 0.027** (0.013) |
| Positive attitude (=1) | 0.008 (0.088) | 0.062*** (0.013) | 0.062*** (0.013) | 0.051 (0.083) |
| High NFC (=1) | 0.009 (0.011) | -0.095 (0.062) | 0.008 (0.011) | -0.076 (0.060) |
| High FTP (=1) | -0.012 (0.010) | -0.013 (0.010) | -0.088 (0.074) | -0.055 (0.071) |
| SAFL*attitude | 0.003 (0.016) | | | -0.000 (0.019) |
| NumFin*attitude | 0.015 (0.024) | | | 0.016 (0.031) |
| Vocabulary*attitude | 0.004 (0.007) | | | -0.002 (0.007) |
| PK*attitude | -0.013 (0.016) | | | -0.012 (0.022) |
| SAFL*NFC | | 0.009 (0.013) | | 0.013 (0.014) |
| NumFin*NFC | | -0.004 (0.017) | | -0.012 (0.020) |
| Vocabulary*NFC | | 0.015** (0.007) | | 0.014* (0.008) |
| PK*NFC | | -0.012 (0.030) | | -0.017 (0.040) |
| SAFL*FTP | | | -0.011 (0.010) | -0.015 (0.010) |
| NumFin*FTP | | | 0.008 (0.019) | 0.009 (0.018) |
| Vocabulary*FTP | | | 0.006 (0.007) | 0.002 (0.008) |
| PK*FTP | | | 0.027 (0.028) | 0.032 (0.034) |
| Observations | 1,351 | 1,351 | 1,351 | 1,351 |
| R-squared | 0.049 | 0.051 | 0.050 | 0.052 |
| F-test all beh. vars (p-value) | 0.629 | 0.000 | 0.000 | 0.463 |
| F-test all attitudes IT (p-value) | 0.575 | | | 0.945 |
| F-test all FL (p-value) | 0.005 | 0.000 | 0.000 | 0.000 |
| F-test all NFC IT (p-value) | | 0.126 | | 0.218 |
| F-test all FTP IT (p-value) | | | 0.149 | 0.290 |

Notes: *** p<0.01, ** p<0.05, * p<0.1. Clustered standard errors in parentheses (at the employer level). The covariates are identical to previous analyses.

C. Survey questions

All questions were in Dutch. The complete questionnaire in Dutch is available upon request by the corresponding author.

i. Demographics

What is your date of birth? (DD/MM/YYYY)

What is your gender?

☐ Male

☐ Female

You live in the following household composition:

☐ single

☐ single with children living at home

☐ (un)married cohabiting, without children living at home

☐ (un)married cohabiting, with children living at home

☐ other, namely [...]

How many children do you have? (Living at home or living separately)

[0-12]

What is roughly your monthly total net household income?

☐ no income

☐ EUR 500 or less

☐ EUR 501 to EUR 1,000

☐ EUR 1,001 to EUR 1,500

☐ EUR 1,501 to EUR 2,000

☐ EUR 2,001 to EUR 2,500

☐ EUR 2,501 to EUR 3,000

☐ EUR 3,001 to EUR 3,500

☐ EUR 3,501 to EUR 4,000

☐ EUR 4,001 to EUR 4,500

☐ EUR 4,501 to EUR 5,000

☐ EUR 5,001 to EUR 7,500

☐ More than EUR 7,500

☐ I really don't know

☐ I don't want to say

What is your highest obtained diploma? (or educational level)

- ☐ Elementary school
- ☐ Lower secondary vocational education, Domestic science school [LBO, huishoudschool]
- ☐ Pre-vocational education (middle management-oriented learning path) [VMBO]
- ☐ Pre-vocational education (theoretical learning path) [VMBO-T or MAVO]
- ☐ Senior secondary vocational education and training level 1 [MBO niveau 1]
- ☐ Senior secondary vocational education and training level 2 [MBO niveau 2]
- ☐ Senior secondary vocational education and training level 3 [MBO niveau 3]
- ☐ Senior secondary vocational education and training level 4 [MBO niveau 4]
- ☐ Further extended primary education [MULO/MMS]
- ☐ Higher civic school [HBS]
- ☐ Senior general secondary education [HAVO]
- ☐ University preparatory education [VWO]
- ☐ University of applied science (college) [HBO]
- ☐ University
- ☐ Other

If the respondent crossed “other”, the following question is being displayed:

You have indicated that your education falls under the category “other”. Here you have the opportunity to provide more details about it: [text box]

The original Dutch abbreviations are in square brackets.

ii. *Need for cognition*

People differ in the extent to which they like to delve into things. Hereunder there are several questions about how much you like to think about and would like to be informed about things.

To what extent do you agree with the following statements? [general NFC]

I like to be in a situation where I need to think a lot.

☐ Completely disagree ☐ Disagree ☐ Don't disagree, don't agree ☐ Agree ☐ Completely agree

Thinking about things is not really my idea of having fun.

☐ Completely disagree ☐ Disagree ☐ Don't disagree, don't agree ☐ Agree ☐ Completely agree

To consider something long-term and precisely gives me satisfaction.

☐ Completely disagree ☐ Disagree ☐ Don't disagree, don't agree ☐ Agree ☐ Completely agree

I like to think about new solutions to problems.

☐ Completely disagree ☐ Disagree ☐ Don't disagree, don't agree ☐ Agree ☐ Completely agree

To what extent do you agree with the following statements? [pension-related NFC]

I would like to be extensively informed about everything related to my pension.

☐ Completely disagree ☐ Disagree ☐ Don't disagree, don't agree ☐ Agree ☐ Completely agree

I like to delve into information regarding the amount of my pension.

☐ Completely disagree ☐ Disagree ☐ Don't disagree, don't agree ☐ Agree ☐ Completely agree

I feel aversion when I need to deal with my pension.

☐ Completely disagree ☐ Disagree ☐ Don't disagree, don't agree ☐ Agree ☐ Completely agree

iii. Future time perspective

Below there are several questions on how important it is to you to deal with the future.

I am regularly occupied with issues that will have a result in many years.

☐ Completely disagree ☐ Disagree ☐ Don't disagree, don't agree ☐ Agree ☐ Completely agree

I'd rather spend money on nice things today than saving money for later.

☐ Completely disagree ☐ Disagree ☐ Don't disagree, don't agree ☐ Agree ☐ Completely agree

I think that it is important to take warnings seriously, even though they become relevant a long time from now.

☐ Completely disagree ☐ Disagree ☐ Don't disagree, don't agree ☐ Agree ☐ Completely agree

iv. *Attitudes regarding pension information*

What is your attitude on information regarding your pension?

I find information regarding my pension: [horizontal 5-point scale]

| | | |
|-------------|--|---------------|
| Unimportant | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Important |
| Interesting | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Uninteresting |
| Difficult | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Easy |
| Reliable | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Unreliable |
| Unclear | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Clear |
| Useful | <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> | Not useful |

v. *Financial literacy*

[Note that the correct answers are marked in italics]

Vocabulary test

Pension information should be understandable for everyone, both for people who are used to reading a lot and for people who are less language-skilled. Which language use are you used to? Hereafter you will find several questions about words that are more or less familiar. Don't think about the answers for too long, this is not an exam. Don't you know the answer? Don't gamble but fill in "I don't know" instead.

She is known to be a **philanthropist**.

What does this word mean?

- ☐ Someone who is very rich
- ☐ Someone who adjusts her opinion according to changing circumstances
- ☐ Someone who is a victim of fraud
- ☐ *Someone who gives a lot to the poor*
- ☐ I don't know

His contribution to this work is **marginal**.

What does this word mean?

- ☐ Large
- ☐ *Small*
- ☐ Positive
- ☐ Negative
- ☐ I don't know

He is a **demagogue**.

What does this word mean?

- ☐ Someone who does a lot for the common people
- ☐ Someone who lets the people co-decide
- ☐ Someone who represents the people in Parliament
- ☐ *Someone who misleads the people*
- ☐ I don't know

She has no **scruples**.

What does this word mean?

- ☐ Setbacks
- ☐ *Guilty conscience*
- ☐ Stress
- ☐ Responsibilities
- ☐ I don't know

His statements were **unambiguous**.

What does this word mean?

- ☐ *Clear*
- ☐ Unclear
- ☐ Friendly
- ☐ Unfriendly
- ☐ I don't know

It is **equitable** for him to pay back.

What does this word mean?

- ☐ Probable
- ☐ Necessary
- ☐ *Reasonable*
- ☐ Unjust
- ☐ I don't know

He is an **erudite** man.

What does this word mean?

- ☐ Attractive
- ☐ *Learned*
- ☐ Unreasonable
- ☐ Thick
- ☐ I don't know

The **segregation** in the Amsterdam suburb Bijlmer has increased.

What does this word mean?

- ☐ Crime
- ☐ Nuisance due to vandalism
- ☐ Cooperation between groups
- ☐ *Separated living of groups*
- ☐ I don't know

She is being **megalomaniac**.

What does this word mean?

- ☐ *Has delusions of grandeur*
- ☐ Is insecure
- ☐ Is sombre
- ☐ Is hyperactive
- ☐ I don't know

Self-assessed financial literacy

How would you assess your knowledge about money issues?

Very bad ☐ ☐ ☐ ☐ ☐ ☐ Very good

Financial literacy questions developed by Lusardi and Mitchell

Question on interest compounding (Q1)

Suppose you have 100 euros on a savings account and the interest is 2% per year.

How much do you think you will have on the savings account after five years, assuming that you leave all your money on this savings account?

- ☐ *More than 102 euros*
- ☐ Exactly 102 euros
- ☐ Less than 102 euros
- ☐ I don't know

Question on inflation (Q2)

Suppose that the interest on your savings account is 1% per year and that inflation amounts to 2% per year. After 1 year, would you be able to buy more, exactly the same, or less than you could today with the money on that account?

- ☐ More than today
- ☐ Exactly the same as today
- ☐ *Less than today*
- ☐ I don't know

Question on risk diversification (Q3)

A share from one company usually offers a more certain return than a fund that invests in shares from different company.*

- ☐ True
- ☐ *Not true*
- ☐ I don't know

*We changed the wording of this question slightly compared to Lusardi and Mitchell (2011) in order to make the question less ambiguous.

Question on relation between bond prices and interest rate (Q4)
If the interest rate goes up, what should happen to bond prices?

- ☐ They should increase
- ☐ *They should decrease*
- ☐ They should stay the same
- ☐ None of the above
- ☐ I don't know

Pension knowledge

Which factors influence the pension that you receive through your employer? Cross what you think has an influence (several answers are possible):

- ☐ *The hourly wage that you earn*
- ☐ Whether or not you receive state pension [AOW in Dutch]
- ☐ *The amount of years you have worked until your retirement*
- ☐ None of the above

Does someone with a higher pension receive less state pension?

- ☐ *No, the amount of the state pension is not related to the amount of the pension.*
- ☐ No, the state pension is a fixed percentage of the pension: someone with a high pension receives a higher state pension than someone with a lower pension.
- ☐ Yes, those who have a pension above 100.000 Euro per year receives less state pension as of the beginning of 2016.
- ☐ I don't know

Which life changes can influence your personal future pension? Cross the factors that you think have an influence (several answers are possible):

- ☐ *Your partner stops with working*
- ☐ You get children
- ☐ *You receive a promotion*
- ☐ You get a divorce
- ☐ *You are going to work less*
- ☐ None of the above changes

Why do pension funds invest money in shares?

- ☐ *Pension funds invest in shares in order to obtain a larger return in the long run rather than putting the money in a savings account.*
- ☐ Pension funds invest in shares in order to be able to pay for their employees and to cover other expenses.
- ☐ Pension funds invest in shares as they trust firms more than the government.
- ☐ I don't know

D. About indicative construct validity

Cronbach's alpha is a measure widely used in academic literature to assess the reliability of a set of items intended to measure a specific concept. This metric has been outlined by Cronbach more than half a century ago (1951). In fact, it had been defined by earlier researchers credited by Cronbach: Guttman (1945) and Hoyt (1941). It is given by the following formula:

$$\alpha = \frac{n}{n-1} \left(1 - \frac{\sum_i V_i}{V_t}\right) \quad (\text{D.1})$$

where n is the number of components (or items), V_t is the variance of the observed total test scores, and V_i is the variance of item scores after weighing (p.299). As our items are not binomial, there was no need to compute the standardised score.

Cronbach's alpha depends on 1) the number of items included (the more items, the higher the alpha), 2) the average of all covariances between items (the higher the average covariance, the higher the alpha) and 3) the average variance of each item (the higher the average variance, the lower the alpha). A rule of thumb of an alpha above 0.7 is regarded as acceptable.

Coefficient alpha (as it is called in academic literature) has been widely discussed in academic literature. See for instance Cortina (1993) and Rodriguez and Maeda (2006) for an overview of coefficient alpha and Raykov (2001), Schmitt (1996) and Sijtsma (2008) for a more critical discussion. For instance, Sijtsma (2008) and Schmitt (1996) argue that alpha is not a measure of internal consistency or uni-dimensionality of the data. Despite this, presenting the inter-item test and rest correlations and the corresponding alphas can be of interest to readers who are involved in developing surveys in the area of financial literacy and pension communication. The only conclusions drawn are whether a set of items can be pooled into a test scale or whether the questions need to be included separately into the statistical analyses.

The first row of each table in this subsection returns the alpha when the respective item has been excluded. The second row presents the item-test correlation coefficients – the correlation of each item with the summed index and the third row displays the computed item-rest correlation coefficients – the correlation of each item with the summed index if this item was excluded. The final row shows the alpha for the entire test scale.

Table D1: Classical FL questions

| | Q1 | Q2 | Q3 | Q4 |
|-----------------------|-------|-------|-------|-------|
| Alpha | 0.429 | 0.319 | 0.294 | 0.520 |
| Item-test correlation | 0.428 | 0.610 | 0.691 | 0.753 |
| Item-rest correlation | 0.270 | 0.375 | 0.341 | 0.225 |
| Test scale | 0.454 | | | |

Note that if I group Q1 and Q2 on the one hand and Q3 and Q4 on the other hand, I obtain an alpha of 0.5 and 0.32 respectively suggesting that the scores on questions 1 and 2 could possibly be analysed separately from questions 3 and 4.

Table D2: Vocabulary test

| | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 | Q8 | Q9 |
|--|----|----|----|----|----|----|----|----|----|
|--|----|----|----|----|----|----|----|----|----|

| | | | | | | | | | |
|-----------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Alpha | 0.801 | 0.813 | 0.802 | 0.804 | 0.817 | 0.821 | 0.796 | 0.803 | 0.798 |
| Item-test correlation | 0.683 | 0.573 | 0.714 | 0.666 | 0.547 | 0.487 | 0.743 | 0.684 | 0.726 |
| Item-rest correlation | 0.585 | 0.483 | 0.576 | 0.551 | 0.468 | 0.398 | 0.616 | 0.559 | 0.601 |
| Test scale | 0.824 | | | | | | | | |

Table D3: Pension knowledge: strict and lenient scales

| <i>Strict scale</i> | Q1 | Q2 | Q3 | Q4 | | | |
|-----------------------|-------|-------|-------|-------|--|--|--|
| Alpha | 0.284 | 0.234 | 0.411 | 0.215 | | | |
| Item-test correlation | 0.716 | 0.695 | 0.229 | 0.589 | | | |
| Item-rest correlation | 0.220 | 0.245 | 0.034 | 0.298 | | | |
| Test scale | 0.363 | | | | | | |

| <i>Lenient scale</i> | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 |
|-----------------------|-------|-------|-------|--------|-------|-------|-------|
| Alpha | 0.361 | 0.446 | 0.472 | 0.580 | 0.359 | 0.408 | 0.420 |
| Item-test correlation | 0.628 | 0.403 | 0.486 | 0.373 | 0.648 | 0.524 | 0.488 |
| Item-rest correlation | 0.377 | 0.228 | 0.168 | -0.009 | 0.366 | 0.383 | 0.292 |
| Test scale | 0.478 | | | | | | |

Table D4: Attitudes towards pension information

| | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 |
|-----------------------|-------|-------|-------|-------|-------|-------|
| Alpha | 0.720 | 0.715 | 0.707 | 0.694 | 0.664 | 0.667 |
| Item-test correlation | 0.531 | 0.650 | 0.635 | 0.657 | 0.733 | 0.723 |
| Item-rest correlation | 0.375 | 0.418 | 0.429 | 0.474 | 0.568 | 0.570 |
| Test scale | 0.733 | | | | | |

Table D5: Need for cognition (general and pension-related)

| <i>General</i> | Q1 | Q2 | Q3 | Q4 | | | |
|------------------------|-------|-------|-------|-------|-------|-------|-------|
| Alpha | 0.552 | 0.592 | 0.697 | 0.626 | | | |
| Item-test correlation | 0.776 | 0.755 | 0.657 | 0.686 | | | |
| Item-rest correlation | 0.571 | 0.507 | 0.351 | 0.460 | | | |
| Test scale | 0.684 | | | | | | |
| <i>Pension-related</i> | Q5 | Q6 | Q7 | | | | |
| Alpha | 0.644 | 0.489 | 0.724 | | | | |
| Item-test correlation | 0.772 | 0.852 | 0.772 | | | | |
| Item-rest correlation | 0.517 | 0.637 | 0.456 | | | | |
| Test scale | 0.713 | | | | | | |
| <i>All together</i> | Q1 | Q2 | Q3 | Q4 | Q5 | Q6 | Q7 |
| Alpha | 0.675 | 0.685 | 0.694 | 0.698 | 0.685 | 0.668 | 0.686 |
| Item-test correlation | 0.631 | 0.610 | 0.581 | 0.533 | 0.606 | 0.669 | 0.632 |
| Item-rest correlation | 0.473 | 0.427 | 0.389 | 0.370 | 0.425 | 0.489 | 0.426 |
| Test scale | 0.717 | | | | | | |

Table D6: Future time perspective

| | Q1 | Q2 | Q3 |
|--|----|----|----|
|--|----|----|----|

| | | | |
|-----------------------|-------|-------|-------|
| Alpha | 0.266 | 0.384 | 0.399 |
| Item-test correlation | 0.770 | 0.701 | 0.597 |
| Item-rest correlation | 0.329 | 0.267 | 0.264 |
| Test scale | 0.456 | | |