The effectiveness of pension communication on pension related decision making

by
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Abstract

In this paper the effectiveness of pension communication on pension decision behavior is investigated. Empirical evidence is presented that shows that pension communication indirectly increases the chance on an active pension decision. We evaluated the effectiveness of the Dutch pension statement and found that receiving the statement increases individuals' active pension behavior, mediated by pension literacy and the feeling of being informed. We showed, using Granger causality, that an increase in pension literacy and the feeling of being informed both increase active decision behavior. To our knowledge, this is the first paper that examines, by using panel data, the mechanism of how communication affects pension behavior. These findings show that communication is an effective tool to improve active behavior. However, policy makers should be more concerned with increasing longstanding pension literacy and individuals' feeling of being informed. We suggest that targeted communication to different socio-economic groups might increase the effectiveness of pension communication, nevertheless policy makers should be careful with these interventions because of the potentially detrimental effects of individuals who feel over-informed.

Keywords: pension communication, decision making, pension behavior, pension literacy, pension confidence, feel informed

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Contents

1 Introduction

To meet the challenges of the aging population, and more recently the economic and financial crisis, many countries have reformed their pension systems (OECD, 2016). Investment returns and interest rates were relatively poor during the last decade, often resulting in solvability problems for pension providers. A large part of the Dutch pension system has changed from a defined benefit (DB) system to a defined contribution (DC) system. Meaning that the pensions are no longer guaranteed and the investment choices and risks are to a great extent shifted towards the pension holders (Bodie and Prast, 2011). New legislation[1] has been adopted last year, which provides the choice to invest part of your pension benefit after retirement date in risky assets. Due to a growth in self-employed individuals it becomes increasingly important that active decisions are made to put money aside for their pension. For these reasons, an increasing amount of individuals have to make their own pension choices. This leads to a concern among policy makers whether individuals possess enough knowledge to collect and process relevant pension information in order to make appropriate active decisions.

This may be problematic since Van Rooij et al. (2011) found that only one out of three Dutch households have thought about retirement. Policy makers have expressed their concerns about whether individuals are able to make active decisions that are in their best interest and if needed, how they can assist individuals in making these decisions.

On January 1st in 2007 a new pension law 'de Pensioenwet' about pension communication came into force in the Netherlands. Due to this legislation, pension providers are obligated to provide specific pension information to their members, (e.g. a start letter, a pension statement ('Uniform Pensioen Overzicht'(UPO)), a stop letter, and- information regarding the provision of indexation), with the goal to increase pension awareness of Dutch citizens (van der Smitte, 2013).

According to Elling and Lentz (2018) the Dutch pension statement (UPO) has three main tasks: i) to inform people on how their pension is built up, ii) to inform people that pension risk might result in a lower pension and iii) which decisions people could and should make when their pension is deficient. However, until now no empirical literature has investigated whether the Dutch pension statement fulfills these tasks and whether this legislation affects active pension decision behavior. Therefore, this research aims to evaluate the effectiveness of the Dutch pension statement. More specifically, we are interested in the relation between pension communication and active decision making and its underlying mechanism. In this study we address the research question:

To what extent is pension communication related to individuals' active pension decision

[1] 'Wet verbeterde premieregeling' ('Stb. 2016', 248).

making and to what extent is this relationship mediated by pension literacy and the feeling of being informed?

The effect of financial literacy on retirement planning has been investigated by Alessie et al. (2011a). They found that financial literacy positively correlates with retirement preparation. Therefore, financial literacy could be an underlying mechanism which explains the effect of communication on pension decision making. However, financial literacy describes the knowledge of an individual of the financial market, which does not fully capture the knowledge of an individual on the pension system. Therefore, in this research, questions from the Dutch Central Bank Household Survey (DHS) were used to assess members' overall knowledge on the retirement account system. We investigated whether pension literacy mediates the effect of communication on active pension decision making.

Palameta et al. (2016) show that financial confidence is a better predictor than financial literacy when it comes to outcomes associated with money and debt management. However, there is little information on confidence in pensions. Therefore, we investigate whether members' feeling of being informed mediates the relationship between pension communication and pension decision making. Past research from the medical field interestingly shows that there is no causal relationship between knowledge on medical care and the patients' perceptions about how informed they were about common medical decisions (Sepucha et al., 2010). Therefore, we also examine whether pension literacy is positively associated with the members' feeling of being informed.

This paper is structured as follows: first we provide a broad overview of the Dutch pension system and the pension-related communication that became mandatory after the new pension law passed in 2007. Next, a literature review on pension communication and active pension behavior and the role of pension literacy and the feeling of being informed herein is provided. Then the hypotheses are presented and depicted in a conceptual model. We will then discuss the methods, measures and statistical analysis used to test the hypotheses, after which the results are presented. Finally, the results are discussed and concluding remarks and recommendations are made.

2 The Dutch pension system

This section presents a brief overview of the most important elements of the Dutch pension system regarding our research question. In section 2.1, we focus on explaining the three pillar system. In section 2.2 we discuss the communication methods used in the Dutch pension sector in more detail.

2.1 Institutional context

The Netherlands' retirement income system comprises of a flat-rate public pension and a quasi-mandatory earnings-related occupational pension linked to sector agreements. Together with the individual retirement savings, this is called the three-pillar system. The first pillar is the public pension, the second pillar consists of the occupational pensions and the third pillar consists of individualized pension arrangements.

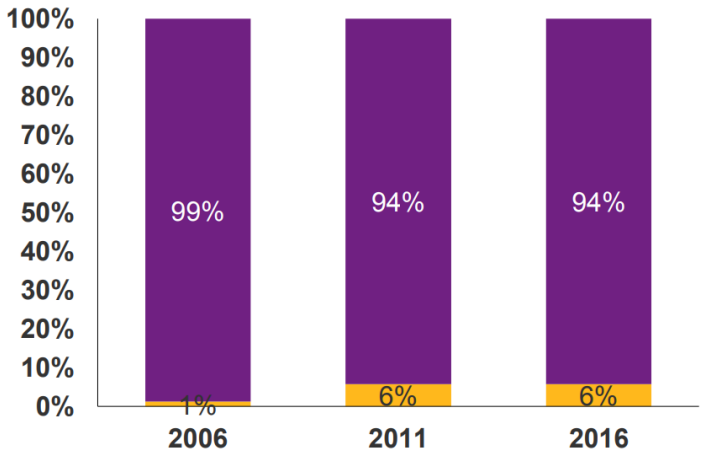
The first pillar is a pay-as-you-go financed state pension, called the Algemene Ouderdomswet (AOW). This is an old age poverty avoiding flat income stream which is relatively generous in comparison to other countries, and entitlement to this public pension is residency based (Cannon et al., 2015). The benefit from the first pillar pension is based on the fraction of years of habitation in the Netherlands between the ages of 15 and the retirement age. The pay-as-you-go public pension is financed by individual people who pay payroll taxes (i.e. current AOW pensions are paid out of current income contributions). Furthermore, the government can give additional funding to provide the benefits needed for the AOW. The public pension for a single retired person is equal to around 1100 euro (2017), which is equal to 70% of the minimum wage. Individuals who live together receive less, they receive around 750 euro (2017) each (50% of minimum wage)[2].

The second pension pillar consists of the compulsory memberships of the employees in company or industry-wide pension schemes. In these schemes employees save on top of the residency based AOW benefit according to a funded system. These second pillar pension schemes are administrated by pension funds or insurance companies. The second pillar is, in comparison to the state pension, capital funded which means that the retirement benefits are financed by contributions and investment returns from the past. More than 90 percent of the employees are obligated to save for an additional pension benefit in their workplace (Els et al., 2007), and these occupational pension plans have historically provided almost no freedom of choice (Van Rooij et al., 2007). The contribution percentage was mostly defined by trade unions, and often a DB system was used. Before the arrival of the second millennium, the pension participants had a sustainable benefit, as the benefit and indexation levels were certain. Pension rights were expanded every year and the participants received compensation through indexation. Employees

[2]https://www.svb.nl/int/nl/aow/hoogte_aow/bedragen/

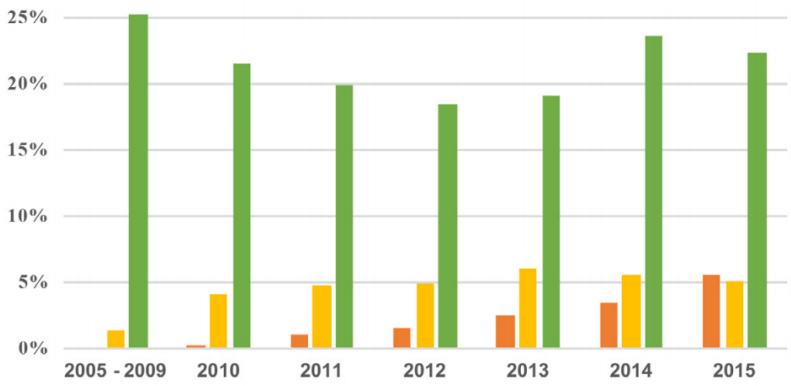
received, due to the high investment returns discount on pension contributions. This lead to the common belief that adequate pensions could be achieved at low costs. however, due the poor performance of the stock market in the late 90's and the aging population, solvency ratios of the pension funds decreased and the funds were no longer sustainable (Goudswaard and Schnabel, 2009). A Large part of the system changed from a defined benefit pension plan to a defined contribution plan, the indexation level became solvency ratio dependent, and the retirement age increased. Similar to a DB plan, the DC plan is capital based. However, the investment and longevity risk is transferred from the employer to the individual. DC pension assets have grown during the last ten years at 5.6% per annum while DB assets have grown at a slower rate of 2.6% per annum (Willis Towers Watson, 2017). Figure 1 illustrates the large growth in DC pension assets from 2006 to 2011 in the Netherlands. A consequence of the change from the DB to the DC plans is that employees have become more responsible for their own retirement planning, because they have to make own investment decisions. Furthermore, in the second pillar occupational pensions individuals have, i) flexibility in how their pension benefit is paid out (i.e. increase short term payouts at the expense of the level of the long-term payouts), ii) early retirement options and, iii) the option to exchange part of the retirement pension for a higher partner's pension. In figure 2 the percentages of individuals who actively make use of these choices are displayed. The part of individuals that make active choices is the last 5 years substantially higher than in the period before, this might be explained by the changing methods of communication (van Ewijk et al., 2017).

Figure 1: Split in DB and DC total pension assets in the Netherlands, DC = yellow, DB = purple



Source: Willis Towers Watson, global pensions asset study 2017

Figure 2: Choices on retirement date. Flexibility in pension payouts = orange, early retirement option = green, exchange partner's pension = yellow.



Source: van Ewijk et al. (2017)

The third pillar consists of individual pension products. These individual products are mainly used by individuals who work in sectors without a compulsory collective pension scheme or vulnerable groups such as the self-employed and women who stopped working due to motherhood (Prast and van Soest, 2015). In the third pillar individuals can save additional pension, which often is stimulated by tax benefits.

2.2 Communication with respect to pensions

Due to changing pension plans, new legislation, and an increase in choice, responsibility shifted more toward employees. Mandatory communication with respect to pension was introduced in 2007 because individuals have become more responsible for their pensions in combination with lacking financial knowledge (Van Rooij et al. (2007); Heuts and Klaver (2011)).

This led, on 1 January 2007, to a new act containing rules on pension communication. The 'Pensioenwet (Pw)' replaced the old 'Pensioen- en spaarfondsenwet (Psw)' dated from 1954 and was in need of revision. A reason to introduce the new legislation was that the legislator wanted more transparency, assurance and knowledge transfers around pensions in order for individuals to be able to bear the increased responsibility (Heuts and Klaver, 2011). The 'Pw' ensures stricter additional information requirements for pension providers. In the explanatory memorandum[3] on the 'Pw' it is explained that the Dutch government finds it of great importance that pension participants receive information in order to ensure an adequate financial planning. However, it is the members' own responsibility to evaluate whether the expected pension benefits are sufficient for their future expenditures. The basic principle here is that the information provided should be sufficient for individuals

[3]https://zoek.officielebekendmakingen.nl/kst-30413-3.html

to take their responsibility. The pension legislation contains information provisions that should be followed by the pension provider. Compulsory information provisions are the start letter, Uniform Pension Overview (UPO), stop letter and information about indexation. We will now discuss the compulsory information provisions and the communication of pension risk in more detail.

Every new participant should receive the start letter within three months after participating in a new pension fund. The start letter is the only provision required by law that provides information on the key elements of the pension plan of the participant. Research has shown that 98% of all pension fund provided a start letter to their participants in 2011 (Heuts and Klaver, 2011). Furthermore, this research shows that all funds provide the mandatory information from the pension legislation in their start letter.

The Uniform Pension Overview (UPO) is the Dutch mandatory pension statement which is provided yearly as obliged by the new pension legislation dated from 2007. The Pension Federation and the Union of Insurers are responsible for the management of the Dutch pension statement, i.e. they are responsible for the design and the content of the UPO (AFM, 2012a). Yearly, the UPO is evaluated and based on this small changes in content are made. In a research conducted by GfK[4] commissioned by AFM[5], it is found that the UPO is almost in all members' interest (89%)(GfK, 2011). Additionally, Kuiper et al. (2013) find that most people find the UPO useful (5.04 on a 7-point scale). However, only one third reads the UPO thoroughly, most of the people quickly scan the document. Similar results have been found by the Pension Federation and the Union of Insurers, they found that 40% reads the UPO thoroughly and 49% of the people only scan the document.

The stop letter provides information on the termination of the pension contract when a participant stopped working or changed jobs. The stop letter contains information on the size of the pension benefit, future development of the benefit due to indexations and the survivor's benefit[6]. The stop letter must be provided within three months after the completion of the contract. Around 80% of the pension funds provide the stop letter in time (Heuts and Klaver, 2011).

Indexation by pension providers ensures that the purchasing power of the participants stays equal throughout the years. Pension providers are also obliged to inform participants about their indexation provision by means of the start letter, pension agreement, and the pension statement.

Due to the change from DB to DC scheme more freedom of investment is offered to individual participants. The 'Pw' states that pension providers have the statutory responsibility to communicate and offer advice regarding diversification of the investment

[4]Gesellschaft für Konsumforschung (GfK)

[5]Dutch Authority for the Financial Markets (AFM)

[6]a survivor's benefit allows a retiree to ensure, after death, a continuous lifetime annuity for their dependents

portfolio. Furthermore, the providers need to verify whether the investment choices match the participant's needs.

Besides information about pension benefits, pension providers are also obliged to inform their participants about cuts in pension provisions due to low solvency ratios.

3 Literature Review

This section presents an overview of the literature concerning active decision making and how communication might affect this. Even though pension policy is highly discussed by policy makers, there is little empirical evidence in how pension communication might affect active behavior in the pension system. Based on the literature available, the expected relationships between pension communication and active pension behavior are discussed. First the direct relationship between pension communication and active decision making is discussed, followed by an explanation of the mediating roles of pension literacy and the feeling of being informed in this relationship. Finally, the direct relationship between pension literacy and feeling informed will be explained.

3.1 The relationship between pension communication and active decision making

In recent years many governments have radically changed their pension systems, carrying out reforms with the goal to significantly ensure financial sustainability (Zaidi and Grech, 2007). In many countries DC pension plans play an important role in providing retirement income (OECD, 2014). Future pension plans will increasingly depend on the choices of members, employers, and regulators on how to invest, how much to contribute, and when and how to withdraw the pension benefit. These choices are highly dependent on changes over time. Therefore, members must understand the risks they face and understand the nature of their pension plans.

A tool which is communicated to participants to help them with their decisions they have to make is the pension statement. However, there are various communication hurdles that prevent participants to make optimal use of their pension statement. According to Lusardi and Mitchelli (2007), most pension providers assume that the average member of a pension fund has a low level of financial literacy, and no access to an expert for advice. Lusardi and Mitchelli (2007) accept that the pension statement should be clear, brief, and simple, however, beyond the mandatory accounting information there is little knowledge on how additional information should be presented and how the effectiveness should be evaluated to accomplish the desired purpose (e.g. active decision making on contribution levels) (OECD, 2016).

In the High Level Principles for the Evaluation of Financial Education Programmes (2012)[7] by the International Gateway for Financial Education (INFE) it is stated that: "evaluation is an essential element of financial education programs". To determine whether a communication campaign has been successful, the evaluation process should distinguish between changes that have happened as a result of the communication and changes that

[7] http://www.oecd.org/finance/financial-education/49373959.pdf

would have occurred as well in absence of the communication (OECD, 2016). Various countries have developed evaluation campaigns themselves, including: the UK, New Zealand, Ireland, Israel and Singapore. These countries have performed a pre-campaign analysis to establish baselines for post-campaign evaluation (Atkinson et al., 2012). In the UK, for example, focus groups were used to test and refine the program's language, campaign materials, information and messages. In Hungary, a behavioral approach to different population categories was used with the communication complexity adjusted for the ability of each group. In Atkinson et al. (2012) various types of campaign monitoring that have been used by different countries are explained. For example, a quantitative comparison between website hits before and after the campaign and the amount of contact with call centers. In Italy and Mexico memory recall surveys were conducted and this information was used to identify the most cost-effective communication channel. In New Zealand press monitoring has been done, for example New Zealand has assessed both the positive content and of media reports as well as the negative. In Israel, an analysis of the cash-flow of the pension providers to follow the development of contributions and withdrawals has been carried out. Indonesia and Estonia used outreach attendance as mean of evaluation to evaluate their campaigns (e.g. seminars and road shows). The USA used the attendance to outreach events as well but in relation to additional inquiries to help lines and web use. Take-up rates and changes to plan details were evaluated in New Zealand, Singapore and Sweden. Due to the absence of a clear evaluation mechanism of the effectiveness, different communication campaigns and their effectiveness are hard to compare.

Duflo and Saez (2003) conducted a randomized experiment to investigate the role of pension communication in relation to individuals' decision to enroll in a retirement plan. Their research was performed among employees from a large university and they found a small positive effect of pension communication on enrollment in a retirement plan. However, the authors showed that the role of social interactions is larger than the role of information provisions.

Gallo et al. (2016) used the Elaboration Likelihood Model (ELM), which represents the individual's attitude and its susceptibility to pension communication to explain the heterogeneity in pension choices. They used data gathered by the Bank of Italy to show that the 2007 Italian pension reform, that allowed transferring of future severance pay's contribution into a pension fund, to assess the effectiveness of the communication message. They found that the the decision to transfer the severance pay to pension fund was taken more by educated and older individuals. However, the reform was mainly directed to low income individuals. Because the target group wasn't highly affected by the communication they suggest that the message of the reform information was not very effective. In addition it was found that generic financial literacy was not positively correlated with conscious pension decision making.

The Dutch Authority for the Financial Markets (AFM) overviews pension communication and pension awareness in the Netherlands. In a report dated from 2012 it is stated that communication about pensions should lead to insights which might result in an adequate action to make an active decision (AFM, 2012a). The authors state that communication about pensions is not sufficient, as individuals need to be able to realize whether their pension benefit is satisfactory and undertake action if required.

The above theory describes the use of pension communication with as goal to enhance active-pension behavior. Given these findings we predict that individuals who receive the pension statement will be more likely to show active pension behavior. This prediction is reflected in the first hypothesis:

H1: Receiving pension communication (i.e. the Dutch pension statement) increases active pension behavior

3.2 The mediating effect of pension literacy

In addition to this main effect, we predict that there is presence of indirect effects between these variables. Indirect effects (or mediation effects) exist when an independent variable influences the dependent variable through its effects on or as a result of a mediator variable (Baron and Kenny, 1986). We are interested in the underlying mechanism of how pension communication increases active pension behavior.

Pension communication campaigns, especially temporary ones, are largely inadequate to bring about longstanding improvement to financial literacy[8]. Therefore it is beneficial to integrate pension communication into a broader continuous on-going program of financial education. Wiener and Doescher (2008) describe the communication approach as one of the two ways of promoting occupational pension savings. The other way of promoting pension savings is through structural changes such as tax reliefs or default choices. They describe the communication approach as focusing:

> "... on changing both workers' knowledge and their perceptions" of pensions (p.137)"

Wiener and Doescher (2008) therefore suggest that pension communication is able to change pension literacy. The pension statement might be an adequate mean to generate higher pension literacy levels. Hence, we predict that pension communication is positively related with pension literacy, more specifically:

[8]See OECD (2005), Recommendation on Principles and Good Practices for Financial Education and Awareness

H2: Receiving pension communication (i.e. the Dutch pension statement) will lead to an increase in pension literacy

Financial education and financial literacy have been a highly discussed area of research in the past 20 years (see e.g. Hilgert et al. (2003); Lusardi and Mitchell (2007); Lusardi and Mitchell (2011)). An eminent surge in governmental interest in financial literacy has taken place as well, stimulated by demographic concerns due to various financial crises and an aging population (Vitt, 2005). A repeated set of financial literacy questions has been used in research, this increases the researchers' ability to compare results across studies. The questions do not guarantee that financial literacy in the most effective way. However, Lusardi and Mitchelli (2007) have shown that these questions are related to several relevant factors, such as failing to plan for retirement.

Lusardi and Mitchelli (2007) state that financial illiteracy is widespread in the U.S. and other countries. Young and older people are unaware of the basic financial concepts which as a result causes these people to undermine their well-being in old age. In response, many governments are providing means of education to increase financial literacy. However, one must be cautious when concluding that increasing financial literacy has a compelling effect on retirement saving (Lusardi and Mitchelli, 2007). Recent pension reforms in Italy transferred responsibility from pension provider to pension participants, they now need to decide whether they participate in a pension plan, how much to contribute and how to invest their wealth. Fornero and Monticone (2011) used the Bank of Italy's Survey on Household Income and Wealth to do an empirical analysis and found that most individuals lack financial literacy. The authors also found that financial literacy has a positive and significant effect on the participation in a pension plan. Alessie et al. (2011b) used the DNB Household Survey to measure the effect of financial literacy on retirement preparation, financial knowledge is found to increase the probability of thinking about retirement planning.

The Dutch Foundation Pension Viewer introduced in 2009 the Pension awareness index (PAI). They formulated the definition of pension awareness as (Wijzer in Geldzaken, 2009):

> "Pension awareness is the extent to which one is aware of pension income in old age, death and disability, knows if this sufficient in one's personal situation, knows what can be done to solve potential problems, and makes a conscious trade off on this."

The pension awareness index is measured in a study, in which a survey is used to ask individuals about their knowledge of pension income. A self-assessment is done by the individuals to evaluate whether or not they know the possibilities in the system. However, the correlation between the PAI and active-pension behavior has not been investigated.

In comparison to financial literacy, pension literacy still does not have repeated questions in various studies, which makes it hard to compare results. Martinez et al. (2009) conducted a research and showed that Chileans with more knowledge about the pension system do more actively contribute and manage their individual retirement accounts. They used three questions pertaining to the contribution phase and five questions address pension benefits from the retirement account system. The members who have the most discretion with their retirement accounts, are least knowledgeable (e.g. self-employed). In 2013, Landerretche and Martínez (2013) addressed pension literacy and show that Chileans with greater knowledge of the pension system have a greater chance to have additional financial savings. They used an instrumental variable approach to show that this effect is causal. In their research a pension literacy measure containing six questions is used, and the authors found that answering one additional question correctly indicates a 50% larger chance that the participants had saved additionally in the surveyed periods and, a 25% larger chance that the individual saved additionally in both periods. Furthermore, they found that people with a higher level of pension literacy switch pension providers more often.

Thus, existing research findings, lead to the third hypothesis regarding the effects of pension literacy on pension decision behavior. The hypothesis is as follows:

H3: An increase in pension literacy will lead to an increase in active pension behavior

Based on the literature, we argued that pension communication will lead to an increase in pension literacy and that pension literacy is positively related to individuals' active decision making. Therefore, we expect that receiving pension communication increases individuals' pension related decision making partially mediated via pension literacy.

3.3 The mediating effect of the feeling of being informed

In addition to the relationship of hypothesis 1, which we suggest is mediated by pension literacy supported by hypotheses 2 and 3, we test for an additional indirect effect, mediated by the feeling of being informed about pensions.

Larsson et al. (2009) found that pension information can also inform, however they state that pension communication is most useful for financially literate pension members. Dolan et al. (2010) found that the effect on how people think caused by communication is small while the method is expensive. Wiener and Doescher (2008) state that communication may affect individuals' perception about pensions. Thus, along with pension literacy, the feeling of being informed is positively related with pension communication. More specifically:

H4: Receiving pension communication (i.e. the Dutch pension statement) increases the participants' feeling of being informed.

Bucher-Koenen et al. (2017) argue that individuals' who are less confident in their financial knowledge are more restrained in taking decisions. Individuals who are overconfident relatively to their objectively measured financial literacy have a greater chance on thinking and setting up a financial retirement savings plan (Van Rooij et al., 2012). In management literature the effect of confidence on managerial decisions is investigated, it is found that older managers were less confident and took longer to make decisions (Taylor, 1975). Palameta et al. (2016) found that financial confidence is a important predictor of saving and planning outcomes. The authors showed that individuals who are more knowledgeable but have a low level of confidence, are likely to perform poorly in active decision making such as saving adequately for retirement and retirement planning. Nenkov et al. (2009) found that feelings and emotions play an important role for mapping out the potential risks and expenses for retirement, so that it influences the chance on active pension behavior. Hence, we predict the following hypothesis:

H5: An increased feeling of being informed about pensions will lead to an increase in active pension behavior

Given that Larsson et al. (2009), Dolan et al. (2010) and Wiener and Doescher (2008) found that pension communication is positively related to the feeling of being informed and that e.g. Bucher-Koenen et al. (2017), Van Rooij et al. (2012) and Palameta et al. (2016) found that the feeling of being informed is positively related to individuals' active decision making, we expect that receiving pension communication increases individuals' pension related decision making partially via the feeling of being informed.

3.4 The direct relationship between pension literacy and the feeling of being informed

The relationship between the feeling of being informed and knowledge is not an active field of research. However, in a health care study conducted by Sepucha et al. (2010), questions about how informed US adults feel about different cancer treatments were used. The individuals had taken decisions in the past two years on which cancer screening or elective surgery to undergo. The participants rated how informed they felt and furthermore answered knowledge specific questions. Sepucha et al. (2010) found that the patients who felt most informed did not have higher knowledge scores. Therefore they suggest that clinicians should be pro-active in providing information and test patients understanding to ensure knowledgeable decisions. Palameta et al. (2016) found that individuals with

high confidence and low knowledge have poor retirement planning and saving behavior. Therefore, we want to test whether pension literacy is positively associated with an individual's perception of the feeling of being informed. This leads to the following hypothesis:

H6: Pension literacy is positively related with the feeling of being informed about pensions

4 Hypotheses and conceptual Model

In this chapter we will present an overview of our overall research questions and the hypotheses. To empirically test the research question we conducted, based on the literature, various hypotheses. The hypotheses are presented below and depicted in figure 3. As mentioned in the introduction, we want to address our overall research question:

To what extent is pension communication related to individuals' active pension decision making and to what extent is this relationship mediated by pension literacy and the feeling of being informed?

H1: Receiving pension communication (i.e. the Dutch pension statement) increases active pension behavior

H2: Receiving pension communication (i.e. the Dutch pension statement) will lead to an increase in pension literacy

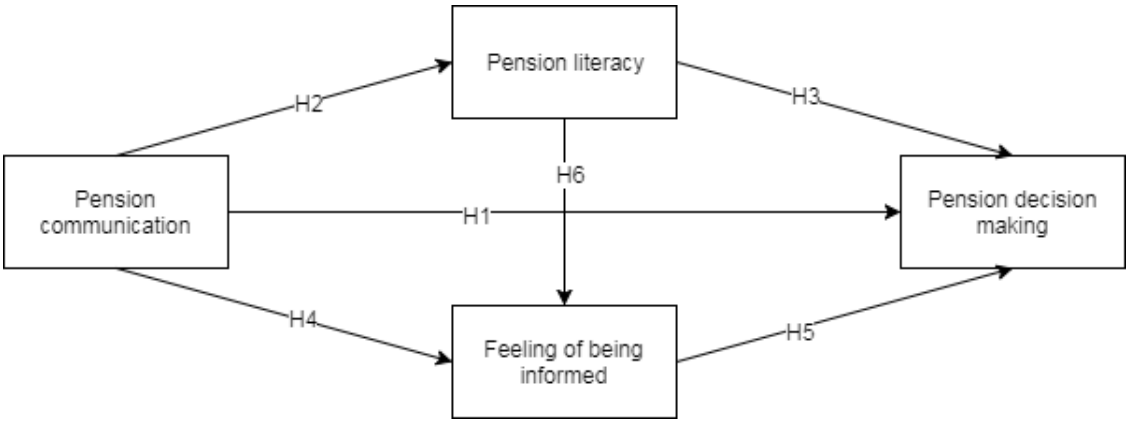
H3: An increase in pension literacy will lead to an increase in active pension behavior

H4: Receiving pension communication (i.e. Dutch pension statement) increases the participants' feeling of being informed.

H5: An increased feeling of being informed about pensions will lead to an increase in active pension behavior

H6: Pension literacy is positively related with the feeling of being informed about pensions

Figure 3: Conceptual model



5 Methods

5.1 Sample

The population of this research is Dutch individuals. The data used is from the DNB Household Survey (DHS) which is collected in a survey among participants in the CentER-panel. The panel is run by CentERdata at Tilburg University and contains roughly 2,000 households whose members fill out short questionnaires on a weekly basis via the Internet. These questionnaires have been collected from 1993 till 2016, due to data constraints, the data from 2004 till 2016 is used. Annually, panel members provide information on "income, wealth, health, employment, pensions, savings attitudes, and savings behavior", which provides researchers with a rich set of background information on the respondents. All yearly waves of the panel data set are used in this study. Furthermore observations who missed data on pension communication, pension literacy or the feeling of being informed were deleted as well as members' who were already retired. This results in 9830 individual observations, providing information on 2691 individual members. We have an unbalanced panel, because of endogenous attrition, a sample selection problem may arise (Heckman et al., 2013). We tested for a possible attrition bias and for the "learning effect" among respondents who repeatedly answered the survey.

5.2 Variables

Active pension behavior

To measure active decision behavior we used a question on whether people will adjust their conduct if pensions are cut. The question was asked in all waves of the DNB Household Survey (DHS), the question and responses were the following:

- *Will you adjust your conduct if the pensions are cut down, for example through an adjustment on the indexation, postponement of the retirement age or a different pension system?*

1. yes, I will put more money aside for my pension
2. no, I will see what I'll do when it happens
3. no, I think I can make ends meet fairly easily with the pension I will have
4. otherwise, answer:.. (string)
5. don't know

The responses were used to create a binary variable on pension decision making which is equal to one if people claim that they will adjust their conduct or that they made the

deliberate decision that they can make ends meet fairly easily (answer 1 and 3). The binary variable is equal to zero if people answer the question with answer 2, which is a form of procrastination in pension decisions. If individuals answered with answer 5, 'don't know', the binary variable is set to zero as well. Furthermore, the responses of answer 4 were reviewed and placed in the most suitable category, depending on whether individuals made a well-considered decision. The distribution of the responses is displayed in chapter 6.2.

Pension communication

The measure for pension communication is a binary response variable which is equal to one if a participant has received a Dutch pension statement in a particular year and zero otherwise. The answers to this question do not contain the option: 'don't know'. This is important because this answer may be the result of low pension literacy and therefore no interest in pensions which may lead to a reverse causality issue. As discussed, the pension statement is since 2008 a mandatory information provision in the Netherlands which is provided yearly to all participants. The pension statement is according to OECD (2014) the most frequent and important form of communication provided by pension funds and insurance companies.

Pension literacy

To access members' overall knowledge of the retirement account system, we use three questions from the DNB Household Survey (DHS). Survey answers were examined and for each question, respondents could reply with a specific answer or 'don't know'. The pension literacy index can obtain values from 0 to the maximum score of 3, depending on the number of correct answers given. Note that we do not have access to administrative databases, and hence we were not able to verify the answers individuals give. The three questions used to address pension literacy are the following:

- *How is your pension built up?*

1. a pension based on the final pay
2. a pension based on the average pay earned during my working career
3. available premium
4. otherwise, answer:..(string)
5. don't know

- *Which part of the pension premium (in percentage points) is paid by the employer?*

1. part, answer:.. (string)
2. don't know

- *A pension plan can include an arrangement for correcting the pension that can be claimed and/or the pension that is actually being paid according to a price-index and/or to a salary-index. Pensions that are corrected in this way are called indexed to inflation. Is your (future) retirement pension indexed to inflation?*

1. yes price index
2. yes salary index
3. yes both salary and price index
4. no
5. don't know

The feeling of being informed

As described in the literature review, the feeling of being informed might mediate the effect of pension communication on pension decision making. A variable was created with a score from 1-5 depending on the following question from the DNB Household Survey (DHS), where 1 corresponds to not well-informed and 5 is well-informed. The specific question used is the following:

- *Do you feel adequately informed about your (future) pension arrangements?*

Control variables

As multiple factors can influence retirement decision making, the following regression controls were added to the analysis: female, age, main wage earner, education level dummies, number of household members, house owner and marital status. female is equal to zero if the individual is male and one if an individual is female. Age is the individuals' age at a moment in time. Main wage earner is a binary variable which is equal to one if the individual is the main wage earner in a household. The education level dummies are equal to one, if a specific education level is the highest education level completed. Furthermore a dummy is added which is equal to one if an individual owns a house and zero otherwise.

5.3 Empirical analysis

The sample contains repeated observations on the same individuals, collected over a number of periods, this is considered panel data. Panel data grants the ability to remove

any unobservable heterogeneity that can be present in the sample. In this section a short algebraic explanation of the panel data models used is given. First, because of the nature of active decision behavior, we will present models for a binary response variable, the linear probability model (LPM), logit, and probit model are discussed. Second, count data models are discussed because of the nature of pension literacy. Finally, we will discuss ordered response models as the feeling of being informed has ordered responses.

5.3.1 The linear probability model for binary response

As discussed, pension decision making is a binary response variable. When analyzing a binary response variable in the context of panel data it is often useful to start with a linear model with an additive, unobserved effect, and then using the within transformation to remove the unobserved effect (Wooldridge, 2010). The LPM was used, in addition to the logit and probit model, to evaluate hypotheses 1,3 and 5. Next, we will give a short algebraic explanation of the LPM:

All index variables are indexed by i for an individual ($i = 1, ..., N$) and for the time period ($t = 1, ..., T$). In very general terms the linear probability model can be specified as a simple linear model:

$$y_{i,t} = x_{i,t}^{\intercal}\beta + \alpha_i + \epsilon_{i,t}$$

In the LPM, the conditional expected value of y equals the conditional probability that the outcome equals one:

$$\mathbb{P}(y_{i,t} = 1) = \mathbb{E}(y_{i,t}|x_{i,t}^{\intercal}\beta, \alpha_i) = \mathbb{E}(x_{i,t}^{\intercal}\beta) + \mathbb{E}(\alpha_i) + \mathbb{E}(\epsilon_{i,t}) = x_{i,t}^{\intercal}\beta + \alpha_i$$
$$\mathbb{P}(y_{i,t} = 0) = 1 - (x_{i,t}^{\intercal}\beta + \alpha_i)$$

observe that the probability $\mathbb{P}(y_{i,t} = 1)$ is a linear function of $x_{i,t}$ and hence can be estimated using the ordinary OLS model, also referred to as LPM in case of a binary dependent variable.

The key assumption for the LPM is that exogeneity is not violated, hence:

$$\mathbb{E}(\epsilon_{i,t}|x_{i,t}, \alpha_i) = 0.$$

We used the LPM described, however this model might not be a good description of the population response probability, feasible outcomes where the outcome of the dependent variable obtains values outside the binary interval exist. Furthermore, the LPM implies that a ceteris paribus one unit increase in an explanatory variable always changes the probability of success by the same amount regardless the initial value of the explanatory variable. This cannot be true because continually increasing the independent value would drive the probability of success be greater than 1 or smaller than zero. Another shortcoming of the LPM is that the error term is heteroskedastic because the variance isn't

constant, the variance depends on the value of the independent variables. Therefore we will use estimates of the errors that are robust to heteroskedasticity. However, the LPM remains a reasonably popular modeling framework (Miguel et al., 2004). Hence, we used it as a convenient approximation of the estimates next to the index models for binary response.

Model selection: the linear probability model (LPM)

First, we conduct the Breusch and Pagan (1980) Lagrange multiplier test. This test statistically tests whether pooled OLS or a random effects model is more appropriate (Breusch and Pagan, 1980). The null hypotheses of the Breusch and Pagan Lagrange multiplier test is that there is no statistically significant difference among panels, thus no panel effect (Torres-Reyna, 2007). If the test statistic rejects the null hypothesis it is concluded that a random or fixed effects estimator is more appropriate than simple OLS.

If the Breusch and Pagan (1980) Lagrange multiplier test shows that a panel model is more appropriate, a Hausman test is conducted. If unobserved heterogeneity is correlated with the independent variables, the random effect model is biased and then the fixed effects estimator has to be used (Wooldridge, 2010). The fixed effects estimator controls for unobserved heterogeneity. The null hypotheses of the Hausman test is that there is no systematic difference in the coefficients. Hence, if the the null hypothesis is rejected the fixed effects estimator needs to be used.

Furthermore multiple additional analysis are conducted, first a test whether time-fixed effects are needed if a fixed effects model is used. This is a joint test to see if year effects are present, the null hypotheses states that the coefficients for all years are jointly equal to zero. If the test statistic fails to reject the null then no time effects are needed. Second, for the fixed effects LPM, a modified Wald test for groupwise heteroskedasticity is performed, the null hypothesis states that there is homoskedasticity (or constant variance), if the null is rejected we use heteroskedasticity-robust standard errors (i.e. Huber/White estimators). Furthermore we conducted a test derived by Wooldridge (2010) for autocorrelation in panel data models. If the test statistic significantly rejects the null hypothesis, there is presence of serial correlation in the idiosyncratic error term, clustering at the panel level will then produce consistent estimates of the standard errors.

5.3.2 Index models for binary response: probit and logit

In order to evaluate hypotheses 1,3 and 5 and address the shortcomings of the LPM, the logit and probit model for binary response variables were used. First, the properties of the fixed effects logit model are discussed, then the random effects logit and probit model will be discussed. Note, that the fixed effects probit model was not used, this due to its complexity.

Index models can only obtain probabilities in the response probability and thus addresses one of the main shortcomings of the LPM model. Another property of the logit and probit models is that the partial effects of changes in the independent variables are not constant. Both models use the same data generating process:

$$y^*_{i,t} = \alpha_i + x^\intercal_{i,t}\beta + \epsilon_{i,t}, \qquad y_{i,t} = \begin{cases} 1 & \text{if } y^*_{i,t} > 0 \\ 0 & \text{otherwise} \end{cases}$$

The assumptions between the random and fixed effects estimators differ. The fixed effects logit model treats the α_i term as a fixed unknown parameter, and to be efficient the following assumptions must hold:

1. $\epsilon_{i,t} \sim \text{logistic}/\Lambda(z)$
2. $\epsilon_{i,t}$ is independent of $x_{i,1}, ..., x_{i,T}$ and $\epsilon_{i,t}$ independent of $\epsilon_{i,s}$ for all $t \neq s$
3. no assumptions on α_i.

The fixed effects approach considers the distribution of $y_{i,t}$ given α_i, where α_i can be estimated. So, $\mathbb{E}(y_{i,t}|x_{i,t}, \alpha_i) = \alpha_i + x^\intercal_{i,t}\beta$.

The random effects probit or logit model assume that the α_i term is a random parameter drawn from a distribution with mean 0 and variance σ^2_α. This α_i term is to be assumed to be independent of the covariates and the error term $\epsilon_{i,t}$. The probit and logit models for random effects have the following assumptions:

1. $\epsilon_{i,t} \sim \text{logistic}/\Lambda(z)$ (logit) or $\epsilon_{i,t} \sim N(0,1)$ (probit)
2. $\epsilon_{i,t}$ is independent of $x_{i,1}, ..., x_{i,T}$ and $\epsilon_{i,t}$ independent of $\epsilon_{i,s}$ for all $t \neq s$
3. α_i independent of $x_{i,1}, ..., x_{i,T}$ and $\epsilon_{i,1}, ..., \epsilon_{i,T}$
4. $\alpha_i \sim N(0, \sigma^2_\alpha)$

The random effects estimators have no assumptions on α_i. This approach compared to the fixed effects estimator is not conditional on the α_i term, hence $\mathbb{E}(y_{i,t}|x_{i,t}) = x^\intercal_{i,t}\beta$.
The marginal effects of the random effects probit model are estimated by:

$$\phi(x'_{i,t}\beta + \alpha_i) * \beta_k$$

Furthermore for the average observation we have that:

$$\Phi(x'_{i,t}\beta + \alpha_i) = \bar{y} \leftrightarrow x'_{i,t}\beta + \alpha_i = \Phi^{-1}(\bar{y})$$

Hence from this we conclude that the average marginal effects are estimated by:

$$\phi(\Phi^{-1}(\bar{y})) * \beta_k$$

The marginal effects of the logit model with explanatory variable x_{it} is given by:

$$\frac{\delta}{\delta x_{it}} P(y_{i,t} = 1|x_{i,t}, \alpha_i)$$

$$= P(y_{i,t} = 1|x_{i,t}, \alpha_i) * [1 - P(y_{i,t} = 1|x_{i,t}, \alpha_i)] * \beta_k$$

Model selection: index models for binary response: probit and logit

First, a test was conducted to find out whether the cross-sectional probit or logit models, to measure the parameters of interest, are preferred rather than a panel model. If there are no unobserved individual effects, the cross-sectional model is most appropriate. Logit and probit models for random effects were used to test whether the panel-level variance is present. ρ is the relative amount of the total variance granted by the panel-level variance component, when ρ is zero the panel-level variance component is unimportant. Then there is no difference between the the panel estimator and the pooled estimator. A likelihood-ratio test formally compares the pooled estimator with the panel estimator. If the test statistic significantly rejects the null hypothesis, a panel estimator instead of the cross-sectional estimator was used.

We compared the probit and logit random effects models using the log-likelihood, the model with the highest log likelihood is more appropriate. Furthermore the logit fixed effects model is used. As stated in Allison (2009) a fixed effects estimator controls for the effects of time-invariant variables with time-invariant effects. However, in the fixed effects estimator the effects of the time-invariant variables that are measured cannot be estimated. To test whether the fixed effects logit model is more appropriate than the random effects logit model we used a Hausman test. If the test statistic significantly rejects the null hypothesis it is concluded that the fixed effects model is more appropriate than the random effects estimator.

5.3.3 Poisson models for count data

In order to test hypothesis 2, that pension communication will lead to an increase in pension literacy, the fixed and random effects model were used. However, the measure of pension literacy can only obtain non-negative integer values and these values arise from counting the number of correct questions. Therefore, the Poisson count data model was used in addition to the fixed and random effects model.

In the Poisson count data model, $y_{i,t}$ can take non-negative integer values $y_{i,t} \in \{0, 1, 2, 3, ...\}$. We estimate the count data using a Poisson distribution both for a fixed

effects and a random effects model. The distribution has the following properties:

$$Y \sim Poisson(\lambda), \quad \lambda > 0$$
$$\mathbb{E}(Y) = Var(Y) = \lambda > 0$$
$$\mathbb{P}(Y = k) = \frac{\lambda^k}{k!} e^{-\lambda}.$$

The properties of the distribution are conditioned on covariates $x_{i,t}$ and individual effect α_i:

$$Y_{i,t}|x_{i,t}, \alpha_i \sim Poisson(e^{\alpha_i + x_{i,t}^{\intercal}\beta}).$$

In the Poisson model for count data we have that $y_{i,1}, y_{i,2}, ..., y_{i,T}|x_{i,1}, x_{i,2}, ..., x_{i,T}, \alpha_i$ are independent of each other. The differences between the random effects and fixed effects model are the following:

- FE: $y_{i,1}, ..., y_{i,T}|x_{i,1}, ..., x_{i,T}$ are independent of each other.
- RE: same as FE, plus α_i independent of $x_{i,1}, ..., x_{i,T}$, $\epsilon_{i,1}, ..., \epsilon_{i,T}$ and $\alpha_i \sim N(0, \sigma_\alpha^2)$ (or $e^{\alpha_i} \sim Gamma(\phi, \phi)$).

There are no assumptions on the error term $\epsilon_{i,t}$ in the model. Note that the estimates obtained in the Poisson model can be interpreted as marginal effects.

Model selection: Poisson model for count data

The likelihood-ratio test was used to test whether the null hypothesis that the individual effects are equal to zero holds, and hence compares the panel estimator with the pooled (Poisson) estimator. Furthermore, a Hausman test was conducted to see whether the random effects estimator or the fixed effects estimator had to be used.

5.3.4 Ordered response models: ordered logit and ordered probit

Hypotheses 4 and 6 measure the effect of pension communication on the feeling of being informed, and the relationship between pension literacy and the feeling of being informed. Because the feeling of being informed has more than two categories, and it has a sequential order, ordered response models were used. In this section the random effects logit and probit model for ordered response are presented. The fixed effects ordered logit model estimators are obtained by using the Das and Van Soest (1999) two-step estimator, for the algebraic explanation of this model we refer to Das and Van Soest (1999). The ordered probit model for fixed effects was not used due to its complexity.

The random effects ordered-response probit and logit model for panel data use the following data generating process:

$$y_{i,t}^* = x_{i,t}^T \beta + \alpha_i + \epsilon_{i,t}$$
$$y_{i,t} = j \text{ if } y_i^* \in (m_{j-1}; m_j), \quad j = 0, ..., J \quad \text{if} \quad m_{j-1} = -\infty, m_j = \infty$$

Where m represents multiple thresholds, and j are the possible responses ($j = 0, ..., J$).

For the ordered logit and ordered probit models for random effects the following assumptions must hold:

1. $\epsilon_{i,t} \sim$ logistic/$\Lambda(z)$ (logit) or $\epsilon_{i,t} \sim N(0,1)$ (probit)
2. $\epsilon_{i,t}$ independent of $x_{i,1}, ..., x_{i,T}$ and $\epsilon_{i,t}$ independent of $\epsilon_{i,s}$ for all $t \neq s$
3. α_i independent of $x_{i,1}, ..., x_{i,T}$ and $\epsilon_{i,1}, ..., \epsilon_{i,T}$
4. $\alpha_i \sim N(0, \sigma_\alpha^2)$

Note that the marginal effects for the ordered logit and ordered probit model can be calculated in a similar way as the marginal effects of the binary response probit and logit models.

Model selection: Ordered response models: ordered logit and ordered probit

A likelihood-ratio test was conducted to find out whether it is favorable to use the random-effects ordered logistic/probit regression over a cross-sectional ordered logistic/probit regression. If we reject the null hypothesis of the likelihood ratio test, the panel random effects estimator is more appropriate than the cross-sectional estimator.

The fixed effects model controls for time-invariant variables. Hence, the fixed effects ordered logit model was used. One approach to estimate the fixed effects logit model with every possible cutoff point is the Das and Van Soest (1999) two-step estimator. We used this estimator to estimate the variables of the fixed effects ordered logit model. Then the Hausman test was conducted to evaluate whether the fixed effects model is more appropriate than the random effects model.

6 Descriptives

This chapter will provide some descriptives of the sample and address socio-economic heterogeneity in the mediating variables, pension literacy and the feeling of being informed. First, in section 6.1 descriptive characteristics of the study sample and a possible attrition bias were addressed. Then the distribution of responses of the question of active decision behavior are discussed. Next, we discuss socio-economic heterogeneity in the mediating variables, pension literacy and the feeling of being informed. Then in section 6.5 we will discuss some descriptive evidence for our hypotheses.

6.1 Descriptive characteristics of study sample

Table 1 shows the descriptive statistics of our sample. All individuals who have been observed at least twice from 2004 till 2016 were included. The sample size is 9830 observations, which consist of 2691 individuals observed at an average amount of 3.7 times. The average age in the sample is 47 years and 42% is female. The average household size is equal to 2.68, and 71% of the individual observations in the sample are breadwinner. The highest level of education achieved is for around 2% of the sample primary education, 22% has completed lower secondary education, 11% has completed pre-university education, 30% completed higher vocational education and 13% has completed university education. The descriptives show that around 53% of the observed have active pension behavior. The average pension literacy is equal to 1.63. Around 79% of the sample has received a Dutch pension statement during the years. For our dependent variables, the within-variation seems to be sufficiently strong to justify making using of the panel structure from our data.

As we exploit the panel structure from our data, we test for a possible learning effect. Members who repeatedly answer surveys may learn and become familiar with then answering process, learn how to interpret questions and make fewer mistakes than new respondents (Toepoel et al., 2008). This is important because in the dataset the attrition rate over the years is high, 40% in our sample. The sample was split in a panel and a fresh sample, i.e. people who are both in the 2005 and 2010 survey are the panel members, and the fresh members are those who took part in the 2010 sample and not in the 2005 sample. Then we investigated whether in 2010 the panel group and the fresh group have, on average, no significant differences in active-retirement decision making, pension literacy, and the feeling of being informed. We performed a χ^2 test and find that the null hypothesis for active pension behavior cannot be rejected $\chi^2(1) = 0.086(p < .766)$, Similar results are found for pension literacy and the feeling of being informed $\chi^2(3) = 0.920(p < .821)$ and $\chi^2(4) = 5.635(p < .228)$, respectively. Hence, we can exploit the panel structure of our dataset with some confidence.

Appendix A.1 shows the correlation table of the variables. In the table no high correlation between variables can be found, Pallant (2013) stated that, when there is no correlation between the variables that is above 0.7 no multicollinearity problem exist and all variables can be retained.

Table 1: Summary statistics

Variable	Obs	Mean	Std. Dev.	Std. Dev. within	Min	Max
DecMak	9,830	.531	.499	.330	0	1
PenLit	9,830	1.634	1.020	.517	0	3
Feel_informed	9,830	3.079	1.061	.608	0	5
Received_UPO	9,830	.787	.4095	.298	0	1
Female	9,830	.417	.493	0	0	1
Age	9,830	47.191	11.163	2.330	16	65
Main wage earner	9,830	.709	.454	.144	0	1
Primary_educ	9,830	.022	.148	.042	0	1
Lower_sec_educ	9,830	.217	.413	.077	0	1
Pre_univ_educ	9,830	.107	.309	.064	0	1
Higher_voc_educ	9,830	.295	.456	.083	0	1
University_educ	9,830	.131	.337	.038	0	1
Household size	9,830	2.682	1.325	.369	1	9
Own_house	9,830	.787	.410	.132	0	1
Married	9,830	.650	.477	.145	0	1

6.2 Heterogeneity of active pension behavior

The average active pension behavior by years is displayed in figure 5. The figure shows that on average half of the Dutch individuals shows active pension behavior, ranging from 0.48 till 0.58. An increase in active behavior can be seen starting in 2007 till 2011. The figure shows a drop in active pension behavior in 2013, which might be explained by the cut in occupational pension plans in April 2013, one out of six occupational pension plan providers had to cut pension benefits in 2013 (AFM, 2012b).

In figure 5 the distribution of specific answers of the variable active pension behavior is displayed. The figure shows that after the introduction of the 'Pw' in 2007 a drop occurred in the percentage of individuals who answered the question with: 'don't know'. An increase is found for individuals who answered the question with: 'No, I think I can make ends meet fairly easily'. However, a drop has also occurred in the average number of respondents who answered with: 'yes, I will put more money aside'. These findings are comforting, as it suggests that the mandatory pension communication might have been effective. Nevertheless, still around 10% of the individuals answers the question with: 'don't know'. The figure shows that around 25% in 2010 of the Dutch citizens would save

additionally if benefits are cut. Around 35% in 2010 stated that they will see what they would do when benefits are cut.

A drop in average active behavior in 2013 is shown, this drop can be explained by the following specific answers: an increase in the answer: 'no, I'll see what I'll do when it happens', and, a decrease in: 'no, I think I can make ends meet fairly easily'. For the sake of completeness we have added the distribution of answers to the questions across demographics in appendix A.3 in table 12.

Figure 4: Average percentage of individuals who show active pension behavior by years

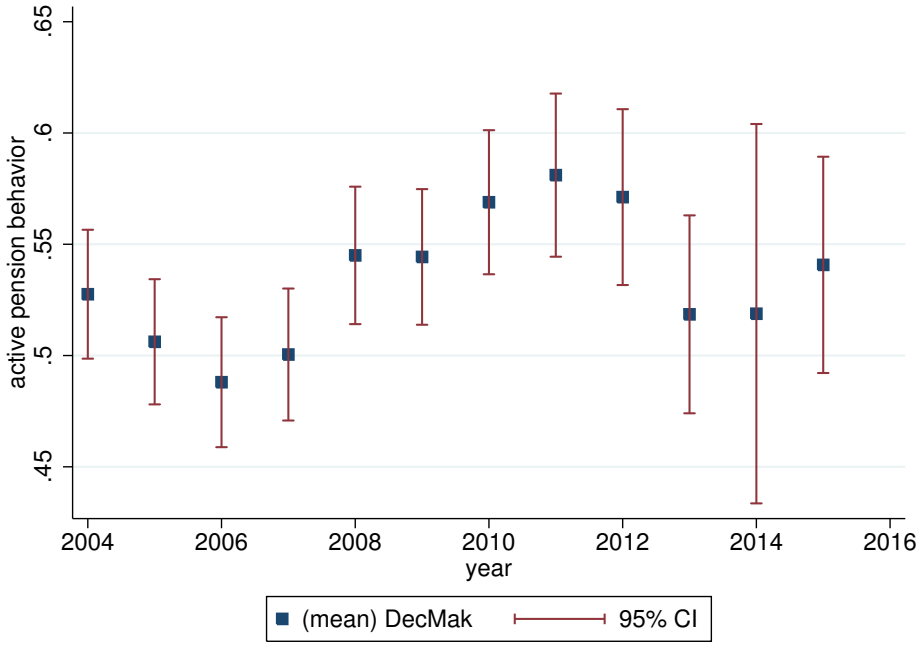
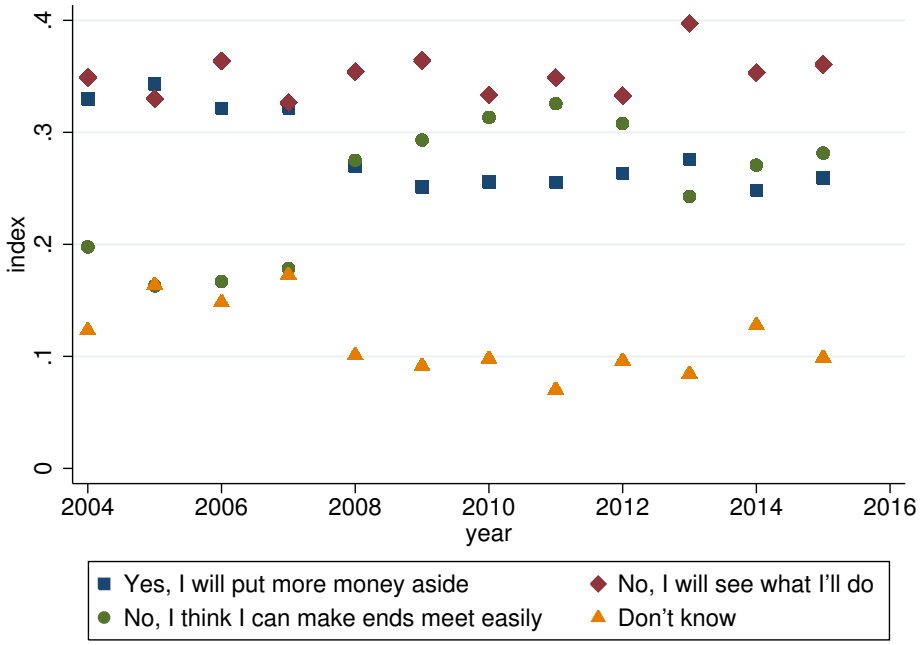


Figure 5: Distribution of responses of specific answers on active pension behavior by years



6.3 Heterogeneity of pension literacy

Pension literacy shows a statistically significant increase from 2005 to 2010, this is shown in figure 6. The average number of correct answers to specific pension literacy questions can be found in figure 7. Note that these numbers cannot be verified as we do not have access to administrative databases of individual pension plans, so these numbers are probably an upper bound of the knowledge of the members. Both figures show a drop in the average number of correct answered questions in 2011, this might be the result of the public anxiety that was aroused by the news in August 2010 that a number of Dutch pension schemes were planning to reduce the accrued rights and entitlements which their members had built up in their occupational pension schemes (van der Meij, 2011). Furthermore, in this period, a growth in DC pension plans had occurred which might also be a reason that individuals were not familiar with their employers contribution levels and pension plan (van Ewijk et al., 2017).

Figure 6: Average number of correct answers to pension literacy questions by years

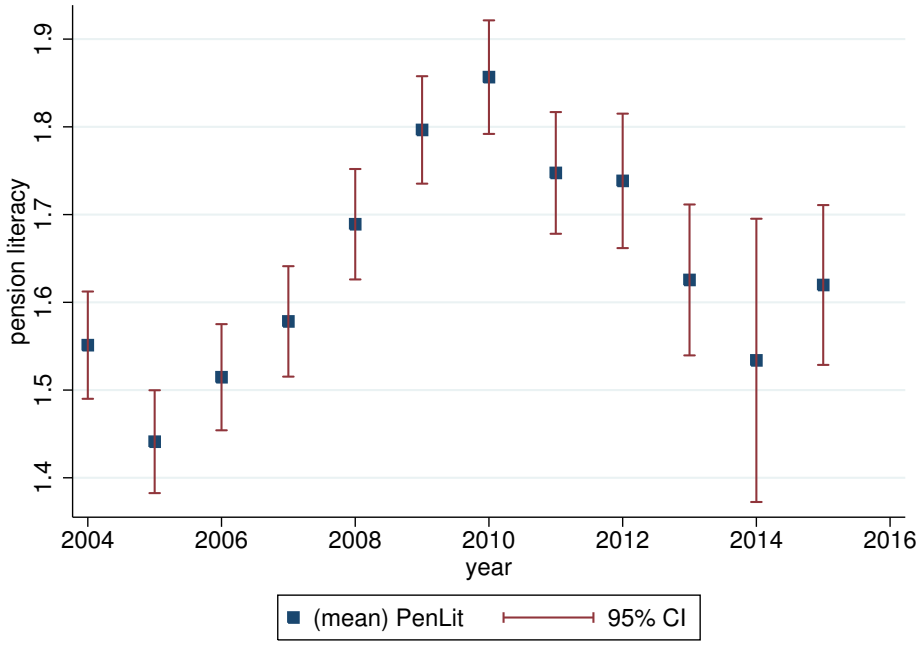
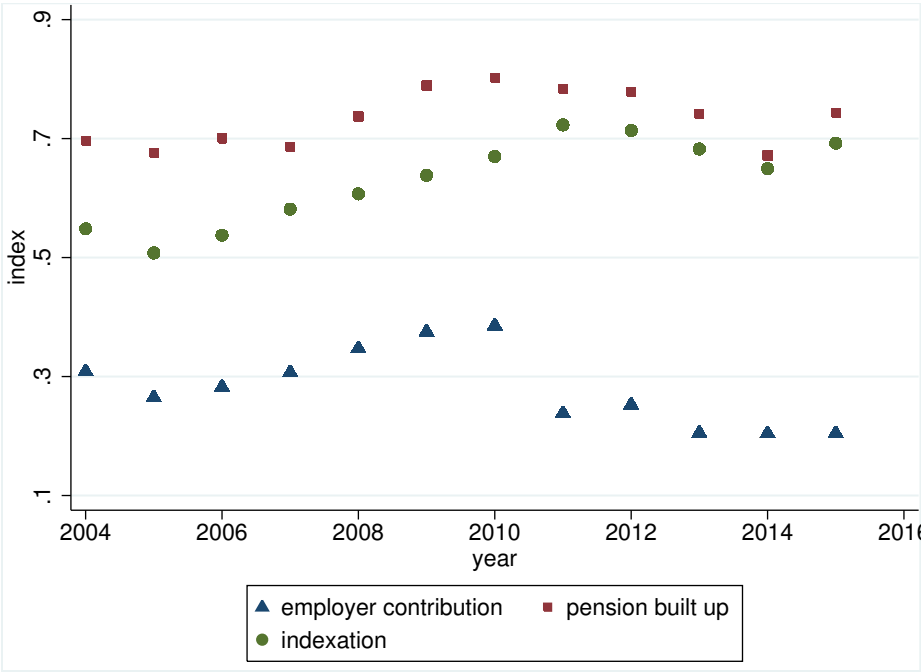


Figure 7: Average number of correct answers to specific pension literacy questions by years



Individual answers to all three pension literacy questions reveal limited overall knowledge of the pension system. On average 1.64 questions were answered correctly in all waves. In 2005 the average number of question answered correctly was equal to 1.45(0.030). In 2010, the number of correct answers is equal to 1.86(0.033) and in 2015, 1.64(0.049) ques-

tions were on average answered correctly.

Figure 7 shows the distribution of average responses for the specific questions. The means are statistically different in each wave. The figure shows that in 2005 around two third of the individuals answered the first question correctly; this amount increased to almost 80% in 2010. This increase might be a result of the new legislation as of 2008 (Pw), because the pension statement might inform people about their pension plan. However, the percentage of members who answered the first question correctly significantly decreased from 80% to 74% from 2010 to 2015.

Members seem to be less knowledgeable about their indexation level, with 50.8% claiming to know their indexation level in 2005. This number has increased to 67% in 2010 and increased further to 69.2% in 2015.

Most of the members do not know the contribution levels provided by their employers. In 2005 only 26.5 percent claims to know the contribution paid by their employer. This number increased to 38.5% in 2010, and then decreased to 20.4% of the members claiming to know the part of the pension contribution paid by the employer in 2015.

We find that the overall knowledge of personal pension finance is very limited. This is worrying since some logic of the system is becoming more and more based on the market disciplining virtues of informed and rational choices (Landerretche and Martínez, 2013).

We found some heterogeneity in pension literacy across different types of pension plan members. In Table 14 in appendix A.3 it is shown that in 2010 members who are working for an employer score higher on the first two questions and lower on the third question. This might make sense because employers deposit their employees' contribution with their pension funds, so most members who are not self-employed do not necessarily have to know their contribution levels. However, this value is important to assess the adequacy of the contributions paid by the employer to meet the benefits needed at retirement. Furthermore, in table 15 is is shown that women have lower scores than men for every question of the pension system. This is in line with other studies on financial literacy in the Netherlands (e.g. Alessie et al. (2011a)). Table 16 shows that the average percentage of correct answers on the first two questions is increasing with age. This demographic result is notable because in previous financial literacy studies we typically see a hump-shaped age profile for financial literacy (Agarwal et al., 2009). To strengthen this finding we have added a scatter plot of the average pension literacy and age in appendix A.2. The demographic results w.r.t. the number of correct answers on pension literacy questions can be found below in table 2.

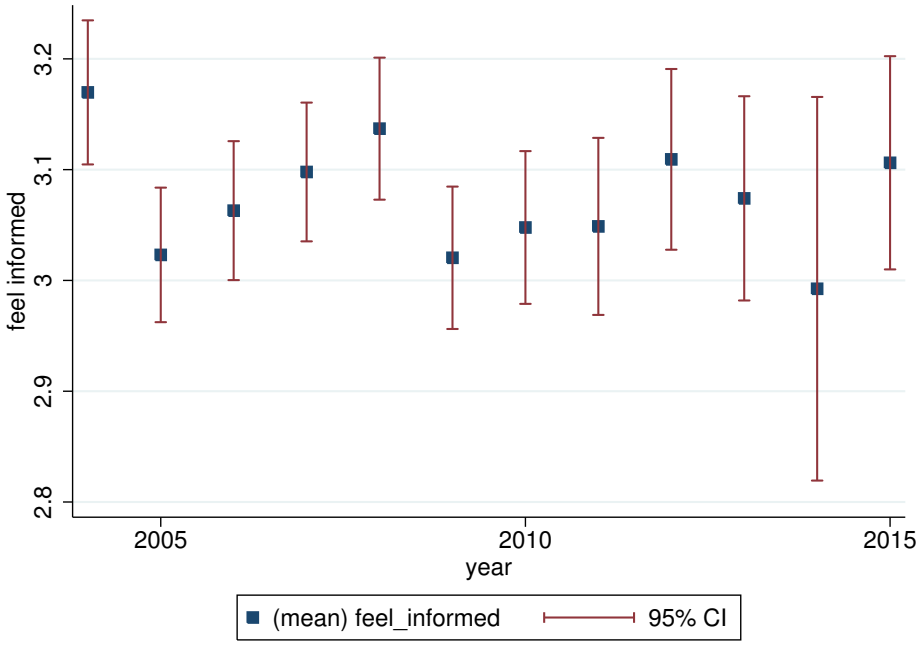
Table 2: Distribution of pension literacy across demographics, 2010 wave

Pension Literacy	0	1	2	3
Age				
≤35	19.23	24.62	34.62	21.54
36 to 50	17.80	19.74	37.54	24.92
51 to 65	7.81	16.05	40.35	35.79
Gender				
Male	10.11	14.52	38.60	36.76
Female	17.13	24.72	38.48	19.66
Education				
Primary_educ (very few obs)	26.67	26.67	26.67	20.00
Low_sec_educ	11.63	20.93	33.95	33.49
Pre_univ_educ	11.24	16.85	40.45	31.46
Higher_voc_educ	11.94	20.15	39.93	27.99
Univ_educ	9.02	11.28	39.85	39.85
Self employed				
Yes	32.26	3.23	25.81	38.71
No	12.20	19.10	39.01	29.69

6.4 Heterogeneity of the feeling of being informed

In figure 8 the average feeling of being informed for each year is plotted. Dutch individuals feel, on average, moderately informed throughout the years where the values range from 3.0 to 3.2. A sharp drop in the feeling of being informed during the 2008/09 recession is shown, a factor that can explain this finding, is that expectations (on the pension benefit) are largely based on the current situation and reported news (Wu et al., 2002). In appendix A.3 in table 17 a decrease in the number of people who feel not well informed (1 and 2) throughout the years is shown. This result is promising as it might suggest that pension communication might contribute to the level of feeling informed of individuals. However, in comparison to pension literacy, the Pearson χ^2 statistic suggests that the observed differences throughout the years for the feeling of being informed are not significant.

Figure 8: The average feeling of being informed by years



Next we will address some heterogeneity issues w.r.t. the feeling of being informed. In past research it has been found that men are more confident than women in financial behavior (Barber and Odean, 2001). The output found in table 3 suggests that older people feel more informed about pensions, in addition it shows that men indeed feel more informed than women, (i.e. a higher percentage of men have score 4-5) which is in line with past research (see e.g. Bucher-Koenen et al. (2017)). Furthermore the demographics found in table 3 suggest that higher educated people have a higher chance of being better informed.

Table 3: Distribution of the feeling of being informed across demographics, 2010 wave

Feeling of being Informed	1	2	3	4	5
Age					
≤35	8.46	30.00	43.85	13.85	3.85
36 to 50	7.44	24.60	48.87	13.92	5.18
51 to 65	5.21	18.87	37.96	19.96	18.00
Gender					
Male	4.78	22.98	40.44	17.46	14.34
Female	8.99	21.63	45.79	16.29	7.30
Education					
Primary_educ (very few obs)	33.33	6.67	26.67	26.67	6.67
Low_sec_educ	3.72	20.93	46.05	18.14	11.16
Pre_univ_educ	6.74	19.10	42.70	19.10	12.36
Higher_voc_educ	6.72	22.01	40.30	18.66	12.31
Univ_educ	4.51	27.82	36.84	15.79	15.04
Self employed					
Yes	12.90	19.35	32.26	22.58	12.90
No	6.21	22.55	42.92	16.80	11.51

6.5 Descriptive evidence

Our main interest is explaining how pension communication affects active decision behavior and its underlying mechanism. In this section we will provide descriptive evidence for the hypotheses presented in chapter 4. The discussed tables can be found in appendix A.3. Note that the tables are constructed with the 2010 sample, hence the content of the tables is rather suggestive.

Table 18 suggests that people who receive pension communication have in comparison to people who do not receive communication a higher chance on a active pension behavior. However, the differences in distribution are statistically not significant. the Pearson χ^2 test statistic is equal to $\chi^2(1) = 0.367(0.545)$, hence no evidence is found that strengthens our first hypothesis.

In the second hypothesis we argued that pension communication will lead to an increase in pension literacy. Table 19 shows that people who receive pension communication have more often a pension literacy index of 2 and 3 (scale: 0-3). The Pearson χ^2 test statistic is equal to $\chi^2(3) = 16.12(0.001)$, this suggests that there is a positive relationship between pension communication and pension literacy, which is in line with hypothesis 2.

Table 20 shows a monotonic increase in active decision behavior as pension literacy

increases. This relationship between pension literacy and pension decision making provides evidence in line with our third hypothesis. Furthermore, individuals with the maximum score of pension literacy tend to make more active decisions (69%) than people with lower scores, e.g. people with one correct questions only tend to make decisions (34%) of the time. We strongly reject the null that there is no relationship between pension literacy and decision making ($\chi^2(3) = 53.54(0.001)$).

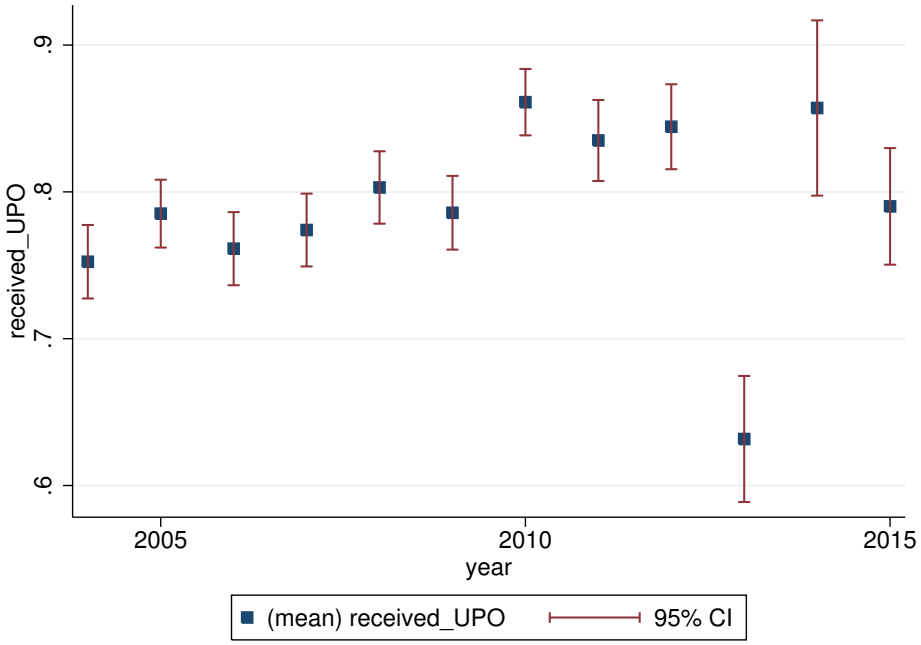
We argued that the receiving pension communication increases the members' feeling of being informed in hypothesis 4. Table 21 shows that people who received pension communication have on average a higher feeling of being informed. Around 40% of the people who did not receive pension communication does not feel well informed (score 1 and 2), This is in comparison to 26% of the people who did receive pension communication. Furthermore 30% of the people who received pension communication feel well-informed (score 4-5), this is for the people not receiving communication 18%. Furthermore the Pearson χ^2 value is equal to $\chi^2(4) = 15.79(0.003)$ which means that there is a significant correlation between the feeling of being informed and pension communication.

Hypothesis 5 states that people who feel more informed will lead to more active decision behavior. This is in line with the descriptives found in table 22. The Pearson χ^2 test statistic equal to: $\chi^2(3)(p-value) = 38.28(0.000)$, hence there is a statistically significant association between the feeling of being informed and active decision behavior. We find that people who feel very well-informed (score 5) show active pension behavior 74% of the time. People who feel not-well informed (score 1) have active pension behavior 38% of the time.

Finally, in hypothesis 6 we argued that pension literacy is positively related with the feeling of being informed. The results shown in table 23 suggest that people with higher pension literacy levels feel on average more informed. The χ^2 test statistic shows that the observed differences are significantly different.

Figure 9 shows a slow but steady increase in the percentage of individuals who received a Dutch pension statement. However, in 2013 we see a large drop, we have no intuition why this drop has occurred. To conclude, the descriptives show an increase in active pension behavior by pension communication through the mediating variables. No evidence is found for a direct effect of pension communication on pension related decision making.

Figure 9: Percentage of people who received a dutch pension statement by years



7 Results

In this chapter the models described in section 5.3 will be used to formally test our hypotheses. To increase the readability part of the output is presented in appendix A.4.

7.1 The effect of communication on active pension behavior

In this section, we discuss the results w.r.t. the first hypothesis. The output is displayed in table 4. First we will discuss the model selection, next the obtained estimates are discussed.

For the LPM, the Breusch and Pagan (1980) Lagrange multiplier test for random effects was conducted. The test statistic rejected the null hypothesis at every reasonable significance level. Hence the random effects LPM is more applicable than simple pooled OLS. Then the Hausman test was used to test whether a fixed effects LPM is more appropriate than the random effects LPM. The test showed that the fixed effects LPM model is most appropriate. Additional analysis were done for the LPM (FE) model. First a test whether time fixed effects were needed was conducted, which resulted in the conclusion that no year effects had to be included. Furthermore, heteroskedasticity-robust (Huber/White) standard errors were used.

The logit and probit models were used next to the LPM, The output is presented in column 3 4 and 5. ρ is equal to around 0.5, thus intuitively we can assume that using the panel data variant of the logit and probit models are more appropriate than the cross-sectional models. This finding was formally tested, concluding that the panel data models are more appropriate. According to the log-likelihood the logit random effects model is more appropriate than the probit random effects model. Furthermore the Hausman test showed that the fixed effects logit model is most appropriate.

The first two columns of table 4 show the output obtained by using the LPM. The fixed effects estimates found in column 2 show that the coefficient of pension communication is equal to 0.015. This means that a one unit change in receiving pension communication changes the probability of showing active pension behavior by 0.015, ceteris paribus. However, this result is statistically not significant. In addition, we found that buying a house negatively affects active decision behavior. The output from the random effects LPM (column 1) is used to address heterogeneity, we found that active decision making is positively associated with age, owning a house, and education level. Furthermore, it is found that women are less active decision makers than men and that active decision behavior decreases with the number of members in a household.

The results of the logit fixed effects model are displayed in column 4 of table 4. The odds ratio and the marginal effects of the fixed effects logit model are presented in table 5. The odds ratio of pension communication is equal to 1.11. This means that, if a member

changes from not receiving pension communication to receiving pension communication, the odds of claiming to make an active pension-related decision are multiplied by 1.11, however this number is statistically not different from 1. The marginal effect of receiving pension communication is equal to 0.024. The only statistically significant estimate in this model is owning a house. The odds ratio of owning a house is equal to 0.66, this means that if someone goes from a renting house to owning a house the odds of having active pension behavior are multiplied with 0.66. The marginal effect is equal to -0.094, which means that if someone buys a house the average probability of making a pension decision goes down by 9.4% points. Interestingly, this effect has the opposite direction of the effect found using the random effects estimator. A possible explanation of this effect is found by GfK (2016) they showed that individuals change to a more affordable renting apartment and use the means obtained by selling their house in addition to their pension. We used the estimates of the random effects logit model to address heterogeneity in pension decision making. The results are similar to those obtained by using the LPM random effects model.

It was expected that receiving pension communication would result in an increase in pension related decision making. However, if we would use the most appropriate models (i.e. the fixed effect LPM and the logit fixed effects model) no statistical significant evidence is found that supports the first hypothesis. Note that the estimates obtained while controlling for pension literacy and pension confidence are similar, the output is presented in table 24 in appendix A.4.

Table 4: Output for testing the effect of communication on active pension behavior

Dep. variable: Pension decision making	(1) LPM(RE) β / SE	(2) LPM(FE) β / SE	(3) Logit(RE) β / SE	(4) Logit(FE) β / SE	(5) Probit(RE) β / SE
Received_UPO	0.021*	0.015	0.136*	0.103	0.080*
	(0.011)	(0.013)	(0.077)	(0.088)	(0.045)
Female	−0.033*		−0.221*		−0.127*
	(0.017)		(0.116)		(0.067)
Age	0.005***	0.001	0.030***	0.004	0.018***
	(0.001)	(0.002)	(0.004)	(0.012)	(0.003)
Main wage earner	−0.002	−0.043	−0.024	−0.288	−0.013
	(0.017)	(0.028)	(0.113)	(0.184)	(0.066)
Self-employed	−0.000	−0.023	−0.010	−0.143	−0.008
	(0.028)	(0.038)	(0.188)	(0.247)	(0.110)
# household members	−0.032***	−0.005	−0.212***	−0.036	−0.124***
	(0.006)	(0.011)	(0.040)	(0.072)	(0.023)
Own house	0.061***	−0.066**	0.387***	−0.407**	0.230***
	(0.017)	(0.031)	(0.110)	(0.197)	(0.064)
Married	0.008	0.026	0.049	0.171	0.025
	(0.017)	(0.028)	(0.110)	(0.185)	(0.064)
Education dummies (base: university education)					
Primary	−0.281***	−0.099	−1.895***	−0.440	−1.106***
	(0.044)	(0.140)	(0.302)	(1.154)	(0.176)
Lower secondary	−0.199***	−0.146	−1.353***	−1.020	−0.787***
	(0.023)	(0.115)	(0.159)	(0.843)	(0.092)
Pre-university	−0.164***	−0.168	−1.115***	−1.089	−0.651***
	(0.029)	(0.115)	(0.197)	(0.779)	(0.115)
Higher vocational	−0.095***	−0.124	−0.671***	−0.919	−0.390***
	(0.024)	(0.103)	(0.164)	(0.779)	(0.095)
Constant	0.479***	0.697***	−0.099		−0.071
	(0.045)	(0.135)	(0.300)		(0.175)
Observations	9830	9830	9830	5495	9830
σ_u	0.294	0.421	1.874		1.096
σ_e	0.385	0.385			
ρ	0.368	0.544	0.516		0.546
log-likelihood			-5685	-2171	-5686

* p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses.

Table 5: The coefficient, odds ratio, and marginal effect of the fixed effects logit model

	(1) Coefficients	(2) Odds Ratio	(3) Marginal Effects
Received_UPO	0.102	1.108	0.024
	(0.088)	(0.098)	(0.022)

* p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses.

7.2 The effect of pension literacy and feeling informed on active pension behavior

In this section we will discuss the obtained results to evaluate hypothesis 3 and 5. We stated that we expect a positive effect for pension literacy and the feeling of being informed on active pension behavior. The estimates obtained testing this relationship can be found in table 7.

For the LPM the Breusch and Pagan (1980) Lagrangian multiplier test was conducted, the test showed that the random effects model is more applicable than pooled OLS. The Hausman test showed that a fixed effects estimator is more appropriate than the random effects estimator. A joint test to see if there is presence of year effects showed that no time fixed effects were needed. Heteroskedasticity-robust standard errors were used.

The value of ρ in the logit and probit models for panel data suggest that the pooled logit and probit model are less suitable than the panel variants. This finding is formally tested using the log-likelihood test and it is concluded that the random effect models are more appropriate than the pooled logit/probit model. The random effect probit and logit models are compared, the probit model has the highest log-likelihood hence we can conclude that the random effects probit model is more relevant. However, the random effects probit model might have omitted variables which are correlated with the variables in our model. Therefore we conduct a Hausman test to see whether a fixed effects model is more suited for the analysis. We conducted the Hausman test to see whether the logit fixed effects model is more suitable then the logit model for random effects. The fixed effects logit model is preferred at any reasonable significance level.

The output of the LPM for fixed effects is presented in the second column of table 7. The coefficient of pension literacy is equal to 0.031, which means that if the pension literacy index increases by one unit the average probability of making an active pension-related decision increases by 3.1%. This positive effect between pension literacy and active pension decision behavior is strongly significant. Additionally the coefficient of the feeling of being informed is highly significant as well and equal to 0.030, which can be interpreted similarly as the coefficient of pension literacy.

The output obtained by using the fixed effects logit model is shown in column 4. The coefficients of the estimates, together with the odds ratios and marginal effects are displayed in table 6. The coefficient of pension literacy is equal to 0.205 and is statistically significant. We calculated the marginal effects for the interpretation of the logit fixed effects model and find that the marginal effect of pension literacy is equal to 0.047, this means that for an average observation an additional correct answer for pension literacy increases the probability of active pension behavior by 4.7% points, ceteris paribus. The marginal effect of the feeling of being informed is equal to 0.045, which shows an effect of similar size. Furthermore the odds ratio for pension literacy and the feeling of being

informed is equal to 1.23 and 1.22, respectively. The latter result means that an increase of one in the feeling of being informed, corresponds to multiplying the odds of making an active pension-related decision with 1.22. The probit random effects model (column 5 in table 7) is shown because we might be interested in the effect of variables whose values do not change over time.

The results show that both pension literacy and the feeling of being informed are significantly positively related with active pension behavior. Therefore we can support hypotheses 3 and 5.

Table 6: The coefficient, odds ratio, and marginal effect of the fixed effects logit model

	(1) Coefficients	(2) Odds Ratio	(3) Marginal Effects
PenLit	0.205***	1.228***	0.047***
	(0.051)	(0.062)	(0.016)
Feel-informed	0.198***	1.219***	0.045***
	(0.044)	(0.053)	(0.014)

* p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses.

Table 7: Output for testing the effect of pension literacy on active pension behavior

Dep. variable: Pension decision making	(1) LPM(RE) β / SE	(2) LPM(FE) β / SE	(3) Logit(RE) β / SE	(4) Logit(FE) β / SE	(5) Probit(RE) β / SE
Pension Literacy	0.066***	0.031***	0.433***	0.205***	0.253***
	(0.006)	(0.008)	(0.039)	(0.051)	(0.023)
Feel-informed	0.037***	0.030***	0.250***	0.198***	0.145***
	(0.005)	(0.006)	(0.034)	(0.044)	(0.020)
Female	−0.003		−0.019		−0.009
	(0.017)		(0.113)		(0.066)
Age	0.003***	0.000	0.017***	0.003	0.010***
	(0.001)	(0.002)	(0.004)	(0.012)	(0.003)
Main wage earner	−0.009	−0.043	−0.070	−0.285	−0.038
	(0.017)	(0.028)	(0.111)	(0.184)	(0.065)
Self-employed	0.002	−0.023	0.010	−0.140	0.003
	(0.028)	(0.038)	(0.185)	(0.249)	(0.108)
# household members	−0.032***	−0.006	−0.208***	−0.044	−0.120***
	(0.006)	(0.011)	(0.039)	(0.072)	(0.023)
Own house	0.039**	−0.072**	0.248**	−0.425**	0.148**
	(0.016)	(0.031)	(0.108)	(0.198)	(0.063)
Married	0.000	0.026	−0.003	0.180	−0.005
	(0.016)	(0.028)	(0.108)	(0.186)	(0.063)
Education dummies (base: university education)					
Primary	−0.229***	−0.101	−1.544***	−0.478	−0.897***
	(0.043)	(0.140)	(0.295)	(1.176)	(0.172)
Lower secondary	−0.169***	−0.137	−1.152***	−0.943	−0.670***
	(0.023)	(0.115)	(0.154)	(0.858)	(0.089)
Pre-university	−0.156***	−0.162	−1.060***	−1.060	−0.619***
	(0.028)	(0.114)	(0.190)	(0.792)	(0.111)
higher vocational	−0.087***	−0.120	−0.617***	−0.867	−0.358***
	(0.023)	(0.103)	(0.158)	(0.796)	(0.092)
Constant	0.360***	0.569***	−0.888***		−0.531***
	(0.045)	(0.137)	(0.299)		(0.174)
Observations	9830	9830	9830	5495	9830
σ_u	0.277	0.409	1.762		1.031
σ_e	0.384	0.384			
ρ	0.343	0.532	0.485		0.515
log-likelihood			-5585	-2151	-5584

* p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses.

7.3 The effect of communication on pension literacy

Hypothesis 2 is discussed in this section, it states that pension communication is will lead to an increase in pension literacy. To increase the readability, the model selection is not discussed and the output is presented in appendix A.4 table 25.

The fixed effects linear model with heteroskedastic-robust standard errors and no time fixed effects is preferable over pooled OLS, and the random effects model. The output

is presented in column 2. Pension communication is highly significant and equal to 0.12. This means that if people change from not receiving pension communication to receiving pension communication they have on average 0.12 higher pension literacy. It is found that age has a significant impact on pension literacy, older people have on average higher pension literacy. Furthermore, there is a positive significant relationship between buying a house and pension literacy.

In addition to the fixed effects model we used the Poisson count data model for fixed effects (column 4). Findings are similar, the coefficient of communication is statistically significant and equal to 0.078. This means that an average individual who changes from not receiving pension communication to pension communication will lead to an increases of pension literacy, ceteris paribus. The coefficient can be interpreted as marginal effects, hence keeping everything else constant, changing from not receiving communication to receiving communication increases for the average person pension literacy by 7.8% points. Furthermore we find that buying a house has a large positive impact on pension literacy.

As discussed we found that pension communication is positively correlated with pension literacy. Hence we can support hypothesis 2.

7.4 The effect of pension literacy and communication on the feeling of being informed

In this section we will discuss the results obtained to test hypothesis 4 and hypothesis 6. The hypotheses state that pension literacy and pension communication are both positively associated with the feeling of being informed. The output of the models can be found in appendix A.4 table 26. Again, we will only present our findings.

The linear fixed effects model with robust standard errors and no year effects turned out to be the more appropriate than pooled OLS or the random effects model. The coefficient for pension literacy and pension communication are both highly significant and equal to 0.101 and 0.087, respectively. This means that if pension literacy increases by one unit the average feeling of being informed changes by 0.101, ceteris paribus. An increase of pension communication results on average to a higher feeling of being informed. This feeling of being informed is also positively associated with pension literacy.

It follows from the log-likelihood that the ordered logit model for random effects is preferable above the ordered probit model for random effects. Furthermore we used the Das and Van Soest (1999) estimator to obtain the estimates of the fixed effects ordered logit model. using the Hausman test we find that the fixed effects ordered logit model is the more appropriate than the random effects ordered logit model.

Therefore, we will discuss the results obtained by the ordered logit model for fixed effects. The coefficients of pension communication and pension literacy are highly significant and equal to 0.351 and 0.284, respectively. The odds ratio for pension literacy is

equal to 1.328 and for pension communication to 1.42, which shows a strong impact on the feeling of being informed. The marginal effects for a change from not receiving to receiving pension communication, for an average respondent (with probability 0.42 of feeling more informed than moderately informed) is equal to $0.42 * 0.58 * 0.351 = 0.086$. Hence an increase in pension communication increases the feeling of being informed with 8.6% points for an average respondent feeling more than moderately informed. The marginal effect of pension literacy is equal to 0.07.

Pension communication increases the participants feeling of being informed. Hence, we can support hypothesis 4. Pension Literacy is positively related with the feeling of being informed about pensions which is in line with hypothesis 6.

8 Additional analyses

8.1 Granger test for reverse causality

We still cannot give a causal interpretation of the relationship of hypotheses 3 and 5. Pension literacy and the feeling of being informed might be endogenous due to reverse causality.

In a study conducted by Martinez et al. (2009) it was found that Chileans with more knowledge about the pension system, i.e. pension literacy, more actively contribute and manage their individual retirement accounts. However they did not show a causal effect of pension literacy on pension-related decision making. The causality might, at the same time run in the opposite direction. This might also be the case in our model, one might become more pension literate because the member might actively manage his/hers retirement account and then becomes more pension literate. In addition, people who claim to have active pension behavior, might by investigating their options, feel more informed.

To empirically investigate the direction of the relationship between pension literacy and pension behavior and the direction relationship between the feeling of being informed and pension behavior a panel Granger causality test was conducted. Granger (1969) developed a methodology for analyzing causality in a relationship between time series: does past information of one series contribute to the prediction of another series. In Bai et al. (2015) an adapted version of the Granger causality test is used to explain causality in panel analysis. The underlying principle of this method is that events in the future cannot predict events of the past, but previous events may affect the present, so if the variable X influences variable Y, then changes in X should precede changes in Y. The Granger causality test can be considered as a test of empirical causal structure rather than a test of causality per se (Singh and Bhattacharya, 2017).

A typical way of Granger causality testing applied to the variables used in this study, is by running bivariate regressions of the form:

$$PenLit_{i,t} = \sum \beta_j PenLit_{i,t-j} + \sum \gamma_j DecMak_{i,t-j} + \zeta Z_{i,t} + f_{1,i} + v_{i,t}$$
$$DecMak_{i,t} = \sum \alpha_j DecMak_{i,t-j} + \sum \delta_j PenLit_{i,t-j} + \eta Z_{i,t} + f_{2,i} + u_{i,t}$$

Where $i = 1, .., N$ denotes the panel and $t = 1, .., T$ denotes the time period dimension of the panel. $f_{1,i}$ and $f_{2,i}$ denote the fixed effects for each panel in the equations. These fixed effects may correlate with the included explanatory variables, hence when the fixed effects are omitted they would become part of the error term, which would lead to a bias in the estimates. The error terms $v_{i,t}$ and $u_{i,t}$ are independently distributed with zero mean. Z represents a vector of control variables similar to the ones used in the empirical analysis. According to Granger (1969) there is presence of Granger causality from $X_{i,t}$ to $Y_{i,t}$ if lagged values of X improve the prediction of Y given lagged values of Y. Applying

this to our equation pension literacy Granger causes pension decision making if not all δ_j are zero. Similarly, pension decision making Granger causes pension literacy if not all γ_j equal zero.

Several econometric problems may arise from estimating the above equations. First Pension literacy is assumed to be endogenous, but because causality might run in both directions pension literacy may be correlated with the error term. Second, the fixed effects may be correlated with the explanatory variables, the fixed effects are contained in the error term in the above equation. Third, the presence of the lagged dependent variable gives rise to autocorrelation.

To deal with the first problem we used the Arellano and Bond (1991) GMM estimator. The second problem, that the fixed effects may be correlated with the explanatory variables is dealt with in the Arellano and Bond (1991) estimator. This estimator uses first differences which results in the following:

$$\Delta PenLit_{i,t} = \sum \beta_j \Delta PenLit_{i,t-j} + \sum \gamma_j \Delta DecMak_{i,t-j} + \zeta \Delta Z_{i,t} + \Delta f_{1,i} + \Delta v_{i,t}$$

Using the first differences the fixed individual effect is removed from the equation, because it does not vary with time:

$$\Delta f_{1,i} = f_{1,i} - f_{1,i} = 0$$

The third problem, that the lagged dependent variables gives rise to autocorrelation, is solved similarly to the second as one can see easily that the first differenced lagged dependent variables are also instrumented with its past levels.

The second way to work around the endogeneity problem is using System GMM. This can be done by instrumenting the lagged dependent variable with variables that are uncorrelated with the fixed effects.

Hence, difference generalized method of moments (GMM) and System GMM dynamic panel estimators developed by Arellano and Bond (1991), Arellano and Bover (1995) and Blundell and Bond (1998) are used to account for the problems described above. The System GMM estimator is more advantageous relative to the traditional GMM estimator when the panel units are large and the time periods are moderately small. In these circumstances the lagged levels of the series are only weakly correlated with subsequent first differences, thus leading to weak instruments for the first differenced equations. Arellano and Bover (1995) demonstrate that the System GMM approach permits lagged first-differences to be used as instruments in the levels equation which corrects for any bias that would emerge using the standard GMM estimator.

We use the model and moment selection criteria (MMSC) for GMM estimation (Andrews and Lu, 2001) to choose the optimal number of lags. We calculate the MMSC Bayesian Information criteria (MMSC-BIC) as well as the MMSC Akaike information

criteria (MMSC-AIC). The model with the optimal number of lags minimizes the MMSC:

$$MMSC - BIC = J_i - log(N)(l_i - K_i)$$
$$MMSC - AIC = J_i - 2(l_i - K_i)$$

Where J_i is the Sargan test statistic used to test the validity for overidentifying restrictions evaluated under model i. The number of parameters estimated is equal to K_i, l_i is the number of moment conditions under model i and N is the sample size.

Various tests for the GMM estimators are conducted. The validity of GMM depends on the crucial assumption that the instruments are exogenous (Roodman, 2006). Hence, the Hansen test for over identifying restrictions is used to test this assumption, the null hypothesis is the following: the instruments as a group are exogenous, and hence valid. Therefore, the higher the p-value of the Hansen statistic the better the result. If the null is rejected we should strongly doubt the estimates. Second, the Arellano-Bond test for autocorrelation is conducted, the null hypothesis states that there is no presence of autocorrelation, to satisfy the Arellano-Bond model assumptions the null of no autocorrelation of order 1 has to be rejected, and the null of no autocorrelation of order 2 should not be rejected.

8.2 Results of the Granger test for reverse causality

We used the model and moment selection criteria (MMSC) for GMM estimation proposed by Andrews and Lu (2001) to identify the appropriate lag length. This resulted in using two lags for both pension literacy and pension decision making in the Granger causality test. Two lags is also preferable for the feeling of being informed and pension decision making.

Table 8 shows the results from the first Granger causality test where pension decision making is the dependent variable across various estimators. In this table column 1 and 2 show the pooled OLS and the fixed effects estimators. The pooled OLS provides a upper bound for the coefficient of active pension decision making and the fixed effects estimator provides a lower bound (Bond, 2002). Column 3 and 4 show one- and two-step Difference GMM estimators, respectively. The estimates shown in column 5 and 6 show System GMM estimates. For the one-step estimates Huber/White standard errors were used, Windmeijer-corrected standard errors were used for the two-step estimates.

Table 8: Models for testing Granger causality

Dep. variable: Pension decision making	(1) Pooled OLS β / SE	(2) Within group β / SE	(3) Diff-1 GMM β / SE	(4) Diff-2 GMM β / SE	(5) Sys-1 GMM β / SE	(6) Sys-2 GMM β / SE
L.Dec_making	0.284***	−0.151***	0.020	0.023***	0.068***	0.069***
	(0.015)	(0.019)	(0.035)	(0.005)	(0.025)	(0.008)
L2.Dec_making	0.255***	−0.097***	0.007	0.011	0.038	0.041***
	(0.015)	(0.018)	(0.026)	(0.007)	(0.025)	(0.011)
L.PenLit	0.025***	0.019	0.006	0.005*	0.039**	0.040***
	(0.010)	(0.012)	(0.027)	(0.003)	(0.017)	(0.006)
L2.PenLit	0.007	0.002	−0.006	−0.006	0.020	0.015***
	(0.009)	(0.012)	(0.018)	(0.004)	(0.016)	(0.006)
Constant	0.014	0.408			0.129**	0.132*
	(0.056)	(0.317)			(0.050)	(0.069)
Hansen			0.821	0.821	0.401	0.401
AR(1)			0.000	0.000	0.000	0.000
AR(2)			0.660	0.823	0.990	0.929
N	4021	4021	2803	2803	4021	4021

* p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses.

Table 9: Models for testing Granger causality

Dep. variable: Pension literacy	(1) Pooled OLS β / SE	(2) Within group β / SE	(3) Diff-1 GMM β / SE	(4) Diff-2 GMM β / SE	(5) Sys-1 GMM β / SE	(6) Sys-2 GMM β / SE
L.PenLit	0.413***	−0.112***	0.014	−0.013	0.254***	0.273***
	(0.015)	(0.018)	(0.040)	(0.021)	(0.025)	(0.022)
L2.PenLit	0.318***	−0.068***	0.004	−0.007	0.168***	0.156***
	(0.015)	(0.018)	(0.026)	(0.010)	(0.024)	(0.016)
L.Dec_making	0.039*	0.006	−0.018	−0.023	0.088**	0.120***
	(0.024)	(0.028)	(0.051)	(0.015)	(0.039)	(0.029)
L2.Dec_making	0.071***	0.020	0.019	0.016	0.111***	0.128***
	(0.024)	(0.028)	(0.037)	(0.012)	(0.039)	(0.026)
Constant	0.200**	1.953***			0.171**	0.104
	(0.086)	(0.476)			(0.079)	(0.098)
Hansen			0.340	0.340	0.000	0.000
AR(1)			0.000	0.000	0.000	0.000
AR(2)			0.984	0.981	0.033	0.171
N	4021	4021	2803	2803	4021	4021

* p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses.

The results obtained for the GMM estimates lie in-between the values of the pooled OLS and the within-group estimator, which suggests that the estimates are valid and unbiased. As discussed in the method, the system GMM (column 5 and 6) might be more appropriate because the panel units are large and the time periods relatively small. Inferences are made from the Difference GMM estimates (column 3 and 4) as well as the System GMM estimates (column 5 and 6). We find that in 3 out of the 4 models the lagged estimate of pension literacy is significantly different from zero. This means that a change in pension literacy in the past period has a significant effect on pension decision making in the present period.

Note that the system GMM estimates are the most appropriate because the panel

units are large and the time periods are moderately small. The GMM system estimator has a point estimate of the lagged version of pension literacy equal to 0.04, implying at face value and controlling for all demographics that if someone has an increase in pension literacy of one unit will result in an expected increase in active pension decision behavior of 0.04 percent point in the next period. The results therefore confirm that pension literacy Granger causes pension behavior.

Table 9 shows the second Granger causality test where pension literacy is the dependent variable. In the table the columns represent the same estimation techniques as in the first Granger causality test. The pooled OLS and within-group estimates provide upper and lower bounds for the corresponding estimates, respectively. We find that the estimates lie in-between the lower and upper bound. We find that the Arellano-Bond test rejects the null for autocorrelation of order 2 and the Hansen test suggests that the instruments used in the System GMM model are invalid (column 5 and 6). This suggests that the system GMM estimates are invalid and therefore we will use the difference GMM of column 3 and 4 for our analysis. The insignificant estimates of decision making indicate that decision making has no Granger causal effect on pension literacy.

Overall the results of the Granger causality tests suggest that the direction of 'causality' is from pension literacy to decision making.

We conducted the same analysis for the effect of the feeling of being informed on pension behavior. The output is shown in table 10 and table 11. All test statistics show the appropriate results and the results lie between the lower and upper bounds. We find that for 3 out of 4 models the lag of feeling of being informed is statistically significant. Therefore we find that the feeling of being informed changes pension behavior. We find no significant relationship between the lagged version of pension decision making and the feeling of being informed.

Therefore, we conclude that the feeling of being informed Granger causes pension behavior and not the other way around. We conclude that, in line with our hypotheses, the relationships of pension literacy and the feeling of being informed on active pension behavior are directional.

Table 10: Models for testing Granger causality

Dep. variable: Pension decision making	(1) Pooled OLS β / SE	(2) Within group β / SE	(3) Diff-1 GMM β / SE	(4) Diff-2 GMM β / SE	(5) Sys-1 GMM β / SE	(6) Sys-2 GMM β / SE
L.Dec_making	0.283***	−0.151***	0.014	0.002	0.060**	0.057***
	(0.015)	(0.019)	(0.035)	(0.012)	(0.025)	(0.008)
L2.Dec_making	0.253***	−0.097***	0.004	−0.008	0.028	0.029***
	(0.015)	(0.018)	(0.026)	(0.012)	(0.025)	(0.009)
L.feel_informed	0.024***	0.012	−0.065***	−0.040***	0.017	0.020***
	(0.008)	(0.010)	(0.023)	(0.012)	(0.016)	(0.004)
L2.feel_informed	−0.000	−0.008	−0.046***	−0.029***	−0.010	−0.002
	(0.008)	(0.010)	(0.015)	(0.008)	(0.014)	(0.006)
Constant	0.032	0.434			0.190***	0.192***
	(0.056)	(0.323)			(0.073)	(0.071)
Hansen			0.706	0.706	0.429	0.429
AR(1)			0.000	0.000	0.000	0.000
AR(2)			0.753	0.624	0.741	0.862
N	4021	4021	2803	2803	4021	4021

* p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses.

Table 11: Models for testing Granger causality

Dep. variable: Feel-informed	(1) Pooled OLS β / SE	(2) Within group β / SE	(3) Diff-1 GMM β / SE	(4) Diff-2 GMM β / SE	(5) Sys-1 GMM β / SE	(6) Sys-2 GMM β / SE
L.feel_informed	0.425***	−0.042**	0.076*	0.060***	0.193***	0.169***
	(0.015)	(0.018)	(0.040)	(0.014)	(0.028)	(0.021)
L2.feel_informed	0.269***	−0.049***	0.012	0.009	0.063**	0.058***
	(0.014)	(0.017)	(0.026)	(0.016)	(0.025)	(0.019)
L.Dec_making	−0.000	0.014	0.009	0.002	0.011	0.005
	(0.027)	(0.032)	(0.060)	(0.031)	(0.044)	(0.027)
L2.Dec_making	0.016	0.019	−0.004	−0.003	0.007	0.013
	(0.027)	(0.032)	(0.044)	(0.019)	(0.044)	(0.017)
Constant	0.326***	2.853***			1.120***	1.257***
	(0.099)	(0.560)			(0.128)	(0.147)
Hansen			0.578	0.578	0.534	0.534
AR(1)			0.000	0.000	0.000	0.000
AR(2)			0.776	0.897	0.900	0.792
N	4021	4021	2803	2803	4021	4021

* p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses.

8.3 Mediator analysis

In this section the mediating effect of pension literacy and the feeling of being informed is evaluated. Although there are many methods available for testing hypotheses about intervening variable effects, the well-known *causal steps approach* is most widely used (Hayes, 2009). Despite the popularity of the causal step approach, it has been widely replaced by methods of testing for mediation that are statistically more powerful, make fewer assumptions on the data and are logically coherent (e.g. Hayes (2009); Shrout et al. (2002)). Next to the the causal steps approach two other approaches called *difference in coefficients* and *product of coefficients* are often used. All of these three methods use

information from the following three regression equations:

$$Y = i_1 + cX + e_1 \tag{1}$$

$$Y = i_2 + c'X + bM + e_2 \tag{2}$$

$$M = i_3 + aX + e_3 \tag{3}$$

where Y is the dependent variable, X is the independent variable and M is the mediator. c is the coefficient of the independent variable and the dependent variable, c' is the coefficient relating the independent variable and the dependent variable with an adjustment for the mediator, b is the coefficient relating the mediator to the dependent variable, a is the coefficient relating the independent variable to the mediator. i_1 and i_2 and i_3 are intercepts and e_1, e_2, e_3 are residuals. The mediated effect in this single-mediator model can be calculated in two different ways: as either ab or $c - c'$. Note that in the panel data models used in this study alters the equations. Furthermore, models with more than one mediator are straightforward extensions of the single-mediator case (MacKinnon et al., 2000).

Because of the nonlinear nature of e.g. the logistic regression, the parameter c, c' and b depend on the other independent variables in the model (residual in each logistic regression is fixed). the methods for calculating the indirect effect, $c - c'$ and ab are therefore no longer equivalent (Winship and Mare, 1983).

However, MacKinnon et al. (2007) advocated an approach where the *product of coefficients* method is still used with the marginal effects instead of coefficients, called marginal mediation. In this method the direct and indirect effect are interpreted in terms of marginal effects. When the mediator outcomes are continuous this is the same as the other methods approach. And when the outcome or mediator is dichotomous then it allows a transformation from e.g. the log-odds scale to probability.

A simple test whether the indirect effect is non-zero can be conducted by the joint significance test. If a and b are statistically different from zero it is likely that the indirect effect is nonzero. Thus, the joint significance test, tests the null hypothesis that $ab = 0$. This approach works rather well (MacKinnon et al., 2007). Hayes and Scharkow (2013) have shown that the joint significance test performs as well other well-known tests (e.g. the bootstrap test).

The marginal mediation approach computes the total mediated effect by using the marginal effect of the a coefficient of equation 3 and multiplying it with the marginal effect of the b coefficient of equation 2. The total marginal effect can be divided in a total direct marginal effect and an indirect marginal effect:

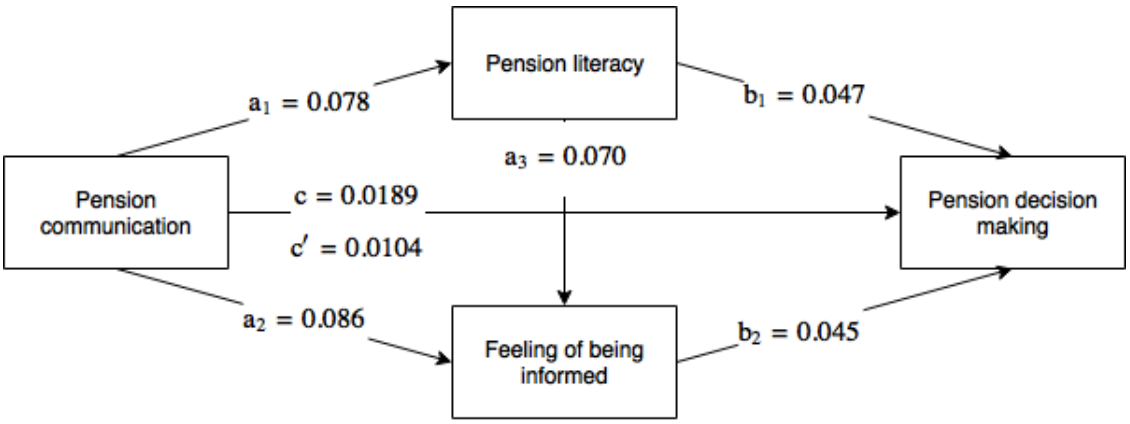
$$\text{total effect} = \text{direct effect} + \text{indirect effect} \tag{4}$$

$$c = c' + ab \tag{5}$$

8.4 Results of the mediator analysis

We used the marginal mediation approach to calculate the mediation effect of the pension literacy and the feeling of being informed. The marginal effects in our model are depicted in figure 10.

Figure 10: Average marginal effects



The total marginal effect is equal to the following equation:

$$c = c' + a_1 b_1 + a_2 b_2 + a_1 a_3 b_2 \tag{6}$$

With the latter three terms being specific indirect effects and their sum being the total indirect effect.

To determine the marginal effects the most appropriate fixed effects models were used. The method is described in section 8.3. The total marginal effect c for pension communication on pension decision making is equal to 0.0189. This effect is not significantly different from zero. However, it is legitimate to conclude that a mediator mediates pension communication and pension decision making if the total effect (c) is not significant. The total effect c should not be used as a criterion for tests of mediation (e.g. Hayes (2009), Shrout et al. (2002)). A reason for the insignificance in the model might be that in the analysis the significance test is underpowered, i.e. assumptions of the test for the total effect are not met or the sample size is too small.

The indirect marginal effect of pension literacy is equal to the marginal effect of the coefficient of the regression of pension communication on pension literacy (a_1) multiplied with the marginal effect of pension literacy on pension decision making (b_1). The marginal effects can be found in figure 10 and are equal to 0.078 and 0.047, respectively.

The mediating effect for an average person with a more than moderately feeling of being informed is equal to the marginal effect of pension communication on the feeling of being informed (a_2) multiplied with the marginal effect of the feeling of being informed on active pension behavior (b_2). The coefficients are equal to 0.086 and 0.045.

Because of the effect of pension literacy on the feeling of being informed part of the total mediated effect is mediated by pension literacy via the feeling of being informed. Hence this effect is equal to a_1 times a_3 and b_2, where a_3 is the marginal effect of an increase in pension literacy for someone who is more than moderately informed. Hence, the effect is equal to 0.078 multiplied with 0.070 and 0.045.

The total indirect marginal effect can be calculated by adding the latter three terms of equation 6. This results in a total indirect marginal effect of pension communication on pension decision making of: 0.0078. The total marginal effect is equal to 0.0189.

As stated in section 8.3 the total effect is equal to the total indirect effect plus the total direct effect $c = c' + ab$. The total marginal direct effect c' is equal to 0.0104. Adding all indirect effects results in a total marginal effect of 0.0181. This is within 4% of the total marginal effect given by c. We can calculate the part of the effect that is mediated in two ways, namely:

$$\text{proportion mediated} = \frac{c - c'}{c} \tag{7}$$

$$\text{proportion mediated} = \frac{a_1 b_1 + a_2 b_2 + a_1 a_3 b_2}{c} \tag{8}$$

Calculating the proportion of the effect that is mediated, we found using equation 7 that 45% of the total effect is mediated by pension literacy and the feeling of being informed. Using equation 8 we find that the proportion mediated by pension literacy and the feeling of being informed is equal to 41%.

9 Discussion

During the last decade, pension plans have changed, new legislation has been adapted, and more freedom of choice has been implemented in the pension system. Resulting in an increase in individual responsibility regarding pension choices. Therefore, it is important that individual participants show active pension behavior to cope with the increased responsibility. A new legislation 'de Pensioenwet' has been adapted in 2007 in the Netherlands, introducing mandatory pension communication with the goal to increase pension awareness in order for individuals to be able to take the increased responsibility.

In this thesis we investigated how pension communication affects individual pension behavior. The research question, as formulated in the introduction is: to what extent is pension communication related to individuals' active pension decision behavior and to what extent is this relationship mediated by pension literacy and the feeling of being informed. Below the most important results, which give an answer to the research question are presented.

Pension literacy

An increase in pension literacy will lead to an increase in active pension behavior.

We found evidence that an increase in pension literacy increases active pension behavior. The relationship survives controls, and answering one additional answer right for pension literacy increases the probability of showing active pension behavior by 4.7% points. The odds of having active pension behavior are for people with an additional correct answer 23% larger in comparison to people who did not have this additional correct answer. Furthermore, the reverse causality issue has been addressed using Granger causality, showing that there is a positive causal effect of pension literacy on active pension behavior. These findings are in line with other studies of pension literacy and financial literacy (Landerretche and Martínez (2013), Alessie et al. (2011a)). Despite the fact that attempts were made to increase longstanding pension literacy, our results show no statistically significant increase in pension literacy in the past decade. However, this might not fully reflect the effect of these attempts, as the increase in complexity of the pension system did not result in a lower average knowledge of the pension system either.

We created a measure of pension literacy using three questions regarding pensions, we found that people are still not aware of their employers' contribution, indexation or their own pension plan. This finding is worrying because the knowledge on the pension system is becoming increasingly relevant, because of the recent changes in the labor market, i.e. more flexibility, a trend in becoming self-employed, and a solid increase in individual ac-

tive choices. Heterogeneity in pension literacy was found: we found that pension literacy is particularly high for older people for whom it might be too late to undertake action to change the level of their pension benefits. Furthermore a large gender gap was found for pension literacy, women are less pension literate than men. This is in line with many studies who found that financial literacy is particularly low for women (e.g. Bucher-Koenen et al. (2017), Lusardi and Mitchell (2008)). Landerretche and Martínez (2013) showed that the low educated self-employed (i.e. mason, hairdresser) have almost no knowledge on the pension system and therefore have almost no idea on what to do about their pension. However, in comparison to Landerretche and Martínez (2013), our findings suggest that there is no evidence for a relationship between being self-employed and pension knowledge.

The feeling of being informed

Individuals who feel more informed are more likely to have active pension behavior.

An important result of our analysis is that an increase in the individuals' level of feeling informed increases active pension behavior. The marginal effect of an average person indicates that an increase in the feeling of being informed makes it 4.7% points more likely to show active pension behavior. A one unit increase in the feeling of being informed (20%), increases the odds of showing active pension behavior by 22%. In addition, we showed a Granger causal effect of the feeling of being informed on active decision behavior. Our results are in line with the financial literature showing that confidence is an important predictor of planning and saving outcomes. It is found that individuals who own a house feel more informed. Furthermore, no evidence for year effects is found for the average feeling of being informed, which suggests that more efforts should be made to increase individuals feeling of being informed.

An individuals feeling of being informed about pensions is positively related with pension literacy.

Our findings showed that an increase in pension literacy is positively associated with an increase in an individuals feeling of being informed. Several studies showed that individuals who rely on their individuals' perception to measure knowledge are likely to overestimate their abilities and therefore make wrong choices (e.g. Palameta et al. (2016), Lusardi and Mitchelli (2007)). Palameta et al. (2016) found that overconfidence in combination with low financial literacy might result in poor financial decisions. In addition, Palameta et al. (2016) found that under-confident individuals have a higher risk of making poor financial decisions in comparison to those who are (over-)confident. Therefore, the

finding that pension literacy is positively associated with an individuals feeling of being informed, is promising as an increase in an individuals perception about the pension system resulting from increasing pension literacy is unlikely to cause an overconfident feeling. However, one must be cautious with increasing the members' perspective of the feeling of being informed when pension knowledge is low, because this can result in undesirable choices.

Pension communication

Pension communication has a postive effect on active pension behavior mediated through pension literacy and the feeling of being informed.

In order to test for mediating effects, marginal mediation analysis was performed. Evidence showed that pension communication affects both pension literacy and the feeling of being informed. Which we found do both increase active pension behavior. An average individual who changes from not receiving pension communication to receiving pension communication has an increase of 7.8% points in pension literacy. This effect is similar for an average individual who feels more than averagely informed: receiving pension communication increases the feeling of being informed by 8.6% points. Using the marginal mediation analysis, we found that an indirect effect of a change from not receiving the Dutch pension statement to receiving the statement leads to an increase in active pension behavior of 0.8% points. This is a promising result as we find that an individuals' perception is a mechanism in explaining active pension decision behavior. Governments should therefore not only be concerned with increasing pension literacy but should also be concerned with an individuals' perception of information on the pension system.

No evidence was found that a change in pension communication directly results in more active pension behavior.

We measured whether a change in receiving pension communication leads to an increase in active-pension behavior. No empirical evidence was found for a direct effect of a change in receiving a Dutch pension statement on the chance of active pension behavior. However, the marginal mediation analysis showed a positive effect of pension communication on active pension behavior mediated by pension literacy and the feeling of being informed. Even if we do not control for pension literacy and confidence, the direct effect lacks of significance. Because we controlled for unobserved heterogeneity using panel data, we have no explanation for the lack of significance. Therefore, we believe that the total effect, which probably lacks of significance because the test is underpowered, is higher.

If we accept the point estimate of the direct effect of pension communication on active pension behavior, an increase in pension communication will lead to an increase of the chance of active pension behavior by 1.9% points. We found that around 41% of this effect is mediated through pension literacy and the feeling of being informed.

Robustness, limitations and future research

Several robustness checks have been performed. For the controls we used various specifications of some of them: dummies for high pension literacy and high feeling of being informed (instead of a linear specification), dummies for household size (instead of a linear) and a quadratic specification for age. We found that all results are robust.

This research contains multiple limitations, we discuss the most important limitations regarding data constraints. The first limitation is that the measure for communication only displays receiving a Dutch pension statement, whereas there are many more types of pension communication, think of e.g. roadshows, interactive workshops, and websites. The second limitation is that self-rated questions have been used. Research has shown that these questions might not relate to actual behavior (Donaldson and Grant-Vallone, 2002).

For future research it might be interesting to measure the effectiveness in combination with various communication types, how do they affect the feeling of being informed and pension literacy. Furthermore it might be interesting to measure the effectiveness of different pension statement designs or types of communication on various socio-economic groups, and whether these designs lead to an increase of the effectiveness w.r.t. active pension behavior. Additionally, the impact of more freedom of choice can be investigated, do more choice options increase active behavior? Moreover, active behavior does not always result in welfare increasing choices, therefore it should be interesting to further investigate the relationship between active pension behavior and welfare increasing decisions made. Based on our results we encourage future researchers to differentiate between socio-economic groups when investigating this relationship.

10 Conclusion

In this thesis, we investigated whether pension communication is related to active pension behavior and to what extent this relationship is mediated by pension literacy and the feeling of being informed. To answer this research question we exploited the panel component of our data and thus correct for unobserved heterogeneity. Our analysis has shown that both pension literacy and the feeling of being informed are important in explaining this mechanism. No direct effect of communication on active decision behavior was found, the effect of the Dutch pension statement on active behavior works indirectly through pension knowledge and the members' perceptions of the pension system. In addition, we have shown using Granger causality that this relationship is directional, addressing the possibility of a reverse causality issue. The findings are based on data of the DNB Household Survey (DHS).

The results have shown that the overall pension knowledge and individuals feeling of being informed vary with demographics. With the increased individual responsibility in the pension sector this can result in serious consequences. Women are less knowledgeable and feel less informed, which might result in widening the gender gap in pension benefits. Furthermore, the results have shown that older individuals and higher educated feel more informed and have more knowledge on the pension system.

While most results were in line with previous research, our results provided new insights regarding the mechanism of how pension communication affects behavior. Pension literacy, the feeling of being informed and pension communication can all influence pension decision making directly or indirectly. Therefore we suggest that the Government, pension policy makers, and the pension industry investigate what the optimal mix is of pension education, information and communication. However, the heterogeneity between socio-economic groups in effectiveness of pension communication, education or information leads to the conclusion that there is no general way of effectively designing optimal policies. Building on our first recommendation, we suggest that an adjusted mix for each socio-economic group should be considered. Additionally, policymakers should be concerned with individuals' who feel over-informed or lack pension knowledge and feel badly informed. We think that for the latter group the relatively new field of research of choice architecture can provide the means necessary to obtain the preferred outcome.

References

AFM (2012a). *Een volgende stap naar meer pensioeninzicht: Pensioeninformatie actief gebruiken.* Autoriteit Financiële Markten, Amsterdam.

AFM (2012b). *Korten op pensioenen raakt alle deelnemers, niet alleen gepensioneerden.* Retrieved from https://www.afm.nl/nl-nl/nieuws/2012/mrt/korten-pensioen.

Agarwal, S., Driscoll, J. C., Gabaix, X., and Laibson, D. (2009). The age of reason: Financial decisions over the life cycle and implications for regulation. *Brookings Papers on Economic Activity*, 2009(2):51–117.

Alessie, R., Van Rooij, M., and Lusardi, A. (2011a). Financial literacy and retirement preparation in the netherlands. *Journal of Pension Economics & Finance*, 10(4):527–545.

Alessie, R. J., Van Rooij, M., and Lusardi, A. (2011b). *Financial literacy, retirement preparation and pension expectations in the Netherlands.* National Bureau of Economic Research.

Allison, P. D. (2009). *Fixed Effects Regression Models.* Los Angeles, USA: SAGE publications.

Andrews, D. W. and Lu, B. (2001). Consistent model and moment selection procedures for gmm estimation with application to dynamic panel data models. *Journal of Econometrics*, 101(1):123–164.

Arellano, M. and Bond, S. (1991). Some tests of specification for panel data: Monte carlo evidence and an application to employment equations. *The Review of Economic Studies*, 58(2):277–297.

Arellano, M. and Bover, O. (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, 68(1):29–51.

Atkinson, A., Harrison, D., Messy, F.-A., and Yermo, J. (2012). Lessons from national pensions communication campaigns. *OECD Working Papers on Finance, Insurance and Private Pensions*, 18.

Bai, Z., Xie, W., and Wong, W.-K. (2015). Panel non-linear causality test. *Online publication https://ssrn.com/abstract=2608388.*

Barber, B. M. and Odean, T. (2001). Boys will be boys: Gender, overconfidence, and common stock investment. *The Quarterly Journal of Economics*, 116(1):261–292.

Baron, R. M. and Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology*, 51(6):1173.

Blundell, R. and Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, 87(1):115–143.

Bodie, Z. and Prast, H. M. (2011). Rational pensions for irrational people: behavioral science lessons for the netherlands. *Netspar Discussion Paper*, 09/2011-076.

Bond, S. R. (2002). Dynamic panel data models: a guide to micro data methods and practice. *Portuguese Economic Journal*, 1(2):141–162.

Breusch, T. S. and Pagan, A. R. (1980). The lagrange multiplier test and its applications to model specification in econometrics. *The Review of Economic Studies*, 47(1):239–253.

Bucher-Koenen, T., Lusardi, A., Alessie, R., and Van Rooij, M. (2017). How financially literate are women? an overview and new insights. *Journal of Consumer Affairs*, 51(2):255–283.

Cannon, E., Stevens, R., and Tonks, I. (2015). Price efficiency in the dutch annuity market. *Journal of Pension Economics & Finance*, 14(1):1–18.

Das, M. and Van Soest, A. (1999). A panel data model for subjective information on household income growth. *Journal of Economic Behavior & Organization*, 40(4):409–426.

Dolan, P., Hallsworth, M., Halpern, D., King, D., and Vlaev, I. (2010). *MINDSPACE: influencing behaviour for public policy*. Institute for Government, Cabinet Office.

Donaldson, S. I. and Grant-Vallone, E. J. (2002). Understanding self-report bias in organizational behavior research. *Journal of Business and Psychology*, 17(2):245–260.

Duflo, E. and Saez, E. (2003). The role of information and social interactions in retirement plan decisions: Evidence from a randomized experiment. *The Quarterly Journal of Economics*, 118(3):815–842.

Elling, S. and Lentz, L. (forthcoming 2018). Tien jaar upo, een terugblik en vooruitblik op inhoud, doelen en effectiviteit. *Netspar Design Paper*.

Els, P. v., Rooij, M. v., and Schuit, M. (2007). *Why Mandatory Retirement Saving? Costs and benefits of collective pension systems*. 159–186, Berlin: Springer.

Fornero, E. and Monticone, C. (2011). Financial literacy and pension plan participation in italy. *Journal of Pension Economics & Finance*, 10(4):547–564.

Gallo, G., Torricelli, C., van Soest, A., et al. (2016). *Individual heterogeneity and pension choices: How to communicate an effective message?* Universita di Modena e Reggio Emilia, Dipartimento di Economia Marco Biagi.

GfK (2011). *Ideale UPO 2012*. UPO-werkgroep.

GfK (2016). *Wijzer in Geldzaken: Pensioenmonitor*. Retrieved from https://www.wijzeringeldzaken.nl/platform-wijzeringeldzaken/publicaties/wijzer-in-geldzaken-pensioenmonitor-2016.pdf.

Goudswaard, Beetsma, N. and Schnabel (2009). *Een sterke tweede pijler*. Commissie Toekomstbestendigheid Aanvullende Pensioenregelingen.

Granger, C. W. (1969). Investigating causal relations by econometric models and cross-spectral methods. *Econometrica: Journal of the Econometric Society*, 37(3):424–438.

Hayes, A. F. (2009). Beyond baron and kenny: Statistical mediation analysis in the new millennium. *Communication Monographs*, 76(4):408–420.

Hayes, A. F. and Scharkow, M. (2013). The relative trustworthiness of inferential tests of the indirect effect in statistical mediation analysis: Does method really matter? *Psychological Science*, 24(10):1918–1927.

Heckman, J. et al. (2013). Sample selection bias as a specification error. *Applied Econometrics*, 31(3):129–137.

Heuts, L. and Klaver, J. (2011). *Evaluatie Informatiobepalingen Pensioenwetgeving*. Regioplan Beleidsonderzoek.

Hilgert, M. A., Hogarth, J. M., and Beverly, S. G. (2003). Household financial management: The connection between knowledge and behavior. *Fed. Res. Bull.*, 89:309.

Kuiper, C., Van Soest, A., and Dert, C. (2013). Naar een nieuw deelnemergericht upo. *Netspar Design Paper*, 24.

Landerretche, O. M. and Martínez, C. (2013). Voluntary savings, financial behavior, and pension finance literacy: evidence from chile. *Journal of Pension Economics & Finance*, 12(3):251–297.

Larsson, L., Sundén, A., and Settergren, O. (2009). Pension information. *OECD Journal: General Papers*, 2008(3):131–171.

Lusardi, A. and Mitchell, O. S. (2007). Baby boomer retirement security: The roles of planning, financial literacy, and housing wealth. *Journal of Monetary Economics*, 54(1):205–224.

Lusardi, A. and Mitchell, O. S. (2008). Planning and financial literacy: How do women fare? *American Economic Review P&P*, 98(2):413–417.

Lusardi, A. and Mitchell, O. S. (2011). *Financial literacy and planning: Implications for retirement wellbeing*. National Bureau of Economic Research.

Lusardi, A. and Mitchelli, O. S. (2007). Financial literacy and retirement preparedness: Evidence and implications for financial education. *Business Economics*, 42(1):35–44.

MacKinnon, D. P., Fairchild, A. J., and Fritz, M. S. (2007). Mediation analysis. *Annu. Rev. Psychol.*, 58:593–614.

MacKinnon, D. P., Krull, J. L., and Lockwood, C. M. (2000). Equivalence of the mediation, confounding and suppression effect. *Prevention Science*, 1(4):173–181.

Martinez, C., Sahm, C., et al. (2009). Limited understanding of individual retirement accounts among chileans. *Serie de Documentos de Trabajo del Departamento de Economía de la Universidad de Chile, STD*, 296.

Miguel, E., Satyanath, S., and Sergenti, E. (2004). Economic shocks and civil conflict: An instrumental variables approach. *Journal of Political Economy*, 112(4):725–753.

Nenkov, G. Y., MacInnis, D. J., Morrin, M., et al. (2009). How do emotions influence saving behavior. *Issue in Brief*, (9-8):97–189.

OECD (2014). *OECD Pensions Outlook 2014*. OECD Publishing, Paris.

OECD (2016). *OECD Pensions Outlook 2016*. OECD Publishing, Paris.

Palameta, B., Nguyen, C., Hui, T. S.-w., and Gyarmati, D. (2016). *The link between financial confidence and financial outcomes among working-aged Canadians*. Social Research and Demonstration Corporation.

Pallant, J. (2013). *SPSS Survival Manual*. McGraw-Hill Education (UK).

Prast, H. and van Soest, A. (2015). *Pension Awareness, Pension Communication, and Choice Architecture*. Mobilising the Potential of Active Ageing in Europe (MOPACT).

Roodman, D. (2006). How to do xtabond2: An introduction to difference and system gmm in stata. *Center for Global Development Working Paper*, 103.

Sepucha, K. R., Fagerlin, A., Couper, M. P., Levin, C. A., Singer, E., and Zikmund-Fisher, B. J. (2010). How does feeling informed relate to being informed? the decisions survey. *Medical Decision Making*, 30(5_suppl):77–84.

Shrout, P. E., Bolger, N., et al. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods*, 7(4):422–445.

Singh, S. K. and Bhattacharya, K. (2017). Does easy availability of cash affect corruption? evidence from a panel of countries. *Economic Systems*, 41(2):236–247.

Taylor, R. N. (1975). Age and experience as determinants of managerial information processing and decision making performance. *Academy of Management Journal*, 18(1):74–81.

Toepoel, V., Das, M., and Van Soest, A. (2008). Effects of design in web surveys: Comparing trained and fresh respondents. *Public Opinion Quarterly*, 72(5):985–1007.

Torres-Reyna, O. (2007). *Panel Data Analysis Fixed and Random Effects using Stata (v. 4.2)*. Data & Statistical Services, Priceton University.

van der Meij, L. (2011). Pensions crisis in the netherlands. *Pensions: An International Journal*, 16(1):13–20.

van der Smitte, J. (2013). *The right too retirement pension information, Prepared for the peer review on pension information*. Spain, Ministry of Social Affairs and Employment.

van Ewijk, C., Mehlkopf, R., van den Bleeken, S., and Hoet, C. (2017). Welke keuzemogelijkheden zijn wenselijk vanuit het perpectief van de deelnemer? *Netspar Industry Paper*, 71.

Van Rooij, M., Lusardi, A., and Alessie, R. (2011). Financial literacy and stock market participation. *Journal of Financial Economics*, 101(2):449–472.

Van Rooij, M. C., Kool, C. J., and Prast, H. M. (2007). Risk-return preferences in the pension domain: are people able to choose? *Journal of Public Economics*, 91(3):701–722.

Van Rooij, M. C., Lusardi, A., and Alessie, R. J. (2012). Financial literacy, retirement planning and household wealth. *The Economic Journal*, 122(560):449–478.

Vitt, L. A. (2005). *Goodbye to Complacency: Financial Literacy Education in the US 2000-2005*. AARP.

Wiener, J. and Doescher, T. (2008). A framework for promoting retirement savings. *Journal of Consumer Affairs*, 42(2):137–164.

Willis Towers Watson (2017). *Global Pension Assets Study 2017*. Willis Towers Watson.

Winship, C. and Mare, R. D. (1983). Structural equations and path analysis for discrete data. *American Journal of Sociology*, 89(1):54–110.

Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data*. MIT press.

Wu, H. D., Stevenson, R. L., Chen, H.-C., and Güner, Z. N. (2002). The conditioned impact of recession news: A time-series analysis of economic communication in the united states, 1987–1996. *International Journal of Public Opinion Research*, 14(1):19–36.

Zaidi, A. and Grech, A. G. (2007). Pension policy in eu25 and its impact on pension benefits. *Benefits*, 15(3):299–311.

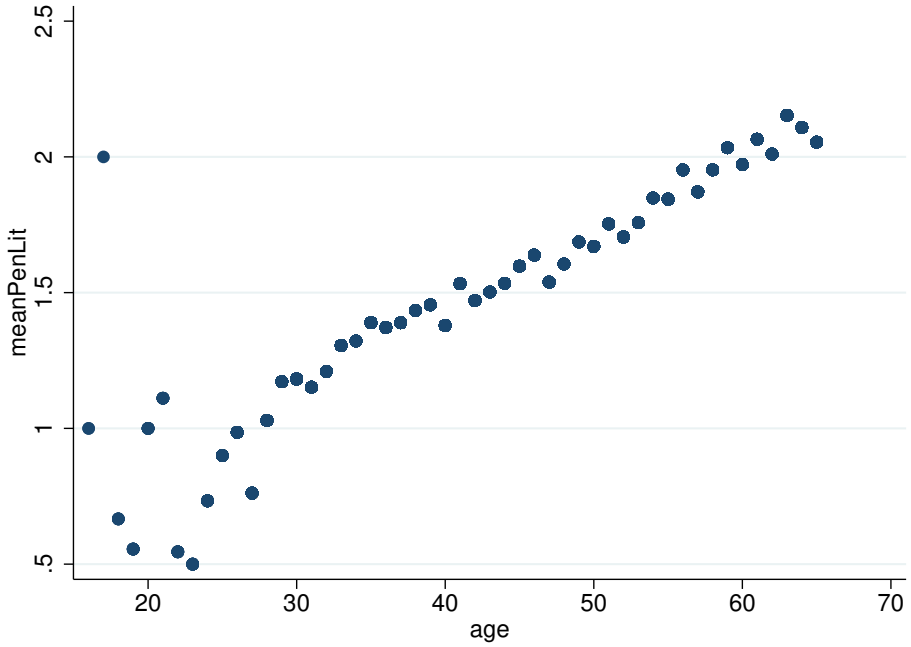
A Appendices

A.1 Correlation matrix

	adj_co~t	receiv~O	feel_~ed	year	female	age	kostwin	primar~c	lower_~c	pre_un~c	higher~c	univer~c	self_e~d	aantalhh	own_ho~e	married
DecMak	1.0000															
received_UPO	0.0449	1.0000														
feel_informed	0.1623	0.1654	1.0000													
year	0.0338	0.0240	-0.0096	1.0000												
female	-0.0414	-0.0488	-0.0956	-0.0005	1.0000											
age	0.1281	0.0811	0.1727	0.2204	-0.1518	1.0000										
kostwin	0.0651	0.0962	0.0744	0.0070	-0.5420	0.1472	1.0000									
primary_educ	-0.0443	-0.0456	-0.0323	-0.0346	-0.0333	0.0659	0.0153	1.0000								
lower_seco~c	-0.1085	-0.0419	-0.0450	-0.0192	-0.0589	0.0574	-0.0751	-0.1520	1.0000							
pre_univ_s~c	-0.0272	-0.0327	0.0020	-0.0120	0.0526	0.0171	-0.0530	-0.0596	-0.3058	1.0000						
higher_voc~c	0.0622	0.0615	0.0527	0.0080	0.0703	-0.0428	0.0526	-0.1114	-0.5713	-0.2241	1.0000					
university~c	0.1223	0.0311	0.0091	0.0456	-0.0402	-0.0749	0.0803	-0.0668	-0.3427	-0.1344	-0.2511	1.0000				
self_emplo~d	0.0044	-0.0655	0.0119	0.0178	0.0002	0.0016	-0.0270	-0.0037	-0.0057	0.0165	-0.0119	0.0112	1.0000			
aantalhh	-0.1209	-0.0223	0.0037	-0.0049	-0.0407	-0.2090	-0.2146	-0.0170	0.0891	-0.0261	-0.0008	-0.0976	0.0136	1.0000		
own_house	0.0788	0.0786	0.1114	0.0937	-0.0327	0.0658	-0.1228	-0.0515	-0.0505	-0.0333	0.0934	0.0040	0.0081	0.2474	1.0000	
married	-0.0243	0.0231	0.0980	0.0168	-0.1007	0.2333	-0.1766	0.0231	0.1455	-0.0580	-0.0358	-0.1240	0.0118	0.4930	0.2825	1.0000

A.2 Pension literacy age plot

Figure 11: Scatter plot of the average pension literacy for each age



A.3 Descriptive evidence

Table 12: Distribution of active pension behavior across demographics, 2010 wave. 1: Yes I will put more money aside for my pension, 2: No, I think I can make ends meet fairly easily with the pension I have, 3: No, I will see what I'll do when it happens, 4: Don't know

Active Pension Behavior	1	2	3	4
Age				
≤35	33.85	17.69	38.46	10.00
36 to 50	19.09	26.21	42.07	12.62
51 to 65	27.55	38.61	26.03	7.81
Gender				
Male	23.90	33.82	34.01	8.27
Female	28.09	27.53	32.30	12.08
Education				
Primary_educ (very few obs)	40.00	20.00	35.00	5.00
Low_sec_educ	21.03	29.23	37.69	12.05
Pre_univ_educ	19.10	37.08	31.46	12.36
Higher_voc_educ	27.24	32.46	29.85	10.45
Univ_educ	37.59	33.08	28.57	0.75
Self employed				
Yes	19.35	38.71	29.03	12.90
No	25.78	31.07	33.49	9.67

Table 13: Pension literacy by years

	year			
Pension Literacy	2005	2010	2015	Total
0	23.79	12.89	15.56	18.57
1	26.50	18.56	23.21	23.13
2	31.52	38.56	44.94	36.19
3	18.19	30.00	16.30	22.10
Total	100.00	100.00	100.00	100.00
Pearson $\chi^2(8)$ (p-value)		106.80 (0.000)		

Table 14: Pension Literacy questions by group, 2010 wave

	Self-Employed		Working	
	Index	S.D.	Index	S.D.
Pension built up	72.0	0.45	80.5	0.40
Claim to know indexation	70.0	0.46	71.4	0.45
Claim to know employer contribution	43.8	0.50	38.4	0.49

Table 15: Pension Literacy questions by gender, 2010 wave

	Women		Men	
	Index	S.D.	Index	S.D.
Pension built up	72.9	0.44	84.7	0.36
Claim to know indexation	60.5	0.49	78.0	0.41
Claim to know employer contribution	30.8	0.46	43.7	0.50

Table 16: Pension Literacy questions by age cohorts, 2010 wave

	$Age \leq 35$		$36 \leq Age \leq 50$		$51 \leq Age \leq 65$	
	Index	S.D.	Index	S.D.	Index	S.D.
Pension built up	66.15	0.48	75.40	0.43	86.98	0.34
Claim to know indexation	53.85	0.50	59.87	0.49	75.27	0.43
Claim to know employer contribution	38.46	0.49	34.30	0.48	41.87	0.49

Table 17: The feeling of being informed by years

	year			
Feel informed	2005	2010	2015	Total
1	7.57	6.44	3.70	6.55
2	22.72	22.44	21.98	22.50
3	41.23	42.56	45.19	42.34
4	16.79	17.00	18.27	17.10
5	11.69	11.56	10.86	11.51
Total	100.00	100.00	100.00	100.00
Pearson $\chi^2(8)$ (p-value)		8.7555(0.363)		

Table 18: Tabulation of respondents w.r.t. receiving pension communication and pension decision making, 2010 wave

	Pension Decision Making	
Received UPO	No	Yes
No	45.60	54.40
Yes	42.71	57.29
All	43.11	56.89
Pearson $\chi^2(1)$(p-value)	0.367 (0.545)	

Table 19: Tabulation of respondents w.r.t. receiving pension communication and pension literacy, 2010 wave

	Pension Literacy			
Received UPO	0	1	2	3
No	22.40	23.20	30.40	24.00
Yes	11.35	17.81	39.87	30.97
All	12.89	18.56	38.56	30.00
Pearson $\chi^2(3)$(p-value)	16.12 (0.001)			

Table 20: Tabulation of respondents w.r.t. pension literacy and pension decision making, 2010 wave

	Pension Decision Making	
Pension Literacy	No	Yes
0	65.52	34.48
1	55.69	44.31
2	39.19	60.81
3	30.74	69.26
Total	43.11	56.89
Pearson $\chi^2(3)$(p-value)	53.54 (0.000)	

Table 21: Tabulation of respondents w.r.t. receiving pension communication and the feeling of being informed, 2010 wave

	Feeling of being Informed				
Received UPO	1	2	3	4	5
No	10.40	31.20	40.00	8.00	10.40
Yes	5.81	21.03	42.97	18.45	11.74
All	6.44	22.44	42.56	17.00	11.56
Pearson $\chi^2(4)$(p-value)	15.79 (0.003)				

Table 22: Tabulation of respondents w.r.t. the feeling of being informed and pension decision making, 2010 wave

	Pension Decision Making	
Feeling of being informed	No	Yes
1	62.07	37.93
2	52.48	47.52
3	44.91	55.09
4	30.72	69.28
5	25.96	74.04
Total	43.11	56.89
Pearson $\chi^2(3)$(p-value)	38.28 (0.000)	

Table 23: Tabulation of respondents w.r.t. pension literacy and the feeling of being informed, 2010 wave

	Feeling of being Informed				
Pension Literacy	1	2	3	4	5
0	15.52	37.93	40.52	5.17	0.86
1	7.78	29.34	47.31	10.78	4.79
2	4.90	20.46	44.67	19.31	10.66
3	3.70	14.07	37.78	22.96	21.48
Total	6.44	22.44	42.56	17.00	11.56
Pearson $\chi^2(12)$(p-value)	108.93 (0.000)				

A.4 Additional output

Table 24: Output for testing the effect of communication on pension related decision making with pension literacy and the feeling of being informed as control variable

Dep. variable: Pension decision making	(1) LPM(RE) β / SE	(2) LPM(FE) β / SE	(3) Logit(RE) β / SE	(4) Logit(FE) β / SE	(5) Probit(RE) β / SE
Feel-informed	0.037***	0.030***	0.250***	0.197***	0.145***
	(0.005)	(0.006)	(0.034)	(0.044)	(0.020)
Pension Literacy	0.066***	0.031***	0.433***	0.203***	0.253***
	(0.006)	(0.008)	(0.039)	(0.051)	(0.023)
Received_UPO	0.002	0.008	−0.002	0.044	0.000
	(0.011)	(0.013)	(0.077)	(0.090)	(0.045)
Female	−0.003		−0.018		−0.009
	(0.017)		(0.113)		(0.066)
Age	0.003***	0.000	0.017***	0.003	0.010***
	(0.001)	(0.002)	(0.004)	(0.012)	(0.003)
Main wage earner	−0.010	−0.043	−0.070	−0.285	−0.038
	(0.017)	(0.028)	(0.111)	(0.184)	(0.065)
Self-employed	0.002	−0.022	0.010	−0.136	0.004
	(0.028)	(0.038)	(0.186)	(0.249)	(0.109)
# household members	−0.032***	−0.006	−0.208***	−0.044	−0.120***
	(0.006)	(0.011)	(0.039)	(0.072)	(0.023)
Own house	0.039**	−0.072**	0.248**	−0.428**	0.148**
	(0.016)	(0.031)	(0.108)	(0.198)	(0.063)
Married	−0.000	0.026	−0.003	0.179	−0.005
	(0.016)	(0.028)	(0.108)	(0.186)	(0.063)
Education dummies (base: university education)					
Primary	−0.228***	−0.101	−1.544***	−0.491	−0.897***
	(0.043)	(0.140)	(0.295)	(1.176)	(0.172)
Lower secondary	−0.169***	−0.136	−1.152***	−0.945	−0.670***
	(0.023)	(0.115)	(0.154)	(0.857)	(0.089)
Pre-university	−0.156***	−0.161	−1.061***	−1.060	−0.619***
	(0.028)	(0.114)	(0.190)	(0.791)	(0.111)
Higher vocational	−0.087***	−0.120	−0.617***	−0.875	−0.358***
	(0.023)	(0.103)	(0.158)	(0.795)	(0.092)
Constant	0.359***	0.563***	−0.887***		−0.531***
	(0.045)	(0.137)	(0.301)		(0.176)
Observations	9830	9830	9830	5495	9830
σ_u	0.277	0.409	1.762		1.031
σ_e	0.384	0.384			
ρ	0.343	0.532	0.485		0.515
log-likelihood			-5585	-2151	-5584

* p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses.

Table 25: Output for testing the effect of communication on pension literacy

Dep. variable: Pension Literacy	(1) Random Effects β / SE	(2) Fixed Effects β / SE	(3) Poisson(RE) β / SE	(4) Poisson(FE) β / SE
Received_UPO	0.150***	0.120***	0.134***	0.078***
	(0.019)	(0.021)	(0.023)	(0.027)
Female	−0.382***		−0.226***	
	(0.036)		(0.028)	
Age	0.021***	0.006**	0.015***	0.004
	(0.001)	(0.003)	(0.001)	(0.003)
Main wage earner	0.080**	0.027	0.064**	0.014
	(0.031)	(0.043)	(0.030)	(0.059)
Self-employed	−0.031	−0.002	−0.034	−0.004
	(0.049)	(0.060)	(0.052)	(0.082)
# of household members	−0.007	0.028	−0.015	0.020
	(0.011)	(0.017)	(0.010)	(0.023)
Own house	0.263***	0.188***	0.224***	0.146**
	(0.032)	(0.048)	(0.029)	(0.069)
Married	0.060*	0.076*	0.038	0.050
	(0.031)	(0.044)	(0.028)	(0.058)
Education dummies (base: university education)				
Primary	−0.602***	0.131	−0.492***	0.066
	(0.089)	(0.220)	(0.076)	(0.273)
Lower secondary	−0.399***	−0.056	−0.272***	−0.049
	(0.049)	(0.180)	(0.035)	(0.217)
Pre-university	−0.132**	0.024	−0.079*	0.007
	(0.060)	(0.180)	(0.045)	(0.217)
Higher vocational	−0.123**	0.092	−0.098***	0.050
	(0.050)	(0.162)	(0.036)	(0.188)
Constant	0.590***	0.946***	−0.337***	
	(0.088)	(0.212)	(0.076)	
Observations	9830	9830	9830	8483
σ_u	0.709	0.917		
σ_e	0.604	0.604		
ρ	0.580	0.697		

* p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses.

Table 26: Output for testing the effect of communication and pension literacy on the feeling of being informed

Dep. variable: Feel-informed	(1) Random effects β / SE	(2) Fixed effects β / SE	(3) O-logit(RE) β / SE	(4) O-logit(FE) β / SE	(5) O-probit(RE) β / SE
Pension Literacy	0.159***	0.101***	0.452***	0.284***	0.251***
	(0.012)	(0.015)	(0.033)	(0.044)	(0.018)
Received_UPO	0.154***	0.087***	0.425***	0.351***	0.245***
	(0.023)	(0.025)	(0.062)	(0.069)	(0.035)
Female	−0.095**		−0.277**		−0.146**
	(0.039)		(0.111)		(0.061)
Age	0.007***	−0.004	0.019***	0.004	0.011***
	(0.002)	(0.004)	(0.004)	(0.764)	(0.002)
Main wage earner	0.028	−0.059	0.075	−0.131	0.043
	(0.038)	(0.058)	(0.099)	(0.177)	(0.055)
Self-employed	0.024	−0.040	0.046	−0.040	0.034
	(0.060)	(0.072)	(0.159)	(0.185)	(0.088)
# household members	−0.006	−0.010	−0.020	−0.002	−0.009
	(0.014)	(0.025)	(0.036)	(0.070)	(0.020)
Own house	0.092**	−0.004	0.247**	−0.183	0.147***
	(0.039)	(0.070)	(0.100)	(0.199)	(0.055)
Married	0.073*	−0.104	0.205**	−0.088	0.110**
	(0.039)	(0.066)	(0.097)	(0.170)	(0.054)
Education dummies (base: university education)					
Primary	−0.099	−0.081	−0.228	−0.603	−0.145
	(0.096)	(0.246)	(0.275)	(0.556)	(0.151)
Lower secondary	−0.005	−0.279	−0.014	−0.897**	−0.005
	(0.051)	(0.208)	(0.150)	(0.454)	(0.082)
Pre-university	−0.011	−0.281	−0.031	−1.018**	−0.022
	(0.065)	(0.210)	(0.184)	(0.447)	(0.101)
Higher vocational	0.045	−0.253	0.130	−1.367***	0.072
	(0.052)	(0.181)	(0.154)	(0.362)	(0.084)
Constant	2.308***	3.420***			
	(0.102)	(0.295)			
Observations	9830	9830	9830	9830	9830
σ_u	0.735	0.966	2.095	2.095	1.139
σ_e	0.710	0.710			
ρ	0.518	0.649			
log-likelihood			-12016	-12016	-12085

* p < 0.1, ** p < 0.05, *** p < 0.01. Standard errors in parentheses.