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Communicating In Scenarios: Towards Improving Participant Decisions Regarding Retirement

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Preface

This thesis represents the final chapter of my Master's programme Financial Engineering and Management at the University of Twente. Reminiscing, I recall my first time visiting the campus and the excitement I felt to start studying there. Since then, I have had the opportunity to take challenging courses, join a committee, study abroad and enjoy many other social activities, for which I am all very thankful. During these years, I have made friendships that last for a lifetime. Now, with this submission, my time as a student has come to an end. A new phase awaits.

Graduating at PGGM has allowed me to learn and apply both theoretical and practical knowledge in a sector with large societal relevance. A study on how individuals can be assisted with their retirement planning on such a large scale makes me feel very humble and proud. During this project, I have had much support from the AA&A department, who helped me get familiar with the complex pension sector. In particular, I would like to thank my two supervisors. Niels Kortleve has been my first supervisor and a true mentor who challenged me along every step of the way. I am very grateful for your endless support and your help in developing myself in a professional context. My second supervisor, Luuk van Benthem, has helped me apply the URM scenario tool in such a relevant context. Thank you for sharing your broad knowledge, your useful feedback and your empathy. I also would like to thank the Marketing & Communication department as well, for their input on how to translate a research idea into a survey for their participants.

From the University of Twente, first I would like to express my gratitude towards Berend Roorda. Thank for your time, our interesting discussions and your sharp criticism to help me write a thesis that meets the scientific standard. Wouter van Heeswijk, thank you for proof-reading my thesis and giving me improvement directions at the final stage of my graduation project.

Last, but certainly not least I would like to thank my friends and family. Especially to my parents, Michael and Ankie, for your love, support and the fact that I can always rely on you. To my close friends, for always being there and the countless memories we shared and will share.

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Management summary

At the end of their working life, participants of a pension fund make a decision regarding their retirement based on the accrued pension wealth: the pension decumulation choice. In recent years, Dutch societal developments such as an individualising society and increasing heterogeneity in households will lead to more freedom of choice and responsibility shifting towards individuals regarding this decision. However, this pay-out phase decision proves to be complex as it is subject to financial uncertainty over a long time horizon. It requires a sufficient level of financial literacy, while behavioural economics indicate that individuals act differently than the completely rational and analytical 'homo economicus'. Hence, not all participants may be able to make a well substantiated and financially adequate pension decumulation choice. To better inform and assist in decision-making, Soetendal et al. (2019) prescribe that the pension sector should take a revised attitude in understanding participant needs and preferences. This entails putting the interest of the participant first in the form of an 'ambition of care'. A new communication method with the purpose of better informing participants is the 'Uniforme Rekenmethodiek', which presents the dispersion in pension outcome in three scenarios. Insight in pension outcome uncertainty may enable a better assessment of retirement income adequacy. Given the new communication method, the complexity of the pension decumulation choice and an ambition of care, we identified a potential next step in improving retirement decisions. Therefore, we constructed the following research question:

"To what extent does a decision environment with three scenarios communicating uncertainty, based on participants' needs and preferences, alter the pension decumulation choice (PDC) made and what are potential improvement directions?"

To answer the research question, we conducted a survey to study the impact of communicating uncertainty on PDC decision-making. Participants indicated their PDC preference based on three types of information provision; with each type we gradually presented more information regarding the dispersion of PDC outcomes. We also let participants substantiate and evaluate their PDCs made. Additionally, we obtained insight in background characteristics to put decision-making in perspective. Here, we particularly focused on the risk preference and the time preference of money. The questionnaire was sent to 22,000 participants between the age of 60-66, enrolled in a DB scheme of a large Dutch pension fund. In total, 3,419 participants completed the questionnaire.

Our study finds that PDC decision-making is significantly influenced by communicating uncertainty in scenarios, especially when the dispersion in outcomes is presented over a longer horizon than solely on the statutory pension age. Moreover, PDCs and their substantiations imply that a longer time horizon provides better insight into the consequences of PDC options. This is also implied by participants evaluating their own PDC consideration; a quarter of the participants evaluated their decisions as better considered from the communication of scenarios beyond the statutory pension age. Here, of the ten percent that changed their PDC preference, half indicated they made a better considered decision. Yet, from incompletion percentages and reactions to our study we learned that communicating scenarios is perceived as complex by participants. We find that participants' level of education and pension literacy influence the extent of this perceived complexity. Besides, given the significant correlation between the level of education and accrued pension wealth, we conclude that scenario communication is more relevant for participants with more accrued pension wealth.

With significant influence on decision-making and a large percentage of the participants evaluating their decisions as better considered, we recommend that the pension sector should further study the communication of PDC options in scenarios beyond the statutory pension age. This study provides several indications that insight in the dispersion of outcomes can assist in making a more substantiated

and financially adequate retirement decision. Yet, our recommendation requires some nuance. The trade-off between information provision and complexity arises, as not all participants may be able to correctly process scenario information. Therefore, we suggest to further improve the method for communicating in scenarios and the corresponding choice architecture as part of future research.

Contents

Glossary

AFM	Authority for the Financial Markets
AOW	State pension
CRRA	Constant Relative Risk Aversion
CS	Choice Sequence
DB	Defined Benefit
DC	Defined Contribution
Ministry of SZW	Ministry of Social Affairs and Employment
MPO	Pension Tracing Service
PDC	Pension Decumulation Choice
RP	Representative Person
SVB	Sociale Verzekeringsbank
UPO	Pension Benefit Statement
URM	Uniforme Rekenmethodiek

1. Introduction

1.1 Context description

The Dutch pension system is internationally perceived as one of the most robust and sustainable pension systems in the world. Key elements are collectivity and solidarity, reflected in poverty amongst elderly being the lowest in Europe (Camaminda, et al., 2016). Besides, the Mercer Global Pension Index (2018) states that the Netherlands has the best pension system in the world, based on adequacy, robustness and integrity. Yet, in recent years influences such as instable financial markets and historically low interest rates have dramatically worsened the financial position of pension funds, putting pressure on this pension system (Pensioenfederatie, 2019). This worsened financial position has led to an increased media attention to the pension sector. The sustainability of defined-benefit (DB) schemes is currently the subject of discussion, which has led to defined-contribution (DC) schemes gaining momentum (Bovenberg, et al., 2019). Last year, a new Pension Agreement was reached to reform and modernise the Dutch pension system and make it more robust (SER, 2019). This Agreement is meant to play into societal developments such as an individualising society, heterogeneous households, a more flexible labour market (e.g., more self-employed), an ageing population and increasing longevity.

Freedom of choice in retirement options

Individualisation and heterogeneity of households have also led to legislation expanding the *freedom of choice* in the second pillar; occupational pension. Along with this development, the *responsibility* for retirement planning has shifted from the state, pension funds and employers to the individual (Bovenberg et al. (2015); Dellaert et al. (2016)). In recent years, more freedom of choice and responsibility have also been developments affecting the second pillar decision made by participants close to retirement; the *pension decumulation choice* (PDC). The PDC determines the starting date and the annuity form of the pay-out phase, based on second pillar pension that the participant has accrued at a pension fund. Regarding this decision, participants prefer more freedom of choice and responsibility to choose depending on their own needs and preferences (Ministry of SZW, 2015). More freedom of choice enables participants to better align the pension to their individual household and may increase confidence and awareness in the pension sector (Goudswaard, et al., 2010). Besides, freedom of choice increases utility and the perception of control (Veitch, et al., 1996). For example, given the high level of annuitisation in the Netherlands, there is an increased desire for liquidity and flexibility in the pay-out phase (Kortleve, et al., 2016). Legislation is currently researching the possibility to withdraw a *lump sum* of second pillar pension, meeting liquidity and flexibility needs of participants (SER, 2019). Van Ewijk et al. (2017) and Bart et al. (2016) show that substantial welfare gain can be achieved and idiosyncratic risk can be covered from the increased liquidity. In the case of decreasing vitality, individuals can also experience more utility from consuming at an earlier point (facilitated by the lump sum) in retirement than later. Yet, similar to all PDC options, with withdrawing a large sum of money comes responsibility. Making a PDC should not result in an inadequate retirement income and hence participants falling back on collective resources. Hence, if advocating for freedom of choice and responsibility for a financial decision with such magnitude, participants should be able to make a *good* decision.

1.2 Problem statement

Pension is a complex product, given the trade-off between investment and consumption, the long time horizon and the uncertainty in future income and expenses. Hence, not all participants are able to make an adequate decision. In fact, several studies have shown that freedom of choice can lead to substantial welfare losses (Leuvensteijn (2015); Van Ewijk et al. (2016)). Retirement planning requires a sufficient level of *financial literacy* (Dinkova, Consumption, financial literacy and tailored pension communication, 2019) and *pension literacy* (Prast, et al., 2016). Van Rooij et al. (2012) find that mostly households of low income are less financially literate and plan little for retirement. Moreover, the extent

to which participants are involved and understand their pension scheme, can forecast and improve their retirement income if necessary, is low (Prast, et al., 2016). A study by GfK (2016) finds that only 1 out of 3 participants understands the Dutch pension system sufficiently to make adequate decisions. Besides, participants do not always act rationally. There is much scientific evidence that the neo-classical 'homo economicus', completely rational and analytical in decision-making, does not exist (Tiemeijer, et al., 2009). Rules and heuristics limit individuals in the optimality of their decisions. Other behavioural elements influencing decision-making are *myopia* in financial planning (Bodie et al. (2012)), *loss aversion* and *procrastination*. Furthermore, despite the desire for more freedom of choice, participants tend to stick to the *default* option and do not make an active decision (Bateman, et al., 2014). Too much choice can also lead to choice stress and participants picking an option randomly or not all. A large majority of participants of the two largest Dutch pension funds ABP and PFZW does not use the freedom of choice regarding the pay-out phase decision (Kortleve, et al., 2016). Moreover, many individuals find themselves not willing or insufficiently knowledgeable to make a (good) decision and resultingly procrastinate this decision (Van Ewijk, et al., 2016). The abovementioned factors increase the risk of a faulty financial-economical decision, which may lead to a substantial welfare loss in terms of consumption (Knoef, et al., 2017). Parallel with the development of more freedom of choice and responsibility (and hence risks), there is an increased necessity for advice (Dellaert, et al., 2016). Given the negative emotions of making a PDC, a study by Limpens et al. (2018) sketches a nuanced image for choice architectures and communication given the desire for freedom of choice. Their conclusion: the information provision to participants should be improved.

Towards an ambition of care

Current pension communication is often only focussed on completeness and *compliance* with regulation instead of usefulness for individual decision-making (Prast, et al., 2016). Pension providers have a duty of care to act in the interest of the participant, but this often results in thinking *for* the participant instead of *from* the participant. Based on collectivity and solidarity principles, this resulted in *one-size-fits-all* management of pension schemes. However, the earlier mentioned societal developments (more freedom of choice and responsibility, heterogeneity of households, e.g., DC schemes becoming the norm and the lump sum) may require a different approach, to better inform and assist in PDC decision-making. Soetendal et al. (2019) advise the pension sector to further develop the duty of care towards an *ambition of care*; placing the interest of the participant at the centre by understanding the needs and preferences of participants as well as possible. This also entails taking a behavioural approach (i.e., understanding emotional barriers and behavioural biases (Limpens, et al., 2018)) when assisting participants with their PDC (Wendel, et al., 2016). The choice architecture of a decision environment is an important element here, as it aims at organizing and presenting options in such a way that potential financially inadequate decisions are reduced as much as possible. The choice architecture is no limitation for the freedom of choice, but can *nudge* participants in the right direction (Prast, et al., 2016). Altogether, an *ambition of care* should aim to better inform and assist in making decisions that are optimal given their perspective yet fit within the collectivity and solidarity principles of a pension fund. We perceive the ambition of care as pension funds and providers taking a *proactive* attitude in mapping participant needs and preferences ("What could be of added value for the participant?"), rather than treating information provision as a *duty*.

More insight in uncertainty surrounding pension outcome

Second pillar pension lies in a financially uncertain landscape with different time horizons for different participants. Fluctuation in investment results, inflation and interest rates, but also pension policy and risk-sharing result in many different potential pension outcomes. Especially with the current financial state of pension funds, increased media attention and the risk of benefits reductions, participants desire honesty and transparency regarding their pension outcome (Pensioenfederatie, 2019). Yet, current decision-making channels solely present the *expected* outcome at the participants target pension age.

Stemming from the Pension Information Act of 2015, one development to inform and assist participants in retirement planning is a method that communicates the dispersion in pension outcome: the uniform calculation method ("*Uniforme Rekenmethodiek"*) (Ministry of SZW, 2015). The goal of this method is to provide participants with a better and more realistic insight in the uncertainty surrounding their pension outcome. The method communicates risks and returns in pension outcomes in the form of three scenarios: expected, optimistic and pessimistic. With more insight in the purchasing power of the three pension outcomes, individuals might make a better assessment of retirement income adequacy. Hence, the communication of dispersion of pension outcomes may give incentive to individuals to undertake action if they perceive their retirement income will be insufficient. As of 2019, pension providers are legally required to use the uniform calculation method for all pension schemes in their portfolio. For both active participants and deferred pensioners, scenario figures will be included in the Pension Benefit Statement ("*Uniform Pensioenoverzicht"*) as of 2020 (Pensioenfederatie, 2019). Moreover, since October 2019 the Pension Tracing Service ("*MijnPensioenoverzicht"*) presents scenario figures in an integrated environment, communicating accrued pension at multiple pension funds.

Given the societal developments, the complexity of the decision and the current state of information provision, we identify a next step towards improving PDC decision-making. Applying the new method for communicating the dispersion of outcomes *per PDC option* may assist participants in their retirement planning. Our hypothesis is that the communication of scenarios significantly influences decision-making, as it may enable an improved assessment of retirement income adequacy for the preferred PDC option. Yet, with this communication the important *trade-off* between information provision and complexity arises.

1.3 Thesis outline

In this thesis, we discuss how the pension sector can make a next step towards improving retirement planning and PDC decision-making. Our main focus is to analyse the impact of communicating uncertainty in scenarios on the preferred PDC of Dutch pension fund participants. We do this by conducting an empirical study among participants in a DB scheme of a large pension fund. Here, we are interested *if* and *how* scenarios in the PDC decision environment can be a next step towards a more *substantiated* and financially *adequate* PDC. From the information above, we arrive at the following research question:

Research question: *"To what extent does a decision environment with three scenarios communicating uncertainty, based on participants' needs and preferences, alter the pension decumulation choice (PDC) made and what are potential improvement directions?"*

To answer the research question, our thesis is structured as follows: First, Chapter 2 elaborates on the Dutch pension system and the new method to communicate the pension outcome in three scenarios. We hereby place our study in its societal context. Hereafter, Chapter 3 presents our research method by setting the scope of our study and constructing several hypotheses to help answer the research question. Chapter 4 consists of a literature study to get an understanding of several topics surrounding retirement planning and individual decision-making in an uncertain landscape. Chapter 5 describes how we construct a questionnaire to use in our empirical study. Then, Chapter 6 analyses the results of this empirical study by discussing PDC behaviour and placing it in perspective. Here, we either confirm or reject the hypotheses formulated in Chapter 3. Chapter 7 presents our main conclusions and recommendations.

2. The Dutch Pension Landscape

In this section, we present the structure of the Dutch pension landscape to place this thesis into context. A presentation of the landscape is necessary to understand what the individual can weigh in order to make a decision regarding the *pension decumulation choice*. In general, flexible and well-communicated *pension decumulation choice* options allow the individual for financial planning surrounding his or her retirement. Firstly, Section 2.1 discusses the pillars of the Dutch retirement provision. Secondly, Section 2.2 presents the most common *pension decumulation choice* (PDC) options for participants within their pension fund and how the Dutch legal landscape is organised around them. In this section, we include the trend in the use of these options, to analyse the development in needs and preferences over the past years. Hereafter, Section 2.3 describes the current level of information provision available for participants when considering the PDC. Lastly, Section 2.4 discusses the development of a new communication method meant to inform and assist participants in PDC decision-making under uncertainty regarding pension income.

2.1 The three pension pillars

First pillar: State pension

The Dutch pension system consists of three pillars, although a fourth and fifth are considered to be present too. The *first pillar* is state pension, also known as the *AOW* (Algemene Ouderdomswet). This pillar is meant to alleviate poverty and requires no individual contributions or income test. In this pay-as-you-go system, solidarity is key as the working force pays for the retirees in the form of premiums and taxes. All citizens working or living in the Netherlands build up state pension, 2 percent per year. The gross annual amount of state pension is adjusted to the development of minimum wage (Rijksoverheid, 2019). As of January 2019, for singles this amount is around €14,500 and for married couples or those living together this amount is €10,000 (SVB, 2019). Individuals receive this type of payment when they reach their statutory pension age (SVB, 2019). The statutory pension age is dependent on the birthdate of a participant and is gradually being increased to 67 in 2024. As of 2025, this number increases with 8 months for each year the life expectancy increases (Ministry of SZW, 2019). As the life expectancy of the Dutch population increases, the statutory pension age increases to keep this pillar affordable. With this increase, the income groups with a large dependency on state pension will have more difficulty aligning their retirement plans with their needs and preferences. Unlike the other pension pillars, the AOW has no flexibility in terms of early withdrawal or a variation in pay-out structure. With higher income the dependency on state pension decreases, as the state pension is a fixed payment based on the social minimum (Knoef, et al., 2017).

Second pillar: Occupational pension

The *second pillar* is occupational pension ("*tweedepijlerpensioen*"), organised through either company pension funds, industry pension funds or occupational pension funds. This pillar is financed entirely through capital funding. Here, employees pay around 1/3rd and employers pay the remaining 2/3^{rds} in pension premiums, which are then invested by the corresponding pension fund. Resulting, employees build up pension rights equivalent to a percentage of the pensionable salary. Moreover, as no tax is paid over the premiums, the pension outcome is a gross figure which is taxable. With the pension funds managing the second pillar wealth, pension rights can be indexed or cut based on the coverage ratio of these funds. This coverage ratio, representing the wellbeing of a fund, is dependent on factors such as investment results, the interest rate and life expectancy. However, careful regulation and supervision is in place to control this wellbeing and practices of the funds. Regulation comes from the Ministry of Social Affairs and Employment ("SZW") in cooperation with the Social and Economic Council ("SER"). The Dutch Central Bank ("DNB") and the Dutch Authority for the Financial Markets ("AFM") are the parties responsible for the supervision of the pension funds.

Most Dutch pension schemes are of the defined-benefit (DB, "*uitkeringsovereenkomst*") type, although defined-contribution (DC, "*premieovereenkomst*") schemes are gaining momentum. DB schemes provide a 'guaranteed' pension income upon retirement, which is a certain percentage of the average wage one has earned over the course of his or her career. On the contrary, DC schemes offer either an annuity or the possibility to continue investing upon retirement. The result upon retirement is based on life cycle investments per individual. Spouse pension, which is the pension that a partner or ex-partner receives in case the participant dies, is usually included in DB and DC schemes as well. Spouse pension is usually around 70 percent of the participant's accrued pension wealth (Pensioenkijker, 2019). This way, those strongly dependent on the income of their partner have a financial safety net. As these benefits are paid out as an annuity, the participant has an income stream for the remainder of his or her life.

There are large differences in dependency on the pension pillars across Dutch households, measured by the replacement rate (Knoef, et al., 2017).[1] Especially higher income households do not meet the gross replacement rate norm of 70 percent when considering the first and second pillar. In their highest income quantile, 87 percent of the households do not meet this norm when observing the first and second pillar. Higher income households are more dependent on second pillar wealth than lower income households (AFM, 2015). This is because higher income households accrue more pension wealth given their higher salaries. The larger the accrued second pillar pension wealth, the more flexibility households have in adapting the PDC to their retirement needs and preferences. This is because larger wealth in the second pillar allows for more freedom to choose[2], such as early retirement or a high-low annuity.

Third pillar and the additional pillars

Voluntary income provisions form the *third pillar* of the pension system. Life annuities, life insurances, and pension saving are examples. Individuals can take out these provisions with banks and insurers. Tax regulations around these provisions are attractive and allow the individual to fill a pension gap or retire early (Rijksoverheid, 2019). Employees not part of a collective pension scheme or the self-employed (*"ZZP'ers"*) are largely dependent on this third pillar. Although having higher disposable income, business equity and home equity, the self-employed have more responsibility in arranging an adequate pension income (Knoef, et al., 2017). Logically, there is more spread in the financial situation of the self-employed due to the reliance on the prosperity of their business.

Lastly, saving for retirement without tax relaxations is considered to be the *fourth pillar* wealth. Examples are owning real estate, stocks, bonds and saving accounts. Households owning a house with excess value have fourth pillar wealth as well, as their home can be an extra form of pension income. These households need less income during retirement to finance their lifestyle than those renting. *Equity release* ("*verzilveren eigen woning*") means bringing the proceeds of a future house sale to the present. Knoef et al. (2017) compare replacement rates of homeowners with those renting and show that substantial increasements when home equity is liquidated. Similar to the third pillar, having fourth pillar wealth allows for more freedom when making the PDC. Wealth from the *fifth pillar* comes from continuing to work after the statutory pension age, thereby accumulating extra retirement incomed.

Figure 1 below visualises the Dutch pension system consisting of three distinguished pillars.

[1] Replacement rate = Pension entitlements / Pre-retirement earnings.
[2] Here, we make the assumption of ceteris paribus regarding the other pension pillars and expenses.

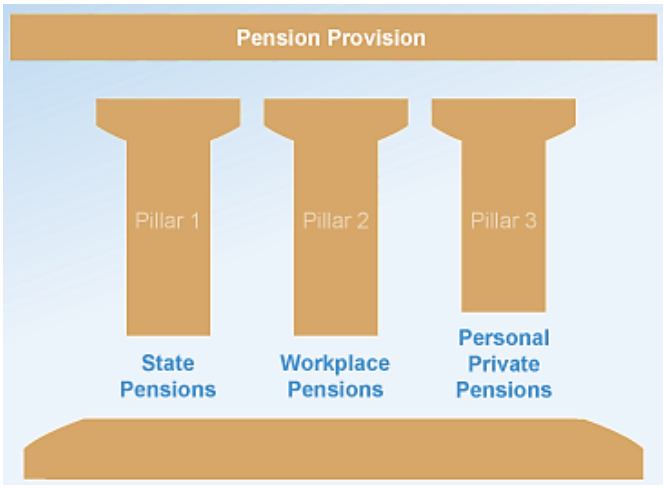

Figure 1: The Dutch pension system consisting of three pillars, source: (Martin, 2017)

2.2 PDC options

The *pension decumulation choice* (PDC) is the choice the participant of a pension fund makes when planning for their retirement. This choice is entirely funded via second pillar pension wealth he or she has accrued. The PDC is made close to the start of the pay-out phase. We consider the following choice options being available within the Dutch pension landscape: a standard annuity at the target pension age, early or late retirement, part-time retirement, the high-low annuity and the upcoming possibility for a lump sum withdrawal. This section discusses the implication of every PDC option and its relationship to flexibility in adapting second pillar wealth to the individual situation.

Standard annuity

The standard (default) PDC in the Dutch pension landscape is second pillar wealth to be paid out as a life-long annuity as of the target pension age ("*pensioenrichtleeftijd"*). The default option implies that if participants follow the *status quo*, this is the PDC option that is selected for them.

Early or late retirement

Participants have the possibility to retire either before or after the statutory pension age. These options are not included in the Dutch Pension Law, but rather element of the pension scheme of pension funds. In these pension schemes the regulation regarding early retirement differs per fund. Second pillar pension pay-out cannot commence later than 5 years after the statutory pension age applicable to the participant.

Compared to the default annuity, retiring earlier than the statutory pension age is a popular PDC (Van Ewijk, et al., 2017). Yet, Kortleve et al. (2016) show that the share of early retirees has remained low over the past years. Mainly the increase in statutory pension age has made early retirement difficult for lower income groups (Baars, et al., 2019). These groups cannot afford this PDC, due to a large dependency on state pension. Namely, for every year retired early it averagely costs 7% in gross pension income. Regarding late retirement, many employees are automatically fired when they reach the statutory pension age. This makes it more difficult to accrue more second pillar pension wealth for those willing to.

Part-time retirement

With *part-time retirement* the participant chooses to work less before the statutory pension age, while supplementing income with second pillar pension. This supplementation lowers the pension income after full retirement, but with part-time work one continues to accrue pension wealth. The participant

can get familiar with working less and living with a different consumption pattern. Again, this PDC option is not included in the Dutch Pension Law, but element of the pension scheme of pension funds. Most pension funds offer a form of part-time retirement (Van de Veen, 2016). These forms have different restrictions, such as the starting and ending period of part-time retirement and the part-time factor.

The idea behind the part-time retirement is meant to increase the participation rate, hence controlling the costs of the population aging and increasing tax income. A study by De Boer et al. (2019) shows that participants with a middle to high education level are increasingly using this PDC option to steadily reduce their working hours. The main driver behind this development is the increase in statutory pension age. Those who can afford it, use part-time retirement to bridge the time until the increased retirement age. An earlier study by Kortleve et al. (2016) confirms this trend, indicating that over the period 2012-2015 part-time retirement has doubled within pension fund PFZW.

High-Low annuity

A *high-low annuity* allows the participant to vary the pay-out of the second pillar pension once. During the first years the participant receives a higher pension, after which the participant receives a lower pension for the remainder of the lifetime. This period of higher pension has a minimum of 1 year and a maximum of 10 years. The maximum ratio of variation possible is 100:75, meaning the low pension should be at least 75 percent of the high pension. The high-low annuity can also be suitable for 'regular' retirees needing more retirement income during the first years of retirement, for example to pay off their mortgage or other debts. There is a positive correlation between the annual retirement income and the use of the high-low annuity. Similarly, a *low-high annuity* works the other way around. The exact figures are determined by fund specific factors, such as the life expectancy and discount factors.

Over the past years, the usage of the high-low annuity has increased considerably. Research by Kortleve et al. (2016) has shown that the high-low annuity is mostly used by those retiring early to cover the *AOW gap*.[3] Hence, this combination forms a flat retirement income as the 'low' pension income is supplemented with the AOW as of the statutory pension age. Furthermore, the increase of the statutory pension age results in this PDC option being chosen more often in combination with early retirement.

Lump sum

A new PDC option is currently in the process of being introduced in the Dutch pension landscape. In 2019, the SER advised the Ministry of Social Affairs and Employment (SZW) an allowance to withdraw a *lump sum* of maximum 10% of accumulated benefits (SER, 2019). This facilitates flexibility (from liquidity) in retirement expenditures, such as paying down a mortgage or leisure activities. The lump sum can be seen as a one-time pay-out plus a low-low annuity, as pension income will be lower after this withdrawal. As for early retirement, part-time retirement and the high-low annuity, individuals must evaluate whether their pension income will be sufficient when choosing for this PDC, given their life standard and future expenses. Similar to other PDCs, withdrawing the lump sum may not lead to a pension that is under the commutation limit (Achmea, 2019). The Ministry of SZW strives to have a bill regarding the lump sum presented to the Lower House by medio 2020 (Ministry of SZW, 2019).

Yet, with bringing second pillar pension wealth to the present comes *selection risk* that pension providers want to avoid, hereby guaranteeing solidarity across participants (Van Ewijk, et al., 2016). Participants with a low life expectancy might want to withdraw much of their accumulated benefits to get their 'share' out of the fund. This is the reason that legislation will only allow the lump sum to be withdrawn *on* the retirement date and not *before/after*. The high-low annuity with the maximum ratio of variation is another PDC option that increases selection risk.

[3] The AOW gap regards a period of no income due to the increase in statutory pension age and hence later pay-outs.

2.3 Information provision for making a PDC

From the range of PDC options being available, correct information provision should assist participants in making this second pillar pay-out decision. Pension providers have a *duty of care* when it comes to communicating information regarding the pension scheme of participants. Societal factors such as individualisation, the need for flexibility in PDC options and increased complexity has led to the Dutch government and the pension sector improving their communication channels. Below, we briefly discuss the most important communication channels with respect to the pension outcome.

Pension Tracing Service ("*mijnpensioenoverzicht.nl*", MPO)

MPO presents participants their accumulated pension wealth and their future entitlements regarding the first and second pillar. This is expressed as net pension income upon retirement. Opposed to other communication channels, MPO shows an integrated overview of all pension wealth accumulated from every pension scheme. Especially for those working at multiple employers or deferred pensioners this communication channel can be insightful. Besides, MPO presents information on for example the impact of life events, interpretation of figures and impact of early or late retirement. MPO also shows a link to the planner of the pension fund where the participant is currently accumulating pension (Pensioenfederatie, 2019). Altogether, this communication channel is meant to give participants more insight in their retirement financials and improve decision-making (Mijnpensioenoverzicht.nl, 2019).

Pension Benefit Statement ("*Uniform pensioenoverzicht*", UPO)

This yearly document is provided by the pension provider where an individual either accumulates or has accumulated pension. The UPO is an insight in accrued and to-be accrued *second pillar* pension wealth. Its main components are: old-age pension, spouse pension and disability settlements. This communication channel allows the individual to evaluate his or her future financial situation and use this information to make a PDC. The Dutch Association of Insurers and the Pensioenfederatie are collectively working to update and develop new UPO models (Pensioenfederatie, 2019). From European guidelines the future UPO must present more information (e.g., premiums paid and coverage ratio), to the reluctance of the pension sector (EIOPA, 2018).

Digital decision environment ("*Mijn Omgeving*")

In this environment the participant can observe his or her accumulated pension wealth, the available PDC options and their consequences. The consequences of PDC options are expressed in the *expected pension outcome* in net figures for choosing either one of the PDC options. These decision environments are usually called the "*Mijn Omgeving*" and are offered by pension providers. Dutch law currently does not require that all pension providers offer such environments; the pension provider must evaluate what the added value is (for participants) and whether or not this environment is cost efficient (AFM, 2015).

2.4 New method communicating uncertainty

From the previous section we conclude that there are already several communication channels available to assist in PDC decision-making. The PDC lies in a financially uncertain landscape with different time horizons for different participants. Moreover, the retirement income is received over time, not in one instance. Yet, in this uncertain landscape, PDC decision environments currently only present the *expected* outcome at the participants' target pension age. Uncertainty in investment results, inflation and interest rates result in many different potential outcomes. The larger the time horizon, the larger the uncertainty.

From the European IORP-II Directive, pension funds and commercial DC providers face an increased obligation to provide financial information to their participants. As of January 2019, this guideline has been implemented in Dutch law. The goal of this guideline is to stimulate further development of second pillar pensions in the European Union (Pensioenfederatie, 2018). This goes along with the Pension

Information Act ("*Wet pensioencommunicatie*"), introduced by Dutch parliament in 2015 (Ministry of SZW, 2015). This Act requires pension providers to give a better and more realistic insight in pension results. Meaning, individual pension outcomes must be communicated in the form of risks and returns. This has resulted in the development of a new communication method called the *Uniforme Rekenmethodiek* (URM). The URM is a calculation method where a scenario set is used as input, the specific accrual arrangements and indexation policy are applied and pension outcomes are produced in three scenarios (see Appendix A for more detail). The Pension Information Act prescribes to communicate these scenarios in *real* figures; adjusted for the inflation of consumer prices, representing today's wealth. In addition to the expected outcome, the participant will gain more insight in the dispersion in potential future outcomes, via an optimistic and pessimistic scenario. With more insight in the purchasing power of the three pension outcomes, individuals might undertake action if they perceive their pension result will be insufficient. Adaptive retirement planning can come in the form of working longer, saving more, et cetera. Yet, due to the difference in time horizon, the uncertainty for young participants regarding their pension result is large. This limits their action perspective. Older participants experience less uncertainty in future investment results, increasing the added value of the new communication method on retirement planning for these individuals. However, communicating uncertainty in the form of scenarios might also cause misinterpretation for participants. We go further into detail on decision-making under uncertainty in Section 4.5.

2.5 Conclusions

This chapter started by giving an overview of the three pillars of the Dutch pension system: state pension, occupational pension and voluntary income provisions. We focussed on the second pillar funded decision made by participants close to retirement: the *pension decumulation choice* (PDC). Here, several options are available for which the scope is set by legislation and their offering is organised by social partners and pension providers. In general, there is an increased need for freedom of choice and responsibility in adapting the pension decumulation choice to the individual situation. Yet, participants face a complex decision involving uncertainty over a large time period. Therefore, several communication channels are available to assist in PDC decision-making, such as the Pension Tracing Service, the Pension Benefit Statement and digital decision environments.

In an uncertain landscape, where many different factors influence the pension outcome, decision environments currently only present the expected outcome at the participants' target pension age. Therefore, to give a better and more realistic insight in the potential outcomes, a new communication method has been developed: the *Uniforme Rekenmethodiek*. In addition to the expected outcome, this method communicates an optimistic and pessimistic *scenario*, ergo uncertainty. With better assessment of income adequacy, adaptive retirement planning may be improved. Given the societal relevance of this new communication method, our research studies the impact of communicating uncertainty on PDC decision-making. The following chapter defines our scope and constructs several hypotheses for answering the research question of this study.

3. Research Method

From the previous chapter we identify that the *pension decumulation choice* (PDC) in the Dutch pension landscape is complex: the PDC is element of a multiple pillar system involving uncertainty over a long time period. Moreover, individuals have a heterogeneous household to which the pension product must align (Ministry of SZW, 2015). As a result, this complexity may lead to potentially sub-optimal decisions. These sub-optimal decisions can for example be the individual saving too little, resulting in too little income after retirement (Brüggen, et al., 2017). Besides, factors such as the long time horizon and myopia, financial literacy and information overload contribute to the risk of these sub-optimal decisions (Bodie, et al., 2012). Hence, the government and the pension sector are assisting with PDC decision-making by improving their communication methods and decision environment tooling. One of these developments is presenting uncertainty in the pension outcome in the form of three *scenarios*: an optimistic, expected and pessimistic scenario. In this study, we study the impact of these scenarios on the PDCs made by participants. First, Section 3.1 presents the scope of our study regarding PDC decision-making. From identifying the scope, we are able to construct an adequate research question for the problem context at hand. Then, Section 3.2 drafts several hypotheses to help answer the research question. Section 3.3 describes how these hypotheses are tested in our study using empirical data. Based on the characteristics of the data and the purpose of the analyses, we use different statistical procedures for this process. Lastly, we discuss our process of data collection in Section 3.4.

3.1 Scope

Over the course of one's career, participants accrue second pillar pension wealth at their employer(s). Since we are interested in *pension decumulation choice* decision-making, we focus on the final stage of a participant's career. Figure 2 presents the scope of this study. In terms of age, our scope is 61-65 years, as these participants are close to retirement and early retirement remains a relevant option. Both active participants and deferred pensioners are in our target group. Deferred pensioners are no longer accruing pension at the pension fund in question, but still receive the UPO and eventually retirement income. Since retirees have already made their PDC, we exclude this group from our scope. The example in the figure below includes a participant who has accrued second pillar pension wealth since the age of 20 and is now 64 years old.

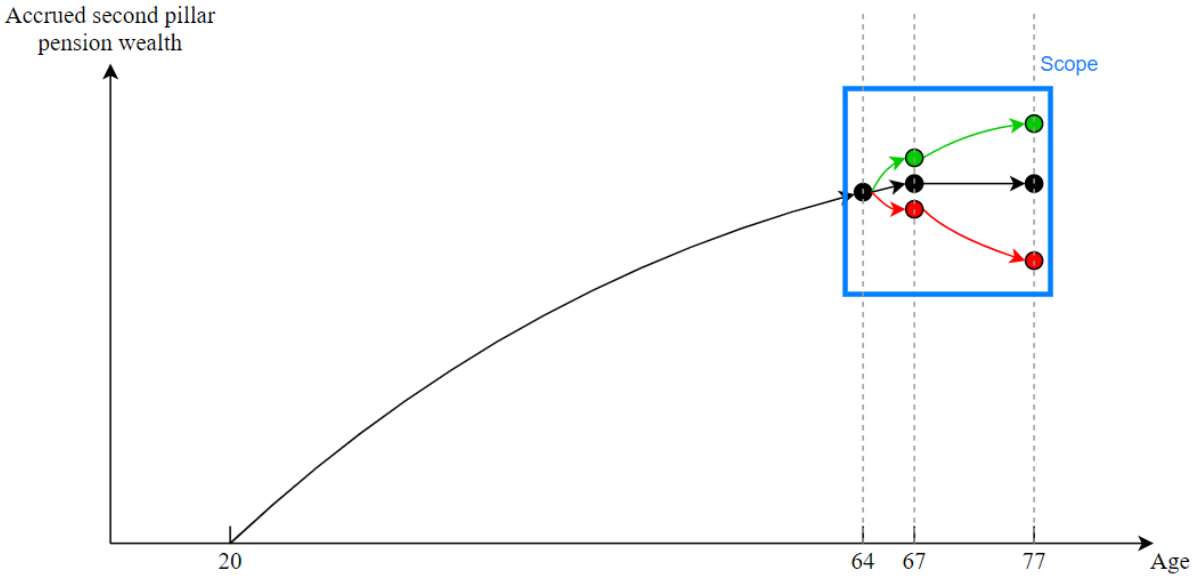

Figure 2: The pension decumulation choice phase being the scope of this study

As introduced in Section 2.4, the new communication method presents dispersion in pension outcome in the form of scenarios. Where current decision environments present the *expected* outcome per PDC,

the new communication method can be applied to introduce uncertainty and purchasing power per PDC option in *three scenarios*. Regarding the pension outcome, the green and red dot in Figure 2 represent upside and downside potential, in addition to the (second) black dot.[4] In our figure we assume that the participant continues to work and accrue wealth until the statutory pension age of 67. At the age of 64, the participant's potential pension outcomes at age 67 are communicated as the green, black and red dot. In Section 4.5 we discuss the communication of scenarios in more detail.

Given the development of this new communication method, we raise the question of whether the participant understands, values and can benefit from this scenario-based approach when considering the PDC. The focus of this study is to investigate *if* and *how* communicating uncertainty in scenarios in the PDC decision environment affects decision-making and can be of added value to the participant. Summarising, the main research question of this study is as follows:

Research question: *"To what extent does a decision environment with three scenarios communicating uncertainty, based on participants' needs and preferences, alter the pension decumulation choice (PDC) made and what are potential improvement directions?"*

As an addition to the scenario approach, we are interested in the extent to which showing scenarios over a *longer time horizon* affects PDC-decision making. The PDC involves a large financial decision with an impact that stretches over a long time horizon. This time horizon is positively correlated with uncertainty in the pension outcome. Participants close to retirement experience less financial uncertainty than younger participants, due to a shorter time horizon. This is because over a longer time period economic developments and life events can alter the pension outcome substantially. Yet, active participants and deferred pensioners are currently presented the pension outcome that they will receive at *one timestamp*: the statutory pension age. In Figure 2 we included a longer time horizon of an extra ten years in our scope: this presents how the pension result can change from the age of 67 to 77. Given our target group, communicating a longer time horizon may also provide more action perspective.

3.2 Hypotheses formulation

In our study, we test several hypotheses to help answer the research question of this study. We use *null hypothesis statistical testing* to make statements about a participant population. The null hypothesis is an expectation which can either be rejected or not. In a statistical test, an experimental factor is tested against the (null) hypothesis of no effect or relationship based on a given observation. The null hypothesis must be 'nullified' before any alternative hypothesis can be accepted (Nickerson, 2000). If no significant effect or relationship are observed, we fail to reject the null hypothesis (Killeen, 2005). One can only reject the null hypothesis if the test statistic falls into the critical region, which depends on the chosen significance level (*p-value*).[5]

Below we construct several null hypotheses and their alternative hypotheses. We hereby evaluate these using expert opinions and literature. We must remain critical when testing our null hypothesis, as nullifying is dependent on multiple factors. It depends on which PDC options we present to the participants, their construction and potential framing effects. Section 5.4 goes into more detail regarding the validity and reliability of the empirical data and hypothesis testing.

Topic 1: "From one scenario to three scenarios communicating uncertainty"

The new communication method presents the pension outcome in an optimistic, expected and pessimistic economic scenario. These scenario figures are currently presented to participants on the Pension Registry (MPO) and as of 2020 the Pension Benefit Statement (UPO) will also show these scenarios (Pensioenfederatie, 2018). In this trend, we study the impact communicating scenarios on the

[4] The *pessimistic* (red) outcome and the *optimistic* (green) outcome are respectively represented by number 500 (5th percentile) and number 9,500 (95th percentile) of 10,000 ranked stochastic outcomes. For more information, see Appendix A.
[5] We use the commonly used statistical significance of $\alpha = 0.05$.

PDC made by participants. Scenarios affect the financial outcome of every PDC differently. This hypothesis tests the difference ('delta') in PDCs between decision environments when this additional information is presented. A subset of participants first base their PDC on a decision environment presenting the *expected* outcome at age 67, after which they base their PDC on a *scenario-based* decision environment. We test whether communicating uncertainty in scenarios in the PDC decision environment has a *significant* effect on participants switching their initial PDC made. A study by the Pensioenfederatie (2019) shows that participants perceive scenarios as something they can influence instead of economic circumstances. These scenarios are either relevant for participants or not of their concern. Our null hypothesis predicts no significant effect of scenarios on the (initial) PDC made. The alternative hypothesis expects that the participants will be influenced by the scenarios and significantly alter their initial PDC made.

1. H_0: If scenario figures are added to the base decision environment, then participants do *not* change their initial PDC.
   H_1: If scenario figures are added to the base decision environment, then participants change their initial PDC.

Topic 2: "From three scenarios back to one scenario"

As a validity check, we test the 'delta' in the exact opposite direction; whether or not PDCs significantly change when the scenario information is stripped from a decision environment. In other words, a different subset of participants first makes a scenario-based PDC and then makes a PDC based on solely the *expected* outcome. This hypothesis is meant to test to what extent the participants understand the scenario approach. Our expectation is that due to the *learning effect*, participants will *not* alter their PDC preference. With the information obtained in a scenario-based environment, participants will be more likely to realise that the base decision environment afterwards is identical.

2. H_0: If scenario figures are stripped from the decision environment, then participants do *not* change their initial PDC.
   H_1: If scenario figures are stripped from the decision environment, then participants change their initial PDC.

Topic 3: "Communicating uncertainty over a longer time horizon"

This hypothesis tests whether presenting pension outcomes over a longer time horizon than the statutory pension age has a significant effect on the PDC made. From the duty of care perspective, informing participants about the future may assist them with their retirement planning. To construct an adequate time horizon for this hypothesis, we follow the legal standards for retirees. Retirees are presented scenario figures indicating the outcomes ten years from now. To follow this standard, we define our longer time horizon as *ten years after the participant's statutory pension age*. If a significant effect on PDC decision-making is proven, this might form an incentive for pension providers to start communicating scenario figures beyond the statutory pension age. With the increasing dispersion of potential pension outcomes, the participant may be positively or negatively affected by this presentation. The null hypothesis assumes no effect of a longer time horizon on the PDC made. Our expectation is that a longer time horizon will give participants more insight in PDC consequences (i.e., the construction and dispersion per option). Therefore, we expect the null hypothesis below to be rejected:

3. H_0: If scenario figures are presented over a longer time horizon than solely on the statutory pension age, then participants do *not* change their PDC.
   H_1: If scenario figures are presented over a longer time horizon than solely on the statutory pension age, then participants change their PDC.

Topic 4: "Reducing the time horizon when communicating uncertainty"

As a validity check, we again measure the 'delta' in the other direction. Meaning, whether or not PDCs significantly change after the scenario figures at a later stage in retirement are stripped from the decision environment, showing scenarios solely on the statutory pension age. Our expectation is that stripping this longer horizon will *not* have a significant effect on the PDC, due to a *learning effect*. With the information obtained when first making a PDC based on scenarios over a longer time horizon, participants are more likely to realise that the stripped decision environment is identical.

4. H_0: If a longer horizon is stripped from the decision environment, showing solely the three pension outcomes on the statutory pension age, then participants do *not* change their PDC.
   H_1: If a longer horizon is stripped from the decision environment, showing solely the three pension outcomes on the statutory pension age, then participants change their PDC.

So, the first and third null hypothesis (Topic 1 and 3) are tested using a first subset of participants from our participant population. The second and fourth null hypothesis (Topic 2 and 4) are tested using a second subset of participants. This construction is further described in Section 5.1.

Every individual responds differently to the communication of uncertainty. In risky intertemporal environments, the *risk and time preference* of individuals are of large influence on the PDC (see Potters et al. (2016) and Booij et al. (2003)). Therefore, we construct two hypotheses that relate these factors to PDC decision-making under uncertainty.

Topic 5: "Risk preference and PDC behaviour under uncertainty"

Every participant perceives risk and return differently. Pension has a long time horizon, is uncertain and involves large monetary amounts. Especially with the new method communicating uncertainty in three scenarios, it is therefore relevant to have a picture of the participants' risk preference. If a participant population is risk averse, the PDCs made when communicating uncertainty can be substantially different than those of risk loving participants. From literature and the context at hand we expect that the risk preference is of *significant* influence on PDC decision-making. Based on the above, we expect to reject the null hypothesis below:

5. H_0: If scenario figures are presented over a longer time horizon than solely on the statutory pension age, then changing the PDC is *not significantly* influenced by the *risk preference*.
   H_1: If scenario figures are presented over a longer time horizon than solely on the statutory pension age, then changing the PDC is *significantly* influenced by the *risk preference*.

Topic 6: "Time preference and PDC behaviour under uncertainty"

Time preference indicates how individuals value time when it comes to monetary rewards, measured by the *subjective discount factor*. Special cases of time preference, such as the phenomena of *hyperbolic discounting* and *preference reversal*, are elaborated on in Section 4.3. Furthermore, as Dutch households plan little for retirement (Brüggen et al. (2017); Van Raaij et al. (2008)), obtaining information about the pension income on the long term may result in a different PDC preference. Our sixth hypothesis tests whether PDC decision-making when communicating uncertainty over a longer time horizon is significantly influenced by participants' *time preference* of money. Our expectation is that hyperbolic time discounting will be reduced and retirement planning is improved, resulting in a different PDC made.[6] Visualisation can contribute in understanding the financial impact of every PDC option on the long term. Therefore, we expect to reject the null hypothesis below:

[6] We base our expectation on the article written on procrastination in retirement planning by O'Donoghue (1999).

6. H_0: If scenario figures are presented over a longer time horizon than solely on the statutory pension age, then changing the PDC is *not significantly* influenced by the *time preference*.
   H_1: If scenario figures are presented over a longer time horizon than solely on the statutory pension age, then changing the PDC is *significantly* influenced by the *time preference*.

3.3 Methods of hypothesis testing

To select the most appropriate statistical test for our hypotheses, we first define the level of measurement for the variables in question. For the first four hypotheses, the PDC data are *nominal*: we do not rank PDC options. We compare PDCs made *before* with PDCs made *after* adding/stripping information to/from the initial decision environment. Therefore, we seek a statistical test that identifies significant differences between two nominal data sets. Second, we deal with a *dependent data sample*, as every participant sees decision environments consecutively. So, the statistical test studies the significance of differences between two *paired* proportions.

The *McNemar test* is a first step towards finding the most adequate statistical test. This test uses a Chi-Square distribution for dichotomous variables. A 2x2 contingency table is tested for symmetry. The null hypothesis assumes symmetry in this table (McNemar, 1947). However, our nominal data has more than two categories since we present more than two PDC options to the participants. Therefore, we must find an alternation or addition to the McNemar test. From Chow et al. (2008) we identify the *McNemar-Bowker test*. Introduced by Albert Bowker (1948), the McNemar-Bowker test allows for three or more categories 'k' when considering paired nominal data. Table 1 below presents an example, applied to the context of this study. The n_{ij} represents the number of individuals choosing PDC option *i* first (before) and PDC option *j* second after adding/stripping information to/from the decision environment.

Table 1: McNemar-Bowker contingency table

		Decision After			
		PDC option 1	PDC option 2	PDC option 3	PDC option 4
Decision Before	PDC option 1	n_{11}	n_{12}	n_{13}	n_{14}
	PDC option 2	n_{21}	n_{22}	n_{23}	n_{24}
	PDC option 3	n_{31}	n_{32}	n_{33}	n_{34}
	PDC option 4	n_{41}	n_{42}	n_{43}	n_{44}

The null hypothesis and alternative hypothesis are as follows:

$$H_0: n_{ij} = n_{ji}\ for\ all\ i \neq j \quad vs. \quad H_A: n_{ij} \neq n_{ji}\ for\ some\ i \neq j.$$

The test works by performing separate McNemar tests, where every test returns a value for χ^2. This number is summed and evaluated by a χ^2-distribution with degrees of freedom $df = k(k-1)/2$. The test statistic therefore looks as follows: $T_{MB} = \sum_{i<j} \frac{(n_{ij}-n_{ji})^2}{n_{ij}+n_{ji}}$. The null hypothesis is rejected when: $T_{MB} > \chi^2_{1-\alpha,k(k-1)/2}$. However, this omnibus test is inherently two-sided, meaning that it can only be said *if* there is a significant change in PDCs and not *how* PDCs change. *How* the PDCs change requires descriptive analyses, which we conduct in Section 6.2.

Logistic regression

As the risk and time preference are measured on a continuous *ratio* scale (see Section 4.3), we use a different procedure for testing the fifth and sixth hypothesis. Here, we test for the significance of both factors on the probability of changing the PDC. This change is a binary variable, i.e. '1' in case of a

change and '0' if there is no change. Hence, we use *logistic regression* in order to test these hypotheses. The goal here is to relate the independent, predicting variables to the dichotomous dependent variable. The dependent variable must be altered in such a way that linear regression is possible. The independent variables influence the odds of the dependent variable occurring, but in a non-linear relationship. We take Y as the binary outcome if a change occurs from one decision environment to another. Let $x_1, x_2 \ \dots \ , x_n$ be the predicting variables (e.g., risk preference or educational level). The logistic regression function then looks as follows:

$$f(y) = \text{logit} = \ln\left(\frac{P(y=1)}{1-P(y=1)}\right) = \beta_0 + \beta_1 x_1 + \ \dots + \ \beta_n x_n,$$

$$\text{where } \frac{P(y=1)}{1-P(y=1)} = \ odds = e^{\beta_0+\beta_1 x_1+ \ \dots + \beta_n x_n}$$

The intercept β_0 is the expected value of Y if there are no predicting variables x. The $\beta_1, \beta_2, \dots \ \beta_n$ are the logistic regression coefficients. If we increase the value of x_i by one unit, the odds ratio changes by a factor of e^{β_i}.

Predicting variables *risk preference* and *time preference* are tested for their significance in Section 6.5 using the statistical tool SPSS. We add other predicting variables such as level of education, income and years to statutory pension age as control variables. Furthermore, we consult the Nagelkerke (1991) pseudo-R^2 value to analyse how much of the variation in binary outcome Y can be explained by the independent variables x. This R^2 value explains the predictive power of the regression model, and how much variation is caused by external, unmeasured factors.

3.4 Data collection

To gain necessary knowledge on PDC decision-making, test the hypotheses and answer the research question, we gather data from several sources. Firstly, we will gain insight in current literature regarding retirement planning and the individual. From the pool of scientific articles, we assess the findings of empirical studies and qualitative studies. Every participant is heterogeneous in household, characteristics, needs and preferences and therefore considers the PDC differently. Decision-making may also be influenced by behavioural biases and subsets of individuals may require further assistance. The literary findings will be used as input for our quantitative study.

Secondly, we will measure PDC preferences of 61- to 65-year-old participants empirically via a survey. The participants, addressed from a participant file of a large Dutch pension fund, will be contacted via email. After participants are linked to a representative person (*"maatmens")*, they are confronted with decision environments with financial data scaled to their financial situation. These financial data are hypothetical figures, estimated as realistically as possible. We measure *stated preferences* instead of revealed preferences, as this is an innovative study on the impact of a new communication method. Stated preferences indicate how participants would/should choose given their preferences (Bodie, et al., 2012). Then, we ask participants for their substantiation. The main goal is to measure to what extent and with what reasoning a participant *alters* the PDC (or not) when confronted with scenarios regarding their pension outcome. Additionally, we measure the impact of presenting scenarios showing a later time stamp in retirement. Besides, in our empirical study we try to steer decision-making in the form of choice architecture as little as possible. Choice architecture can considerably affect decision-making because it plays into emotional barriers and behavioural biases that participants may experience (Limpens, et al., 2018). We want to measure preferences and needs where participants have *full freedom of choice*. As such, we do not steer decisions in any direction and we can empirically prove how communicating uncertainty is perceived and aligns with participants' needs. Chapter 5 discusses the context, structure and execution of the questionnaire. Chapter 6 discusses our main findings and tests our hypotheses. With these results, we are able to answer the research question of this study.

3.5 Conclusions

This study measures the impact of communicating uncertainty of pension outcome on the pension decumulation choice (PDC) made by participants. We have defined our scope to be 61- to 65-year-old participants, including both active participants and deferred pensioners. We question whether participants will understand, value and can potentially benefit from a scenario-based approach in the PDC decision environment. Furthermore, the PDC involves a large financial decision stretching over a long time horizon. The longer the time horizon, the more economic developments and potential life events influence the pension outcome. For this reason, we will measure the impact of communicating a later timestamp than the statutory pension age on decision-making as well. We will conduct a survey among participants of a large Dutch pension fund, to measure PDC preferences and substantiations.

To help answer the research question of this study, we will test six hypotheses. Four hypotheses test whether or not PDCs *significantly* change when information on uncertainty is either added or stripped to/from a decision environment. For this purpose, we use the McNemar-Bowker test. The other two hypotheses test the influence of the two behavioural factors on decision-making in risky intertemporal environments: the *risk preference* and *time preference* of individuals. For testing these two hypotheses we perform regression analyses. In the next chapter, we conduct a literature study to gain knowledge on retirement planning and individual decision-making, in the context of an uncertain landscape.

4. Literature Review

In Chapter 3 we identified hypotheses and methods to help answer the research question of this study: to what extent the communication of uncertainty influences the *pension decumulation choice* (PDC) made. Yet, to understand participants' needs, preferences and behaviour surrounding this element of retirement planning, we require more theoretical knowledge. Pension is a complex product, where the participant faces the trade-off between saving and consumption. In terms of lifecycle planning, this means weighing short-term gains of consumption now versus long-term gains of consumption after retirement (Adams, et al., 2011). Besides, the financial position of the individual after retirement involves more than solely second pillar pension wealth. The significance of the other pension pillars results in heterogeneous retirement planning for every individual. Regarding the PDC, individuals must understand the (consequences of the) decision and its effect on the financial position of their household now and in the future. First, Section 4.1 discusses the elements of retirement planning individuals face and use as foundation for making the PDC. Yet, in decision-making individuals have proven to behave and act differently than the fully rational 'homo economicus' (Tiemeijer, et al., 2009). Therefore, Section 4.2 presents on a micro-level how humans deal with choice and financial planning. Here, we discuss several behavioural biases that can influence PDC decision-making. Third, in Section 4.3 we discuss the two characteristics of individuals most relevant for this study: the *time preference* and the *risk preference* towards pension outcome. Yet, as retirement planning is difficult and behavioural biases influence decision-making, particular individuals may need assistance in making an adequate PDC. Therefore, from a *duty of care* perspective, Section 4.4 weighs several approaches to support and facilitate participants in making a substantiated and financially adequate PDC. Lastly, Section 4.5 evaluates (PDC) decision-making under *uncertainty* and the potential influence of the new method communicating this uncertainty.

4.1 Retirement planning

Individuals plan for retirement in a broad process involving the identification of (future) sources of income and expenses and assessing their 'readiness to retire'. Second pillar pension wealth is one of these income sources, where the PDC is a later-stage decision translating wealth to income. This section discusses how individuals can put the PDC and retirement planning in a broader perspective than solely the second pillar. Willemsen (2015) proves that individuals often put the PDC in a 'household' perspective; evaluating second pillar pension wealth decisions in the context of the entire household. As our study focusses on PDC decision-making, we discuss this broader perspective to help understand how the individual links the PDC to his or her heterogeneous financial situation.

The scope of this study is the *phase of wealth decumulation*, close to retirement and after. The red arrow in Figure 3 roughly indicates the timestamp where individuals are confronted with the PDC and usually make their decision. We review several important decisions individuals face in the decumulating stage of their lifecycle and what substantiation they may have when making the PDC. The figure shows that the AOW, pension, annuities and one's house form the important income components in this stage. Additionally, savings and investments are other financial resources that are element of retirement planning.

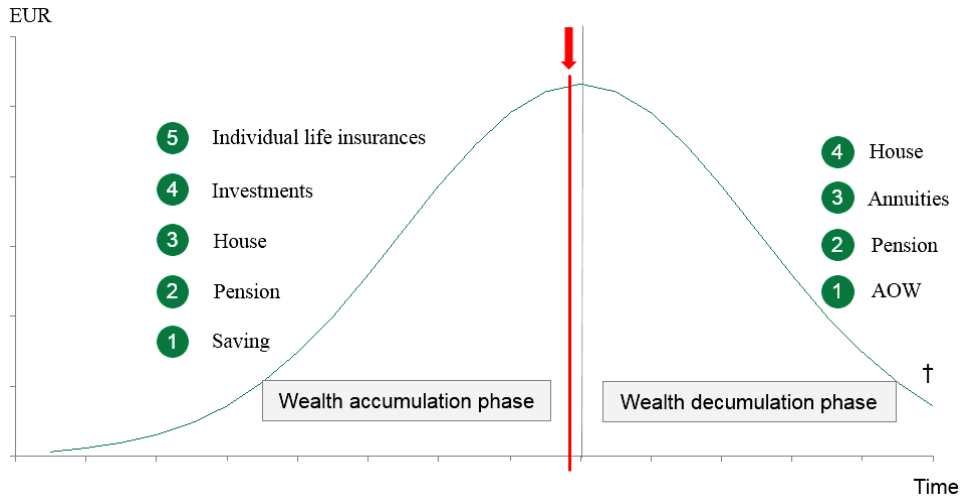

Figure 3: Wealth development of individuals over the lifecycle

Over the course of life, the theory of microeconomics states that with saving and investing individuals try to smooth consumption to maximize utility. During the working life, wealth is accumulated to maintain a desired consumption level after retirement.[7] The early life-cycle model by Modigliani et al. (1954) describes that in a situation without longevity risk and bequest motive, individuals accumulate wealth during their working days and use their savings after retirement to support consumption. Utility is hence maximised when all wealth is depleted upon death.

However, due to *uncertainty in remaining lifetime* (longevity risk), the decumulation of wealth may be slower than originally predicted. An extended life-cycle model by Yaari (1965) and Davies (1981) shows that households in fact dissave at a lower rate than predicted by the early life-cycle model. In this lifecycle model including lifetime uncertainty, Van Ooijen et al. (2015) write that the *risk preference* and *time preference* of money are the two most important behavioural factors influencing consumption and saving after retirement. We go further into detail on these factors in Section 4.3. Other factors are the economic environment and social safety net benefits (Browning, et al., 1996). Individuals having too little retirement income rely upon social safety net benefits to maintain a sufficient life standard. Furthermore, also *bequest motives* can substantially reduce consumption during retirement (Hurd, 1989). Compared to the early life-cycle model, utility is then derived from dying with positive net worth. This way, the wealth trajectory in retirement is flattened (De Nardi, et al., 2014). Another important factor for saving after retirement is *uncertain health expenses* (Kotlikoff, 1989). Just like disability or a house fire, this idiosyncratic risk requires either insurance or lumpy expenses (Bart, et al., 2016). If the health risk cannot be insured, risk averse individuals will save as a precaution and hence the wealth trajectory during retirement flattens (Alessie, et al., 2019).

Another important factor of retirement planning is the potential presence of *home equity*. In PDC context, individuals having substantial home equity can afford to choose more freely given their needs and preferences. Homeowners have a potential buffer that can be addressed at any future time. Discussing home equity helps understanding the adequacy of savings to support income after retirement (Venti, et al., 2004). Individuals in the Netherlands experience a relatively high level of financial illiquidity, with pension wealth and net housing wealth being substantially larger than the freely disposable financial assets. The accumulation of this wealth is highly influenced by policy, such as compulsory pension accrual or the fiscal stimulation of owning houses (CPB, 2018). In 2010, Dutch households hold an estimated total of €500 bn. in home equity: an average of €257,000 per household. In terms of savings adequacy, home buyers may potentially 'oversave' while renters may 'undersave' for retirement (Hendriks, et al., 2017). A possible solution for housing illiquidity and increasing

[7] For life-cycle models on the smoothing of consumption, we refer to Deaton (1992) and Deaton et al. (1980).

adequacy in retirement income is *equity release*. Equity release allows for the equity one has in the house to be transformed into extra pension income or cash. This way, individuals can bring the proceeds of a future house sale to the present, either in the form of attracting a loan or selling the property (and renting it back). Brounen et al. (2019) state: "*Actively releasing equity can offer the possibility to help fill in lifecycle planning with an adequate pension income.*" From the liquidity that arises, equity release can hence help the individual smooth consumption better over the remaining lifecycle (Bart, et al., 2016).

Summarising, the pension system is an interplay between the domains pension, healthcare and living (Bovenberg, et al., 2011). Regarding retirement planning, the PDC context is for every individual unique and requires many factors and financial resources to be weighed in order to make a substantiated decision. Besides, the physical/mental condition and financial milieu of participants may limit the set of feasible retirement options.

4.2 The human aspect of choice and planning

Every individual approaches retirement planning differently, as it involves many factors and resources to be weighed over a long period of time. Capabilities and human characteristics largely influence how one perceives and deals with retirement planning and PDC decision-making. This section discusses this decision-making from a micro perspective.

Financial literacy, numeracy and pension awareness

Adequate retirement decisions require a sufficient level of financial literacy. To quote Remund (2010): *"Financial literacy is a measure of the degree to which one understands key financial concepts and possesses the ability and confidence to manage personal finances through appropriate short-term decision-making and sound, long-range financial planning, while mindful of life events and changing economic conditions."* Yet, multiple studies have shown that not all individuals possess this level of literacy. This is troubling, as more and more financial decisions in the pension sector are borne by the individual rather than the state (Dinkova, 2019).

Empirical research by Lusardi et al. (2011), (2014) shows that due to a low level of financial literacy individuals fail to plan for retirement, even 5-10 years off from retiring. Individuals with more confidence in their financial knowledge have a higher propensity to plan. Together with a study by Lusardi (2012), for a low level of *numeracy* individuals tend to make sub-optimal financial decisions regarding their retirement plans. With age, individuals become increasingly less numerate. With respect to the PDC this can become troublesome, as this decision is made at a higher age. Furthermore, with high compulsory participation in Dutch pension schemes, there is a low level of pension literacy and *awareness*. In DB schemes, retirement saving decisions are mostly made outside the employees' control and gradually accrue up to a predefined goal in terms of retirement income. Moreover, with the new Pension Information Act, the mandate for funds and insurers to provide accurate information has led to individuals delving less in their own pension situation. There is less urgency to read pension documents and planning for retirement is postponed (Krijnen, et al., 2014). Besides, retirement planning is time-consuming, difficult, in many cases far away and involves much uncertainty. Resulting, many individuals procrastinate retirement planning. However, improving financial literacy and pension awareness may be instruments for improving the quality of decisions related to (second pillar) retirement planning (Prast, et al., 2016).

Behavioural biases

Compared to the neo-classical homo economicus, which is completely rational, acts in its own self-interest and analyses all info, individuals act differently in decision-making. Individuals use rules of thumb, may not be able to process all information correctly and are influenced by the organisation and presentation of choices. This section focusses on the time-inconsistencies and cognitive limitations

influencing participants when uncertainty is communicated. To describe these behavioural influences on decision-making, we follow the *conventional paradigm of rationality*, where we use the literary sources below to substantiate our statements.[8]

Present-bias

Individuals tend to give a disproportionate weight to the present. This bias indicates the impatience of individuals or *immediate gratification* regarding decision-making. This is closely related to the concept of *hyperbolic discounting*, which we further discuss in Section 4.3. Regarding the PDC, individuals experiencing present-bias will value the option with immediate gratification high, such as the high-low annuity or the future possibility to withdraw a lump sum. These individuals receive their second pillar pension wealth much rather today than tomorrow.[9] Yet, it is questionable whether participants are fully aware of the consequences of these present-oriented financial decisions.

Loss aversion

For a loss averse person, "losses loom larger than gains" (Kahneman, et al., 1979). From a neutral reference point, these individuals are more averse to a loss of $X than gaining $X is attractive (Kahneman, et al., 1984). The ratio between the two is about 2:1, which increases as the individual approaches retirement (Kahneman, et al., 1991). Furthermore, loss aversion also explains individuals sticking to the *status quo* when making a decision. Potential disadvantages of diverting from the status quo loom larger than the potential advantages. Additionally, framing effects play a large role in the prevalence of loss aversion (Kahneman, et al., 1986). Certain visual communication or textual formulations have a large impact on the perception of the PDC. For example, an annuity is more appealing in a loss (consumption) frame than in a gain (investment) frame, as individuals fear losing longevity protection more than potentially gaining from another asset (Brown, et al., 2016). When communicating scenarios, this bias leads to individuals weighing losses (pessimistic scenarios) more heavily than gains (optimistic scenarios) when uncertainty in the pension outcome is communicated. Uncertainty may lead to individuals choosing a different PDC, to 'minimize losses'.

Multiple selves

Multiple selves refers to the individual experiencing an intertemporal effect: trading off outcomes at different moments in time. For a decision over time, an individual must imagine him- or herself at different future moments in time; comparing different 'selves' (Jameson, et al., 2009). This becomes more difficult if this future moment is further away and the situation becomes more unpleasant (e.g., illness or poverty). Most multiple selves models indicate myopic (near-sighted) selves being in conflict with more future-oriented selves (Frederick et al., 2002). In fact, Selten (1999) describes the split of a person into multiple selves with conflicting goals as a boundary for the rationality of the person as a whole, with goals being either cognitive or motivational. In PDC context, many individuals find it difficult to picture their lives after retirement. Individuals tend to be negligent regarding illness or financial distress, hence the effect of multiple selves on the PDC made is larger. Meaning, if one has difficulty or is ignorant in depicturing (the financial state of) a future self, he or she will more likely retire early or choose the high-low annuity ('temptation' as referred to by Selten (1999)). In short, the effect of multiple selves may lead to individuals choosing naively and thereby neglecting the consequences and uncertainty of a PDC on future retirement income.

[8] For a recent paper constructing an axiomatic, normative framework for complete preference orderings, giving rise to rethink the commonly adopted narrow boundaries of rationality, we refer to Roorda et al. (2019).

[9] Participants with low *life expectancy* (or higher mortality risk) may have a higher preference for options with immediate gratification than those with a higher life expectancy (Inkmann, Lopes, & Michaelides, 2011). Yet, strategic behaviour does not play a prominent role in PDC decision-making, as Kortleve et al. (2016) find evidence for *anti selection* as it are mainly those of higher income (and corresponding higher life expectancy) that choose early retirement.

Distortive effect of complexity on choice

From the point of view of a rational economist, more choice is better. This corresponds with Dutch pension fund participants demanding more flexibility in and the number of PDC options. Yet, neurological research has shown that choice leads to *less* positive emotions and *more* irritation, as choosing is difficult and can lead to frustration (Limpens, et al., 2018). Moreover, Scheibehenne et al. (2010) show that too much choice can in fact lead to choice stress if the options are complex and a clear dominant option is missing. This can result in individuals picking randomly or adopting a default option (see Schwarz (2004) and O'Donoghue et al. (1999)). In our study, we present more information in the form of uncertainty and a longer time horizon. As this information may be perceived as complex and confusing by the individual, there is a potential distortive effect on the PDC made.

Anchoring

This practice draws upon the tendency of individuals to attach or 'anchor' their thoughts and estimates around an initial reference point (Van Zyl, et al., 2016). This initial reference point might stem from the problem formulation, the result of a partial computation or something the individual is familiar with. The anchor point carries a disproportionate weight in subsequent decision-making, as individuals often make insufficient adjustments away from this anchor (Tversky, et al., 1974). Especially uncertainty and impulsive decision-making heavily play into this bias. In PDC context, an experiment by Hurwitz et al. (2018) shows that setting a minimum annuity as regulatory signal has an anchoring effect on annuity decisions made. Another example is individuals retiring early because their friends and family have done it as well. In our study, individuals may anchor their thoughts around an initial PDC made, using this PDC as their reference point throughout the remainder of the questionnaire. Anchoring may refrain these individuals from switching PDC when either more or less information is presented to them.

Behavioural biases and insufficient capabilities may result in a sub-optimal PDC made. Given the (financial) situation of the individual, behavioural biases influencing the PDC may for example lead to too little retirement income or dissatisfaction after some time. Figure 4 presents a classification of the aforementioned biases. The *framing effect* is discussed in Section 4.5, where we focus on its impact with regard to how uncertainty is perceived by individuals.

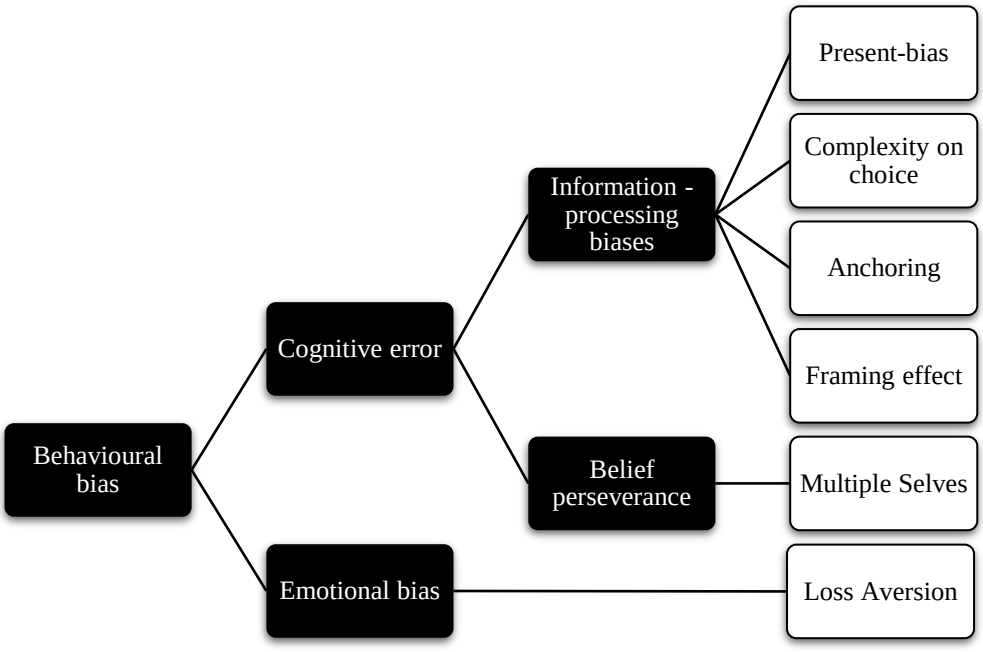

Figure 4: Classification of the behavioural biases most relevant for this study

4.3 Time preference and risk preference

From the previous section we identify that human characteristics play a large role in PDC decision-making. In Chapter 3 we identified the two most important factors in this context: the *time preference* and *risk preference*. These factors influence how individuals perceive uncertainty over time regarding their pension outcome. After giving a definition and describing phenomena, we discuss the most suitable methods for measuring these two factors.

Time preference of money

Throughout the course of life, individuals constantly make decisions what to have immediately, and what to postpone until later. In financial terms, this preference for time is measured by the *subjective discount factor*. The higher the subjective discount factor, the more present-oriented an individual is. It determines the extent to which money is perceived to be less worth for the individual if received in the future. In pension context, the time preference is related to the preferred level of annuitisation per participant (Schreiber, et al., 2016). Regardless of the consumption pattern, the level of annuitisation indicates to what extent a participant desires to withdraw their wealth out of the pension fund.

An extreme case of time preference is called *hyperbolic discounting*, where immediately available rewards have a disproportionate effect on preference than more delayed (higher) rewards (Ainslie, 1975). This is the exact opposite of *exponential discounting*, where individuals have a constant discount factor, regardless of the time delay. Thaler (1981) found that the subjective discount factor over a longer time horizon is smaller than for a shorter horizon. Individuals show impatience regarding short-horizon decisions, but have more patience when a long-horizon is presented (Benhabib, et al., 2007). Therefore, the hyperbolic discounting model is deemed to be more consistent with the intertemporal preferences of individuals than the exponential discounting model.[10] Hyperbolic discounting explains the phenomenon of *systematic preference reversal* which participants can experience (Meier, et al., 2010). In PDC context this preference reversal is present too. A considerable group of participants prefers a PDC option with immediate gratification (Kortleve, et al., 2016). However, these participants may reverse this preference when looking back after some time.[11] In general, Dinkova et al. (2019) find that young and middle-aged participants have time-inconsistent preferences. For participants close to retirement, the horizon of future benefits is logically shorter and less time-inconsistency is apparent. Furthermore, a negative correlation is present between the *risk preference* and the *time preference*. Intertemporal decision-making involves certainty and uncertainty regarding outcomes; one must deal with the concept of risk over time. Risk-averse participants are likely to discount the future more heavily (Anderhub, et al., 2001).

To arrive at an appropriate measuring method for discounting, we use the paper written by Hardisty et al. (2013). The authors discuss the *choice method* and a *matching method*. The *choice method* is a sequence of binary comparisons ($10 now or $11 in one year, if $10 now: compare $10 now and $12 in one year, et cetera) until the future reward is chosen. If the individual prefers the future reward when it is $15, the indifference point is then the average of the upper and lower bound, being $14.50. In contrast, the *matching method* directly asks for the indifference point ("What amount of money Y would make you indifferent between $10 now and $Y in one year?"). Comparing these methods, Manzini et al. (2008) find that the matching method yields lower discount rates than the *choice method*. This can be partially explained by the magnitude effect between the two rewards; the matching method results in a better attentional balance between magnitude and delay attributes (Tversky, et al., 1988). The choice method is better suited for consequential intertemporal choices, predicting real-world behaviour and

[10] Meier et al. (2010) prove that the willingness-to-pay is steeper for monetary amounts closer to the present.
[11] For a study on dynamic preference reversal, we refer to Chen et al. (2019).

outcomes. Yet, it takes longer to complete. To obtain an indifference point (i.e., subjective discount rate) quickly and create less experimenter bias, the matching method should be used.

Risk preference

Contextually, we define *risk preference* as follows: a measurement of the preference the participant has towards the uncertainty of their individual pension outcome. Especially with the new method communicating the dispersion of pension outcomes (URM), it is relevant to understand the participants' perception of risk and how it influences decision-making.

In general, humans are risk averse. Individuals are expected to be utility maximisers under uncertainty, but have a disproportionate preference for certainty when available (Andreoni, et al., 2010). Over the individual lifecycle, studies by Trokasti (2016) and Dohmen et al. (2017) find that the risk aversion increases with age. The elderly are less willing to take risk and spend money, which explains the flattened wealth trajectory described earlier. However, it is difficult to measure risk preference, as it cannot be observed directly. Risk preference is a latent trait which can be measured by observing decisions of individuals who face a well-defined trade-off between choice options having a different riskiness. This requires that all other factors influencing this trade-off are kept constant and that the method of measuring is perceived exactly as intended by the researcher (Dohmen, et al., 2018).

To come to the most appropriate method for measuring risk preference regarding pension outcome, we use the paper written by Van der Meeren (2017). Two academic methods checking all the boxes are the *HL method* (Holt, et al., 2002) and the *CS method* (choice sequence).

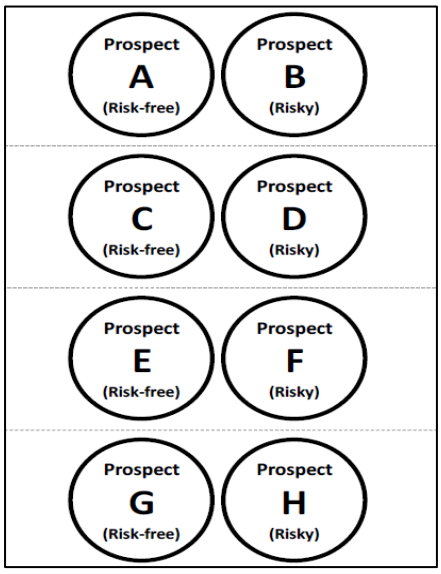

Figure 6: The Holt & Laury method (2002)

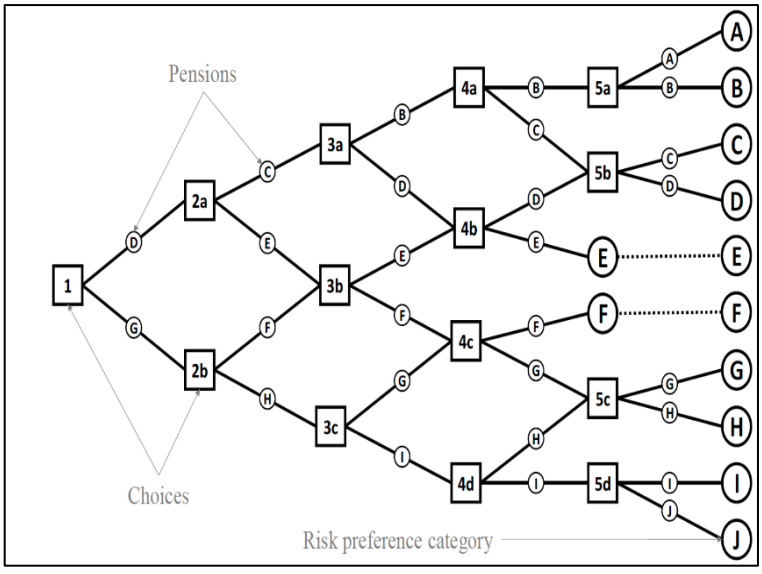

Figure 5: The CS method, source: Van der Meeren (2017)

The HL method is a binary questionnaire where the participant chooses between two prospects: a safe one showing left, a risky one showing right. As the participant moves down the list, the riskier prospect becomes more attractive. The *payoffs* of the lotteries are kept constant, but the *probabilities* change. The 'tipping point' from the safe to the risky prospect determines the risk preference. In the pension context, these prospects are presented as pensions in the form of pie charts (Reynaud, et al., 2012). The prospects come from salary figures being translated to pension outcomes via multiplication factors used in Alserda et al. (2016). Figure 6 presents the sequence. The CS method lets the participant pick from two risky products in a sequence, narrowing down to a more exact risk preference. Figure 5 shows the procedure. The participant chooses between pension G and D, and depending on this decision he or she will choose between C and E or F and H. This procedure has the advantage of producing a more robust

risk preference parameter compared to the HL method. Multiple paths can lead to the same final product, hence tackling mistakes made and identifying inconsistencies.

To define a risk preference per individual, both methods use an expected-utility theory model (EUT) in combination with the constant relative risk aversion (CRRA). The EUT prescribes how rational people should behave and the risk preference can be deduced from the individual utility function (Bernoulli (1738); Von Neumann et al. (1944)). The result is a quantified absolute risk preference, predicting the preference in similar risk-taking situations. For risk preference parameter r, $r > 0$ indicates a risk averse individual and $r < 0$ a risk loving individual. This relative risk aversion is found to be practically constant in the pension context (Binswanger (1981) and Holt et al. (2002)). The HL and CS method meet the four criteria posed by Van der Meeren (2017): produce CRRA parameters, use realistic pension scenarios, test rational risk preferences and can be conducted easily and short.

4.4 Duty of care

The PDC is part of a broad process of retirement planning, involves a large financial decision with much uncertainty and requires a sufficient level of financial and pension literacy. Moreover, the individuals that make the PDC can experience multiple behavioural biases that can influence the *optimality* of this decision. For the reasons above, the social function and the level of information symmetry between pension providers and their participants, the *duty of care* principle is borne. Supervisor AFM defines the duty of care of pension providers as: "*Acting in the interest of the participant* (AFM, 2017). Within the scope of this study, we restrict ourselves to how pension providers are obliged to inform participants who are in the decision-making phase close to retirement. Therefore, we define the duty of care as follows: "*From the interest of the participant, support and facilitate the participant in making a substantiated and financially adequate PDC.*" We state 'support' and 'facilitate', as the AFM allows pension providers to *guide* the participant when making PDC decisions, yet not to *advise* (subject to the *Wet financieel toezicht*). Moreover, adequate information should help the participant to make a substantiated PDC and result in a sufficient level of retirement income throughout retirement. Yet, filling in the duty of care *from* the interest of the participant instead of *for*, requires distancing from the 'one-size-fits-all'. Due to individualisation and the desire for more responsibility to choose, the practice of uniformity over all participants of a heterogeneous fund is outdated (Soetendal, et al., 2019). From uniformity, we identify two prominent dimensions for differentiation and shaping the PDC decision environment: *tailoring* and *freedom of choice* (Bart, et al., 2016). Figure 7 shows these dimensions, reflecting a current political and societal discussion: who should make the PDC?

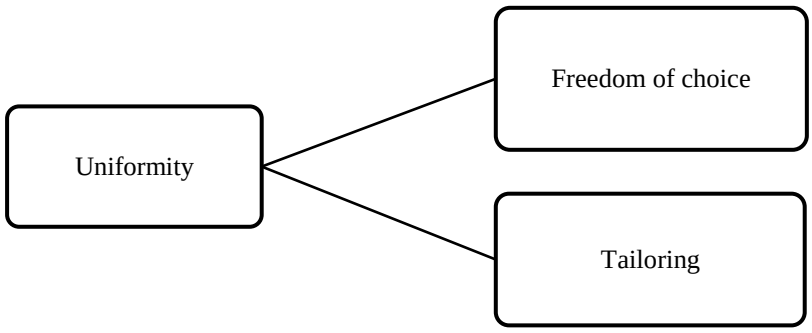

Figure 7: Dimensions of differentiation and shaping choice. Source: Bart et al. (2016)

A common yet more paternalistic form to help pension participants make decisions, is *tailoring* ("*maatwerk*"). The paternalistic nature of tailoring limits the level of autonomy of the participant with the intention of benefiting that person. The pension provider focuses the product on a single participant or subset based on characteristics. This reduces the risk of the participant making a faulty decision, choice stress and is less time consuming for the participant (AFM, 2018). In terms of PDC, this entails excluding options that might be unsuitable for certain participants. However, disadvantages of tailoring

are the requirement of extensive financial information per participant and a potential misfit with his or her needs and preferences. On the other hand there is *freedom of choice* (*"keuzevrijheid"*), where the participant has full control and responsibility to adapt the PDC to their household, no limitations. Based on a study by Limpens et al. (2018), freedom is choice is desired and can substantially improve involvement and satisfaction of participants. However, it can give rise to behavioural biases such as the present-bias or multiple selves[12] and therefore brings the risk of the participant *not* making a decision or making a *faulty* decision.

To use the strengths of both differentiation dimensions, Van den Bleeken et al. (2017) argue for finding an adequate balance between tailoring and freedom of choice. Ponds (2018) further examines this so called *conditional freedom of choice*, which can offer the flexibility the participants need while restricting negative consequences.[13] This way, pension providers help participants make a better decision, but do not impinge on their freedom of choice (Sunstein, et al., 2003). For example, by using a default PDC in combination with an opt-out (Bart, et al., 2016).

So, to guide participants towards a substantiated and financially adequate PDC, a decision environment must have a good *choice architecture* in place. Concerned with the design, presentation and consequences of the PDC options, the architecture takes the emotional barriers and behavioural biases of participants into account (Limpens, et al., 2018). Van Soest et al. (2015) argue for complete insight into the PDC options, indicating what consequences each decision has on the individual pension outcome. This also entails providing an integrated overview of all income and equity sources, such as the AOW, personal savings and home equity. The authors also plead for this communication to be on both a factual level and on an emotional level, to increase involvement and create an action perspective when income adequacy is perceived as too low.

4.5 Decision-making under uncertainty

In the previous sections we discussed retirement planning, individual characteristics and the duty of care related to PDC decision-making. Now, related to the development of the new communicating method discussed in Section 2.4, we address decision-making under uncertainty. This section discusses the development, value and presentation of communicating uncertainty on the pension outcome.

Pension outcome uncertainty in DB and DC schemes

When in 2015 the AFM addressed digital pension communication, one of the key points was to give participants insight in uncertainties surrounding the pension outcome, including purchasing power (AFM, 2015). Especially for DB schemes the communication of this uncertainty can be tricky, as many participants may still have the belief that their pension outcome can be fully guaranteed. Motivaction (2018) finds that in combination with a lack of financial literacy, continuing political discussions and years of austerity, the trust of Dutch participants in their pension outcome has decreased. Van Rooij et al. (2007) elaborate on the risk-return preferences of pension fund participants. Given a relatively high risk aversion, a low self-perceived level of financial literacy and a perceived lack of self-control, most participants favour a DB system with compulsory saving and a predefined goal in terms of retirement income.

Scenarios and the quality of the PDC made

Communicating scenarios over a long time horizon may benefit participants in terms of the quality of the PDC. Acquiring more information about the pension outcome can help retirement planning in the form of *mental accounting*. This economic concept involves allocating funds to several buckets (e,g.,

[12] According to van Leuvenstijn et al (2015), more freedom of choice leads to a lower pension outcome due to cognitive limitations and low financial literacy.
[13] A more relaxed form is called 'libertarian paternalism', where participants are given full freedom to choose, but with good defaults (Bovenberg, et al., 2011).

necessities or healthcare) in order to economize thinking and increase self-control (TIAA, 2017). Furthermore, a behavioural economics study by Aarts (2009) shows that information on risk can in fact be effective, as long as individuals know what measures can be taken to improve their financial situation after retirement and make an action plan. However, Boyle et al. (2015) mention that over a long period many potential future events influence the perception of individuals that their pension outcome is very uncertain. Examples are fluctuations in investment results, life events or career developments (AFM, 2012). This raises the question to what extent communicating uncertainty on several communication platforms is of added value for young participants. Additionally, more information is not always for the better. Previous studies (see Iselin (1988); Lee et al. (2004)) have shown that confronting consumers with more information creates the risk of information overload and might lead to sub-optimal financial decisions. Besides, the distortive effect of complexity may result in participants picking randomly when confronted with a scenario approach on the PDC options.

Framing of uncertainty

Framing can substantially change the perception of individuals towards PDC options. We quote: "*Framing is the phenomenon that the description of a problem or situation itself influences the reaction or decision made by an individual*" (Keren, 2012). Framing PDC options in a particular fashion may lead to participants perceiving certain options as either more desirable or less desirable. Prast et al. (2019) describe the non-neutrality of quantitative pension communication and conclude that a *percentage frame* works best in terms of perceiving the adequacy of future pension income. However, individuals have on average difficulties with percentages (Tversky, et al., 1982). Erev et al. (1990) find that verbal expressions are preferred over numerical ones when talking about probabilities. As the pension sector is a difficult sector with much complexity and uncertainty, finding a communication method suitable for all is a difficult process. Individuals with little financial/pension literacy, having little second pillar pension wealth and of a lower age may prefer a different form of communicating uncertainty. Furthermore, findings by Van Hekken et al. (2019) show that participants prefer the perception that retirement wealth is gradually accrued. Their metaphor, saying "*Your pension will continue to grow, yet the pension outcome is subject to uncertainty*", brings across honesty and can help increase communicator credibility. It might even go as far as incentivising participants to track their personal retirement situation more closely (Taylor, et al., 1995).

4.6 Conclusions

The pension decumulation choice (PDC) is element of the broader process of *retirement planning*. Every individual bases retirement decisions on their heterogeneous household, which consists of multiple financial factors and is subject to uncertainty over time. The life-cycle model by Modigliani describes that individuals try to smooth consumption over the course of life to maximize utility. Before retirement, wealth is accumulated and afterwards it should be steadily decumulated. However, uncertainty in the remaining lifetime, bequest motives, uncertain health expenses and behavioural factors flatten the wealth trajectory during retirement. We briefly discussed home equity as a potential means for individuals to deploy to increase retirement income.

Compared to the fully rational and informed homo economicus, individuals act differently in PDC decision-making. Insufficient capabilities and the presence of behavioural biases may result in a sub-optimal outcome, in the form of inadequate retirement income or dissatisfaction. Besides financial literacy, numeracy and pension awareness, we discussed the following behavioural biases for the context at hand: the present-bias, loss aversion, multiple selves, the distortive effect of complexity on choice, anchoring and framing effects.

To study how individuals perceive uncertainty over time regarding their pension outcome, we analysed the behavioural factors *time preference* and *risk preference*. Regarding time preference, we discussed the hyperbolic and exponential discounting of money over time. We compared the 'choice method' with

the ‘matching method’ for measuring participants’ subjective discount factor. Especially with the new method communicating uncertainty, it is also relevant to understand the participants’ perception of risk and how it influences decision-making. We identified two methods for measuring risk preference: the Holt & Laury method and a choice sequence method. Both methods use an expected-utility model and produce CRRA parameters that are comparable to other subsets of participants or studies.

Given the complexity and magnitude of the PDC, the societal function and the level of information asymmetry, pension providers have a *duty of care*. From the interest of the participant, pension providers must support and facilitate the participant in making a substantiated and financially adequate decision. Regarding the decision environment, we discussed the trade-off between tailoring and freedom of choice. Tailoring limits the risk of a faulty decision, but may require extensive financial information and result in a misfit with needs and preferences. On the other hand, freedom of choice may enable flexibility and responsibility, but may give rise to behavioural biases and hence a sub-optimal decision. We also discussed a hybrid form of these two dimensions: conditional freedom of choice.

To explore the practical implications of communicating uncertainty, we discussed its development, potential value and methods for presentation. Especially for participants in a DB scheme the communication of uncertainty may be troublesome, as these participants might still have the belief that their pension outcome can be fully guaranteed. Risk aversion and a low perceived level of financial literacy and self-control may result in a negative attitude towards the communication of scenarios. Furthermore, framing effects can substantially influence the perception of pension decumulation choice options. However, if communicated *adequately*, communicating in scenarios may be a step towards improving retirement decisions. Using our findings from the literature, the following chapter discusses how we construct a questionnaire to measure the impact of communicating uncertainty on PDC decision-making.

5. Questionnaire Setup

From the previous chapter we have gained theoretical knowledge on retirement planning and the potential influence of uncertainty on the pension decumulation choice (PDC) made. To study the influence of this uncertainty in practice, we conduct a survey to participants of a large Dutch pension fund. In this chapter, we discuss the setup of our questionnaire. In Section 5.1 we present its main elements and the overall structure. Yet in communicating uncertainty, we must consider what figures to present and which participants to approach. Section 5.2 discusses the construction of representative financial figures to create familiarity and our assumptions we hereby make. Hereafter, we describe how we come to a suitable sample size for our study. Section 5.3 summarizes what literary findings we apply in our questionnaire. For example, we describe how our questionnaire aims to limit the influence of behavioural biases. Relevant practices, behaviour and beliefs that have been researched by others are hereby brought to use. Lastly, Section 5.4 discusses the validity and reliability of our study.

5.1 Questionnaire content

To measure the impact of communicating uncertainty on the PDC made, we start by constructing the structure of the questionnaire and the necessary elements. One of these elements is our selection of PDC options we present to the participants.

Selection of PDC options

From Section 2.2 we identify that individuals desire more flexibility and responsibility when it comes to PDC options and retirement planning. Yet, from literature we find that the PDC is complex and behavioural biases have a large influence hereon. Ergo, in our PDC options selection we make the trade-off between flexibility in PDC options and the risk of information overload.

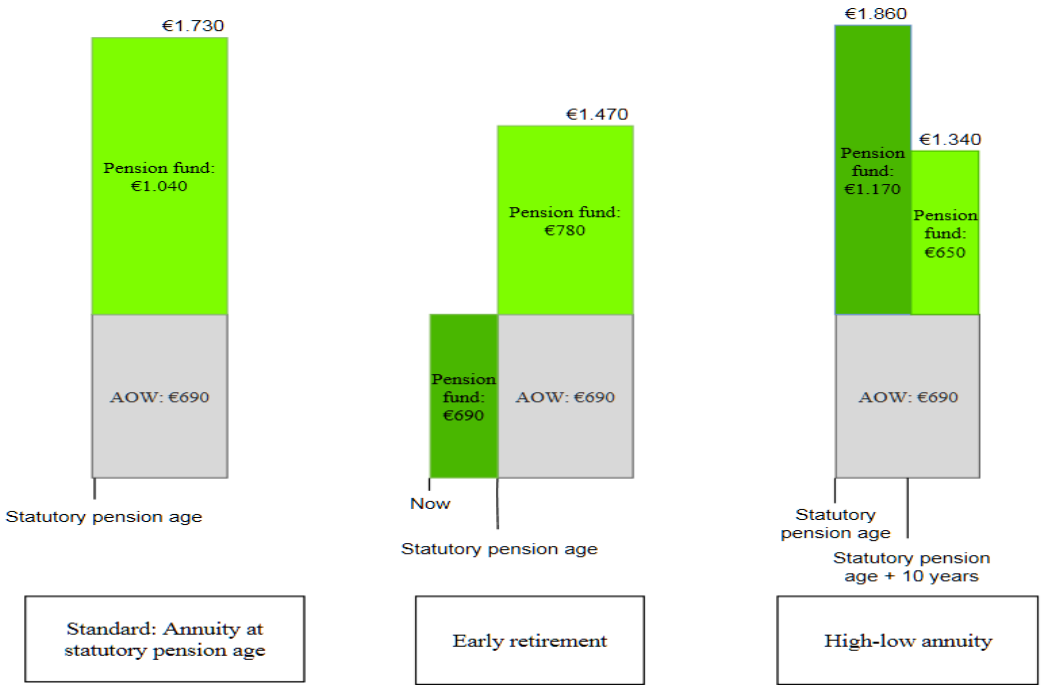

Figure 8: Breakdown of selected PDC options for this study

Figure 8 above presents our selection of PDC options, expressed in net monthly figures.[14] From left to right: *standard* annuity at statutory pension age, *early retirement* and a *high-low annuity* starting at the statutory pension age. Our selection is primarily based on popularity and the hypotheses we test. The

[14] The financial figures depicted are based on representative person "Middle", which we further explain in Section 5.2.

first PDC option is the standard/default option in every pension scheme: retirement at the statutory pension age, paid out as an annuity. As participants in our sample size may have different statutory pension ages, we communicate that the pay-out starts at 'statutory pension age' instead of a certain age. We assume here that the statutory pension age is equal to the target pension age. The second option is retiring early; retiring *before* the statutory pension age, therefore accumulating less pension and receiving an earlier and lower annuity. The difference in monthly payments can be explained by AOW premiums that must be paid until reaching the statutory pension age. The third PDC option we present is the high-low annuity, where the participant receives a higher pension during the first *ten years* of retirement. Hereafter, the participant receives a lower amount for the remainder of the lifetime. We use the maximum high-low ratio of 100:75 (or 4:3), as this ratio has the highest popularity, will expectedly appear the most attractive and allows us to test the time preference of participants better. Showing in Figure 8, the AOW figures (grey) are obtained from the SVB ("*Sociale Verzekeringsbank*") website (SVB, 2019). Here, we assumed that the individual receives AOW based on a two-person household. From the uniform calculation method (URM) model of the pension provider, we obtain the annual rights and transform this output into net monthly figures (green).[15]

Due to low popularity, the risk of information overload and choice stress we decide to exclude any other PDC options from our questionnaire. We acknowledge that this reduces the quality of measuring the normative preferences (or intentions) of the participants. As we limit our selection of PDC options, participants might find our selection to be inapplicable to their personal situation.

Structure of the questionnaire

The structure of our questionnaire consists of two paths for communicating uncertainty, presented in Figure 9. The first path takes a participant from the current (*base*) decision environment to a *scenario approach* environment showing uncertainty at the statutory pension age to an environment showing scenarios over a *longer time horizon*: both the statutory pension age and ten years after. This way, we stepwise measure the impact of (gradually) adding information regarding the pension outcome on the PDC made. Important here is that we ask participants for their substantiation behind every PDC made. Furthermore, we also ask participants for their PDC evaluation; whether showing scenarios (over a longer time horizon) helps them make a better *considered* decision.

The second path does the exact opposite by gradually stripping information. This path is a validity check, meant to observe PDCs made directly based on an enriched environment. Participants are randomly assigned to either one of the two paths.

Then, to further colour the PDC situation per participant, we pose several background questions. In addition to secondary data from the participant file, we measure the following variables:

- Level of education
- Household situation (i.e., breadwinner status)
- Dependency on income from pension fund in question
- Other monetary factors when considering PDC besides AOW and second pillar wealth
- Time preference of money

Lastly, we measure the risk preference of every participant. Our measurement of risk preference is further explained in Section 5.3. The structure of the questionnaire is based on priority, since participants hold the right to cancel their progress at any time. Interim results are saved. The PDCs made and the corresponding substantiation have our highest priority, hereafter the background information to put the former in perspective.

[15] To transform gross annual rights to net monthly figures, we divide by 12.96 and then use the online tool from Loonwijzer (https://www.loonwijzer.nl/home/salaris/brutonetto). Our assumption: Labour tax credit is applied to occupational pension instead of state pension. The progressive Dutch tax system explains the differences in the gross to net transformation per RP.

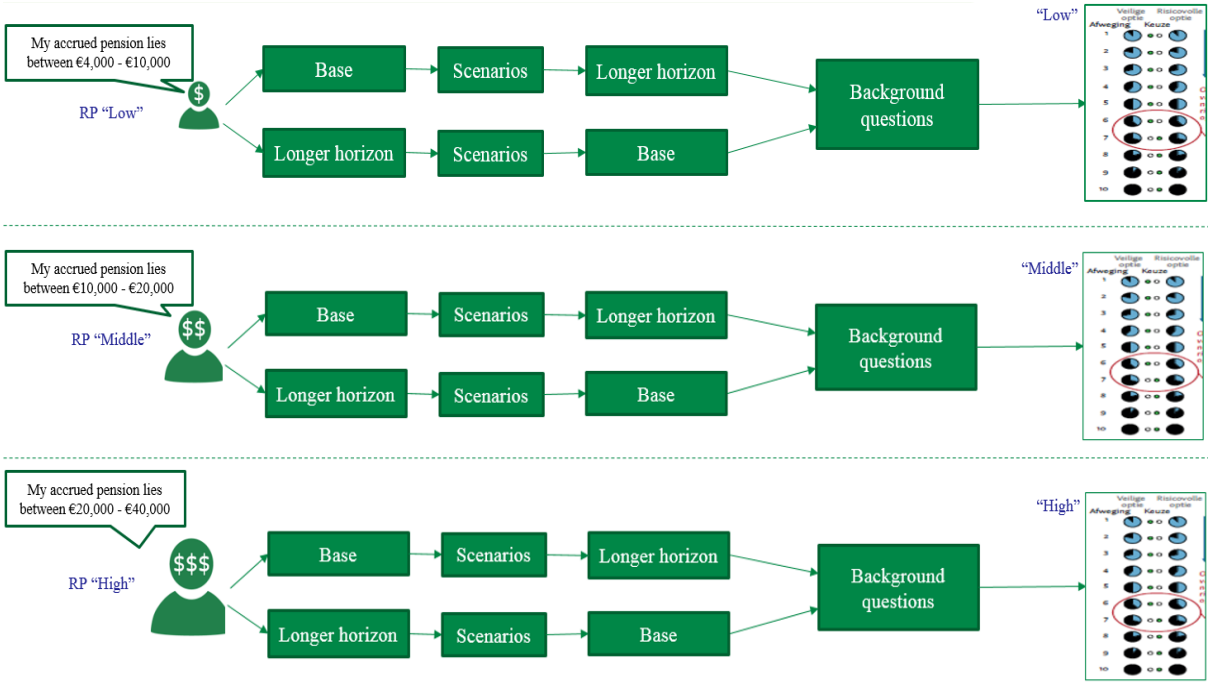

Figure 9: Questionnaire structure for each representative person

As visible in Figure 9, we split the participant population in groups: *representative persons*. The financial figures in the questionnaire are scaled to the financial situation of the participant: *accrued pension* at the pension fund in question. The questionnaire we used for our quantitative study is presented in Appendix B.

5.2 Participant data

With the abovementioned structure to measure the impact of uncertainty, we must find a representative participant sample. We do this by approaching 61- to 65-year-old participants, as this group is close to retirement and is therefore the most relevant target group for our study. Our scenario figures are based on a *64-year-old participant*, as early retirement is on average 3 years before the statutory pension age and the median age of our target group is close to 64. Furthermore, our study involves DB participants only as the pension fund in question is of the DB type.

Representative persons

For the participants to feel familiar with the financial figures, we use representative persons ("*maatmensen*", from hereon: RPs) to bring the PDC as close to their financial situation as possible (see Willemsen (2015)). We hereby reduce the *alienation bias* common in questionnaires with uniform decision problems (Whittington, 2002). To link participants to a RP, we use the *accrued pension* ("*reeds opgebouwd recht*") as single criterion. We choose accrued pension as criterion over salary, as the second pillar pay-out decision is largely based on accrued pension and less on salary. Furthermore, it also allows us to include deferred pensioners in our study since their current salaries are unknown to the fund.

To calculate scenario figures, we start by identifying suitable reference values of accrued pension. These RP specific reference values are applicable to all participants linked to a certain RP. To find substantiated values, we consult financial data from the participant file of the pension fund. This financial data contains info of our target group regarding accrued pension, salary, status and the part-time factor.[16] Table 2 shows our construction per RP. Ideally, the accrued pension boundaries are as

[16] In the participant file, additional information such as gender and pension literacy are stated per participant.

small as possible. Yet, we deal with population size (N) restrictions of the pension fund, which influence our eventual sample size.[17] Therefore, we stretch the boundaries such that there are enough participants per RP to make statistically significant statements. Furthermore, as the distribution of accrued pension is highly skewed to the right, current age boundaries result in a shortage of participants in the "High" class. Therefore, we stretch the age boundaries to 60-66 for this class.

Table 2: Summary of key characteristics per representative person

Representative person	Age	Accrued pension boundaries	Reference value accrued pension
"Low"	61-65	€4,000 - €10,000	€7,000
"Middle"	61-65	€10,000 - €20,000	€15,000
"High"	60-66	€20,000 - €40,000	€30,000

Additionally, to calculate the *to-be accrued* pension, we also must make some assumptions regarding salary and the part-time factor.[18] Analysing the (weighed) average and median salary within the RP boundaries, we come to representative (gross yearly) salary numbers per RP. Table 3 shows these numbers, where the salary ascends per RP from €30,000 to €50,000. For the part-time factor, we perform the same procedure. This factor represents the percentage of hours an individual works compared to the hours stated in the *collective labour agreement* ("*CAO*"). In the respective pension fund, the level of part-time labour is high. This explains the distributions of accrued pension and salary being highly skewed to the right.

Table 3: Salary and part-time assumptions per representative person

Representative person	Reference value accrued pension	Salary	Part-time factor
"Low"	€7,000	€30,000	0,500
"Middle"	€15,000	€40,000	0,666
"High"	€30,000	€50,000	0,875

Sample size

A large enough sample size (*n*) is crucial in order to get statistically significant, valid results. These results determine we can either reject or hold the hypotheses we test. The larger the sample size, the smaller the margin of error (Rumsey, 2016). The smaller the margin of error, the closer the results are to the true figures of the entire population. Besides, increasing the sample size also increases the precision of estimating variables we do not test with hypotheses. However, as we conduct a survey, we have limited influence on the sample size due to an unknown response rate. For this study, we follow a prescribed response rate of 5% based on earlier studies done at the pension fund in question. Additionally, as we deal with population size restrictions, we are after the minimum sample size to ensure statistical significance. By analysing the same participant file and applying the accrued pension boundaries stated above, 24,000 participants can be contacted, divided equally over the three RPs. Then, with the response rate of 5%, 1,200 participants will complete the questionnaire. Using an online tool, we find that for a margin of error of 2.75% the minimum sample size is exactly 1,200 participants.[19] We find this margin of error *acceptable*; then we have 95% confidence that the 'true' values of the participant population are within ± 2.75% of our measured values. Furthermore, as our questionnaire has two paths, we expect 12,000 * 0.05 = 600 participants per 'path' to base our statements on. Hence, the margin of error per path becomes 3.90%.

[17] One of the most dominant restrictions is a research exclusion of 200 days between successive studies per participant.
[18] With this input, the 'generic method' is used in calculating the URM figures (Pensioenfederatie, 2018).
[19] We use the tool on https://www.calculator.net/sample-size-calculator.html with a 95% confidence interval.

5.3 Influences derived from literature

Chapter 4 identified several important literary findings, which we now translate to our questionnaire. Below we discuss these findings and their practical implication.

Background variables to control for household perspective

The household perspective is of large relevance on PDC decision-making (Bovenberg et al. (2011); Bart et al. (2016); Willemsen (2015)). Besides the AOW and second pillar wealth, participants weigh other income sources, expected future costs and life events when planning for retirement. Therefore, pension providers are increasingly aggregating financial data of their participants to create more informative, personal decision environments. Therefore, we pose several background questions to help colour our sample size. These background variables are control variables in the regression analyses we perform in Section 6.2.

'Matching method' for measuring time preference

We want to test a potential relationship between the time preference of individuals and the PDCs made. A high preference for immediate monetary benefits may result in sub-optimal decision-making. The *present-bias* and the temporal effect of *multiple selves* explain the presence of hyperbolic discounting among individuals. Yet, in literature there are many methods available for measuring the time preference. We find that the *matching method* by Hardesty et al. (2013) is the most suitable for the purpose at hand; obtaining an indifference point which can be relatively compared across a population without too much effort. We hereby also reduce the risk of experimenter bias, compared to the choice method.

For transparency and interpretability reasons we decide to quantify the time preference data based on Samuelson's (1937) *continuously compounded exponential model*. This makes it easier for the pension fund to compare participant data across studies, as the results are annual discount rates that are comparable to interest rates. Regarding magnitude, we select a large amount as we want to match real-world phenomena as closely as possible. Hence, we formulate our single time preference question as follows: "*What minimum amount "Y" would make you indifferent between $1,000 immediately and $Y in one year?"* Besides the risk of fatigue and abandonment of the study, another reason for not using more than one question is the intensity of heuristics and hence bias (Li, et al., 2016). Hence, reliability and external validity of preference measurement is reduced. However, we acknowledge the potentially large standard error of our time preference estimate.

'HL method' for measuring risk preference

Each individual perceives the uncertainty of their pension outcome differently. Section 4.3 compares the Holt & Laury (HL) method with the choice sequence (CS) method. Both methods deliver an objective risk preference coefficient and the results can be easily compared across other studies and weighed when constructing an investment mix as a fund. For practical reasons, we select the HL method by Holt & Laury (2002). Conform the study by Van der Meeren (2017), using ten risk preference categories and hence ten CRRA ranges allows us to apply the same multiplication factors presented by Alserda et al. (2016). These multiplication factors are necessary to transform the salary figure per RP participants into a realistic pension outcome.[20] Furthermore, these prospects are presented in terms of percentages, as argued by Cuite et al. (2008). Following Zimmer (1983) and Erev et al. (1990), we provide the necessary verbal explanation to ensure all participants understand our method for measuring risk preference.

[20] Gross annual salary figures are transformed to net monthly pension outcomes. We divide the annual figures by 12.96, use the online tool by Loonwijzer (https://loonwijzer.nl/salaris/brutonetto) to obtain net figures and lastly apply the multiplication factors from Alserda et al. (2016). These factors are: 0.4 and 0.9 for the 'risky' prospect and 0.6 and 0.7 for the 'safe' prospect.

Questionnaire design reducing influence of behavioural biases

In decision-making, individuals divert from the *homo economicus* due to bounded rationality and a lack of self-control (Thaler, et al., 2004). Section 4.2 identifies the most relevant behavioural biases in the context of this study, potentially influencing the PDC made by a participant. As we strive to measure normative preferences (or intentions) regarding the PDC as closely as possible, we restrain ourselves from using framing techniques and *set no default* for the PDC in our questionnaire. Defaults substantially influence the perception of individuals and steer the PDC in a certain direction (Van Rooij, et al., 2014). Moreover, setting no default also reduces the *anchoring* effect. Furthermore, we aim to minimise the *present-bias* by clearly communicating the details of every PDC. This way, participants might understand the consequences of their decision better. Lastly, by communicating uncertainty in pension outcome at the statutory pension age and especially ten years after the statutory pension age, we assist participants in recognising their *multiple selves* in terms of their retirement income. Lastly, for practical reasons we do not randomise the order of PDC option presentation between consecutive decision environments. We acknowledge that this increases framing effects.

Link participant population to representative persons

As mentioned earlier, we make use of representative persons when communicating PDC options and their dispersion in pension outcomes. For privacy and time-related reasons, we do not use individual figures. However, we do not communicate that our figures are fictitious, as it may substantially influence the response rate and increase the *alienation bias*. Yet, we are aware that individual figures would have better measured participants' normative preferences, as these figures are more relatable and assist in more accurate retirement planning.

Interval diagrams to present pension outcome uncertainty in three scenarios

DB participants are likely to be unfamiliar with uncertain pension outcomes, which makes the communication of scenarios tricky. These participants may have heard their entire career that their pension outcome is 'guaranteed' and might have difficulty understanding (and accepting) this uncertainty. For the presentation of uncertainty in pension outcome, we consult both literature and the Marketing & Communication department of the pension fund. We are mindful about information overload (Iselin (1988); Lee et al. (2004)), yet we want to provide participants with all necessary information to make a substantiated PDC (Rijksoverheid, 2014).

We use bar charts to *explain* the PDC options, based on an earlier study by Willemsen (2015). For communicating PDC options in scenarios however, we present in *interval diagrams*. We deem interval diagrams as understandable and consistent over the questionnaire structure.[21] Figure 10 below shows our presentation: the green bar showing the optimistic scenario, black indicating the expected outcome and red representing the pessimistic scenario for the standard annuity option. By not communicating percentages, using textual descriptions and rounding our figures we reduce the *distortive effect of complexity on choice* (Zimmer (1983); Erev et al. (1990)). Yet, given our presentation form, *loss aversion* might result in participants being negatively influenced by scenarios and choosing more 'defensive' (i.e., less direct withdrawal of pension wealth). The PDC options have asymmetry in the three scenarios due to various reasons, such as the indexation ambition and adverse investment results. This is expressed in a larger difference between the expected and pessimistic scenario than the between expected and optimistic scenario. Over a longer time horizon this asymmetry becomes larger, as the optimistic scenario is capped by the indexation ambition and the pessimistic scenario can potentially end up being €0.

[21] In addition to literature, we base our decision on a small field study where PGGM employees stated their preferred method for communicating PDC options in scenarios. Interval diagrams were preferred over bar charts or line diagrams.

Figure 10: Explanatory interval diagram, communicating dispersion in pension outcomes in three scenarios (translated)

5.4 Validity and reliability

Two elements influence the quality of this study: *validity* and *reliability*. Since one of the goals of this study is to have practical significance, this quality is related to the *generalisability* of the results. This generalisability indicates to what extent the methods used and results of our study are applicable and representative to/for the Dutch pension sector.

Validity

To define validity, we use the definition by Joppe (2000): "*Validity determines whether the research truly measures that which it was intended to measure or how truthful the research results are*." Both expert judgement and statistical significance contribute to evaluating whether a study is valid. With good validity, a study produces results that represent true phenomena of the population it is studying. In our study, we want to measure normative PDC preferences when uncertainty is communicated. We consider (internal) validity in the construction of this study by selecting methods that are scientifically proven and techniques that are known to measure needs and preferences. For example, the Holt and Laury (2002) method for obtaining an objective, robust risk preference parameter and the presentation technique used in Willemsen (2015) for communicating PDC options. Section 5.2 is concerned with *external validity*, where we specify our target group, representative persons and the sample size we use for our empirical study.

We identify three types of validity: content validity, criterion validity and construct validity (Drost, 2011). First, we are aware that the *content validity* of this study, the extent to which our measurement covers all aspects of PDC preferences, is restricted as the number of questions we pose is limited. However, carefully constructed substantiation questions contribute to increasing this type of validity. Controlling for the household perspective is another example. Second, *criterion validity* deals with how the result of a measure corresponds to other valid measurements of the concept. As our study is the first to measure the impact of PDC decision-making under uncertainty, there are no other valid measurements to compare our study with. However, this validity can be assessed by comparing the stated PDC preferences (intentions) with *revealed* preferences of the respondents in a follow-up study. In terms of measuring risk and time preference, as Anderhub et al. (2001) found a positive relationship between risk aversion and time preference, we expect to find the same. Lastly, *construct validity* assesses to what extent the measurement adheres to existing theory and expertise on the concept being

measured. To deal with this type of validity, our questionnaire design is partially based on earlier studies by Willemsen (2015) and Van 't Klooster (2016) who conduct identical research on PDC decision-making.

Reliability

Reliability is a measurement of the consistency of a method. Following the definition by Joppe (2000): "*If the results are consistent over time and an accurate representation of the total population under study and if the results of a study can be reproduced under a similar methodology, then the research instrument is considered reliable.*" In fact, reliability is inherently integrated and internally needed for validity of a study (Lincoln, et al., 1991). To increase reliability in our study, each participant receives the questionnaire at the same time, reducing influence of external factors that could result in variation.

This quantitative study lends itself for future repetition, as the methods and techniques used are timeless. Yet, due to the current financial situation of pension funds and increased media attention, participants' perception of the PDC with uncertainty might be somewhat distorted. Other factors such as pension literacy and life events also influence a future measurement of needs and preferences. Hence, the level of *test-retest reliability* is questionable. The *inter-rater reliability*, a measure for the consistency across different observers, is appropriate due to many closed questions and hence objectivity throughout the questionnaire. However, the term 'needs' and has a value judgment for which we are careful when interpreting the results. In Chapter 7 we further assess validity and reliability by discussing the limitations of our study.

Additionally, to measure the response and understandability of our questionnaire, we conducted a mini study beforehand consisting of 500 participants of RP "Low". As this group is likely to have the lowest level of education and financial literacy, it is therefore the most relevant group to test a first concept of the questionnaire. Not only does this mini study give us insight in the *content validity*, it allowed us to tweak last details before the large questionnaire is sent out. As this mini study is mainly used for measuring response and understandability, its results are excluded from our data analysis in Chapter 6.

5.5 Conclusions

This chapter constructed a structure and included elements to a questionnaire to measure the impact of communicating uncertainty on the pension decumulation choice (PDC). We designed two paths: one path where information on uncertainty is gradually added to a PDC decision environment and one path where this information is gradually stripped. In this study, we present three retirement options: the standard *annuity at the statutory pension age*, *early retirement* and a *high-low annuity*. Hereafter, to put PDCs in perspective, we measure several background variables, among which time preference and risk preference.

For our empirical study we can approach 24,000 participants in a DB scheme. To make these participants feel familiar with the financial figures in our questionnaire and therefore reduce the alienation bias, we use *representative persons* (RPs). Linking participants to a representative person is based on a sole criterion: *accrued second pillar pension wealth*. We constructed three representative persons: RP "Low", "Middle" and "High" and calculated the corresponding scenario figures using financial data of the pension fund in question. Besides accrued pension, to calculate scenario figures for RPs we made assumptions for salary figures and part time factors. The scenario figures are based on a 64-year-old participant.

In designing our questionnaire, we use several findings from the literature. We decided to use the 'matching method' and the Holt & Laury method for measuring respectively the time preference and risk preference of participants. Furthermore, we strive to minimise the influence of behavioural biases. We do this by setting no default and clearly communicating the consequences of options. Furthermore, the (new) communication (method) of scenarios can be tricky and give rise to behavioural biases. We

use bar charts to explain PDC options and interval diagrams to present the PDC options and their dispersion in pension outcomes. From applying several findings from the literature, we ensure that our study is theoretically sound and its results are generalisable across the pension sector. Moreover, we discussed several steps we took when executing our research to ensure *validity* and *reliability*. In the next chapter we will discuss the main findings of our questionnaire.

6. Empirical Results

In this chapter we discuss the main findings from our quantitative study on the influence of communicating uncertainty on the pension decumulation choice (PDC) made by participants. We start by giving a description of the participant population. Section 6.1 presents the summarised statistics regarding participant characteristics and further background variables we control for. To measure the comprehensibility/complexity of our questionnaire used, we also discuss common characteristics and causes linked to incompletion. Hereafter, Section 6.2 discusses how the introduction/communication of uncertainty affects PDC decision behaviour. To put this behaviour in perspective, we also study the substantiations and the participants' own evaluation of their PDCs. Then, Section 6.3 statistically tests if adding or stripping information regarding uncertainty leads to a *significant* change in PDCs. Related, Section 6.4 goes more into detail on the two behavioural factors important in this study: *time preference* and *risk preference*. Here we discuss the scores of our sample size, the extremes, relevant correlations and the effect of these factors on PDC behaviour. Last, Section 6.5 researches what variables *drive* an individual to *change* the PDC when uncertainty (over a longer time horizon) in pension outcome is communicated. We do this by performing several logistic regression analyses. Throughout the chapter, we reflect on the hypotheses constructed in Section 3.2.

6.1 Summary statistics of sample size

In Section 5.1 we presented the structure of our two questionnaire paths. Depending on the path, participants are gradually confronted with either more or less information in terms of uncertainty when making the PDC. In the questionnaire, the participant makes three PDCs in three consecutive decision environments. One decision environment communicates solely the *expected outcome* at the statutory pension age (base), a second environment presents *three scenario outcomes at the statutory pension age* and a third environment communicates *three scenario outcomes for both the statutory pension age as ten years afterwards*. Each participant is linked to either one of three representative persons (RPs) based on accrued pension, such that the financial figures in the questionnaire are relatable to that participant.

From studying background characteristics, we get familiar with our sample size. This helps to put the PDCs and their substantiations in perspective. To study these characteristics, we collect the information from both questionnaires and create one dataset. In Figure 11 we present the range, the average value and the N statistic for each of the background variables we measured. The N statistics vary, due to the ordering of questions in the questionnaire and interim results of 'incompletes' being saved. Moreover, the 'Valid N (listwise)' represents the number of cases that do not have any missing values (user-missing or system-missing) for any of the variables shown in Figure 11. For example, for deferred pensioners we lack salary or part time factor data. We also include the *skewness* and *kurtosis* per variable to study the asymmetry and the degree of outliers in our data. Data with an extreme skewness or kurtosis deserve our attention, as it can influence the regression analyses we perform in Section 6.5. Such data can have a disproportionate influence on parameter estimates. We remain critical when using these data and remove outliers when necessary.

In our dataset there are considerably more females present than males, indicated by a large skewness. Salaries are highly positively skewed and there is much part time labour; all indicators for the particular sector of this empirical study. There are also considerably more active participants in our dataset than deferred pensioners, as the participant file from the pension fund consists of mostly active participants. The large presence of active participants also explains the dependency on pension outcome of the pension fund in question (2.12 on a scale of 5). Furthermore, we measured the trust that participants have in the pension fund twice: once before making the PDCs and once afterwards. We find that the questionnaire significantly *decreases* trust: 0.18 points on a scale of 5 ($p<0.05$, Wilcoxon test). This raises the question if the new form of communicating uncertainty is the main driver for this

development; participants might realise that the pessimistic scenario decreases their pension outcome more than expected. From follow-up analysis we find a significant positive correlation (*p<0.01*, Spearman correlation) between initial trust in the pension fund and accrued second pillar pension wealth. This explains the percentual decrease in trust being the largest for participants with more accrued pension, since the dispersion in pension outcomes is larger for these participants. We also find lowered trust in the pension fund to be more common for those of lower education and less pension literate.[22] We also observe that the influence of other financial factors besides AOW and second pillar pension wealth (e.g., bequests, savings and investments), with low average values and high skewness, appears to be insignificant on PDC decision-making for our sample size. Furthermore, the behavioural factors *risk preference* and *time preference* are discussed in more detail in Section 6.4. The full questionnaire can be found in Appendix B.

	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic
Academic degree (1=None, 7=University)	4053	1	7	4,39	1,427	-,038	-,540
Age (years)	5885	60	65	62,40	1,439	,253	-,906
Bequest (0=Not of influence, 1=Of influence)	4012	0	1	,04	,206	4,427	17,609
Breadwinner (1=Sole breadwinner, 2=Together breadwinner, 3=No breadwinner)	4048	1	3	1,88	,843	,239	-1,552
Dependency on pension from pension fund (1=Very dependent, 5=Independent)	4001	1	5	2,12	,856	,263	-,450
Completion time (seconds)	3419	221	1272123	28612,78	116487,210	5,245	31,394
Equity in house (0=Not of influence, 1=Of influence)	4012	0	1	,29	,453	,933	-1,130
Gender (0= Male, 1=Female)	5885	0	1	,78	,413	-1,363	-,143
Healthcare costs (0=Not of influence, 1=Of influence)	4012	0	1	,20	,401	1,496	,237
Mortgage debt (0=Not of influence, 1=Of influence)	4012	0	1	,37	,484	,525	-1,725
Parttime factor	5311	,0069	1,2223	,7646	,1987	-,512	-,342
Pension of partner (0=Not of influence, 1=Of influence)	4012	0	1	,54	,498	-,171	-1,972
Persona (0=No planner, 3=Committed planner)	5885	0	3	1,52	1,278	,004	-1,682
Representative person (1=Low, 2=Middle, 3=High)	5885	1	3	2,01	,789	-,021	-1,393
Risk aversion	2490	-4.82	4.46	1.67	2.45	-,762	,309
Salary (gross per year)	5277	25,017.05	118,026.92	44,821.81	11,930.45	1,832	5,229
Savings and investments (0=Not of influence, 1=Of influence)	4012	0	1	,37	,482	,550	-1,698
Status (0=Deferred pensioner, 1=Active)	5885	0	1	,90	,297	-2,714	5,366
Time preference_bins	3767	1	6	3,24	1,701	,308	-1,154
Trust after (1=Very much, 5=Very little)	3817	1	5	2,76	,710	,553	,951
Trust before (1=Very much, 5=Very little)	5431	1	5	2,58	,693	,549	,759
Valid N (listwise)	2006						

Figure 11: Summary statistics of sample size (N=5,885)

Questionnaire incompletes

From our participant file, we contacted 22,000 participants for our empirical study. In total, 5,885 people started the questionnaires (sample size), in Figure 11 visible from generic information such as *age* or *status*. This gives an overall *gross response rate* of 5,885/22,000 = 27%. The gross response rate per RP (Low, Middle, High) is: 22%, 28% and 31%. However, not all participants completed the questionnaire. From the variable *completion time* we obtain the *net response rate:* 16% (3,419 completes). Per RP, these response rates are 12%, 16% and 21%. We find a significant correlation (*p<0.01*) between the level of education and RP, indicating that incompletion is higher for those of lower education. This may be explained by lower educated individuals being more likely to experience issues with the complexity of the questionnaire. Moreover, Kortleve et al. (2016) find a positive correlation between income and pension literacy (and therefore knowledge of PDC options). Furthermore, in terms of participant status, we find the response rates between active participants and

[22] We use the variable *persona* from our participant file as an indicator for the pension literacy of a participant.

deferred pensioners to be similar. In a dataset with mostly active participants, the gross response rates are 26.9% versus 25.2%, while the net response rates are 15.5% versus 16.3%.

The extent of questionnaire completion is influenced by many factors, among which *complexity*. From comparing incompletes across the two questionnaires we learn more about the effect of complexity (or information overload) on completion. Hereby, we gain input for the potential implementation process of scenarios in the PDC decision environment: in one instance or gradually. Figure 12 presents the incompletes over the two questionnaires: the upper path where information on uncertainty is gradually added, and the lower path where this information is gradually stripped. The building blocks of these paths are the three communication forms for making the PDC, the time preference measurement and lastly the risk preference measurement. As the current state of pension sector is the *base decision environment*, we have approached more participants for the questionnaire where information is added.[23] This explains the larger sample size: 3,478 versus 2,407.

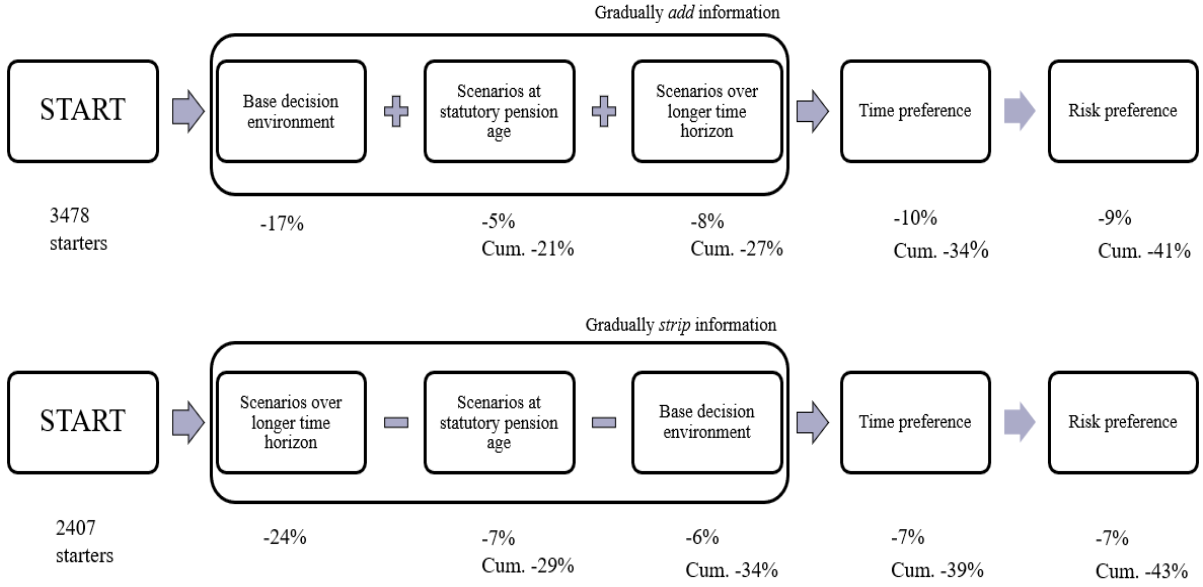

Figure 12: Incompletes across the two questionnaires; gradually adding or stripping information to/from a PDC decision environment

Adding information on uncertainty to the PDC decision environment

Adding information on uncertainty to the PDC options, hence increasing complexity, leads to more incompletes between consecutive decision environments. 17% of the participants drop out before making a PDC in the base decision environment, then compared to the previous stage another 5% drops out, then 8%. After the background questions and the time preference measurement, another 10% has abandoned the questionnaire. The risk preference measurement decreased the sample size further by 9%. As this study is the first to communicate dispersion in pension outcomes per PDC option from the new communication method (i.e., URM, see Appendix A), the message that the pension outcome is uncertain appears to come across. This is reflected in the reactions of the participants towards our questionnaire; around 10% of the participants express surprise, confusion and disappointment. This could explain the significant decrease in trust in the pension fund.

Stripping information on uncertainty from the PDC decision environment

In the path gradually stripping information, participants directly base their PDC on scenarios *and* a longer time horizon than the statutory pension age. This direct confrontation with much information (and complexity) leads to 24% of the participants directly abandoning the questionnaire. This is nearly as much as the result of gradually adding information via three decision environments (27%).

[23] Distribution: 13,000 people to questionnaire *adding* information, 9,000 to the questionnaire *stripping* information.

Interestingly, the 24% direct incompletes are split over the RPs (Low, Middle, High) as follows: 25%, 25% and 22%, compared to respectively 32%, 27% and 22% incompletes after the three decision environments in the other path. We find the discrepancy in percentages to be significant on a 0.10 significance level (Chi square test, see Appendix C for example). This is an indication that incompletion when directly presented scenarios over a longer horizon has less to do with accrued pension wealth/level of education than if presented scenarios over a longer horizon after gradually adding information. After the first decision environment the questionnaire becomes less and less complex, indicated by the marginal decrease in incompletes shown in Figure 12 (7%, then 6%). From the reactions of the participants we identify that gradually removing information is counterintuitive and can in some cases lead to the wrong perception of the pension outcome (see Section 6.2). Again, reactions to our study imply that the message of the pension outcome being uncertain comes across.

Incompletes from measuring time preference and risk preference

After the three PDC communication forms (either adding or stripping information), all participants are posed the same background questions. Here, we measured the two most important behavioural factors relevant for this study: the time preference of money and risk preference. In Section 5.3 we defined the measurement methods used in this study. To measure time preference, the participants were asked: "*What minimum amount "Y" would make you indifferent between $1,000 immediately and $Y in one year?"* (Hardisty, et al., 2013). This question proves to be ambiguous, which resulted in many outliers and confusion indicated by the participants. The single question for measuring time preference resulted in an average decrease in sample size of 6%.

The final block in Figure 12 represents the Holt & Laury method (2002) measuring risk preference. We pose three criteria for a valid measurement: the participant must *complete all ten steps*, must select the *risky prospect at the final step* and can only *switch between prospects once*. This way, the filtered participants represent the fully rational 'homo economicus' and allow us to measure a reliable risk preference. From 3,571 participants starting the measurement, 2,490 participants obtained a risk preference score. Ergo, we have *30% inconsistency*, which we find relatable to the 25% in a similar study by Van der Meeren (2017). Our inconsistency is somewhat higher as our sample size is lower educated and less financially literate than the sample size used in the study by Van der Meeren (2017). On average, measuring risk preference resulted in a decrease of another 8% of our sample size. 5% immediately drops out when the method is explained and 3% abandons the study somewhere during the measurement. These individuals dropping out are mostly of lower education and are less pension literate.

Characteristics of incompletes

Incompletes are mostly further away from the statutory pension age, have a lower level of education and less accrued second pillar pension wealth and are less pension literate. For participants further away from the statutory pension age, our questionnaire may be of less relevance as this group might want to postpone planning for the PDC. A low level of education and/or pension illiteracy might explain incompletion due to complexity issues. Lastly, those with little accrued pension wealth might find uncertainty regarding their pension wealth of less relevance, due to their larger dependency on the AOW. Hence, our findings on decision-making are somewhat biased compared to the true participant population, as we have more higher educated, wealthier, pension literate and interested participants filling out our questionnaire. We account for this bias by studying correlations with background characteristics when analysing PDC behaviour.

6.2 PDC behaviour

When information is added to or stripped from the decision environment, it can change participants' perception of PDC options. Gradually communicating uncertainty may enable the participant to re-evaluate their earlier PDC made by assessing its future adequacy. In this section we study the PDCs

made and their substantiation, changes in PDC preference and how participants evaluate their own PDC after deciding with new information regarding uncertainty.

Adding information on uncertainty to the PDC decision environment

Figure 13 shows the PDC behaviour for the path where information is *added*; participants are provided more and more information regarding the PDC options. The N statistic per decision environment is included to indicate how many participants made a PDC. Overall, the standard annuity as of the statutory pension age is the most popular PDC option. Hereafter comes early retirement and then the high-low annuity. Most of the participants choosing early retirement substantiate their decision by mentioning fatigue and saturation after a lengthy career in the sector. Leisure purposes (40%) and uncertainty regarding developments in the pension sector (20%) are the main drivers for choosing the high-low annuity.

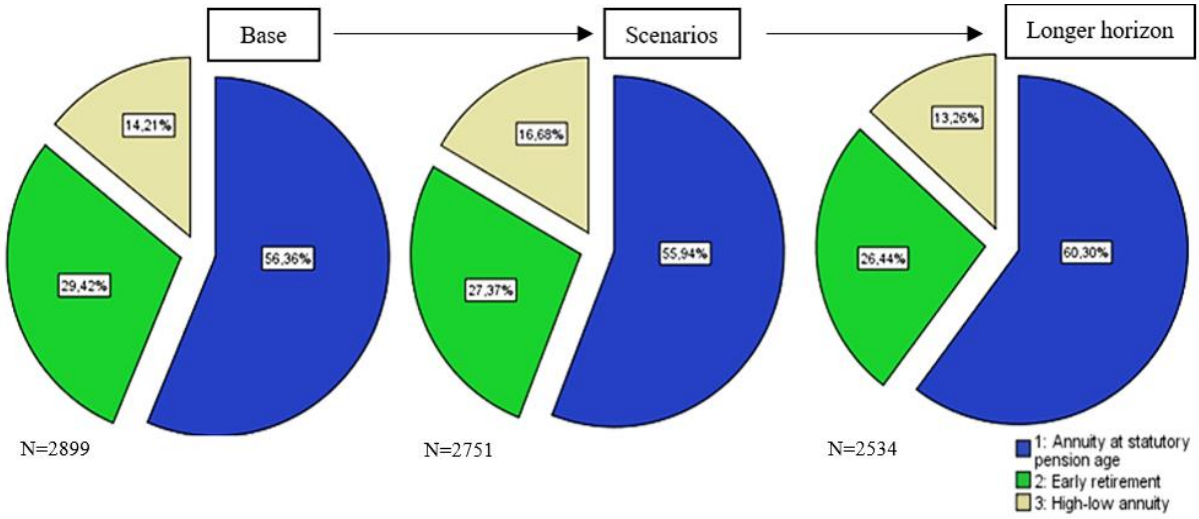

Figure 13: PDC behaviour when gradually adding information on uncertainty to the PDC decision environment

When the pension outcome per PDC option is communicated in three scenarios instead of solely the expected outcome (*base*), the majority (92% of 2,751 participants) does not alter their PDC preference. Potential explanations are insensitivity to dispersion of pension outcome, *anchoring* to an option, the questionnaire not offering a suitable alternative or clicking-through due to complexity or disinterest. Yet, 213 participants (8%) do switch their initial PDC. The most dominant switch direction is from *early retirement* to the *high-low annuity* (Table 4). Among the individuals that switch their initial PDC, early retirement drops in popularity from 44% to 18%. With early retirement the pension accrual ends directly, hence the pension outcomes are the lowest at the statutory pension age compared to our other PDC options. Among the individuals switching, the high-low annuity rises over 35% in interest. Causes for the dominant switch are the pessimistic scenario being perceived as insufficient and/or potentially a framing effect[24] of the high-low annuity. From the substantiations we find that participants *change* PDC because they do not want to end up under a certain income and started doubting their initial decision**.** Population wise, those switching are predominantly active participants instead of deferred pensioners. As active participants choose early retirement more often than deferred pensioners (30% versus 16%), the most common switch from *early retirement* to the *high-low annuity* is also visible for this group. 8% of active participants switch from PDC option upon seeing scenarios, compared to 5% of deferred pensioners. Deferred pensioners might be less affected by the dispersion of outcomes due to the presence of multiple pension rights (accrued at different funds).

[24] At the statutory pension age, the high-low annuity presents the largest figures. Participants can perceive this option as the most attractive, not realising/reading that after 10 years the annuity is lowered due to the nature of the construction.

Table 4: Popularity of PDC options among those switching PDC, upon seeing scenarios at statutory pension age (N=213)

Base decision environment

		Frequency	Percent	Valid Percent
Valid	1: Annuity at statutory pension age	92	43,2	43,2
	2: Early retirement	93	43,7	43,7
	3: High-low annuity	28	13,1	13,1
	Total	213	100,0	100,0

Scenarios at statutory pension age

		Frequency	Percent	Valid Percent
Valid	1: Annuity at statutory pension age	72	33,8	33,8
	2: Early retirement	38	17,8	17,8
	3: High-low annuity	103	48,4	48,4
	Total	213	100,0	100,0

When communicating uncertainty over a longer time horizon, 218 (9%) participants switch their PDC. Among those switching, the standard annuity regains interest as the impact of uncertainty over a longer time horizon becomes visible (Table 5). Namely, after ten years the pay-out of the high-low annuity is lowered and the optimistic and pessimistic scenarios per PDC option disperse further. The most common switch is from the *high-low annuity* to the *standard annuity*. Among the individuals switching their earlier PDC, the standard annuity rises almost 50% (in Table 5: 17% to 65%) in interest. These participants substantiate their switch by stating that over a longer time horizon the high-low annuity may result in an inadequate retirement income. This is an indication for *loss aversion*, as the standard annuity can be chosen to 'minimize losses'. Yet, we cannot specify if participants switched because of insight in the lowered annuity due to the construction or insight in its dispersion (lowest figure in the graph is the pessimistic scenario of the high-low annuity). Interestingly, now 14% of the deferred pensioners switch their earlier PDC, compared to 8% of active participants. A potential explanation is that the communication (of scenarios) over a longer time horizon makes deferred pensioners realise that the (one of potentially multiple) pension right at the fund in question can in fact be subject to substantial uncertainty. Another explanation is the higher popularity of the high-low annuity for this group and the longer horizon resulting in better income assessment and hence adaptive retirement planning. Lastly, 8% of the responses to our questionnaire address the understandability and purpose of our method used for communicating uncertainty: interval diagrams. To these individuals, deciding based on the interval diagrams comes across as probability calculation ("*I found it difficult to find the right answer*"), suggestive or a marketing trick by the pension fund to steer decisions.

Table 5: Popularity of PDC options among those switching PDC, upon seeing scenarios over longer time horizon (N=218)

Scenarios at statutory pension age

		Frequency	Percent	Valid Percent
Valid	1: Annuity at statutory pension age	36	16,5	16,5
	2: Early retirement	62	28,4	28,4
	3: High-low annuity	120	55,0	55,0
	Total	218	100,0	100,0

Scenarios over longer time horizon

		Frequency	Percent	Valid Percent
Valid	1: Annuity at statutory pension age	142	65,1	65,1
	2: Early retirement	46	21,1	21,1
	3: High-low annuity	30	13,8	13,8
	Total	218	100,0	100,0

Stripping information on uncertainty from the PDC decision environment

The second path for introducing uncertainty surrounding PDC options, gradually stripping information, is used to validate PDC behaviour in the other path. Figure 14 presents this PDC behaviour, again with the N statistic per decision environment. From the start, early retirement is a much more popular option than in the questionnaire where information is *added*. This can be explained by the mean age of the participants in the *strip* questionnaire being 61.3 years, compared to 63.2 years in the *add* questionnaire.

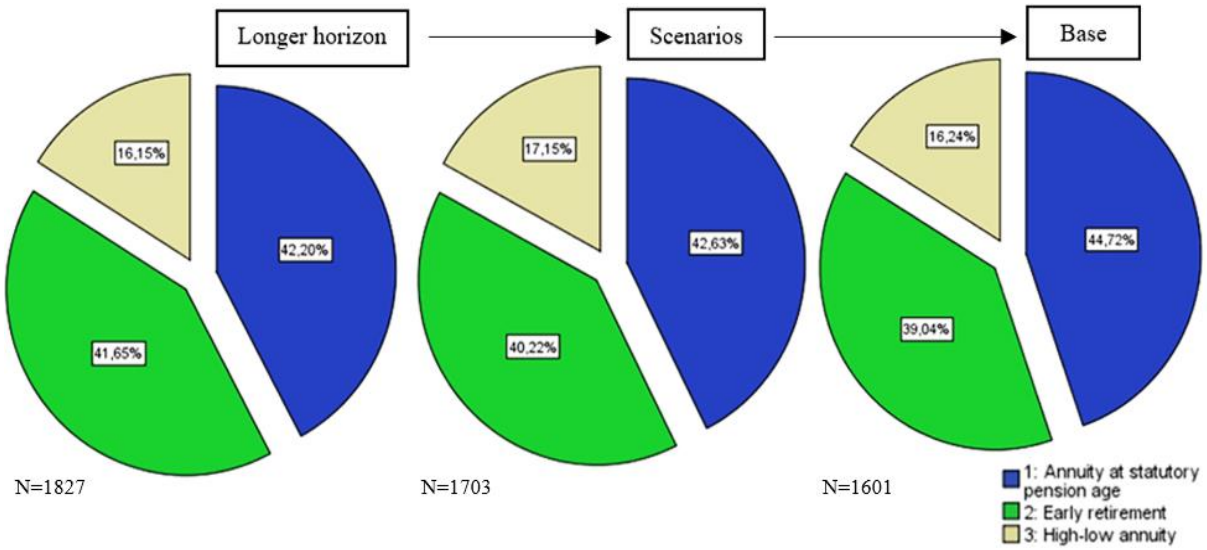

Figure 14: PDC behaviour when gradually stripping information on uncertainty from the PDC decision environment

If the extended horizon is stripped from the decision environment, presenting solely the three scenarios at the statutory pension age, the majority (91% of 1,703) of participants does not alter their PDC preference. Fully informed participants understand that the decision environments are identical (except the presentation excluding a part of the time horizon), explaining the robustness in PDC preferences. Other explanations may again be *anchoring* or clicking-through. However, 148 (9%) participants do switch their initial PDC. A longer time horizon may give participants better insight in consequences than solely the outcomes at the statutory pension age. The most common switch in this step is from the *standard annuity* to the *high-low annuity*. A potential explanation is participants forgetting the impact of the high-low annuity on the long term (due to stripping the longer time horizon). This despite our communication method consistently using text blocks to explain the consequences per PDC option.

When completely stripping scenarios and presenting solely the expected outcome (*base*), 117 (8%) of the participants switched their earlier PDC. Again, it can be argued that fully informed individuals should not switch their PDC, as all PDC options throughout the three decision environments and their consequences remain identical. However, stripping information from the PDC options can create the misconception for some individuals that communicating PDC options presenting solely the *expected outcome* (one scenario) are one hundred percent certain. Quoting one participant: "*I prefer a certain outcome over uncertainty please"*.

Communicating scenarios over a longer time horizon: Introduce gradually or in one instance

The questionnaire uses two methods for the introduction of communicating uncertainty over a *longer time horizon*: gradually expanding the decision environment (path *add*) and directly communicating the longer time horizon (path *strip*). From comparing the PDCs made *between paths*, we learn more about the decision-making of participants and gather evidence for the implementation of either one of the two methods. We expect the complexity issues of implementing scenarios (over a longer horizon) to be the largest for RP "Low", because these individuals are more likely to be of lower education. Therefore,

we compare the PDCs between paths for this RP, as aggregating over all RPs can give a distorted image. Figure 15 presents the comparison (relatable to Figure 12).

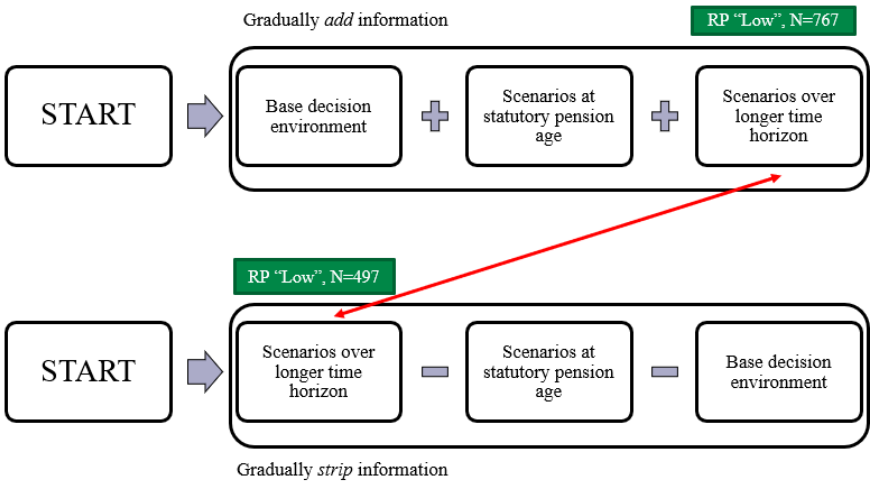

Figure 15: Comparing PDCs made in a decision environment presenting dispersion in pension outcomes over a longer time horizon

For the ages 61-65, we find PDC option popularity (standard annuity: early retirement: high-low annuity) to differ around 3% between the two methods for introducing the longer time horizon. This difference is *not statistically significant** (see Appendix C and footnote 26). Meaning, PDC decision-making based on the longer time horizon is unrelated to the *method* of introduction. This finding can be incorporated in the evaluation to either implement scenarios in one instance or gradually. In general, participants further away from the statutory pension age in our sample size prefer early retirement, participants closer to the statutory pension age prefer the standard annuity.

From the same comparison, the popularity of the high-low annuity is similar (16% versus 17%). High-low annuity choosers can experience a *learning* effect when gradually presented more information (indicating that participants become aware of the consequences of the construction and potentially switch to the standard annuity), unlike for direct communication of scenarios over a longer time horizon. Comparable percentages and their substantiations also indicate that this option is not chosen to withdraw money from the fund due to distrust in the pension sector.

Participants' evaluation of their PDC consideration after new information on uncertainty

To assess whether this new method for communicating uncertainty can be a next step in *improving* PDC decision-making, we also let participants evaluate their own decisions. This way, we can put PDC behaviour in perspective; whether the participant thinks he or she made a *better considered decision*. In the questionnaire we asked for their evaluation each time after making a PDC. So, we asked their evaluation twice: once based on scenarios at the statutory pension age, and once based on scenarios over a longer time horizon.

Dispersion of pension outcomes at the statutory pension age

Communicating three scenarios in pension outcome per PDC option makes participants evaluate their decisions as better considered for a considerate share of our sample size. Figure 17 presents the evaluation of participants who switched their PDC when presented with the three scenarios at the statutory pension age, Figure 16 of those who did not.

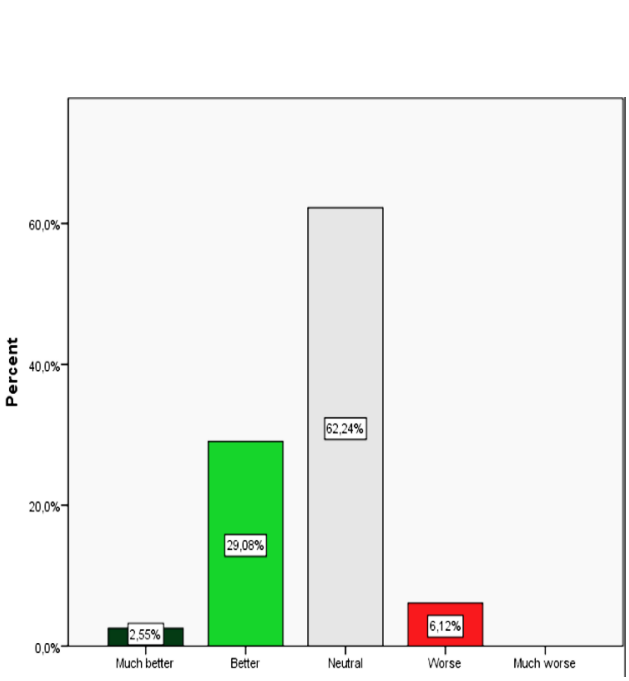

Figure 17: Evaluation of consideration PDC based on scenarios at statutory pension age, switching (N=196)

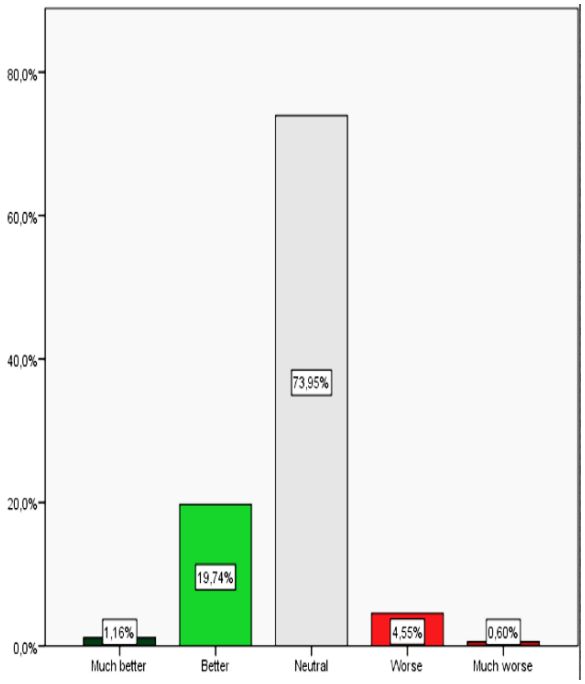

Figure 16: Evaluation of consideration PDC based on scenarios at statutory pension age, not switching (N=2,507)

For those who did not switch their PDC preference, which is the vast majority (N=2,507), 21% made a (much) *better considered* decision. Hence, even though not altering the PDC, the decision made is now better considered with insight in uncertainty. Of those switching the PDC, 32% of the participants evaluate their decision as (much) more considered. The communication of scenarios at the statutory pension age may assist these individuals in assessing the adequacy of retirement income. In general, most participants have a neutral opinion in this question, also those who switch their PDC preference. The 'neutral' evaluation can either indicate participants being unaffected or somewhat disappointed by the communication of uncertainty in pension outcome, but also indifference or fatigue. Furthermore, 6% and 5% of participants that indicate they made a (much) worse considered decision. Substantiations for switching and reactions to the questionnaire are indications of proof that participants are surprised and/or are disappointment in the dispersion of outcomes. Another explanation may be that participants perceive scenarios as being too complex for PDC decision-making. Lastly, a *confirmation bias*[25] may refrain individuals from evaluating their own decision as worse considered.

Dispersion of pension outcomes over a longer time horizon than statutory pension age

For a considerate share of the participants, the communication of a longer time horizon than solely the statutory pension age leads to better considered PDC decision-making. Figure 18 and Figure 19 present the evaluation for those switching the PDC and those not switching the PDC when scenarios over a longer time horizon are communicated. Of those switching PDC, almost half of all participants (49% of N = 206) indicate that their decision is made *better considered* than before. For those sticking to the same PDC (N=2,282), this percentage is 26%. Indifference, fatigue or the participants being unaffected by the communication of uncertainty in pension outcome are potential explanations for the neutral evaluation. Now, 4% (switching PDC) and 5% (not switching PDC) evaluate their PDC consideration as (much) worse when deciding based on scenarios over a longer horizon. Potential explanations may be the difficulty to plan over a longer period or stress/worry as the dispersion in outcomes might have caused participants to rethink their preferred retirement plan.

[25] This cognitive bias entails an individual seeking, interpreting, favouring and returning information that confirms his/her earlier beliefs, expectations or hypothesis.

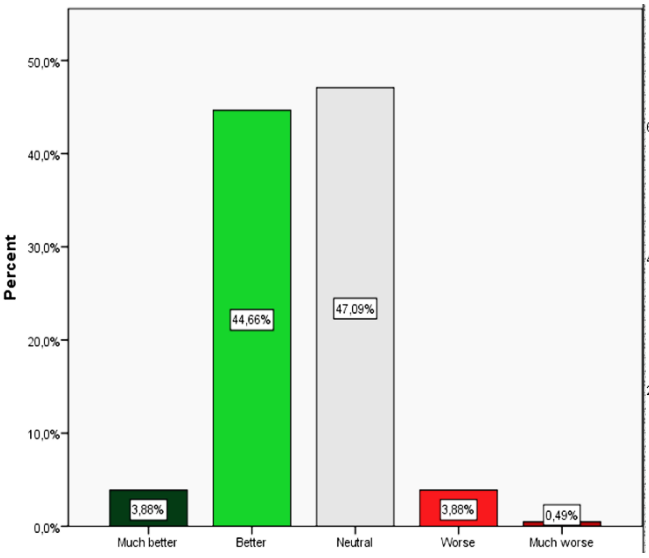

Figure 19: Evaluation of consideration PDC based on scenarios over longer time horizon, switching (N=206)

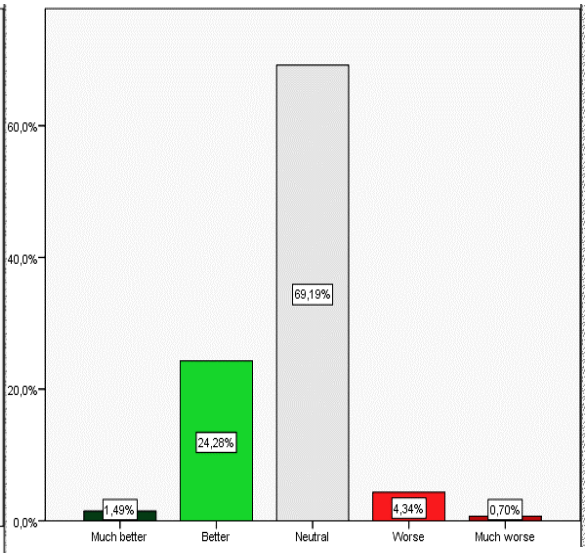

Figure 18: Evaluation of consideration PDC based on scenarios over longer time horizon, not switching (N=2,282)

We find a significant positive correlation between the consideration of the PDC and accrued second pillar pension wealth ($p<0.05$). The same holds for the level of education ($p<0.01$). For individuals with more accrued pension the insight in the dispersion is of larger relevance than for individuals more dependent on the AOW, hence a better considerate decision. Those with a higher level of education might be able to grasp the complexity of scenario communication better and hence make a better considered decision, as these individuals are likely to be more financially literate (Lusardi, et al., 2007).

6.3 Hypothesis testing

Additional or missing information on uncertainty in pension outcome can lead to a participant *switching* the preferred PDC. To prove whether gradually adding or stripping information on uncertainty leads to a *significant* change in PDCs, we conduct the *McNemar-Bowker test* (Chow, et al., 2008). If the p-value of the test is *smaller* than the threshold value of 0.05, we reject the null hypothesis.[26] In Section 3.2 we introduced the six hypothesis that are tested in this section.

From one scenario to three scenarios communicating uncertainty

Figure 20 shows the contingency table for participants moving from the base decision environment to the scenarios at the statutory pension age (N=2,751). Most participants stick to their initial PDC. Conform earlier statements, the most common switch direction is towards the high-low annuity when uncertainty is communicated. For this step, we find T_{MB} = 17.06 resulting in a *p-value of 0.00069***. With this result, we reject the null hypothesis of no significant change in PDCs when adding scenarios to the expected pension outcome at the statutory pension age.

		Scenarios at statutory pension age		
		Standard annuity	Early retirement	High-low annuity
Base	Standard annuity	1467	28	64
	Early retirement	54	715	39
	High-low annuity	18	10	356

Figure 20: State transitions in PDC preferences, from base decision environment to scenarios at statutory pension age (N=2,751)

[26] $\ldots^{*} = p < 0.05, \ldots^{**} = p < 0.01$

Null hypothesis: If scenario figures are added to the base decision environment, then participants do *not significantly* change their initial PDC. **Reject H_0**

Communicating uncertainty over a longer time horizon

Consecutively, for adding scenarios over a longer time horizon to the PDC options, we perform the same test. Figure 21 presents the contingency table (N=2,534). Conform the earlier mentioned trend, a considerate number of individuals change their PDC from a high-low annuity into a standard annuity. For this step, we find T_{MB} = 30.99, resulting in a *p-value of 8.43E-07***. This means we *reject* our third hypothesis stating that scenarios over a longer time horizon do *not* significantly change the PDC earlier based on scenarios at the statutory pension age. So, both steps in adding information regarding the communication of uncertainty result in a statistically significant change in PDCs.

		Scenarios over longer time horizon		
		Standard annuity	Early retirement	High-low annuity
Scenarios at statutory pension age	Standard annuity	1386	18	18
	Early retirement	50	624	12
	High-low annuity	92	28	306

Figure 21: State transitions in PDC preferences, from scenarios at statutory pension age to scenarios over a longer time horizon (N=2,534)

Null hypothesis: If scenario figures are presented over a longer time horizon than solely on the statutory pension age, then participants do *not significantly* change their PDC. **Reject H_0**

Stripping information on uncertainty from the PDC decision environment

When stripping information from the decision environment, our null hypotheses assume that participants do not significantly change their earlier PDC. Theoretically this makes sense, as fully informed individuals are aware that the PDC options and their consequences are identical over the three decision environments. No significant change in PDCs can also be explained by *anchoring* or clicking-through. Yet, moving from a complex environment to a simplified environment might result in the misconception of 'certain outcomes' and a framing effect. We find that the step from the longer time horizon to the scenarios at statutory pension age yields a *p-value of 0.3854* (N=1,703). The second step, stripping scenarios entirely and solely presenting the expected outcome, yields a *p-value of 0.4776* (N=1,601). Hence, as both p-values are *larger* than 0.05, both steps in stripping information are statistically insignificant for PDC switching behaviour and *we fail to reject* our second and fourth hypothesis.

Null hypothesis: If scenario figures are stripped from the decision environment, then participants do *not significantly* change their initial PDC. **Do not reject H_0**

Null hypothesis: If a longer horizon is stripped from the decision environment, showing solely the three pension outcomes on the statutory pension age, then participants do *not significantly* change their PDC. **Do not reject H_0**

Lastly, to validate the added value of communicating uncertainty, we perform a McNemar-Bowker test for PDCs made in the first and last decision environment, for both paths. Meaning, we compare the PDCs based on the *expected* outcome at the statutory pension age with PDCs based on *scenarios over time*. Participants can show back-and-forth behaviour in PDC preferences between the three decision environments; altering the PDC twice yet ending up with the initial PDC. This would reject our null hypotheses above, hence questioning the added value of a decision environment with an extended horizon. Figure 23 and Figure 22 present the contingency tables: left the PDC transitions from directly *adding* all information and right the PDC transitions from directly *stripping* all information regarding uncertainty. Of those initially preferring the high-low annuity and early retirement, respectively 19% and 12% end up with the standard annuity. We find p-values *0.00037*** for the path *adding* information and *0.10721* for the path *stripping* information. Therefore, we conclude that additional information regarding uncertainty decisively results in an altered PDC whereas removing this information does not.

		Longer time horizon		
		Standard annuity	Early retirement	High-low annuity
Base	Standard annuity	1369	27	39
	Early retirement	90	625	26
	High-low annuity	69	18	271

Figure 23: State transitions in PDC preferences, from environment solely communicating expected outcome to scenarios over a longer time horizon (N=2,534)

		Base		
		Standard annuity	Early retirement	High-low annuity
Longer time horizon	Standard annuity	648	16	21
	Early retirement	42	593	31
	High-low annuity	26	16	208

Figure 22: State transitions in PDC preferences, from scenarios over a longer time horizon to environment solely communicating expected outcome (N=1,601)

Robustness of decision-making under uncertainty for different levels of accrued pension

Adding information regarding uncertainty significantly changes the PDC, while stripping this information does not. However, this significance might differ for different levels of accrued second pillar wealth. The higher second pillar pension wealth, the larger the pension outcome uncertainty. Hence, these participants might value the communication of this uncertainty more than participants with less accrued pension wealth. Therefore, we conduct a McNemar-Bowker test for each of the representative persons (RPs). The results are presented in Table 6 below.

Table 6: McNemar-Bowker test per representative person for measuring significance of changes in PDC

		RP "Low"	***RP "Middle"***	***RP "High"***
ADD	**Base → Scenarios**	Not significant	Not significant	**Significant**
	Scenarios → Longer time horizon	Not significant	**Significant**	**Significant**
STRIP	**Longer time horizon → Scenarios**	Not significant	Not significant	Not significant
	Scenarios → Base	Not significant	Not significant	Not significant

Communicating uncertainty in pension outcome leads to a significant change in PDCs for participants with the highest level of accrued second pillar pension wealth. For RP "High", the step towards scenarios over a longer time horizon leads to 12% switching their earlier PDC. For RP "Middle", there is a significant change in PDCs when scenarios are communicated over a longer time horizon. However, communicating uncertainty in scenarios has no significant effect on the PDC for participants with the lowest level of second pillar pension wealth. These participants experience only a small dispersion of

their accrued pension wealth and are likely to be more dependent on the (constant) AOW. Reversely, stripping information from the decision environment has no significant effect on the PDCs for all RPs.

6.4 Time preference and risk preference

In risky intertemporal environments, the *risk and time preference* of individuals are of large influence on the PDC (Potters et al. (2016)**;** Booij et al. (2003)). A large financial decision, entails a certain level of risk and the individual makes the trade-off between having money now or later. In this section, we discuss the time and risk preferences of our sample size, identify significant correlations with background characteristics and link PDCs to these preferences.

Time preference of money

To put PDCs made in perspective, we measured the time preference of our participants. Namely, a high time preference of money could explain the preference for PDC options with immediate monetary rewards. Furthermore, individuals hyperbolically discounting the future might end up with a suboptimal PDC (e.g., inadequate retirement income) over time, hence the relevance to measure this factor. Figure 24 presents the distribution of answers given to the question: "*What minimum amount "Y" would make you indifferent between $1,000 immediately and $Y in one year?"* As visible, most values are close to or exactly $Y = €1{,}000$. This can either indicate participants applying the current interest rate, or not understanding the time preference question. Also visible from Figure H is the large number of participants providing values for Y that are lower than €1,000 (N=691) or values far away from $Y = €1{,}000$.[27] Small values for Y can be explained by participants applying a negative interest rate or correcting for current inflation rates. Large values for Y can be explained by either distrust in the pension sector, understandability issues or participants filling in extreme values with the purpose to skew the results. The median Y is €1,080, representing a subjective discount rate (SDR) of 7.7% (calculated from the model by Samuelson (1937). This percentage is considerably larger than market interest rates, conform findings by Frederick et al. (2002). We refrain ourselves from making statements based on *exact* values of time preference, as these values is largely dependent on the type of measurement (single question, monetary amount of €1,000, time horizon of one year and hypothetical rewards). We therefore use the time preference data solely for correlation and regression purposes.

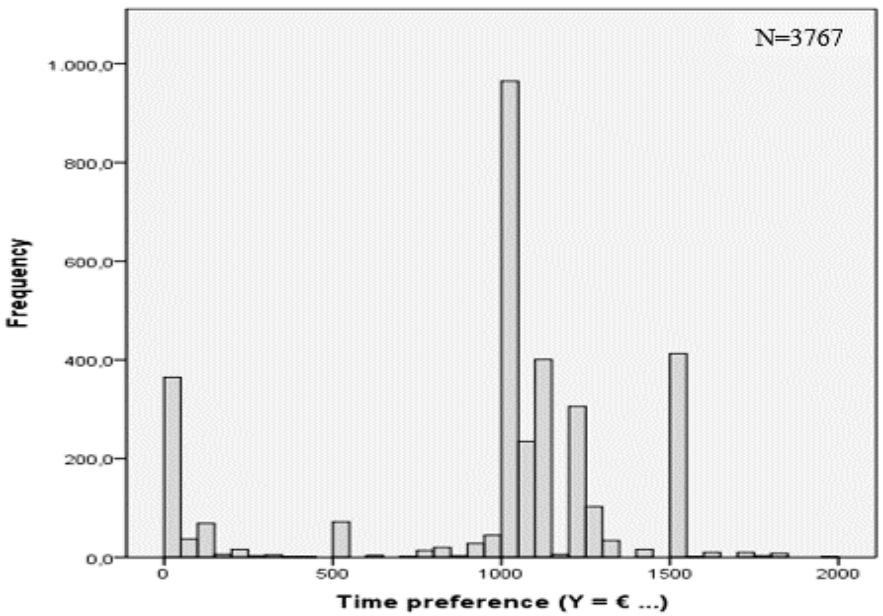

Figure 24: Distribution of values of Y (amount received one year from now) for measuring time preference (N=3,767)

[27] Figure 24 is cut of at $Y = €2{,}000$ for presentation purposes.

Correlations

To identify significant correlations between the time preference of individuals and background characteristics, we remove the extremes. This entails removing negative discount rates and removing large values (resulting: $€1{,}000 \leq Y \leq €1{,}590$).[28] By doing so, we find a significant negative correlation (*p<0.01*) between time preference and the level of education. Meaning, lower educated individuals discount the future heavier (or do not understand the question) and provide larger answers for *Y* (conform Diekmann et al. (2014)). The same applies to time preference and our second measurement of trust in the pension fund (*p<0.05*); individuals with less trust in the pension fund *after* the introduction of communicating uncertainty discount the future heavier. Lastly, accrued pension wealth is significantly negatively correlated with the time preference (*p<0.05*); those with less accrued pension wealth discount the future heavier. We find that time preference is positively correlated with time to the retirement age, yet not significantly (*p>0.05*), conform Chao et al. (2009) and Trokasti (2016).

Time preference and PDC behaviour

The participants choosing the high-low annuity when presented uncertainty in pension outcome have a higher time preference than those choosing early retirement or the standard annuity (subjective discount rate = 9.5% versus 4.9% on average). This is the case for all three decision environments. This could indicate the intention to withdraw money from the pension fund. However, from substantiations behind the PDC made we identify that this is not the case. In Section 6.5, we discuss the significance of time preference on the probability of *switching* PDC when the dispersion in pension outcomes is presented.

Risk preference

Every participant perceives risk and return differently with the pension having a long time horizon, being uncertain and involving large monetary amounts. In our study, we measured risk preference via the Holt & Laury method (2002), described in Section 4.3. From applying the criteria described in Section 6.1, we obtain reliable risk preferences for our sample size (N=2,490). Figure 25 presents the distribution of CRRA parameter *r* for risk preference; a higher value for CRRA parameter *r* is associated with a higher risk aversion. For our population, the median risk preference is $r = 1.67$. As $r > 0$, we can conclude that we have a relatively risk averse population. Our findings are conform studies by Van der Meeren (2017) and Alserda et al. (2016), who find respectively $r = 1.95$ and $r = 1.92$. In the large-stake domain of pension risk, a risk averse population favours less risky options, such as early retirement.

The peak at $r = -4.82$ (i.e., extremely risk loving) has two explanations. First, these participants truly are risk loving and receive a risk preference that is appropriate for them. Second, from incomprehension the participants directly pick the *risky* prospect and then stick to this prospect until the end. In our study we set the lower boundary of the CRRA range at $r = -4.82$, yet in reality the participant might have an even higher risk preference. On the other hand, the peak at $r = 4.46$ (i.e., extremely risk averse) represents the participants not switching from the *safe* to the *risky* prospect until there is no more risk involved. We set the upper boundary at $r = 4.46$, yet some participants may be even more risk averse in reality. From the reactions to our questionnaire we learn that choosing between two prospects can be perceived as (involving) "gambling with pension wealth", which can be an explanation for the large peak at the final step.

[28] Value Y = €1,590 is the lower bound for the bin 'Extreme', which is 1 of the 6 time preference bins created for regression purposes. This binning procedure is further discussed in Section 6.5.

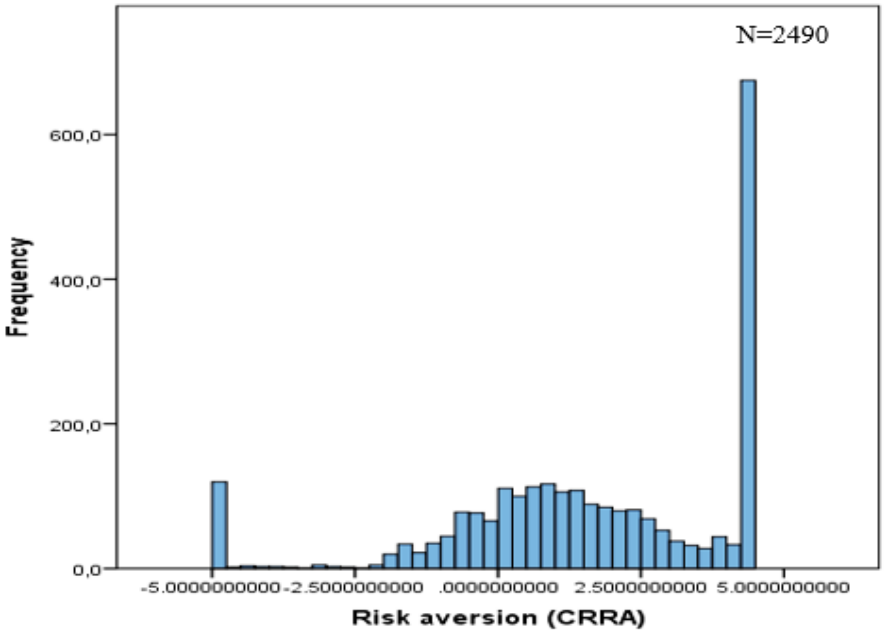

Figure 25: Risk preference measurement of pension fund participants (N=2,490)

Correlations

Again, to identify significant correlations between the risk preference of individuals and background characteristics, we remove the extremes; r = -4.82 and r = 4.46. We find a negative correlation between the years to retirement age and risk preference. This is conform findings by Dohmen et al. (2017), who analyse the risk attitude over the course of life. Furthermore, we find a positive correlation between risk preference and accrued pension wealth and salary. Individuals with more accrued pension wealth and salary might be able to take more risk over their second pillar wealth due to the presence of other income sources, hence resulting in sufficient retirement income. The connection with level of education also tells that lower educated individuals are more risk averse (conform Sahm (2008)). However, the above correlations are not statistically significant ($p>0.05$).

Risk preference and PDC behaviour

The risk perception can influence the PDCs made when communicated uncertainty (riskiness) in pension outcome. Participants choosing the high-low annuity when communicated uncertainty over a longer time horizon have a higher risk preference than those choosing either one of the other two PDC options. From substantiations we learn that these participants with their higher risk preference have a somewhat different attitude towards the scenarios; they are less influenced by the pessimistic scenario, especially on the long term. Besides, the participants switching PDC have a higher risk preference than those who do not. This can be an indication for less *anchoring* behaviour for individuals that switch their PDC preference. In Section 6.5, we further discuss the significance of risk preference on the probability of *switching* PDC when the dispersion in pension outcomes is presented.

Correlating time preference and risk preference

We find a significant correlation ($p<0.05$) between the risk preference and time preference. This is in line with findings by Anderhub et al. (2001): "*Risk-averse agents discount the future more heavily*". For example, we observe that risk-averse participants with a high time preference predominantly choose the high-low annuity when presented scenarios at the statutory pension age. Moreover, Booij et al. (2003) recommend measuring risk preference with the subjective discount rate at all times. The evaluation of a monetary reward does not solely depend on the amount of the reward, but also on the way it can be gradually spent over time.

6.5 Logistic regression

The PDC is significantly influenced if additional information in terms of scenarios on pension outcome is communicated. Every participant bases the PDC on his or her heterogeneous (financial) household and is influenced by the communication of uncertainty differently. Studying background information and financials allows us to gain more perspective on what *drives* an individual to *change* the PDC. From this analysis we strive to identify which groups benefit most from the communication of uncertainty to make a more substantiated, financially adequate PDC. We do this by performing several regression analyses with independent background variables predicting the binary event of a change in PDC. An appropriate analysis in this context is *logistic regression*, since we have a non-linear relationship between the background variables and a *change*. We are specifically interested in the behavioural factors *time preference* and *risk preference*. As the current state of pension sector is the *base decision environment*, we only regress over the path where information on uncertainty is *added* to the decision environment.

Assumptions

Logistic regression makes use of several assumptions to which our data must comply. As part of data preparation, we briefly discuss these assumptions and how we ensure our data complies:

- Dependent variable *change* is binary, independent variables are binary, ordinal and/or scale;
- Observations are independent of each other;
- Linearity between independent variables and log odds (of binary dependent variable)

Although logistic regression requires no linearity between the independent variables and the dependent variable, it does so for the log odds. To test this for all our independent variables, we perform the Box-Tidwell test (1962). To the regression model we add interaction terms: the cross product of independent variables times their natural log. From this test we conclude that the *time preference* variable is the only variable *not linear* to the log odds of the change variable. This makes sense, as there are many outliers (answers far away from $Y = €1{,}000$). Therefore, we transform this variable into a categorical (ordinal) variable with six equally sized bins, presented in Figure 26 below[29]:

Time preference_bins

		Frequency	Percent	Valid Percent
Valid	Negative	691	11,7	18,3
	Unaffected	811	13,8	21,5
	Low	784	13,3	20,8
	Middle	455	7,7	12,1
	High	430	7,3	11,4
	Extreme	596	10,1	15,8
	Total	3767	64,0	100,0
Missing	-99	2118	36,0	
Total		5885	100,0	

Figure 26: Time preference transformed into a categorical variable (N=3,767)

After this computation, all background variables are suitable for our logistic regression analyses.

- Independent variables have little to no multicollinearity

High correlations among explanatory variables is an issue for logistic regression models, as it results in unstable estimates of regression coefficients. We test our variables for multicollinearity by measuring the Variance Inflation Factor (VIF). The VIF is $1/(1\text{-}R^2)$. From the *Collinearity Statistics* in SPSS we find VIF values of no larger than 3, also complying to the criteria posed by Allison (2012). Furthermore,

[29] Due to granularity of the data, the minimum number of bins required by SPSS is six. 16.66% of the participants are placed into a bin, for which the boundaries are: €0-€999.9, €999.9-€1000.1, €1000.1-€1100, €1115-1315, €1315-€1590 and > €1590.

from constructing a Pearson correlation matrix we do not find high correlation values ($\rho>0.8$) among our continuous variables (salary, risk aversion, part time factor and age). Therefore, we conclude that in our dataset *multicollinearity can be disregarded*;

- Large enough sample size.

Now, with our data complying with the logistic regression assumptions, we use three more procedures for our regression analysis: *under-sampling*, *(semi)randomisation* of these samples and *forward selection* of significant variables. First, we under-sample the population not switching their PDC preference, as the ratio *non-switch to switch* is approximately 12.5 participants to 1. As we strive to find significant drivers for a *change* in PDC, our regression model cannot underrepresent those switching. Second, we use several (semi)random samples (of non-switchers) in our regression model. If a random sample contains a large quantity of an infrequent variable such as 'bequest', the regression model can incorrectly indicate this variable as significant. Therefore, we ensure that the random samples used match the background information of the individuals switching PDC preference. Lastly, we perform a stepwise selection called *forward selection* (based on likelihood ratio), where only predictor variables are added to the regression model if they have a significance level of 0.05 or lower. This way, we ensure our logistic regression model does not over or underfit the data. Another benefit of this method is visualisation and understandability, as only significant variables are presented.

Additionally, we split variables measured by our questionnaire (e.g., risk aversion and level of education) from pre-known information from the participant file (e.g., age and salary) in our regression model, as logistic regression uses *listwise deletion*. If one (regressed) variable misses for a case, that entire case is removed from the regression model. Splitting the variable selection allows for maximum usage of the cases to study significance.

Analysis 1: From one scenario to three scenarios communicating uncertainty

We find *two significant drivers* ($p<0.05$) for changing the PDC when communicating uncertainty in pension outcome at the statutory pension age. Figure 27 presents the SPSS output of the logistic regression model used. We interpret the output in the metric of *odds ratios* (Exp(B) in Figure 27) for understandability purposes.

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	Age_Bin(1)	-,565	,202	7,785	1	,005	,568
	Constant	,211	,123	2,936	1	,087	1,235
Step 2[b]	Age_Bin(1)	-,617	,207	8,893	1	,003	,540
	PERSONA			8,385	3	,039	
	PERSONA(1)	,687	,304	5,123	1	,024	1,988
	PERSONA(2)	,769	,314	5,994	1	,014	2,158
	PERSONA(3)	,303	,240	1,594	1	,207	1,353
	Constant	-,111	,192	,335	1	,563	,895

Figure 27: Significant variables in regression model for switching PDC upon communicating scenarios at statutory pension age

The significant variables are *years to retirement age* and *pension literacy* (i.e., 'persona', measured in four ordinal categories). First, the *years to retirement age* variable is tricky, as early retirement is less attractive for those of higher age. Therefore, as we did for *time preference* for regression purposes, we split *years to retirement age* into bins (Figure 27: "age_bin"): <64 years and ≥ 64 years. We choose age 64 as cut-off value, as early retirement is on average 3 years before the statutory pension age (which is on average 66 for our sample size).

We interpret the results as follows: those being 64 years or older have a 0.54 times smaller probability of switching PDC than those younger than 64. Early retirement is mostly chosen by participants further away from the retirement age, and the most common switch direction when adding scenarios is *early retirement* to the *high-low annuity*. Therefore, it makes sense that *years to retirement age* is a significant

variable for switching the PDC. Second, from Figure 27 we observe that *pension literacy* is another significant variable for switching the PDC. Compared to the first category in pension literacy (no literacy or unknown literacy), the second and third category are statistically significant. In figures: participants with pension literacy category 2 (3) have a 2.0 (2.2) times higher probability of switching PDC than those of no/unknown pension literacy. The fourth category has no additional significance compared to the first category. Pension literacy being significant for switching the PDC can be explained by participants understanding the (method of the questionnaire and the) impact of scenarios and starting to reassess their income adequacy. Lastly, the behavioural factors *time preference* and *risk preference* are *not* statistically significant in this step in terms of adding information regarding uncertainty. A potential explanation is the relatively short time period until the statutory pension age and therefore relatively little dispersion (riskiness) of pension outcome. With the significant variables, the regression model looks as follows:

$$f(y) = logit = \beta_0 - \beta_1 x_{yrs\ to\ retirement\ age} + \beta_2 x_{pension\ literacy}$$

The Nagelkerke pseudo-R^2 of *all* background variables predicting a switch in PDC is 16.6%. When solely constructing a logistic model using the significant variables above, we find a R^2 value of less than 10%. Meaning, the independent variables are a weak explanation for the variance in the dependent variable of a change. This gives an indication for other (external) factors influencing PDC decision-making that we empirical study does not measure.

Analysis 2: Communicating uncertainty over a longer time horizon

When communicating scenarios over a longer time horizon than the statutory pension age, we find *four significant drivers* for switching the PDC. Figure 28 presents the SPSS output:

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	RiskAversion	-,120	,050	5,754	1	,016	,887
	Constant	-,055	,141	,152	1	,697	,947
Step 2[b]	PensionOfPartner(1)	-,539	,238	5,157	1	,023	,583
	RiskAversion	-,118	,050	5,547	1	,019	,888
	Constant	,186	,177	1,105	1	,293	1,204

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1[a]	RP			16,105	2	,000	
	RP(1)	,124	,209	,353	1	,552	1,132
	RP(2)	,779	,216	13,045	1	,000	2,179
	Constant	-,988	,159	38,389	1	,000	,372
Step 2[b]	RP			16,849	2	,000	
	RP(1)	,133	,210	,402	1	,526	1,142
	RP(2)	,805	,217	13,742	1	,000	2,238
	Age_Bin(1)	-,477	,173	7,582	1	,006	,621
	Constant	-,802	,172	21,693	1	,000	,449

Figure 28: Significant variables in regression model for switching PDC upon communicating scenarios over longer time horizon

First, *risk preference* is of significant influence ($p<0.05$) on the probability of switching PDC when confronted with uncertainty over a longer time horizon than the statutory pension age. For every unit higher in risk aversion, the odds of switching decrease by 0.89, holding all other variables constant. In detail, those switching the PDC have a risk preference of $r = 0.94$ versus $r = 1.67$ of those who do not. A first explanation is that since it is mostly the group with *more* accrued second pillar wealth that has a higher risk preference, this group firstly decides on PDCs with *more* dispersion of pension outcomes and is therefore (from a learning effect) more willing to take risks in the later risk preference measurement in our questionnaire. A second explanation is that those with a higher risk preference experience less *anchoring* behaviour and are more willing to adjust their PDC when confronted with uncertainty. With this result, we *reject* our fifth hypothesis assuming that changing the PDC is *not significantly* influenced by the risk preference when communicating scenario figures over a longer time horizon than solely the statutory pension age.

Second, the dependency on the *pension of the partner* is also of significant influence on whether a participant switches PDC or not. The more dependent on the pension of partner, the less affected/influenced by the dispersion of their own pension outcome. Those independent of the pension of their partner have less of a safety net and are more likely to alter their PDC when confronted with uncertainty. Third, also statistically proven in Section 6.3, *accrued second pillar wealth* is significantly related to the probability of switching PDC. The difference between RP "Middle" and RP "Low" is not

statistically significant, the difference between RP "High" and RP "Low" is. Participants classified as RP "High" have a 2.2 times higher probability of switching PDC than those classified as RP "Low". Lastly, again *years to retirement age* proves to be a significant variable for switching the PDC. Resulting, the regression model looks as follows:

$$f(y) = logit = \beta_0 - \beta_1 x_{risk\ preference} - \beta_2 x_{pension\ partner} + \beta_3 x_{accrued\ pension\ wealth} - \beta_4 x_{yrs\ to\ retirement\ age}$$

Nagelkerke's pseudo-R^2 using *all* background variables is 23.7%, whereas this R^2 using only the significant variables is less than 10%. As for the other regression analysis with low R^2 values, this indicates that there are unexplained factors for the variance in the *change*, such as the framing effect, the questionnaire complexity, fatigue or unreliable PDC behaviour.

Time preference is not a significant variable for a switch in PDC preference when communicating scenarios over a longer horizon. Combined with earlier discussed PDC behaviour, we therefore find no clear indications for the presence of the *present-bias* on the PDCs made. With this result, we *fail to reject* our sixth hypothesis stating changing the PDC is *not significantly* influenced by the time preference when communicating scenario figures over a longer time horizon than solely the statutory pension age. So this can be explained by participants not experiencing the present-bias or having intentions to withdraw money from the fund, yet also by the inability of our chosen measurement method to fully capture participants' time preference of money.

Null hypothesis: If scenario figures are presented over a longer time horizon than solely on the statutory pension age, changing the PDC is *not significantly* influenced by the *risk preference*. **Reject H_0**

Null hypothesis: If scenario figures are presented over a longer time horizon than solely on the statutory pension age, changing the PDC is *not significantly* influenced by the *time preference*. **Do not reject H_0**

6.6 Conclusions

Our research shows that pension decumulation choices (PDCs) are significantly influenced by the communication of uncertainty in three scenarios. Especially when presenting a later timestamp in retirement than the statutory pension age, it appears that communicating in scenarios provides insight in PDC consequences and may help participants improve their assessment of retirement income adequacy. We find that participants with more accrued second pillar wealth significantly change their PDC preference from this communication, as they face more dispersion of pension outcomes than those with lower accrued pension wealth. Moreover, a large percentage of participants evaluates their PDC as better considered due to this new communication method.

Significant drivers for changing the PDC when scenarios are communicated are: years to retirement age, pension literacy, pension of partner, risk preference and accrued second pillar pension wealth. Among a relatively risk averse sample size, those with a higher risk preference are more likely to adjust their PDC due to the influence of the communication of uncertainty in scenarios. Yet, from low observed R^2 values we conclude PDC decision-making is also influenced by other (external) factors, unmeasured in this study.

Groups that potentially need attention when considering the introduction of scenarios in the PDC decision environment are those with a low level of education and little pension literacy. The level of incompletes, the indication of a framing effect and reactions to our questionnaire show that the communication method needs to be further improved or targeted. The following chapter presents the conclusions of our study and provides several recommendations and suggestions for the pension fund and the sector.

7. Conclusions and Recommendations

In an individualising society, pension fund participants desire more flexibility and responsibility to align the pension decumulation choice (PDC) with their needs and preferences (Ministry of SZW, 2015). The PDC is part of the broader process of retirement planning, where individuals base this second pillar decision on their (financial) household. Yet, retirement planning is complex and involves uncertainty over a long time period. Complexity and the long horizon give rise to the potential risk of sub-optimal decisions; participants having inadequate income after retirement or being dissatisfied with their decision afterwards. Despite participants making a PDC in an *uncertain* landscape, most decision environments currently only present the *expected* outcome at the target pension age. However, many factors can influence this pension outcome. A recent development to better assist in PDC decision-making is a new method for communicating uncertainty in three scenarios. Participants are provided more insight in the dispersion of potential future outcomes, by showing an optimistic and pessimistic scenario in addition to the expected outcome. This insight may assist in assessing retirement income adequacy and if needed with adaptive retirement planning. This study investigated *if* and *how* communicating uncertainty in scenarios at both the statutory pension age and over a longer time horizon can be a step towards a more *substantiated* and financially *adequate* PDC. Section 7.1 presents our main conclusions, answering the research question of this study. Hereafter, using the findings of our study, we deliver several recommendations in Section 7.2. Finally, we provide suggestions for further research in Section 7.3, taking into account several constraints that this study is subject to.

7.1 Conclusions

In Section 3.1 we defined the research question of our study as follows:

"To what extent does a decision environment with three scenarios communicating uncertainty, based on participants' needs and preferences, alter the pension decumulation choice (PDC) made and what are potential improvement directions?"

First, our empirical study finds that PDCs made are *significantly influenced* by communicating PDC options in *three scenarios* instead of solely the expected pension outcome. Here, we find several indications that participants weigh the pessimistic scenario heavily in this decision. Section 6.2 describes that the pessimistic scenario is the main cause for switching the PDC towards less direct withdrawal of second pillar funds (indicating *loss aversion*). Besides, reactions to our study indicate that participants are surprised by the downside potential. Explanations may be the timing of our study, the novelty of (communicating in) scenario figures, and our sample size being risk averse. This study took place in a period of financial pressure on the sector, increased media attention, a new Pension Agreement and scenarios being firstly introduced/communicated on the Pension Tracing Service (MPO). Therefore, participants' perception of their pension outcome and the actions of the sector might have been negatively influenced by these recent developments. This is also indicated by our measurement of a significant decrease in trust in the pension fund before and after our questionnaire on communicating uncertainty. We find inconclusive evidence that the decrease in trust stems from the fear/expectation of benefits reductions or from the communication of scenarios in itself.

Second, communicating pension outcomes in scenarios over a *longer horizon than the statutory pension age* has a significant influence on the PDC made. From switching behaviour and reactions to our study we learn that participants become more aware of PDC consequences from this communication. These PDC consequences entail both the construction of an option (annuity form and time-horizon) and the dispersion in outcomes. For example, 12% of the participants that initially preferred early retirement ends up with the standard annuity when having seen the longer time horizon. If a longer horizon is presented, the dispersion of outcomes per PDC option becomes more visible. Furthermore, given our target group of 61- to 65-year-old participants, there is relatively little dispersion of pension outcomes at the statutory pension age, but this dispersion increases over time. Therefore, the extension of the time

horizon of the decision environment (with ten years) is of greater impact on the *PDC consideration* of participants than the addition of scenarios in itself. Of the participants switching their PDC preference (9%), almost half evaluates their PDC as better considered when presented the extended horizon (indicating *adaptive retirement planning*). For the majority of the participants that does not switch preference (91%), 1 out of 4 participants nonetheless evaluates their decision as better considered. This implies that the communication of PDC options and their dispersion over a horizon beyond the statutory pension age is also valuable for these individuals. Communicating pension outcomes solely at the statutory pension age might give participants the wrong perception of the (consequences of the) PDC options, potentially allowing for *framing effects*. Especially with the planned introduction of the lumpsum, this wrong perception may cause financial distress over time. So, our findings of participants evaluating their PDC as better considered indicate an improved assessment of retirement income adequacy (assisting with *multiple selves*), which suggest improved rationality[30] and may lead to greater satisfaction with this decision made. Only a low percentage of individuals evaluates their PDC as worse considered, implying the added value of scenarios over time, yet also a potential presence of the confirmation bias. Furthermore, removing information from a decision environment with an extended horizon does *not significantly* change PDC preferences of participants.

To put PDC preferences in perspective, we measured the significance of several background variables on decision-making under the new communication method. This way, we find evidence to which participants the communication of uncertainty is of most relevance/added value. The significant variables are: years to retirement age, pension literacy, accrued pension of partner, risk preference and accrued second pillar pension wealth. For example, participants further away from the retirement age with much (dependency on the) pension of partner are more likely to choose early retirement and stick to this option. However, as the explanatory strength of these background variables is weak (low R^2 values), we conclude that there is a considerate influence of other factors that our study did not measure. We also find substantial incompletion percentages over our two questionnaires. After communicating an extended horizon (both from gradual introduction and directly), roughly 25% of our sample size drops out. Our study sketches a fictional environment, but if 25% in a real-time decision environment would perceive the PDC as too complex, procrastinates and/or makes a sub-optimal decision, this is unacceptable. We find that incompletes to our questionnaire are mostly of lower level of education, little pension literacy and little accrued pension wealth.

Potential improvement directions for the PDC decision-making are given in the following section.

7.2 Recommendations

Sector

From a *duty of care* perspective, given a significant influence on PDC behaviour and the effect on the PDC consideration, we recommend to further study the communication of uncertainty in *scenarios* in PDC decision environments. This study has found several indications that the communication of scenarios may be a next step for the sector towards supporting and facilitating a more *substantiated* and financially *adequate* PDC; improving retirement decisions. This step has societal relevance, as the recent evaluation of the Pension Information Act concludes that further improving participants' assessment of retirement income adequacy is the most important next step (Ministry of SZW, 2020). Moreover, we recommend the sector to hereby study communicating uncertainty over a *time horizon beyond the statutory pension age*. One might even argue that participants will *miss* the communication of scenarios in the PDC decision environment, since the Pension Benefit Statement (UPO) and the Pension Tracing Service (MPO) already do. Our recommendation, to be consistent with URM practices, is for the pension sector to take a time horizon of *ten years* after the statutory pension age into

[30] An academic suggestion for further research is to revise current modeling of multiple selves and corresponding rationality of individuals in PDC decision-making (for an axiomatic framework to rethink bounded rationality, see Roorda et al. (2019)).

consideration (Pensioenfederatie, 2019). We leave the added value of an even further extended time horizon as a suggestion for further research.

However, the trade-off between *information provision* and *complexity* should be kept in mind when further studying the communication of scenarios in a decision environment. More information is not always for the better, as not all participants may be able to process and decide on this new information adequately. From a duty of care perspective, subsets of individuals may not be able to make a financially *adequate* PDC based on communicating uncertainty in scenarios. Therefore, certain subsets of individuals *may need further assistance* in decision-making as scenarios (over an extended time horizon) may be perceived as difficult, misleading or worrying if retirement income is perceived as inadequate. From our findings, these individuals are likely to be of lower education and with little pension literacy. In fact, as the more interested, higher educated and more pension literate individuals filled out our questionnaire, we expect that the level of experienced complexity of scenario communication may lie even higher in practice. This further stresses the importance of the trade-off between information provision and complexity. Also participants somewhat further away from the statutory retirement age are a relevant group, as this group might need assistance in adaptive retirement planning and can be incentivised to delve into their own pension situation. Assistance may come in the form of optimising the design of the communication method further, information sessions or call centre support. Besides assistance *during* decision-making, Soetendal et al. (2019) also suggest *aftercare* in their paper on the *ambition of care*. We find inconclusive evidence that scenarios should *not be communicated* for any subset individuals based on their characteristics or preferences.

So, communicating scenarios over a longer horizon in a decision environment requires a communication method that is suitable for all participants. Especially for those being less financially literate, and therefore potentially having a less adequate retirement income (Wilming, 2018), an *understandable* communication method may improve retirement planning. By using two forms of introducing uncertainty, gradually and directly, this study finds evidence for designing a potential *decision architecture* of this method. We find no significant discrepancy in PDC option popularity if we compare PDCs based on the longer horizon after gradual introduction versus after direct communication. Furthermore, a real-time decision environment would never let participants decide on their PDC based on three types of information provision as we did in our questionnaire. Therefore, we would advise the pension sector to let participants *make one PDC* based the communication of uncertainty over a horizon further than the statutory pension age, instead of doing so via multiple decision phases. Note, in the process of *introducing* scenarios over a longer horizon, multiple forms can be used. One form could be sequential explanation phases showing the build-up from the expected pension outcome to scenarios over time. Moreover, we provide several suggestions for a design of the new communication method in a PDC decision environment in the following section.

Furthermore, it is a consideration to make the communication of an extended horizon *age-dependent*. For our target group (age 60+) showing pension outcomes beyond the statutory pension age is beneficial, for both active participants and deferred pensioners. From the age of 60, when participants increasingly start to plan for retirement, insight in (scenarios of) pension outcomes over an extended horizon is the most relevant. For participants younger than 60 (outside of the scope of this study), we suggest further research on what horizon to communicate. The further away from age 60, the less retirement planning is of interest and the larger the dispersion of pension outcomes. Therefore, to reduce complexity stemming from uncertainty (e.g., life events and investment results) over time, the pension sector should research the added value of communicating scenario outcomes of a later stage in retirement for these participants.

Pension fund

We proved that scenario figures significantly influence PDC decision-making and a considerable share of participants evaluated there decision as better considered. Regarding the scenario communication

(URM), in September 2020 a national evaluation will be organised by the Ministry of SZW to discuss its working. Therefore, we recommend our findings on communicating uncertainty over a time horizon beyond the statutory pension age to be used as input by the pension fund for this evaluation. Currently, participants close to retirement are presented scenarios showing the *statutory pension age*, while retirees are presented scenarios showing a timestamp *ten years ahead*. This national evaluation may result in research on including scenarios over time in *existing* communication channels such as the Pension Benefit Statement (UPO) or the Pension Tracing Service (MPO). This is in line with the Ministry of SZW allowing pension providers for more freedom in their pension communication for better alignment with their participants' characteristics and needs (Ministry of SZW, 2020).

Furthermore, communicating uncertainty regarding individual decision-making is already element of DC schemes. Given the DB character of the pension fund, the risk preference data obtained in this study can be used by the fund as input for exploring/designing risk profiles in DC schemes. The Holt & Laury method (2002) could be used for measuring the risk attitude of (more age cohorts of) participants: for example in an individual DC scheme. For DC schemes, this risk preference measurement allows for better alignment of the individual investment mix and corresponding risks with participant preferences. For designing lifecycles, the study by Dohmen et al. (2017) on the relationship between age and risk preference can be used. In DC schemes, given the heterogeneity of risk preference in our sample size and pension funds in general, participants should be given the opportunity to select their preferred risk profile. Sector wide, the Holt & Laury method (2002) can be used to measure risk preference both within DB as DC schemes.

7.3 Suggestions for further research

In this section, we provide several suggestions for further research given our recommendations and limitations of our study. We structured our suggestions based on their priority for the *sector*.

1. *Further optimise the method for communicating uncertainty*

Our method to communicate scenarios to participants consisted of interval diagrams and corresponding textual explanations. Our goal in the design was to reduce the distortive effect of complexity on choice, minimise the present-bias and ensure construct validity. Yet, from incompletion percentages, indications of a framing effect for the high-low annuity and reactions to our study we conclude that a future communication method needs further optimisation. Especially for participants having a lower education and being less pension literate, making a PDC based on scenarios over a long time horizon could be (too) complex. This induces the risk of a sub-optimal PDC from picking randomly, misperception or procrastinating and sticking to the default option (Brown, et al., 2016). For the abovementioned reasons, further research should be done regarding the *design* for communicating scenarios. It can be argued that this communication should involve pay-out streams and their dispersion development per PDC option over *time*. For this purpose, we suggest the communication of PDC options in *line diagrams* to be further researched by the pension fund. Furthermore, it can be interesting to include the opportunity to compare PDC options interactively (e.g., letting participants compare multiple PDC options in one graph). Interactive pension planners may increase engagement with retirement planning (Brüggen, et al., 2019).

2. *Research a choice architecture for PDC options with scenario communication*

Our second suggestion is to research an appropriate choice architecture for communicating uncertainty surrounding PDC options. Not all participants may be able to make a well substantiated and financially adequate decision. Especially with the increase in freedom of choice (risk of *choice stress*) and the complexity of the PDC, designing a choice architecture is of large relevance. We suggest, from a *libertarian paternalism* perspective (Thaler, et al., 2003), to research the impact of setting scenarios in the decision environment as *default* but giving the option to *opt-out* from the scenario communication. Meaning, after building up the information and presenting the options in scenarios over time,

participants have the possibility to remove the scenarios (by clicking) from the digital environment. Given the default sensitivity, we expect that most participants will not opt-out. An opt-out system can assist individuals with lack of self-control substantially, while not harming the individuals without self-control issues (Loewenstein, et al., 2003). Those wanting to compare multiple PDC options at once, adequately understanding the concept or those perceiving their decision is better without scenarios (rising the question of rationality) can opt-out. Offering the possibility to opt-out for all individuals should be assessed in the context of the duty of care. In line with behavioural economics, Knoef et al. (2017) suggest an evidence-based policy where the pension fund evaluates what participants opt-out in such environments and what their substantiations are.

3. *Further study relationship between trust in pension fund and communicating PDC uncertainty*

Our study measured a significant decrease in participants' trust in the pension fund before and after our questionnaire on communicating uncertainty. Yet, it is unclear whether participants were mostly influenced by the timing of our study (risk of benefits reductions) or the novelty of communicating PDC options in scenarios. Regarding the latter, our sample size is not yet 'URM (scenario) conditioned'. Since our study is conducted in a time where scenarios were just starting to be introduced, our sample size was likely to have trouble interpreting the scenarios. However, after time, participants may understand scenarios better and perceive this communication as honest and transparent (Pensioenfederatie, 2019). Therefore, we suggest further research on the relationship between pension fund trust and communicating scenarios, where the researcher controls for the (financial) state of the pension landscape.

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Appendix A: URM

In this appendix we describe the working of the URM in more detail. This appendix is meant as substantiation for how we come to the scenario figures used in our quantitative study, as mentioned in Section 5.2. Furthermore, we discuss the implementation of this new communication method in the Dutch pension landscape.

Working of the URM

To calculate scenario figures, a scenario set from the DNB is used as input. This scenario set is published every quarter on the website of the DNB, making the scenario figures up to date. These scenarios are consistent with the scenarios that are used for the yearly feasibility test ("*haalbaarheidstoets*"). As of 1 January 2020, the scenario set is expanded from 2,000 to 10,000 scenario's (DNB, 2020). With this input, the black box pension plan (whether DB or DC schemes) does the calculation. From three available calculation methods (generic method, URM-1 and URM-2), the pension provider selects the method that is most appropriate given its characteristics and the pension schemes being provided (DNB, 2019). For DB schemes the purchasing power factors are determined *per scheme*, while for DC schemes the purchasing powers are determined *per individual*. Scenario outcomes is based on a stochastic analysis of the interest rate, stock trajectories (based on the interest rate term structure) and the inflation (Pensioennavigator, 2019). The scenario outcomes also take indexation, cuts and future inflation into account (DNB, 2019). The 10,000 outcomes are then ranked from low to high. Number 5,000 is called the median and is by law labelled as the *expected pension outcome* of the participant. Meaning, 50% of the outcomes lie above the median and 50% lie below. The *pessimistic* outcome and the *optimistic* outcome are respectively represented by number 500 (5^{th} percentile) and number 9,500 (95^{th} percentile). This risk measure can be seen as the *Value-at-Risk* (VaR). Even though the Tail-VaR could be a better risk measure, as it deals more appropriately with extreme values, it knows some practical limitations (Rijksoverheid, 2014). Especially for DB schemes, the outcomes of the three scenarios are not symmetrical. The downside risk is larger than the upside potential, because pension providers will generally not index more than their ambition. Figure 29 visualises the URM process. Back in 2013, the Ministry of SZW stated that the URM must meet three criteria; *feasible*, *comparable* due to equal principles and *addable* to facilitate a total overview of all pension income (Rijksoverheid, 2013).

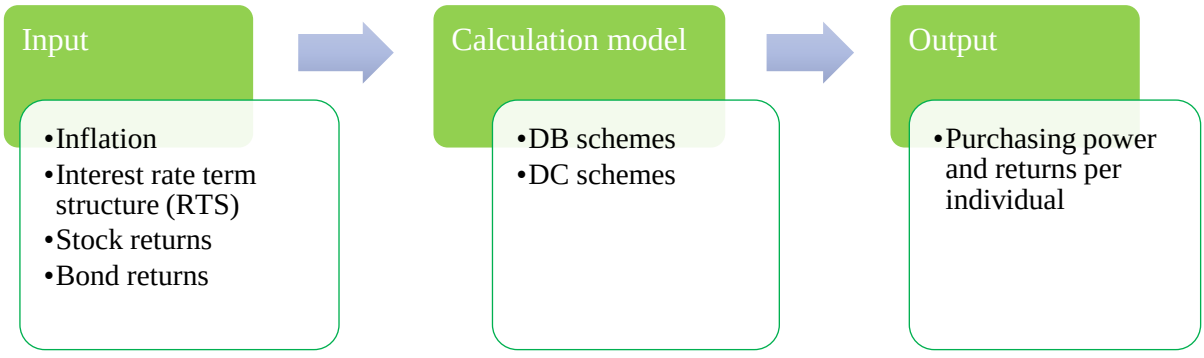


Figure 29: URM process

Implementation in the Dutch pension landscape

As of 2019, pension providers are legally obliged to use this method. As of October 2019, these scenarios are presented on the Pension Tracing Service (MPO). As such, participants can get an overview of what their *total* pension outcome (aggregated over all funds) is for the three scenarios. Here, AOW figures are included in this overview as well. The AOW figures are constant, (largely) unaffected by the economic scenarios since it is state pension. For those not receiving AOW yet, pension outcomes are net monthly (rounded) amounts. For those receiving AOW, pension outcomes are presented in gross yearly figures showing three outcomes ten years from now (Pensioenfederatie, 2019).

Opposed to the MPO, the Pension Benefit Statement (UPO) shows participant their 'accumulated benefits' at the pension provider in question. For DC schemes this outcome is referred to as 'pension indication upon termination of employment' (Rijksoverheid, 2014). In 2020, both active participants and deferred pensioners will see the (URM) scenario figures in their yearly UPO. These numbers will be gross yearly figures as of the target pension age ("*pensioenrichtleeftijd"*). Pension providers are not required to communicate the navigation metaphor on the UPO for retirees and ex-partners.

Figure 30 presents the AFM 'navigation metaphor' as the communication method to be used in the 2020 UPO and on MPO (AFM, 2019). The figure at the bottom tells the participant what he or she has accumulated, while the dotted arrows represent the optimistic and pessimistic scenario. The filled, straight arrow represents the 'expected' outcome. AOW figures are included in all outcomes. Pension providers are also required answer all participants' questions regarding these scenario figures. Summarizing, with the URM a more realistic picture is sketched of individual pension outcomes, and it aims to help participants evaluate whether their retirement provision will be sufficient.

Figure 30: "Navigation metaphor" to present individual scenario figures. Source: (AFM, 2019). Translated and used in (van Hekken & Das, 2019)

The navigation metaphor showing scenario figures calculated with the URM is a new legal means of communication. Despite much research in preparation of the URM, its effectiveness remains unknown. In September 2020 there will be a national evaluation organised by the Ministry of SZW in cooperation with the AFM and the pension sector.

Appendix B: Questionnaire

In our empirical study we used two types of questionnaires to communicate uncertainty in pension outcome to our participants. Introduced in Chapter 5, we either gradually *add* or *strip* information in terms of communicating uncertainty to/from the PDC decision environment. The questionnaire below represents the path where we *add* information. Furthermore, the financial figures presented in the questionnaire represent the financial situation of the participants as closely as possible. Namely, we linked participants to representative persons (RPs) based on the single criterion *accrued second pillar wealth*. The questionnaire below is applicable to RP "Middle". Moreover, our (URM) scenario figures are based on a 64-year-old participant.

Participants are first presented the current (base) decision environment, communicating solely the *expected outcome* per PDC option. Hereafter, participants are presented the three scenario outcomes at the *statutory pension age* per PDC option. Lastly, the participants are presented scenarios *over a longer time horizon*; both at the statutory pension age as ten years beyond this age. We explained the goal of this questionnaire to be to *study what presentation method of PDC options works best*. Throughout the questionnaire, participants are asked for their substantiation and evaluation of their PDC consideration under the new communication method. After the decision environments, we pose several background questions and measure time preference and risk preference. Lastly, we provide participants the possibility to leave suggestions or comments to our questionnaire. For the path where information is gradually *stripped* from the decision environment, question 2 and 8 are reversed.

1 **Uw pensioen en de beschikbare pensioenkeuzes** *Single-responsevraag*

Welkom bij het deelnemersonderzoek van Pensioenfonds Zorg en Welzijn (PFZW). Allereerst zijn we benieuwd naar uw huidige vertrouwen in PFZW. Hoeveel vertrouwen heeft u in PFZW?

- ○ Zeer veel vertrouwen
- ○ Veel vertrouwen
- ○ Niet weinig, maar ook niet veel vertrouwen
- ○ Weinig vertrouwen
- ○ Zeer weinig vertrouwen
- ○ Weet ik niet / Geen antwoord

Vanaf 2020 krijgt u op uw jaarlijkse pensioenoverzicht meer informatie gepresenteerd over uw pensioen bij PFZW. Het pensioen is namelijk onzeker: het kan meezitten en tegenzitten. Met dit onderzoek laten wij zien wat deze mee- en tegenvallers betekenen voor verschillende keuzes die PFZW aanbiedt: de (standaard) pensionering op AOW-leeftijd, vervroegd met pensioen en een hoog-laaguitkering. In de komende vragen zijn we benieuwd wat uw voorkeur heeft en waarom. Het doel van dit onderzoek is te onderzoeken welke presentatiemethode van keuzes voor u het beste werkt.

Tussenpagina

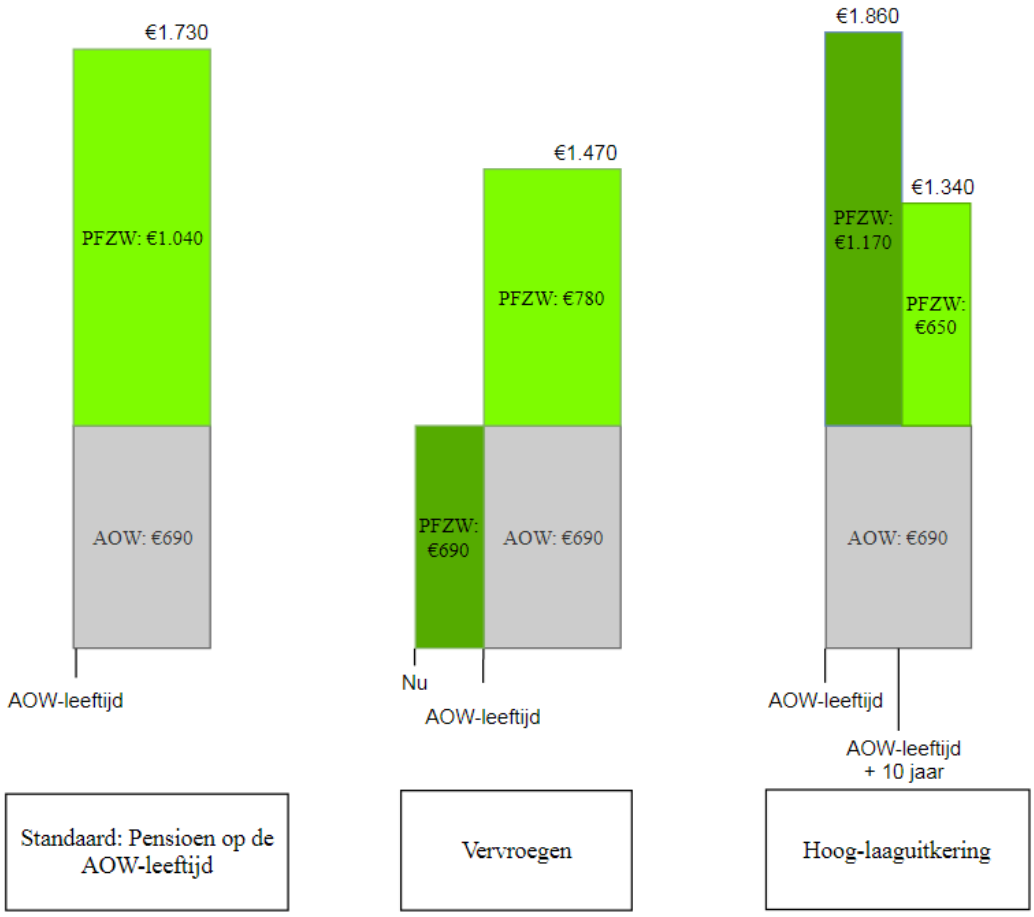
Hieronder worden deze drie keuzes uitgelegd. De weergegeven bedragen zijn een voorbeeld.

Tussenpagina

(Standaard) Met pensioen gaan op de AOW-leeftijd
Dit is de standaardkeuze: u werkt door tot uw AOW-leeftijd. Uw pensioen van PFZW gaat in op dezelfde datum als uw AOW. Vanaf de AOW-leeftijd ontvangt u elke maand een even hoog pensioenbedrag. Daarnaast ontvangt u een AOW-uitkering.

Vervroegd met pensioen
U kunt er ook voor kiezen om eerder met pensioen te gaan. De eerste jaren tot uw AOW-leeftijd ontvangt u pensioen van PFZW. Dit pensioen is lager dan de standaardkeuze die hierboven staat, omdat u

Tussenpagina



eerder stopt met pensioen opbouwen en langer pensioen ontvangt. Vanaf uw AOW-leeftijd ontvangt u daarnaast de AOW-uitkering.

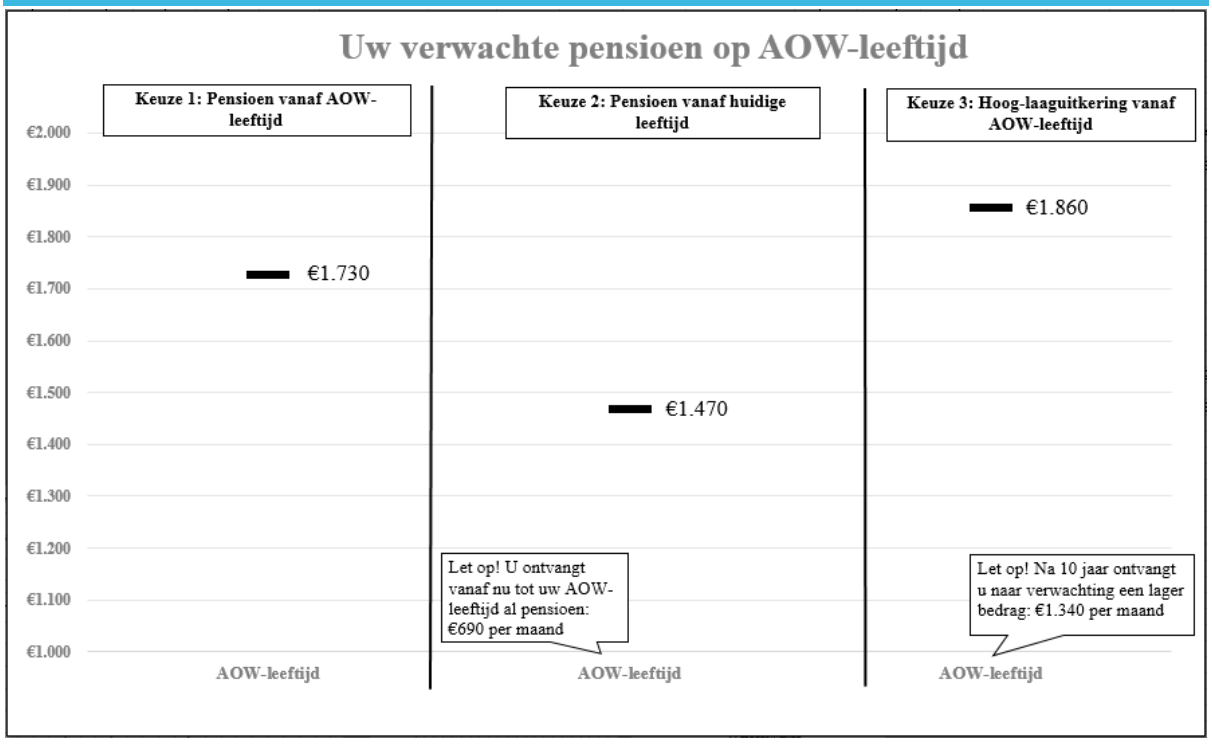
Hoog-laaguitkering
U kunt er voor kiezen eerst een tijd een hoger pensioenbedrag te krijgen. Dit hogere bedrag ontvangt u 10 jaar lang. Dit betekent wel dat u na die 10 jaar een lager bedrag per maand krijgt. De AOW-uitkering blijft gelijk.

Tussenpagina

2 **Uw verwachte pensioen**

Single-responsevraag

In dit onderdeel ziet u per keuze het verwachte pensioen van PFZW. De AOW is hierbij opgeteld. De bedragen zijn netto (na belasting) per maand. In de figuur ziet u van links naar rechts de keuzes: (standaard) pensioen vanaf AOW-leeftijd, vervroegd met pensioen gaan en een hoog-laaguitkering. Welke van deze keuzes heeft uw voorkeur?



- ○ Keuze 1: Pensioen vanaf AOW-leeftijd
- ○ Keuze 2: Pensioen vanaf huidige leeftijd
- ○ Keuze 3: Hoog-laaguitkering vanaf AOW-leeftijd

3 **Voor welk doel wilt u het hogere pensioen gebruiken?**
Geef het doel aan wat voor u het belangrijkst is.

Single-responsevraag

VRAAG 3 ALLEEN TONEN ALS AAN DE ONDERSTAANDE VOORWAARDEN WORDT VOLDAAN, INDIEN NIET VOLDAAN SPRING NAAR: >> ***VOLGENDE VRAAG***

vraag 2 is beantwoord met 3 (Keuze 3: Hoog-laaguitkering vanaf AOW-leeftijd)

- ◯ De hypotheek of een lening aflossen
- ◯ De kinderen geld schenken
- ◯ Ontspanning
- ◯ Onzekerheid over het pensioenstelsel
- ◯ Anders, namelijk:

  [ ]
- ◯ Ik heb geen doel hiervoor

4 Wat is voor u de belangrijkste reden om vervroegd met pensioen te gaan?

Single-responsevraag

VRAAG 4 ALLEEN TONEN ALS AAN DE ONDERSTAANDE VOORWAARDEN WORDT VOLDAAN, INDIEN NIET VOLDAAN SPRING NAAR: >> ***VOLGENDE VRAAG***

vraag 2 is beantwoord met 2 (Keuze 2: Pensioen vanaf huidige leeftijd)

- ◯ Meer tijd besteden aan mijn partner en/of (klein)kinderen
- ◯ Meer ontspanning
- ◯ Ik heb/mijn partner en ik hebben genoeg pensioen opgebouwd
- ◯ Ik ben niet meer (goed) in staat mijn beroep uit te voeren
- ◯ Anders, namelijk:

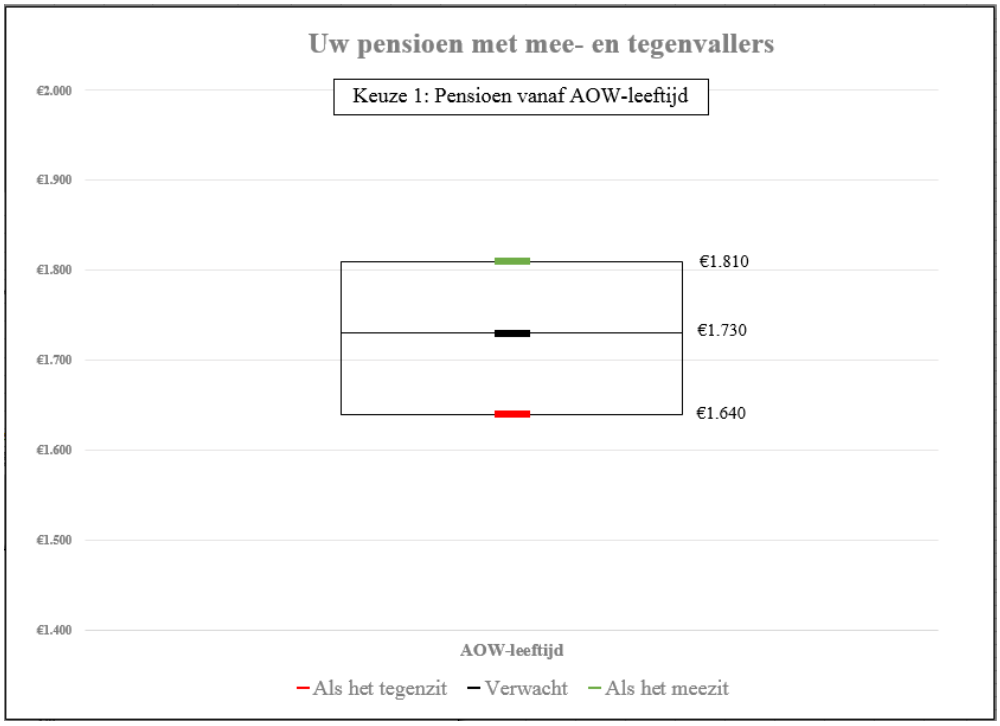
  [ ]

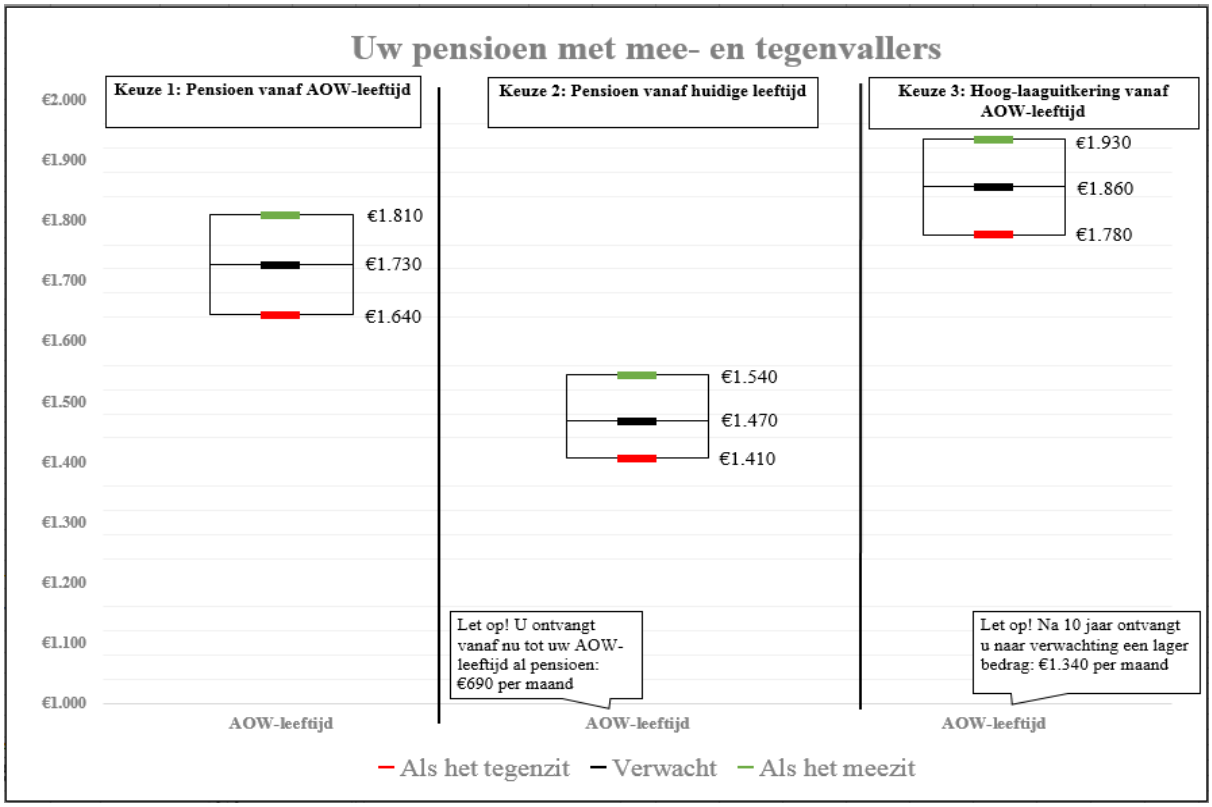
Mee- en tegenvallers *Tussenpagina*

Zoals genoemd is het pensioen onzeker. Wanneer het meezit wordt uw pensioen geïndexeerd met de prijsstijging, wanneer het tegenzit kan dit niet en moet uw pensioen wellicht verlaagd worden.

In de figuur hieronder laten we zien hoe mee-en tegenvallers eruit kunnen zien. Dit is een voorbeeld. De bedragen zijn netto (na belasting) per maand. De AOW-uitkering blijft gelijk. Het verwachte pensioen is €1.730 per maand, maar als het meezit ontvangt u €1.810 (groen) en als het tegenzit €1.640 (rood) per maand.

Tussenpagina





5 **Nu leggen wij u opnieuw de keuze voor met voorbeeldbedragen. In de onderstaande figuur ziet u van links naar rechts de keuzes: (standaard) pensioen op AOW-leeftijd, vervroegd met pensioen gaan en een hoog-laaguitkering. Welke van deze keuzes heeft op basis van deze informatie uw voorkeur?** *Single-responsevraag*

- ○ Keuze 1: Pensioen vanaf AOW-leeftijd
- ○ Keuze 2: Pensioen vanaf huidige leeftijd
- ○ Keuze 3: Hoog-laaguitkering vanaf AOW-leeftijd

6 **U heeft nu een andere keuze gemaakt dan bij de figuur zonder de mee- en tegenvallers. Wat is de belangrijkste reden voor het wijzigen van uw voorkeur?** *Single-responsevraag*

VRAAG 6 ALLEEN TONEN ALS AAN DE ONDERSTAANDE VOORWAARDEN WORDT VOLDAAN, INDIEN NIET VOLDAAN SPRING NAAR: >> ***VOLGENDE VRAAG***

Minstens één van onderstaande voorwaarden is waar:

- *of alle onderstaande voorwaarden zijn waar:*
  - *+ en vraag 2 is beantwoord met 1 (Keuze 1: Pensioen vanaf AOW-leeftijd)*
  - *+ en vraag 5 is niet beantwoord met 1 (Keuze 1: Pensioen vanaf AOW-leeftijd)*
- *of alle onderstaande voorwaarden zijn waar:*
  - *+ en vraag 2 is beantwoord met 2 (Keuze 2: Pensioen vanaf huidige leeftijd)*
  - *+ en vraag 5 is niet beantwoord met 2 (Keuze 2: Pensioen vanaf huidige leeftijd)*
- *of alle onderstaande voorwaarden zijn waar:*
  - *+ en vraag 2 is beantwoord met 3 (Keuze 3: Hoog-laaguitkering vanaf AOW-leeftijd)*
  - *+ en vraag 5 is niet beantwoord met 3 (Keuze 3: Hoog-laaguitkering vanaf AOW-leeftijd)*

- ○ Ik kan er financieel meer op vooruit gaan
- ○ Ik wil niet onder een bepaald inkomen uitkomen
- ○ Door het zien van mee- en tegenvallers twijfel ik over mijn eerdere keuze
- ○ Anders, namelijk:

  [ ]
- ○ Weet ik niet

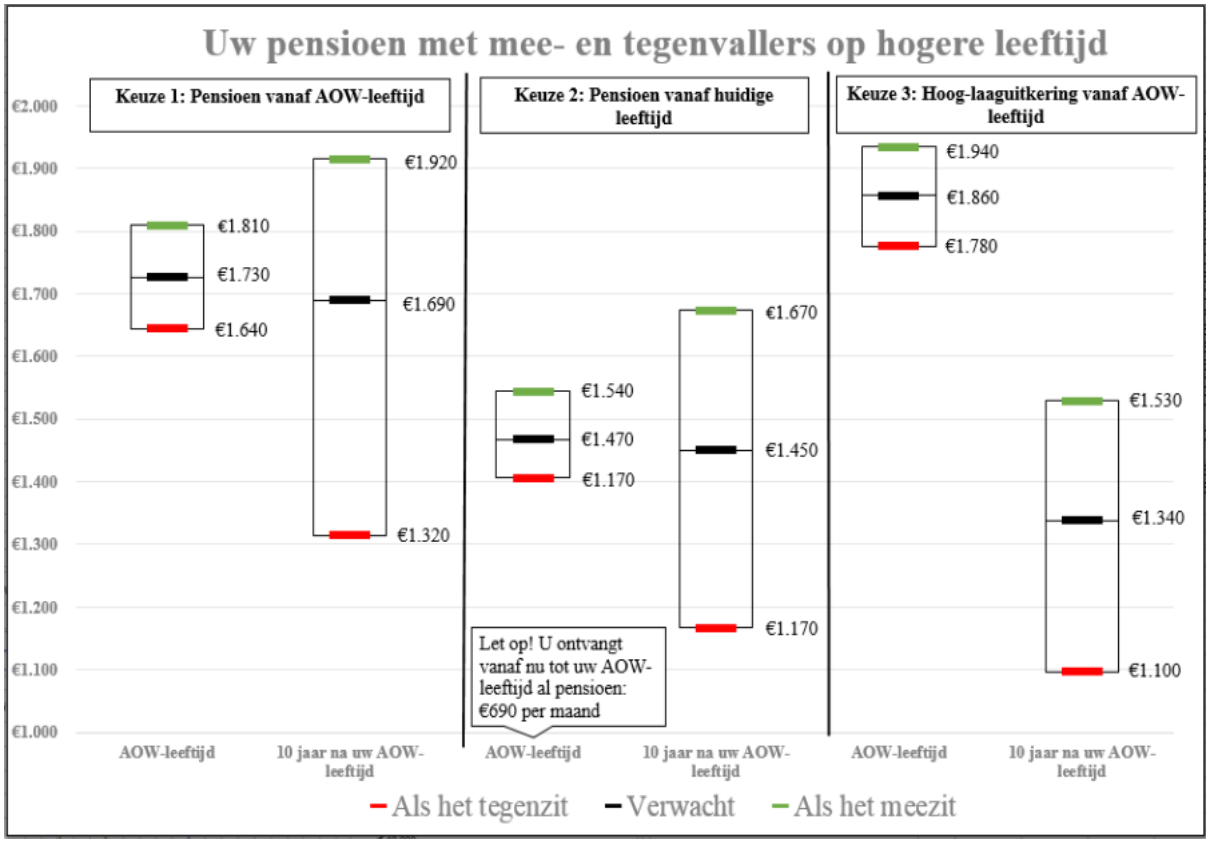
7 **Maakt u door de mogelijke uitkomsten (als het tegenzit, verwacht, als het meezit) een beter of slechter afgewogen keuze?** *Single-responsevraag*

- ○ Veel beter
- ○ Beter
- ○ Neutraal
- ○ Slechter
- ○ Veel slechter

Mee-en tegenvallers op hogere leeftijd *Tussenpagina*

We zijn benieuwd hoe u aankijkt tegen uw pensioen op hogere leeftijd. Het pensioen is onzeker, doordat het over een langere periode zowel mee kan zitten als tegen kan zitten.

8 **In de onderstaande vraag krijgt u de keuzes opnieuw met mee- en tegenvallers te zien. We tonen het mogelijk pensioen op zowel uw AOW-leeftijd als 10 jaar na uw AOW-leeftijd. Per keuze is te zien hoe deze mee- en tegenvallers uw pensioen kunnen veranderen. De bedragen zijn netto (na belasting) per maand en inclusief AOW. In de figuur ziet u van links naar rechts de keuzes: (standaard) pensioen op AOW-leeftijd, vervroegd met pensioen gaan en een hoog-laaguitkering. Welke van deze keuzes heeft op basis van deze informatie uw voorkeur?** *Single-responsevraag*



- Keuze 1: Pensioen vanaf AOW-leeftijd
- Keuze 2: Pensioen vanaf huidige leeftijd
- Keuze 3: Hoog-laaguitkering vanaf AOW-leeftijd

9 U heeft nu een andere keuze gemaakt dan bij de figuur zónder de uitkering 10 jaar na AOW-leeftijd. Wat is de belangrijkste reden voor het wijzigen van uw voorkeur?

Single-responsevraag

VRAAG 9 ALLEEN TONEN ALS AAN DE ONDERSTAANDE VOORWAARDEN WORDT VOLDAAN, INDIEN NIET VOLDAAN SPRING NAAR: >> ***VOLGENDE VRAAG***

Minstens één van onderstaande voorwaarden is waar:

- of alle onderstaande voorwaarden zijn waar:

+ en vraag 5 is beantwoord met 1 (Keuze 1: Pensioen vanaf AOW-leeftijd)

+ en vraag 8 is niet beantwoord met 1 (Keuze 1: Pensioen vanaf AOW-leeftijd)

- of alle onderstaande voorwaarden zijn waar:

+ en vraag 5 is beantwoord met 2 (Keuze 2: Pensioen vanaf huidige leeftijd)

+ en vraag 8 is niet beantwoord met 2 (Keuze 2: Pensioen vanaf huidige leeftijd)

- of alle onderstaande voorwaarden zijn waar:

+ en vraag 5 is beantwoord met 3 (Keuze 3: Hoog-laaguitkering vanaf AOW-leeftijd)

+ en vraag 8 is niet beantwoord met 3 (Keuze 3: Hoog-laaguitkering vanaf AOW-leeftijd)

- ○ Ik zie nu dat ik op hogere leeftijd voldoende inkomen overhoud voor mijn gewenste keuze, eerder niet
- ○ Ik wil gedurende mijn oude dag graag meer besteden van mijn pensioen
- ○ Ik kan als het tegenzit er teveel op achteruit gaan
- ○ Ik kan als het meezit er op vooruit gaan
- ○ Anders, namelijk:

  [ ]
- ○ Weet ik niet

10 Maakt u door het zien van uw pensioen over een langere periode (als het tegenzit, verwacht, als het meezit) een beter of slechter afgewogen keuze?

Single-responsevraag

- ○ Veel beter
- ○ Beter
- ○ Neutraal
- ○ Slechter
- ○ Veel slechter

11 Hoeveel vertrouwen heeft u in PFZW, na het zien van de keuzemogelijkheden en de bedragen in deze vragenlijst?

Single-responsevraag

- ○ Zeer veel vertrouwen
- ○ Veel vertrouwen
- ○ Niet weinig, maar ook niet veel vertrouwen
- ○ Weinig vertrouwen
- ○ Zeer weinig vertrouwen

- ○ Weet ik niet / Geen antwoord

12 **Hieronder volgen enkele vragen over uw persoonlijke situatie. Wat is uw hoogst afgeronde opleidingsniveau?** *Single-responsevraag*

- ○ Geen diploma of basisonderwijs
- ○ VMBO
- ○ Havo/VWO bovenbouw
- ○ MBO-1, MBO-2, MBO-3 of MBO-4
- ○ Propedeuse HBO/WO
- ○ Bachelor HBO/WO
- ○ Master WO / WO doctoraal / postdoctoraal

13 **Hoe ziet uw huishouden er momenteel uit?** *Single-responsevraag*

- ○ Alleenstaand
- ○ Samen met partner, ik ben kostwinner
- ○ Samen met partner, partner is kostwinner
- ○ Samen met partner, beiden kostwinner
- ○ Gescheiden, met of zonder partner
- ○ Weduwe/Weduwnaar

14 **In welke mate bent u afhankelijk van het pensioen dat u van PFZW gaat ontvangen om later te kunnen leven zoals u wilt?** *Single-responsevraag*

- ○ Ik ben daar vrijwel volledig van afhankelijk
- ○ Ik ben daar sterk van afhankelijk
- ○ Ik ben daar deels van afhankelijk
- ○ Ik ben daar weinig van afhankelijk
- ○ Ik ben daar niet van afhankelijk

○ Weet ik niet

15 **Met pensioen gaan heeft financiële gevolgen. Als u met pensioen gaat ontvangt u géén salaris meer en bent u afhankelijk van andere soorten inkomen, zoals de AOW en uw aanvullend pensioen. Naast de AOW en uw aanvullend pensioen: Waarmee heeft u in bovenstaande vragen rekening gehouden bij het inschatten hoeveel inkomen u vanaf uw AOW-leeftijd nodig heeft? Let op: U kunt meerdere antwoorden aanvinken.** *Multi-responsevraag*

Minimaal aantal vinkjes: 1

Toon antwoorden in willekeurige volgorde

☐ Overwaarde huis

☐ Pensioen van partner

☐ Hoeveelheid Hypotheekschuld

☐ Erfenis

☐ Spaargeld en beleggingen

☐ (Verwachte) Ziektekosten

☐ Anders, namelijk:

16 **De volgende vraag is bedoeld om erachter te komen hoe u aankijkt tegen het hebben van geld nu tegenover geld later. Stel: U kunt óf nu eenmalig een bedrag van 1.000 EUR ontvangen óf eenmalig een bedrag 'Y' over 1 jaar. Welk bedrag Y wilt u minimaal over 1 jaar ontvangen als dat betekent dat u nu geen €1.000 krijgt?** *Invulveldenvraag*

Y=€

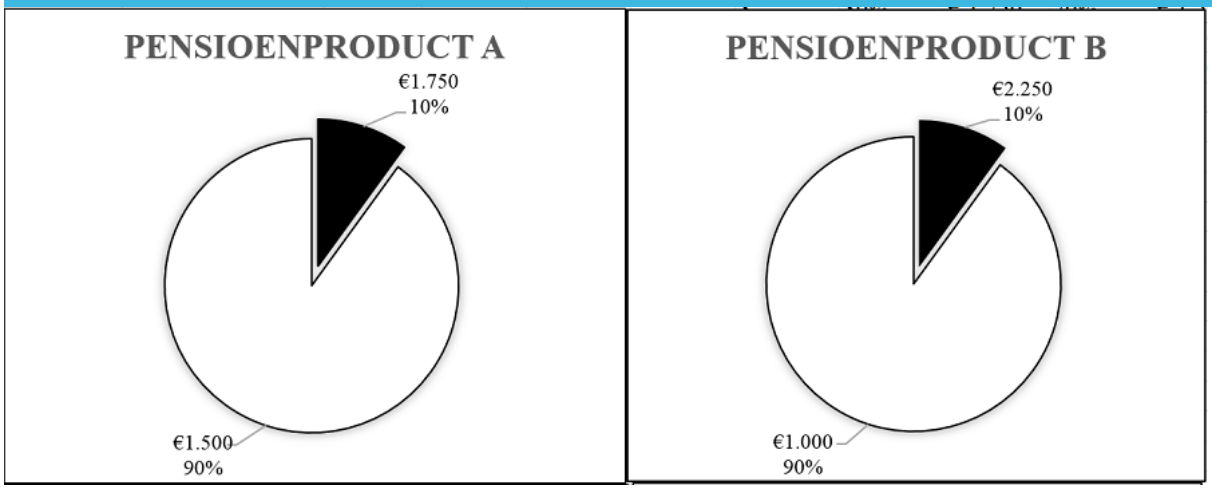
Tot slot wordt u tien keer gevraagd te kiezen tussen twee pensioenproducten. U kunt per vraag steeds één van de twee pensioenproducten kiezen, links product A of rechts product B. Elk pensioenproduct toont een hoog bedrag en een laag bedrag. Er is een kans dat u het hoge bedrag aan pensioen gaat ontvangen en een kans dat u het lage bedrag aan pensioen gaat ontvangen. Deze kansen staan met percentages (%) aangegeven. Hoe hoger het percentage, hoe groter de *Tussenpagina*

kans dat u dat pensioenbedrag gaat ontvangen. De bedoeling is om per vraag het pensioenproduct te kiezen dat uw voorkeur heeft.

17a

De bedragen in de figuren zijn netto per maand (AOW + aanvullend pensioen) vanaf uw AOW-leeftijd. Het hogere bedrag en het lagere bedrag blijven bij iedere vraag gelijk. De kans op het hogere bedrag en de kans op het lagere bedrag verandert bij iedere vraag; de kans op het hogere bedrag wordt steeds groter. Er zijn geen goede of foute keuzes. Het gaat uitsluitend om uw eigen voorkeur. Welke van de twee onderstaande pensioenproducten heeft nu uw voorkeur?

Single-responsevraag

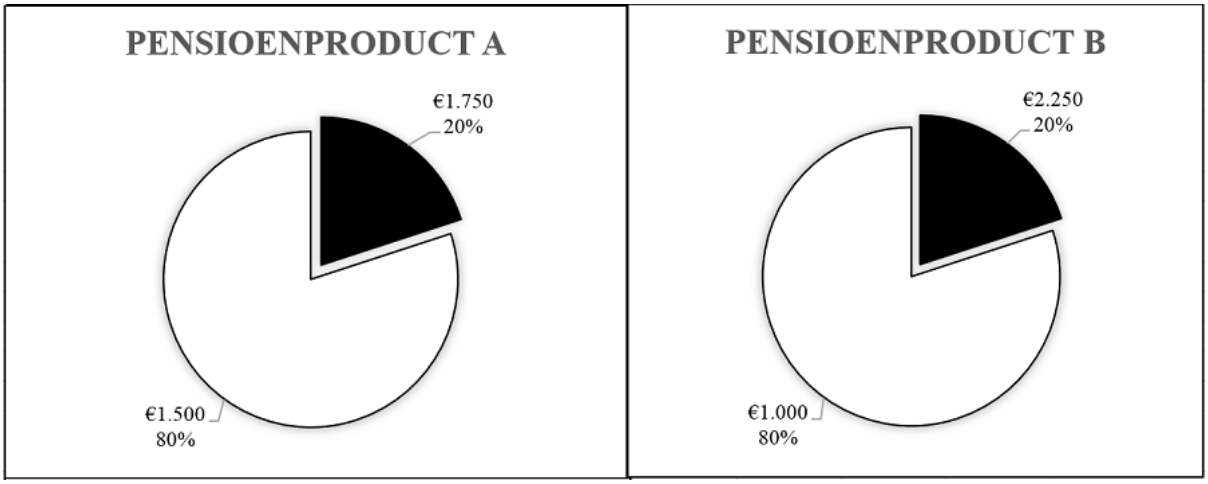


- Pensioenproduct A: 90% kans op €1.500, 10% kans op €1.750
- Pensioenproduct B: 90% kans op €1.000, 10% kans op €2.250

17b

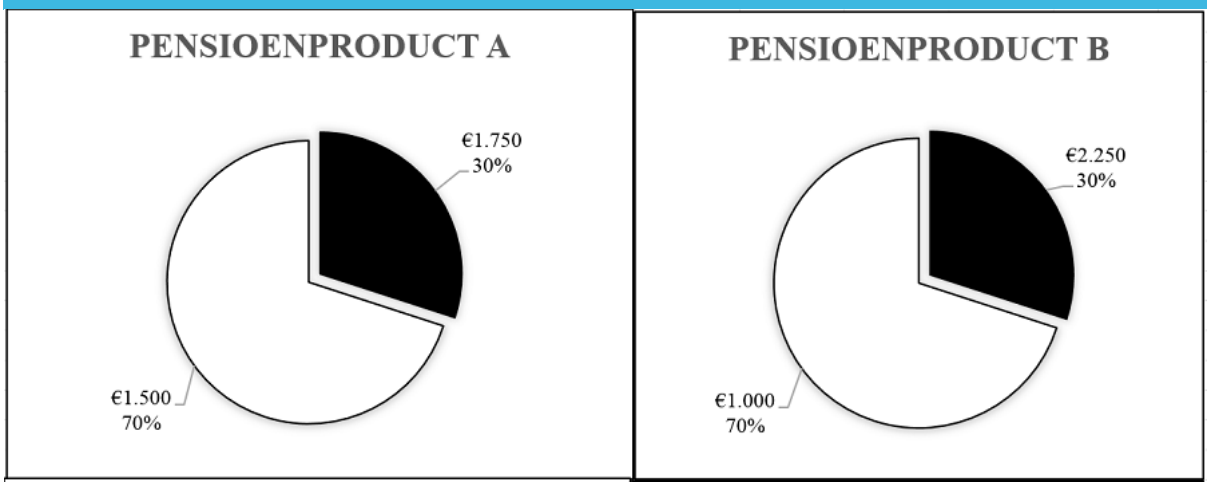
Welke van de twee onderstaande pensioenproducten heeft nu uw voorkeur?

Single-responsevraag



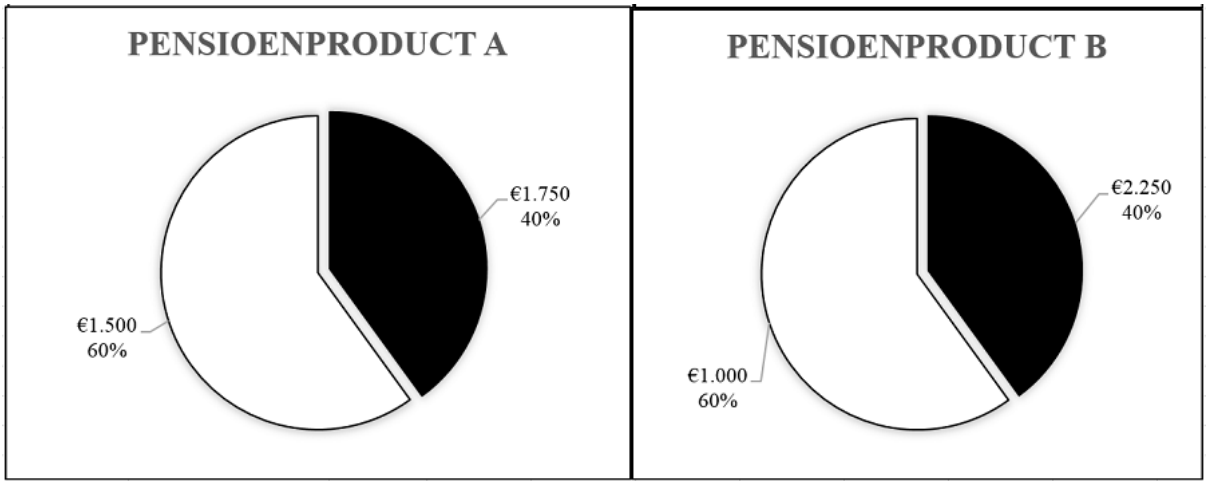
- Pensioenproduct A: 80% kans op €1.500, 20% kans op €1.750
- Pensioenproduct B: 80% kans op €1.000, 20% kans op €2.250

17c **Welke van de twee onderstaande pensioenproducten heeft nu uw voorkeur?** *Single-responsevraag*



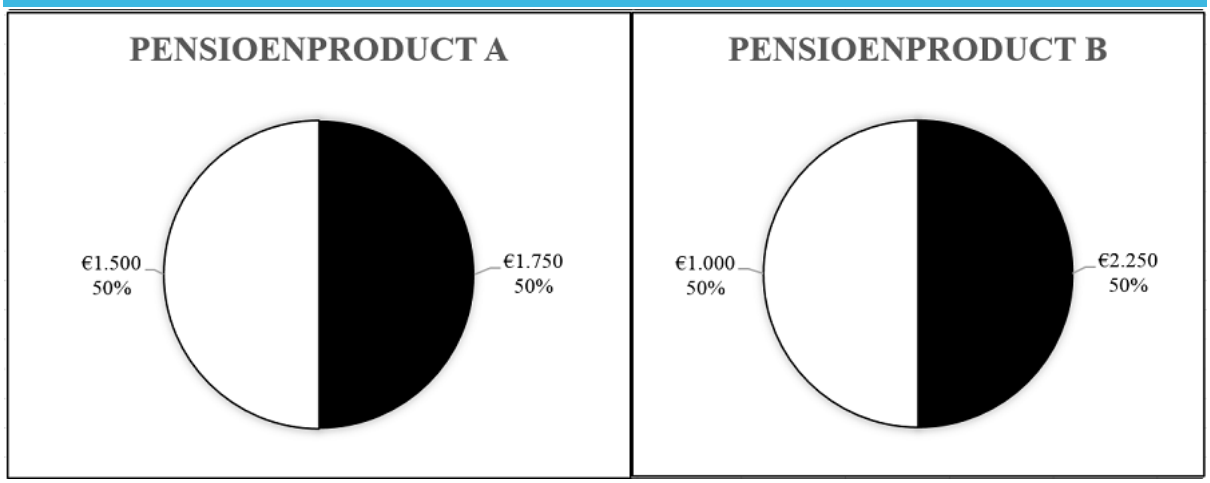
- Pensioenproduct A: 70% kans op €1.500, 30% kans op €1.750
- Pensioenproduct B: 70% kans op €1.000, 30% kans op €2.250

17d **Welke van de twee onderstaande pensioenproducten heeft nu uw voorkeur?** *Single-responsevraag*



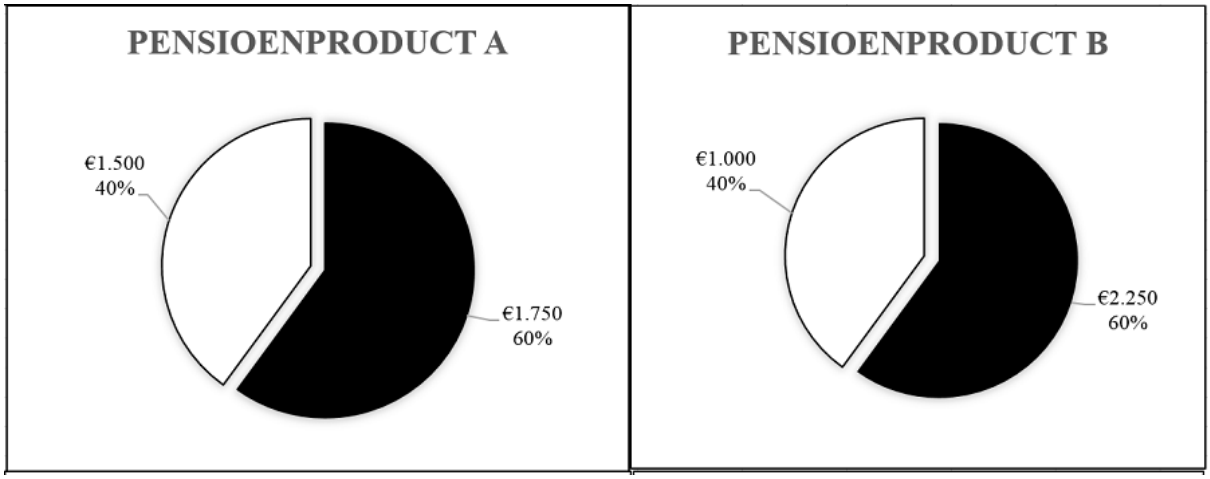
- Pensioenproduct A: 60% kans op €1.500, 40% kans op €1.750
- Pensioenproduct B: 60% kans op €1.000, 40% kans op €2.250

17e **Welke van de twee onderstaande pensioenproducten heeft nu uw voorkeur?** *Single-responsevraag*



- Pensioenproduct A: 50% kans op €1.500, 50% kans op €1.750
- Pensioenproduct B: 50% kans op €1.000, 50% kans op €2.250

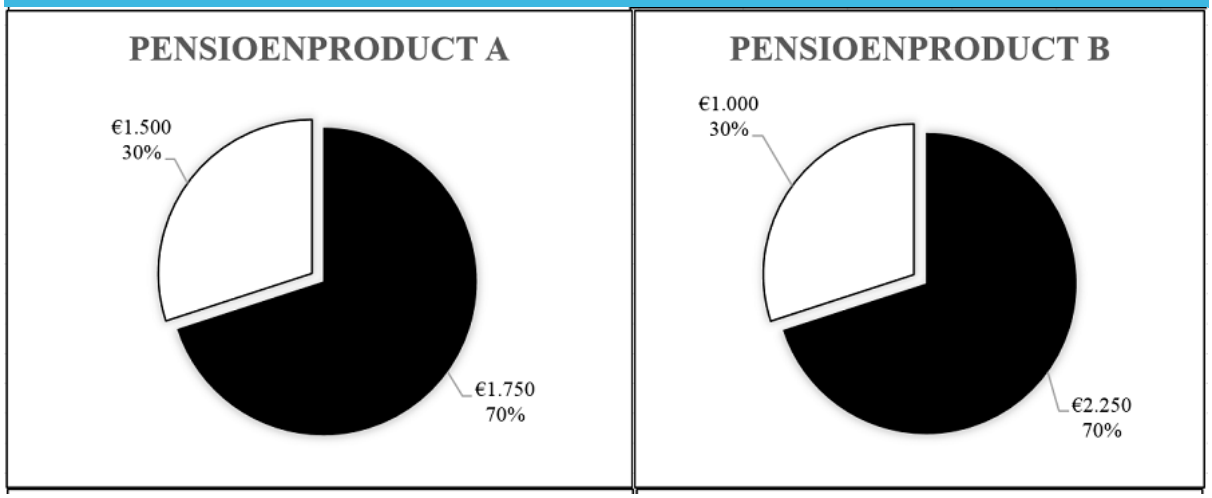
17f **Welke van de twee onderstaande pensioenproducten heeft nu uw voorkeur?** *Single-responsevraag*



- Pensioenproduct A: 40% kans op €1.500, 60% kans op €1.750
- Pensioenproduct B: 40% kans op €1.000, 60% kans op €2.250

17g

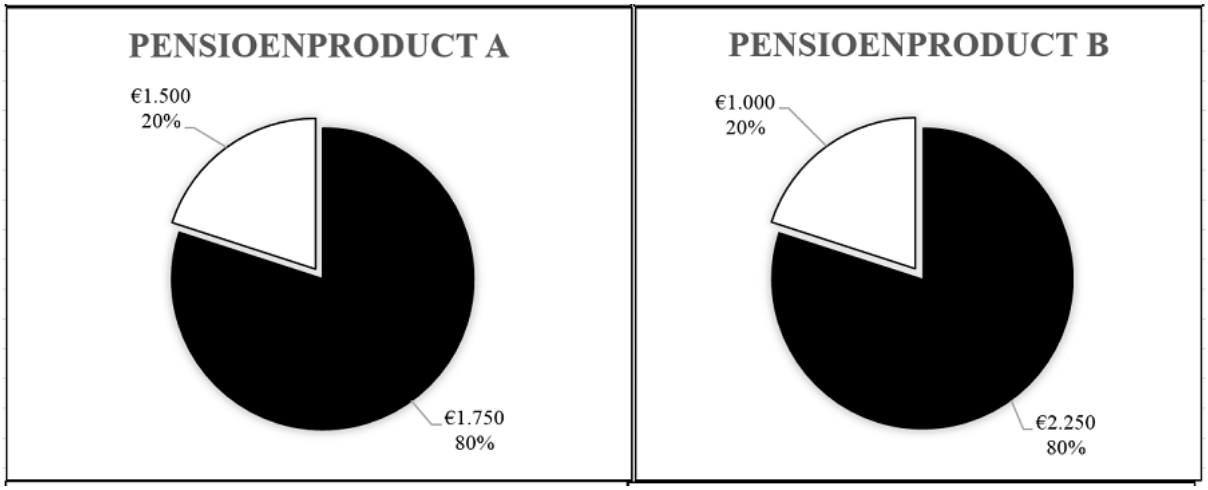
Welke van de twee onderstaande pensioenproducten heeft nu uw voorkeur? *Single-responsevraag*



- Pensioenproduct A: 30% kans op €1.500, 70% kans op €1.750
- Pensioenproduct B: 30% kans op €1.000, 70% kans op €2.250

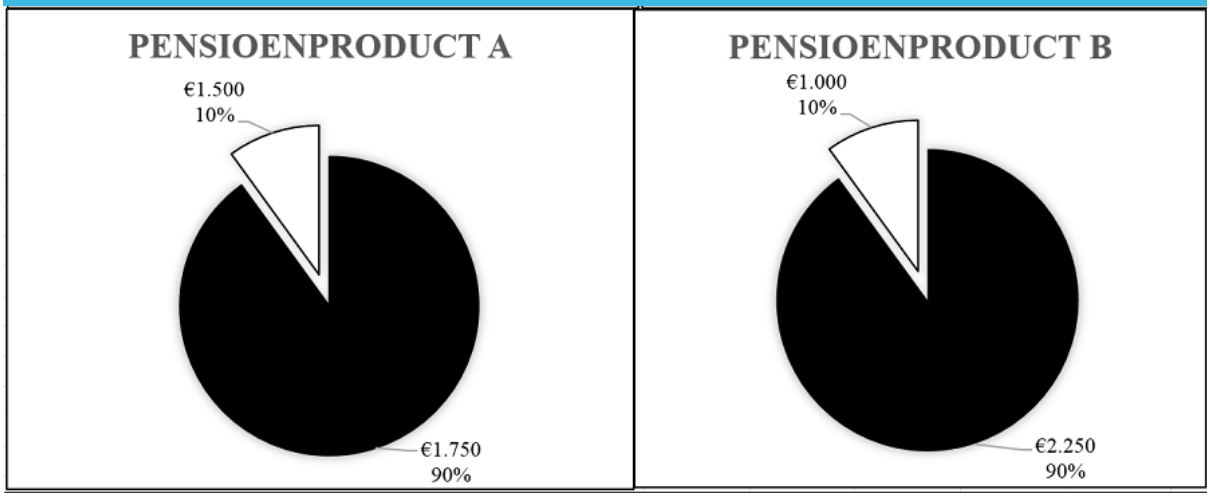
17h

Welke van de twee onderstaande pensioenproducten heeft nu uw voorkeur? *Single-responsevraag*



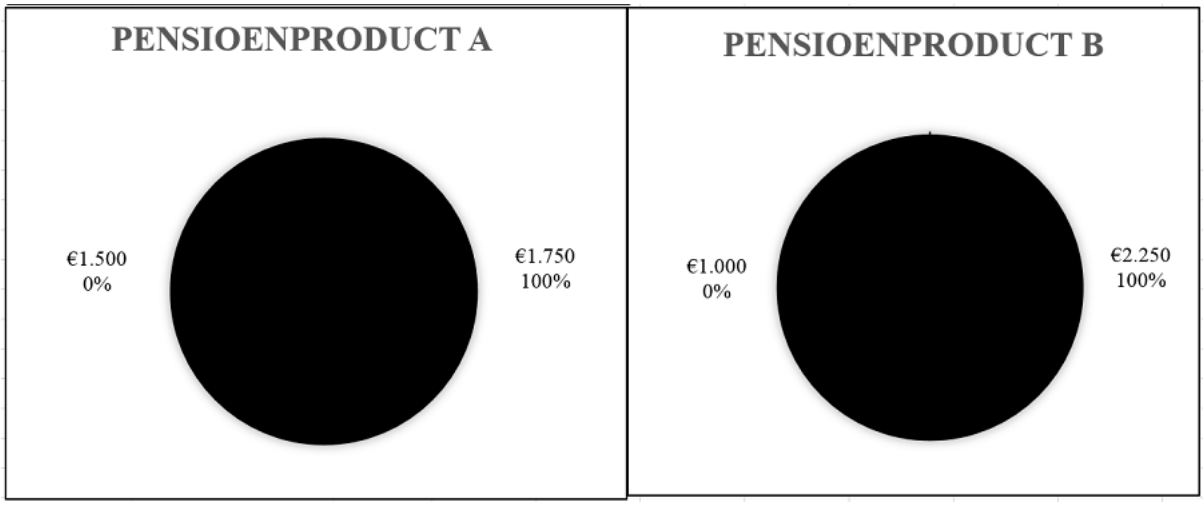
- Pensioenproduct A: 20% kans op €1.500, 80% kans op €1.750
- Pensioenproduct B: 20% kans op €1.000, 80% kans op €2.250

17i **Welke van de twee onderstaande pensioenproducten heeft nu uw voorkeur?** *Single-responsevraag*



- Pensioenproduct A: 10% kans op €1.500, 90% kans op €1.750
- Pensioenproduct B: 10% kans op €1.000, 90% kans op €2.250

17j **Welke van de twee onderstaande pensioenproducten heeft nu uw voorkeur?** *Single-responsevraag*



- Pensioenproduct A: 0% kans op €1.500, 100% kans op €1.750
- Pensioenproduct B: 0% kans op €1.000, 100% kans op €2.250

18 **Heeft u nog suggesties of opmerkingen naar aanleiding van dit onderzoek?** *Open vraag*

Appendix C: Chi-square Test

To prove whether or not the discrepancy in PDC popularity between the two methods for introducing the longer time horizon is statistically significant, we use the *Chi-square test*. This test is adequate as we have two independent comparison groups. The goal of the analysis is to compare the distribution of responses to the discrete outcome variable (categorical; PDC options) among the two groups. We control for age and RP.

We follow the following steps:

1. **Hypotheses and level of significance**

H_0: There is no difference in the distribution of responses (PDCs) across the two comparison groups
H_1: H_0 is false

We use a 0.05 level of significance (α) for this test.

2. **Test statistic**

We use the following formula for the test statistic (with *i* denoting the specific case):

$$\chi^2 = \sum_i \frac{(O_i - E_i)^2}{E_i}$$

3. Decision rule

The decision rule, whether or not to reject the null hypothesis, depends on the level of significance and the degrees of freedom. For this test, we use a 0.05 level of significance. The degrees of freedom is determined by the number of independent comparison groups and the number of discrete groups for the outcome variable. The formula is: *df = (independent comparison groups – 1) * (discrete groups for outcome variable – 1)*. As such, we find *df* = 2 as we have three PDC options.

For *df* = 2 and α = 0.05 we find that the critical value is 5.99. Hence, reject H_0 if $\chi^2 \geq 5.99$.

4. Computing the test statistic

Now, as we control for age, we perform this statistical test for the ages 61 to 65. In this appendix, we test the age 61 since the discrepancy in PDC popularity (%) is the largest:

	Standard annuity	Early retirement	High-low annuity
PDCs from longer horizon from gradual introduction	44%	38%	18%
PDCs from longer horizon from direct introduction	39%	41%	20%

The two-way table showing the observed frequencies and expected frequencies (in brackets) per PDC option is presented below. The expected cell frequency is calculated as follows:

$$E_i = (Row\ total\ *\ Column\ total)\ /\ N$$

	Standard annuity	Early retirement	High-low annuity	*Total*
PDCs from longer horizon from gradual introduction	65 (62.1)	56 (58.1)	28 (28.8)	149
PDCs from longer horizon from direct introduction	60 (62.9)	61 (58.9)	30 (29.1)	151
Total	125	117	58	300

The test statistic is then calculated as follows:

$$\chi^2 = \frac{(65-62.1)^2}{62.1} + \frac{(56-58.1)^2}{58.1} + \frac{(28-28.8)^2}{28.8} + \frac{(60-62.9)^2}{62.9} + \frac{(61-58.9)^2}{58.9} + \frac{(30-29.1)^2}{29.1} = 0.49$$

5. Conclusion

As $\chi^2 < 5.99$, we fail to reject H_0. Ergo, we have evidence on a 0.05 significance level that our two methods for introducing the longer time horizon and PDC popularity are independent. As the discrepancy in PDC popularity (%) is smaller for the other ages, we also fail to reject H_0 for the ages 62, 63, 64 and 65.