Policy uncertainty in social security: Do subjective expectations relate to savings?

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Abstract

As an ageing population creates policy uncertainty in old age social security, forward-looking individuals are likely to adapt savings. This paper examines the relationship between subjective expectations regarding a policy change and private savings. First, a model is developed that explains optimal savings behavior in the instance of different types of policy uncertainty in the old age social security system. Second, using a longitudinal savings dataset, the empirical relationship between subjective probabilities of a policy change and wealth is examined for the Netherlands. A positive relationship is found between the probability individuals assign to lower benefits in future and their accumulated savings, whereas a negative relationship is found between the probability respondents assign to a later eligibility age in future and wealth. The latter relationship is partly mitigated when the expectations regarding the general retirement age are taken into account. This indicates that the Dutch public confuses the benefits eligibility age with a mandatory retirement age.

Keywords: Social security, Ageing, Subjective probabilities, Savings behavior, Panel data models

JEL-classification: C23, D84, D91, H55

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1 Introduction

This paper investigates whether and how consumers' accumulated savings reflect the subjective probability they assign to a policy change in the Pay-As-You-Go (PAYG) pension system. First, a model is developed that explains optimal savings behavior in the instance of different types of policy uncertainty in old age social security. Second, the empirical relationship between subjective probabilities of several policy changes and wealth is examined for the Netherlands. Neither has been done before, while relevant to various fields of the economic literature. By answering the research question, I hope to shed more light on the relationship between old age social security and private pension savings, on the expectations of individuals regarding the future of social security and on the general relationship between expectations and behavior. In this paper, evidence is found that subjective expectations of changes in the old age social security system relate to savings.

1.1 Social Security and Savings

The establishment and existence of old age social security has triggered economists to assess the effect of this important development on wealth accumulation. A relationship between savings and social security was first empirically revealed by Feldstein in 1974. Feldstein argued that theoretically the foundation of old age social security could both reduce and induce private savings. On one hand, savings could decrease because of the certain income from PAYG-benefits in retirement. On the other hand, savings could increase for those who would initially prefer to retire after the eligibility age as their new optimal retirement age would expand the time period over which to consume accumulated wealth. Empirically however, Feldstein found that the net effect of social security wealth on savings was negative. He used aggregate time series on consumption, savings and social security wealth to show that social security wealth had halved the rate of private savings in the US.

This 'crowding out effect' of old age social security has since then been addressed by many scholars using both macro- and micro-datasources. The results based on individuals' information provide weak to strong evidence of crowding out effects in various industrial countries (e.g. Kotlikoff, 1979, Jappelli, 1995 and Guariglia and Markose, 2000). Panel datasets were used to test Feldstein's hypothesis in the Netherlands: Alessie, Kapteyn and Klijn (1997) used the Socio-Economic Panel, while Euwals (2000) used the CentERpanel Savings Survey. Alessie et al found a full displacement effect of the public, mandatory pension system (AOW). Euwals however has trouble identifying the effect of state pensions on discretionary private pension savings as there is too little variation in the state pension variable. To

my knowledge, the effects of a potential degeneration of the social security system on wealth accumulation has not been a topic in economics so far.

1.2 Social Security and Expectations

In 1974, when Feldstein published his paper, the outlook on the future of social security in the US was very optimistic, as the following quote indicates.

> *"The history of social security shows continually rising benefit levels, a fact that individuals no doubt perceive when they contemplate the order of magnitude of their benefits at retirement age."* (p. 911)

Since the publication of the article, increased awareness of ageing altered this outlook on publicly provided old age pensions in most Western countries. In The Netherlands, the 'greying' of the population as well as changing economic and political circumstances triggered discussions on the sustainability of PAYG-pensions (*Algemene Ouderdomswet*, AOW). The complete Dutch policy debate is summarized by Van Eekelen (2006). Despite this debate the old age social security arrangement has remained roughly as introduced in 1957.

A public discussion on the future of the first pillar pension scheme is likely to influence public confidence in the continued viability of the system. This paper indeed finds that many Dutch individuals are pessimistic on the future of AOW. A majority of respondents fears a deterioration in the level of first pillar benefits and an increase in the eligibility age. This replicates findings by Dominitz, Manski and Heinz (2003), who have described confidence levels in old age social security for the United States using data from the Survey of Economic Expectations (SEE) for 1999 to 2002. They find substantial uncertainty and heterogeneity of beliefs about the long-term sustainability of the social security system.

However, in the U.S. the probability that one will receive PAYG-benefits depends on both idiosyncratic risk factors concerning personal eligibility and covariate risk factors concerning policy uncertainty. As eligibility in the Dutch system is universal and the level of benefits is uniform, old age social security expectations in The Netherlands reflect policy uncertainty expectations only. This renders the Dutch case particularly useful to study the relationship between the perception of policy uncertainty and savings behavior.

1.3 Expectations and Savings

The analysis of explicit subjective expectations is a popular new field of research in economics. Manski (2004) provides an overview of the use of subjective probabilities in modern economics. Individuals seem surprisingly

able to translate their knowledge on the idiosyncratic risk they face into a probability that matches the objective probability. For example, Hurd and McCarry (2002) find that elderly who die within two years of participating in the Health and Retirement Study (HRS) report a much smaller probability of surviving until the age of 75 as those who actually survive.

It is unclear however whether people are able to assign a 'correct' probability to the occurrence of low-frequency events that arise independent of individual characteristics, such as a policy change or a natural disaster. This is partly because the 'correct' probabilities of such events are almost impossible to identify. To objectively estimate a probability for policy uncertainty in old age social security for example one would need many changes in policy, whereas a national pension scheme is unlikely to be altered often. Note that for the research question in this paper the objective probability of a policy change in the AOW is of no consequence; individuals will act (or not) upon their subjective expectations. I am interested in whether these expectations lead to an adaptation of private wealth.

The relationship between subjective expectations and individual savings behavior is analyzed by authors such as Stephens (2004) and Kleinjans and Lee (2006). Neither of them finds evidence that HRS respondents manage to adapt savings to their job loss expectations or to their expectations of entering a nursing home respectively. Stephens claims ignorance over the event's probability might be at play or perhaps loss aversion as suggested by Bowman, Minehart and Rabin (1999). Kleinjans and Lee have trouble finding an empirical relationship as it is already ambiguous from a theoretical point of view. Although these examples seem discouraging, it is likely that the relationship between subjective expectations and behavior differs from situation to situation. The specific type of uncertainty analyzed in this paper, policy uncertainty independent of personal characteristics, might provide a different picture.

1.4 Paper lay-out

The remainder of this paper starts out with an introduction to the Dutch pension system and its potential future unsustainability in Section 2. Section 3 then sets out a theoretical model of optimal savings under various policy options for the old age social security system. Subsection 3.1 presents a model in which an individual fully understands the pension system, whereas subsection 3.2 presents an alternative model that takes into account confusion between a mandatory retirement age and the benefits eligibility age. Subsection 3.3 then provides a numerical example of both theories and consequently poses some (opposing) hypotheses concerning the expectations-savings relationship.

Subsequently, Section 4 includes a description of the dependent variables used in the regressions (subsection 4.1) and a description of the expectations

indicators (subsection 4.2). The latter subsection discusses the subjective expectations of policy changes in old age social security in The Netherlands. Specific attention is paid to whether the probabilities provided are 'rational'. Subsection 4.3 deals with the applied empirical methodology. Section 5 presents the empirical results. This section is divided in two: subsection 5.1 shows the results of random effects probit regressions on the ownership of voluntary second and/ or designated third pillar pensions, while subsection 5.2 deals with several random effects GLS regressions on accumulated wealth. Finally, Section 6 concludes and gives some policy advice.

2 Old age social security in The Netherlands

2.1 The Dutch pension system

The Netherlands is renowned for its hybrid pension system. All three traditional pillars - the mandatory public pillar, the mandatory occupational pillar and the voluntary private pillar - are of considerable importance in providing an income for pensioners when compared to other countries (see Boersch-Supan, 2004, for more information). The first pillar has a Pay-As-You-Go character, while the second and third pillar are capital funded. A fourth pillar can be identified as the stock of human capital someone possesses.

The old age social security arrangement in the Netherlands, the AOW, was established in 1957 to provide a base pension for all inhabitants of the Netherlands. Designed on Beveridge's principle, the eligibility for and level of AOW benefits does not depend on contributions paid, income or wealth, only on years of residence in the Netherlands. For each year one has legally resided in The Netherlands between the ages of 15 and 65, one receives two percent of the maximum AOW amount from the age of 65 onwards. The real gross level of AOW benefits has remained stable since 1979, at approximately seventy percent of the minimum wage. The net level of a couple's AOW benefits equals the net minimum wage. In 2007, this came down to a gross monthly allowance of €945 for singles and €648 for pensioners with a partner. A couple thus receives €1,296 a month.

The system is financed through an earmarked payroll tax, which constitutes 17.9% on the first €30,000 of gross income. Those over 64 do not pay this tax as they are already receiving benefits. In 1997 the AOW tax rate was legally capped so that the remainder of AOW expenditures are now financed through general taxes which are also paid by elderly with a substantial pension income.

Most employees are furthermore obliged to participate in occupational pension schemes. A wide array of firm-, sector- and occupation-specific pension funds collect and invest contributions and pay out mandatory annuities to the pensioners. Employees may save more than officially required

in their second pillar pension accounts. Third pillar pension savings can be narrowly or broadly defined. The narrow definition contains only the institutional voluntary private pension savings. In the Netherlands, the most common designated private pension savings are the so-called *lijfrente-polissen* and *koopsom-polissen*. Consumers can buy these annuities from banks and insurers either through the deposit of a lump-sum (koopsom) or through regular contributions (lijfrente). The contributions are to a certain degree tax-deductible. The broad definition of third pillar pension savings is all private wealth (or debt) other than first and second pillar pension savings. Private wealth as such includes assets such as designated third pillar pensions, savings account balances, housing wealth, stocks and bonds.

Another stock of pension wealth, namely human capital, is often forgotten in the pension discussion. The Dutch Council of Economic Advisors of Parliament published a report on ageing (Buiter et al., 2006) emphasizing this. Instead of decumulating assets after the age of 65 one could still generate labor income. It is important to note in this respect that in The Netherlands there is no national mandatory retirement age, only an old age social security eligibility age. As old age social security as well as occupational pensions are not income- or means-tested and as the tax rates are lower for people over 64, it is actually financially attractive to work at a high age. Notwithstanding these favorable circumstances, participation in the labor force is uncommon for those over 64; less than five percent of individuals participated in 2004 (Central Bureau of Statistics, 2006).

2.2 Policy uncertainty

In this subsection some background information is provided on the policy debate regarding the sustainability of the old age social security system in The Netherlands. Figure 4 in the appendix shows the Dutch old-age dependency rate over the last fifty years. The straight line represents the percentage of the population that receives AOW (right y-axis). As can be seen this percentage has risen steadily over the years. The government expenditures on old age social security as a percentage of GDP (left y-axis) nonetheless decreased from the late 1970s onwards due to the stable level of benefits and relatively high economic growth. The sustainability of the PAYG pension system is thus not evidently threatened in the short run.

However, the prospect of the generation of baby boomers retiring in the coming fifteen years has stirred public debate on the topic. This discussion is not new. Already in the late 1970s the ageing of the Dutch workforce started to attract attention. Scholars warned of the 'greying' and 'degreening' of the population from the early 1980s. Van den Bosch, Van den Eekelen and Petersen (1983) were the first to mention the detrimental effect of ageing on the AOW. Recently the debate on the sustainability of the AOW and other ageing dependent government expenditures - such as health care - has

intensified. Examples of recent studies on the economic effects of an older population are De Vries (2005) and CPB (2006).

As a result of this discussion, how to deal with ageing was a major theme in the general elections of November 2006. Several political parties proposed changes to the AOW, such as letting those over 64 also contribute to the PAYG-system. The new government even informally agreed to such a policy change. Hence, policy uncertainty in old age social security does exist.

Consumers are likely to worry about their future PAYG pension allowances when they take notice of this public and political debate. In the US social scientists have analyzed confidence in old age social security using longitudinal public opinion polls (e.g. Baggette, Shapiro and Jacobs, 1995, and Shaw and Mysiewicz, 2004). These authors find a stable low confidence in but high support for the PAYG public pension system. Reno and Friedland (1997) argue that the extent of coverage in the media of both the sustainability issue itself and of the measures undertaken to cope with the sustainability issue can fairly well explain the intertemporal variability in confidence levels.

Literature on confidence in the Dutch old age social security system is scarce. Surveys enumerating the subjective probabilities that individuals assign to policy changes have been absent altogether. In subsection 4.2 I report recent expectations information from the Pensionbarometer, a Dutch panel dataset collected by Tilburg University's CentERdata. Analysis of the data confirms the notion that, like U.S. citizens, Dutch respondents are pessimistic about the future of old age social security.

However, individuals will differ in their expectations towards the future of old age social security. Not every individual is equally informed about the situation, equally forward-looking, or equally pessimistic about the future in general. Dominitz et al. (2003) indeed find sizable variation in their assessment of expectations regarding U.S. social security. Subsection 4.2 in this paper reports on the distribution of expectations across Dutch individuals. The apparent heterogeneity in subjective probabilities on the future of AOW is exploited in the empirical part of this paper to identify the relationship between policy uncertainty and savings behavior.

3 Theoretical model

In this section I develop a theoretical model that sheds light on whether and how expected utility maximizers should adapt their savings behavior to their expectations regarding the sustainability of the first pillar pension system. The discussed model builds on the life-cycle hypothesis[1], that is based on

[1]This term is widely used for different concepts. The *standard additive model* Browning and Lusardi (1996) refer to is the life-cycle model intended here.

work of Modigliani and Brumberg (1954) and Friedman (1957). The life-cycle hypothesis basically tells us that rational, forward-looking individuals keep the marginal utility of consumption out of anticipated lifetime income constant from each period to the next. As income varies over time, individuals will thus adapt the propensity to save in order to equalize the marginal utility of consumption across periods.

Subsection 3.1 presents a deterministic model of optimal savings behavior if the individual fully understands old age social security and retirement under the Dutch law. As the data and empirical results (described in subsection 4.2 and Section 5) suggest this understanding is lacking, an alternative theory is developed in subsection 3.2 that takes this 'irrationality' into account. Subsection 3.3 then continues to develop a stochastic version of both models. This subsection furthermore provides a numerical example of optimal savings behavior as it turns out that there is no analytical solution to the stochastic model. The - in some cases opposing - hypotheses drawn from both theoretical models are also highlighted in this subsection.

3.1 Deterministic model with correct perception of old age social security

The life-cycle model developed here is a three-period overlapping generations model without production, not justifying the complexities of other models on this topic by e.g. Cooley and Soarez (1999) and Bohn (2003). Every period individuals are born. They live for three periods and all die at the end of their third period. This subsection deals with the discussion of optimal saving for an individual with a correct perception of the old age social security under the status quo.

In the first period everybody is young and working. The relative age of individuals in this period is reflected in the fact that the effort they need to exert while working is negligible (e_1). To stay as close to reality as possible and needed individuals can choose whether to work ($x_i = 1$) or retire ($x_i = 0$) in the second period. Remember that there is no mandatory retirement age in The Netherlands. In subsection 3.2 this will be different. Individuals in the second period already 'suffer' from their age in that they have to exert some costly effort (e_2) in order to produce something, i.e. to work. In the third period all are retired. This could be seen as setting the effort level of work for the oldest old at a very high level.

$$e_t \begin{cases} = 0 & \text{in period 1,} \\ \epsilon\, \Re_+ & \text{in period 2,} \\ \to \infty & \text{in period 3.} \end{cases}$$

Workers receive individual-specific wages (I_i), which are positive and time-independent for everyone. As always, people will choose to work ($x_i =$

1) in any period if the marginal benefit of working exceeds the marginal cost of working. I assume the level of effort depends only on the life-cycle period, not on individual characteristics.

The utility an individual obtains from a single period depends positively on his or her consumption and negatively on (when working) his or her exerted effort. Lifetime utility is additive. Moreover, utility in my model is logarithmic. I have chosen this specific utility function in order to come up with a clear prediction of optimal savings behavior. The model developed should be seen as an example of what could happen to savings under old age social security policy uncertainty, not as a universal theory. This is sufficient as I will not be testing the model formally. It should be noted however that a more general model reaches the same conclusions for most of the types of policy uncertainty.

$$\begin{aligned} U &= u_1 + u_2 + u_3 \\ U &= \ln(c_1, e_1) + \ln(c_2, e_2) + \ln(c_3, e_3) \end{aligned}$$

While maximizing their lifetime utility individuals face three decisions: one decision in the first period and two decisions in the second period of their lives. They choose the level of savings (S_i) in the first period and they choose whether they are going to work (x_i) and the level of consumption from savings (z_i) in the second period.

Furthermore, there exists a government that collects a proportional consumption tax to pay out a fixed old age social security benefit (P) to all citizens. Hence, there is a Pay-As-You-Go pension system in place. The government raises both a general tax τ and a contribution for the PAYG system θ. Note that the PAYG system is not necessarily actuarially fair as I assume there exists a financial fund that accumulates the excess contributions in certain periods and that pays the shortcoming in benefits in other periods.

For simplicity reasons, it is impossible to leave a bequest in the model and the market interest rate and the discount rate are set to zero. To simplify the analysis even more there is no borrowing constraint in place as long as lifetime consumption plus taxes paid equals lifetime income. These assumptions do not seriously affect the outcomes of my analysis.

In the status quo, individuals receive PAYG-benefits in the second and third period. The tax-level for young individuals consists of a general tax τ and a contribution for the PAYG-system θ. The tax-level for the older and the oldest individuals consists only of the general tax τ. Individuals in the second and third period do not contribute to the pension system because they are themselves receiving benefits. The experienced utility levels in the three periods are as below.

$$
\begin{aligned}
u_{i1} &= \ln((1-(\tau+\theta))(I_i - S_i)) \\
u_{i2} &= \ln((1-\tau)(z_i + P) + x_i((1-\tau)I_i - e_2)) \\
u_{i3} &= \ln((1-\tau)(S_i - z_i + P))
\end{aligned}
$$

In the first period only consumption matters for utility as effort is set to zero. In the second period a choice of working (x_i) is introduced and an effort cost of labor potentially kicks in. In the third period nobody works as effort is set to infinity so again only consumption enters the utility function. The lifetime utility maximization problem individuals face is shown in equation 1. The pertaining constraints can be found in equations 2 and 3. Savings in the first period cannot exceed income and consumption out of savings cannot exceed savings. It turns out that the maximization problem can be solved sequentially. The decision on work in period 2 is made first, then the consumption from savings in period 2 is decided upon and finally the first period savings are chosen.

$$\max_{S,x,z} \ln((1-\tau)^3((1-\theta)(I_i - S_i)(z_i + P + x_i(I_i - \frac{e_2}{1-\tau}))(S_i - z_i + P))) \quad (1)$$

s.t.

$$
\begin{aligned}
S_i &< I_i && (2) \\
z_i &< S_i && (3)
\end{aligned}
$$

As mentioned above, an individual will choose to work ($x_i = 1$) in the second period if the marginal benefit exceeds the marginal cost, so if $(1-\tau)I_i - e_2 > 0$. The second period utility function can then be rewritten as follows and the choice x_i is no longer an element of the maximization problem as can be seen in equation 4.

$$u_{i2} = \ln((1-\tau)(z_i + P) + \max(0, (1-\tau)I_i - e_2))$$

$$\max_{S,z} \ln((1-\tau)^3((1-\theta)(I_i - S_i)(z_i + P + \max(0, I_i - \frac{e_2}{1-\tau}))(S_i - z_i + P))) \quad (4)$$

The optimization problem for the choice of consumption out of saving z_i can be solved by taking the level of savings S_i as given. The first period then drops out of the analysis and the following equations result.

$$\max_{z} \ln((1-\tau)^2((z_i + P) + \max(0, I_i - \frac{e_2}{1-\tau}))((S_i - z_i + P))) \quad (5)$$

F.O.C.:

$$z_i^* = \frac{1}{2}S_i - \frac{1}{2}\max(0, I_i - \frac{e_2}{1-\tau}) \quad (6)$$

When the optimal level of consumption from savings is inserted in the general maximization problem only the savings level is left to optimize over.

This leads to the same utility specification in period 2 and 3 as can be seen below. The maximization problem then becomes as equation 7. The optimal savings level is derived in equation 8.

$$u_{i2} = u_{i3} = \ln(\frac{1}{2}S_i + P + \frac{1}{2}\max(0, I_i - \frac{e_2}{1-\tau}))$$

$$\max_S \ln((1-\tau)^3((1-\theta)(I_i - S_i)(\frac{1}{2}S_i + P + \frac{1}{2}\max(0, I_i - \frac{e_2}{1-\tau}))^2)) \quad (7)$$

F.O.C.:

$$S^*_{i,A,I} = \frac{2}{3}I_i - \frac{2}{3}P - \frac{1}{3}\max(0, I_i - \frac{e_2}{1-\tau}) \quad (8)$$

Hence, in the status quo and when individuals have a correct perception of the old age social security system, optimal savings depend on income and the benefit level and when working in the second period on the level of effort exerted and the general tax rate. The higher an individual's income, the higher his or her optimal savings. The relationship is stronger for low levels of income. If one earns less than the tax-corrected effort cost of labor (and one therefore doesn't work) the marginal effect of income on optimal savings is 2/3. The marginal effect of income on savings for higher income groups, that choose to work in the second period, is 1/3 however. Furthermore, the level of savings is negatively related to the level of PAYG-benefits. The marginal effects of the exerted effort in the second period and the general tax rate τ depend on whether one works or not in the second period, i.e. on a person's income. When one doesn't work there is no marginal effect on optimal savings. When one does work in the second period, the marginal effects on savings of the effort cost and of the general tax rate are both positive.

In the model, one could think of the government's financial fund running out of money because of persistently shrinking generations. The policy-makers could respond to this 'ageing of the population' by adapting the PAYG pension system. The government can choose one of the following policy options, modeled after the Dutch institutional environment. For the moment, there is *no uncertainty* about the policy option chosen, so each individual is fully informed about the future of the old age social security system.

- Option A: status quo. Each individual will receive P in period 2 and period 3.
- Option B: providing a lower benefit. Individuals will receive a benefit that has the level of $(1-\lambda)P$ in period 2 and period 3. λ is smaller than one, so that the new benefit level will be lower.
- Option C: only providing benefits in period 3. The government shifts the eligibility age upwards: it only provides benefits of level P in period 3.

- Option D: letting the elderly contribute proportionally to the PAYG system. Individuals in the second and third period also pay the additional consumption tax θ.

If policy-makers prefer policy option B the level of pension benefits will decrease. The utility levels a person can then enjoy are different from the status quo as a result of a tighter budget constraint. The pertaining utility functions and maximization problem are shown below. Maximizing the additive lifetime utility function leads to the following optimal first period savings level (see equation 10).

$$\begin{aligned} u_{i1} &= \ln((1-(\tau+\theta))(I_i - S_i)) \\ u_{i2} &= \ln((1-\tau)(z_i + (1-\lambda)P) + \max(0,(1-\tau)I_i - e_2)) \\ u_{i3} &= \ln((1-\tau)(S_i - z_i + (1-\lambda)P)) \end{aligned}$$

$$\max_S \ln((1-\tau)^3((1-\theta)(I_i - S_i)(\frac{1}{2}S_i + (1-\lambda)P + \frac{1}{2}\max(0, I_i - \frac{e_2}{1-\tau}))^2)) \quad (9)$$

F.O.C.:

$$S^*_{i,B,I} = \frac{2}{3}I_i - \frac{2}{3}(1-\lambda)P - \frac{1}{3}\max(0, I_i - \frac{e_2}{1-\tau}) \quad (10)$$

The equation for the optimal savings level with lower benefits is almost identical to the equation for the status quo optimal savings level (see equation 8). The only difference is that the benefits term is multiplied by $(1-\lambda)$. This means that, compared to the status quo, optimal savings are higher for everyone when the PAYG-benefits are lower. The difference in savings between the status quo and option B is equal for all income groups.

When the policy-maker certainly chooses policy option C nobody will receive old age social security benefits in the second period. Again, the pertaining maximization problem can be solved sequentially. Equation 11 displays the maximization problem where the decisions to work (x_i) and what to consume out of savings (z_i) are already filled in. Optimal savings then result as in equation 12.

$$\begin{aligned} u_{i1} &= \ln((1-(\tau+\theta))(I_i - S_i)) \\ u_{i2} &= \ln((1-\tau)(z_i) + \max(0,(1-\tau)I_i - e_2)) \\ u_{i3} &= \ln((1-\tau)(S_i - z_i + P)) \end{aligned}$$

$$\max_S \ln((1-\tau)^3((1-\theta)(I_i - S_i)(\frac{1}{2}S_i + \frac{1}{2}P + \frac{1}{2}\max(0, I_i - \frac{e_2}{1-\tau}))^2)) \quad (11)$$

F.O.C.:

$$S^*_{i,C,I} = \frac{2}{3}I_i - \frac{1}{3}P - \frac{1}{3}\max(0, I_i - \frac{e_2}{1-\tau}) \quad (12)$$

The difference between this optimal savings formula and that for savings in case the government maintains the status quo (equation 8) depends only on the benefit level. Whereas the marginal effect of P on savings is $-2/3$ in the status quo, it is only $-1/3$ in case of later eligibility for benefits. This means that, compared to the status quo, optimal savings are higher when the government chooses policy option C.

In case the government chooses option D, the consumption possibilities differ from the standard case. In period 2 and 3, individuals pay an additional tax (θ) on their consumption and this lowers their added lifetime consumption. (This policy option is chosen so as to reflect the current proposals of reform in The Netherlands). The optimal savings in case of contributions paid by the elderly can be found in equation 14.

$$\begin{aligned} u_{i1} &= \ln((1-(\tau+\theta))(I_i - S_i)) \\ u_{i2} &= \ln((1-(\tau+\theta))(z_i + P) + \max(0, (1-(\tau+\theta))I_i - e_2)) \\ u_{i3} &= \ln((1-(\tau+\theta))(S_i - z_i + P)) \end{aligned}$$

$$\max_S \ln((1-(\tau+\theta))^3((I_i - S_i)(\frac{1}{2}S_i + P + \frac{1}{2}\max(0, I_i - \frac{e_2}{1-(\tau} + \theta)))^2)) \quad (13)$$

F.O.C.:

$$S^*_{i,D,I} = \frac{2}{3}I_i - \frac{2}{3}P - \frac{1}{3}\max(0, I_i - \frac{e_2}{1-(\tau+\theta)}) \quad (14)$$

The inclusion of the contributions tax rate θ in the optimal savings equation is the only difference between optimal savings under option D and the status quo. As the marginal effect of the tax rate is zero or positive, option D apparently leads to an optimal savings level that is equal or higher than in the status quo, depending on one's income level. Lower income groups (that don't work in the second period) have identical optimal savings as before. Higher income groups (that do work in the second period) will have higher optimal savings.

To conclude: in a deterministic world in which everybody fully understands the old age social security system, individuals save less under the status quo institutions (A) than under all other institutions. If the government thus changes its policy to lower benefits (B), later benefits (C) or contributions by the elderly (D) savings should go up.

3.2 Deterministic model with incorrect perception of old age social security

The previous subsection predicts higher individual savings under alternative, less-generous PAYG-schemes. My exploratory study of expectations on savings however found positive marginal effects for some policy options,

but a negative marginal effect for the expectations regarding a later benefits-eligibility age (more on this in the empirical Section 5). This suggests something is different about the policy option to postpone the benefits eligibility age. A potential explanation for this different treatment is laid out in this subsection.

The model in subsection 3.1 assumes individuals exactly know the attributes of old age social security. It is possible however that they have imperfect or incorrect information about the system. People are for example likely to confuse the old age social security eligibility age with a mandatory retirement age. As discussed in Section 2.1 the latter doesn't exist in The Netherlands. Someone is allowed to receive AOW and work at the same time. Framing issues regarding the AOW-eligible age could however lead to a perceived constraint on the retirement age; Individuals could believe that the retirement age can only be at or before the eligibility age for AOW-benefits. This subsection models this incorrect perception of the old age social security system.

In the status quo, when individuals receive PAYG-benefits in the second and third period, the incorrect perception of the eligibility age implies that everybody is retired in these periods. The choice to work in the second period (x_i) is hence set to zero in the option A model for all individuals. The utility levels in all three periods are then as below. The lifetime utility maximization problem (equation 15) is still subject to the constraints in equations 2 and 3. The optimal savings level can be found in equation 16.

$$\begin{aligned} u_{i1} &= \ln((1-(\tau+\theta))(I_i - S_i)) \\ u_{i2} &= \ln((1-\tau)(z_i + P)) \\ u_{i3} &= \ln((1-\tau)(S_i - z_i + P)) \end{aligned}$$

$$\max_S \ln((1-\tau)^3((1-\theta)(I_i - S_i)(\frac{1}{2}S_i + P)^2)) \tag{15}$$

F.O.C.:

$$S^*_{i,A,II} = \frac{2}{3}I_i - \frac{2}{3}P \tag{16}$$

Hence, when individuals have an incorrect perception of the old age social security system, optimal savings in the status quo depend on income and the benefit level only. The higher an individual's income, the higher his or her optimal savings. The marginal effect of income is constant. Moreover, the level of savings is negatively related to the level of PAYG-benefits.

Under policy option B (lower benefits) everybody will be retired in period 2 and 3 if individuals misperceive the eligibility age for a compulsory retirement age. The choice to work in the second period (x_i) is set to zero

for everyone. Maximizing the additive lifetime utility function then leads to the following optimal first period savings level.

$$S^*_{i,B,II} = \frac{2}{3}I_i - \frac{2}{3}(1-\lambda)P \tag{17}$$

The equation for the optimal savings level with lower benefits is almost identical to the equation for the status quo (compare with equation 16). The only difference is, like in subsection 3.1, that the benefits term is multiplied by $(1-\lambda)$. If the government decides upon lower benefits and individuals confuse the benefits eligibility age with a mandatory retirement age, the optimal level of savings is thus higher than in the status quo.

When the policy-maker certainly chooses policy option C the benefits-eligibility age shifts one period up. Nobody will receive old age social security benefits in the second period. Instead, as people misperceive the shift in eligibility age as a shift in the mandatory retirement age, they receive an 'option' to work (x_i). This means that the optimization problem an individual faces is exactly identical to the problem for option C in the 'correct' model in subsection 3.1. Optimal savings then remain as in equation 12.

$$S^*_{i,C,II} = \frac{2}{3}I_i - \frac{1}{3}P - \frac{1}{3}\max(0, I_i - \frac{e_2}{1-\tau}) \tag{18}$$

The difference between this optimal savings formula and that for the status quo when individuals misperceive the eligibility age (equation 16) now depends on the benefit level, but when one decides to work in the second period also on income, the effort cost of working and the general tax level. The marginal effect of the benefit level on savings is higher (less negative) in option C than in the status quo. For low incomes, there is no further difference between equation 16 and 18. So, under an incorrect perception of the system and when the government decides to only provide benefits in the third period, optimal savings for low incomes are higher than in the status quo. For higher incomes ($I_i > \frac{e_2}{1-\tau}$) the marginal effect of income on savings is lower than in the status quo, namely 1/3. Furthermore, a positive intercept of $\frac{e_2}{1-\tau}$ is added that doesn't feature in their optimal savings equation in the status quo. So, under an incorrect perception of the system in option C, optimal savings for high income individuals are equal to or higher than those in the status quo only when $I_i \leq P + \frac{e_2}{1-\tau}$. When income is higher, so $I_i > P + \frac{e_2}{1-\tau}$, the optimal level of savings is actually lower than in the status quo.

When the government chooses option D (introducing an additional consumption tax for the elderly to pay for PAYG-benefits), one receives benefits in both period 2 and 3 and thus one sets the option to work (x_i) in the second

period to zero. The benefits-eligibility age is after all perceived to be a compulsory retirement age. The optimal savings level in case of contributions paid by the elderly can then be found in equation 19.

$$S^*_{i,D,II} = \frac{2}{3}I_i - \frac{2}{3}P \tag{19}$$

In the deterministic model with an incorrect perception of old age social security, option D apparently leads to an optimal savings level that is identical to that in the status quo (see equation 16). The introduction of the additional tax rate θ for those in the second and third period of their lives obviously doesn't influence savings behavior.

To conclude: in a deterministic world in which individuals misinterpret the eligibility age for old age social security as a mandatory retirement age, individuals save more under the lower benefits (B) institutions than under the status quo institutions (A). The savings levels in the status quo (A) and in case the elderly will have to contribute to the PAYG system (D) are identical. For the low income group, the optimal savings level in option C is higher than in the status quo, while for the high income group, the optimal savings level when the eligibility age rises is lower than in the status quo.

This leads to two testable differences between the model under perfect and imperfect knowledge of old age social security. For higher incomes under an incorrect perception of the system, savings are lower in the later-benefits policy option than in the status quo, whereas savings are higher than the status quo under a correct perception. Furthermore, optimal savings in the contributions-for-elderly option are equal to the status quo savings under an incorrect perception of the system, whereas they are higher than in the status quo under a correct perception. Note that this distinction in savings behavior between high and low income individuals follows from the assumption that higher income individuals choose to work in the second period when they are allowed to, while low income individuals don't. This is off course not necessarily the case in practice.

3.3 Stochastic model

The model has been deterministic so far. In this subsection I will move to a stochastic model with policy uncertainty. As policy-makers are able to adjust government policies from time to time including policy uncertainty in the model seems realistic. Other parameters of the model such as income and life duration are however still deterministic.

Hence, in the first period individuals choose an optimal savings level (S_i) under *uncertainty* over the state of the world in the second and third period.

Four possible states of the world can be distinguished that correspond to the four policy options introduced in Section 3.1. The government decides on a policy option after the first period and this decision is carried out and publicly known in period 2 and period 3. In their first period maximization problem consumers take into account the probabilities they assign to possible policy options. Each individual is one of many and can thus be seen as a 'system-taker' (think of price-taker). Everyone thus subjectively distributes probabilities to the social security reform options and these assignments are exogenous. Here I assume that the subjective probabilities (α_i, β_i, γ_i and δ_i) always add up to one.

$$\begin{aligned} P(\text{Option A: Status quo}) &= \alpha_i \\ P(\text{Option B: Lower benefits}) &= \beta_i \\ P(\text{Option C: Later benefits}) &= \gamma_i \\ P(\text{Option D: Contributions for the elderly}) &= \delta_i \end{aligned}$$

After the state of the world is revealed consumers choose whether to work or retire (x_i) in the second period and a consumption level (z_i) out of the savings stock, just like in the deterministic version of the model. If I subsequently solve the maximization problem as I did above, the problem with only the savings decision left can be found in equations 20 and 21. Equation 20 represents the problem in the model with the correct perception of old age social security. Equation 21 represents the same problem, but now for the model with an incorrect perception.

$$\begin{aligned} \max_S \; & 4\ln((1-\tau)) + \ln((1-\theta)(I_i - S_i)) \\ & + 2\alpha_i \ln(\frac{1}{2}S_i + P + \frac{1}{2}\max(0, I_i - \frac{e_2}{(1-\tau)})) \\ & + 2\beta_i \ln(\frac{1}{2}S_i + (1-\lambda)P + \frac{1}{2}\max(0, I_i - \frac{e_2}{(1-\tau)})) \\ & + 2\gamma_i \ln(\frac{1}{2}S_i + \frac{1}{2}P + \frac{1}{2}\max(0, I_i - \frac{e_2}{(1-\tau)})) \\ & + 2\delta_i \ln((1-\theta)(\frac{1}{2}S_i + P) + \frac{1}{2}\max(0, I_i - \frac{e_2}{(1-(\tau+\theta))})) \end{aligned} \tag{20}$$

$$\begin{aligned}\max_S\ & 4\ln((1-\tau)) + \ln((1-\theta)(I_i - S_i)) \\ & +2\alpha_i \ln(\frac{1}{2}S_i + P) \\ & +2\beta_i \ln(\frac{1}{2}S_i + (1-\lambda)P) \\ & +2\gamma_i \ln(\frac{1}{2}S_i + \frac{1}{2}P + \frac{1}{2}\max(0, I_i - \frac{e_2}{(1-\tau)})) \\ & +2\delta_i \ln((1-\theta)(\frac{1}{2}S_i + P))\end{aligned} \tag{21}$$

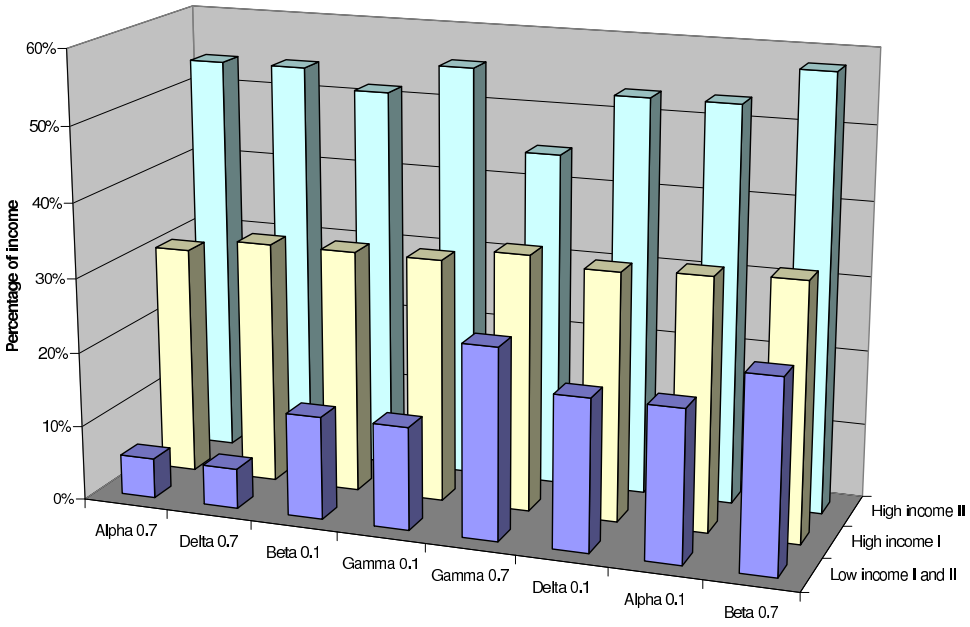
Although the equations above appear orderly, the pertaining first order conditions unfortunately do not have an analytical solution for the optimal savings level. As these f.o.c.'s are polynomials of the fifth and fourth degree, it is impossible to isolate S_i. So I cannot identify the effect of the different subjective probabilities on optimal savings by means of calculus.

Therefore a numerical example is included here to illustrate the theoretical impact of the probabilities assigned to different policy options on optimal savings for low and high income individuals. The representative low income person has a preference for retirement in the second period while the representative high income individual has a preference for working. Eight different probability profiles are identified. The profiles single out the probability of one event relative to the remaining events. Hence, if α (the probability that the government will maintain the status quo) is equal to 0.10, the remaining probabilities will be equal to 0.30 (β is 0.30, γ is 0.30 and δ is 0.30). Consequently, if α is set to 0.70, the other probabilities have a value of 0.10. The parameters of the example are as follows: Income is either 2 or 12, P is 2.2, effort is 2, τ is 0.3, λ is 0.5 and θ is 0.2. Note that this is not an official calibration, but merely a reasonable choice of parameters that doesn't influence the most important conclusions of the example.

Figure 1 displays the percentage of income an individual saves in the first period when he or she believes one of the eight probability profiles. Results for both the model with a correct perception (I) and the model with an incorrect perception (II) of the PAYG system are displayed. For a representative low income individual, who doesn't work in the second period by definition, the percentage of income saved is the same under perfect (I) and imperfect (II) knowledge about the PAYG system. For a representative high income individual, the percentage saved is higher for each probability profile when individuals mix up the benefits eligibility age with a mandatory retirement age (II).

The savings rank ordering over the probability profiles are different for the three groups. For the low income group, two profiles result in the lowest savings, the profile that assigns the highest probability to the status quo ($\alpha = 0.7$) and the profile that assigns the highest probability to the payment

Figure 1: The percentage of income a low and high income individual save for different probability profiles under a correct (I) and incorrect (II) perception of old age social security



of contributions by the elderly ($\delta = 0.7$). Two profiles, the one that assigns the highest probability to lower benefits in the future ($\beta = 0.7$) and the one that assigns the highest probability to later benefits in the future ($\gamma = 0.7$), result in the highest savings as a percentage of income for this group.

When a high income individual knows that there is no mandatory retirement age (I) the percentages of income saved are very similar for all probability profiles. There are larger differences in the savings rate for a representative high income individual that is confused between the benefits eligibility age and a mandatory retirement age (II). The probability profile that clearly gives lowest savings for this group is the profile that assigns a high probability to a later eligibility age ($\gamma = 0.7$). Having an incorrect perception of the system, high income individuals save most when they believe a probability profile that assigns a high probability to lower benefits ($\beta = 0.7$). Assigning profiles with a high or low δ, the probability that the elderly have to contribute to the PAYG system, doesn't significantly alter the percentage of income saved.

The results discussed above indicate that the relative differences in optimal savings behavior between the four policy options are similar in a stochastic and a deterministic world. The marginal effects of the different subjective probabilities on savings in a stochastic world can therefore be hypothesized

informally on the basis of the results in subsection 3.1. The hypotheses read as follows:

1. Individuals that assign a higher probability to the occurrence of a decrease in benefit levels have higher savings.

2. Individuals that assign a higher probability to the possibility of an upward shift in the eligibility age have higher savings if they do not choose to work in the 'second' period anyway or if they correctly perceive the eligibility age as having nothing to do with a mandatory retirement age.

3. Individuals that assign a higher probability to the possibility of an upward shift in the eligibility age have lower savings if they mistakenly perceive the eligibility age as a mandatory retirement age and if they choose to work in the 'second' period when they believe they can.

4. Individuals that assign a higher probability to the occurrence of proportional contribution to the PAYG system by the elderly have higher savings if they do not choose to work in the 'second' period.

5. Individuals that assign a higher probability to the occurrence of proportional contribution to the PAYG system by the elderly do not adapt their savings to this probability if they choose to work in the 'second' period.

As I cannot observe whether individuals would choose to work in the 'second' period of their lives or whether they perceive the old age social security system correctly, it is impossible to test hypothesis two and three and four and five separately. Luckily, the hypotheses predict opposing marginal effects of the subjective probabilities of later benefits and contributions for the elderly. Therefore the signs of the coefficients of the subjective probability variables will tell me whether people confuse the benefits eligibility age with a mandatory retirement age. To a lesser extent, the empirical analysis in the remainder of this paper can also say something about people's preference for work at a higher age.

As the accumulation of savings is a complex process, the five hypotheses formulated in this section will be tested empirically in a reduced-form model. In Section 5 subjective probabilities of the policy changes serve as regressors in regression models of savings behavior. The probabilities are treated as independent of each other as in the real world multiple policy changes take place at the same time.

4 Empirical model and data

In the empirical analysis of private pension savings I use data from the Dutch Central Bank Households Savings Survey (DHS), waves 2001 up to 2006[2], and data from the Dutch Pensionbarometer, wave 2006. These datasets are both collected by Tilburg University's CentERdata[3]. The surveys enumerate the same respondents so that they could easily be merged on the identification number of individuals. The DHS is an intensively used dataset. Euwals (2000) explains the DHS dataset more extensively in his appendix. As the Pensionbarometer is a new dataset I will explain this more thoroughly in subsection 4.2.

4.1 Descriptives on wealth

Both the participation in designated private pension savings and the level of voluntary private pension savings will be assessed empirically in the remainder of this paper. That is to say that these two measures of savings serve as dependent variables. The dummy variable on participation measures whether someone ever voluntary contributed more to their occupational pension fund and/or whether someone ever contributed to a designated third pillar pension account.

Table 1 presents the number of respondents in my sample owning one of these assets per dataset. The lowest row, representing whether an individual owns any of the asset types above, is the variable used in the regressions. The most popular voluntary pension savings product is a so-called 'lijfrente-polis', described in Section 2.1. Almost thirty percent of respondents participate in such a scheme. Hardly anyone contributes extra to their occupational pension account however. Overall, about forty percent of my sample owns at least one type of designated voluntary pension assets.

The variable on the level of accumulated savings includes e.g. designated third pillar pensions, savings account balances, stocks, bonds and housing wealth minus mortgage loans. The variable excludes second pillar pension savings because I lack information on accumulated occupational pension savings. The logarithm of the wealth (w_{it}) variable is used in the regressions in the following way.

$$\text{log of wealth} = \begin{cases} \log(w_{it}) & \text{if wealth}>0, \\ \log(w_{it}+1) & \text{if wealth}=0, \\ -\log(-w_{it}) & \text{if wealth}<0. \end{cases}$$

[2]Earlier years of the DHS are available but not included as the definition of aggregate savings variables has changed over time.

[3]Although this is an Internet panel much is done to prevent selection effects. The respondents are randomly selected from the general municipalities' administration. When a chosen individual does not have access to the Internet, access is provided.

Table 1: Percentage of respondents participating in voluntary pension asset types (Source: DHS sample)

Asset type	2003	2004	2005
third pillar - 'lijfrente'	28%	29%	30%
third pillar - 'koopsom'	10%	13%	11%
second pillar - extra entitlements	1%	2%	2%
second pillar - extra payments	2%	1%	1%
participation in one of the above	37%	41%	40%
N	552	630	710

A histogram of the logarithm of aggregate, private savings in my sample is shown in figure 5 in the appendix. The mean of wealth in my regressions is about €226,000. The median is, as expected, lower at about €158,000. Of the 2,850 observations in my regressions, 138 own negative accumulated savings, 19 own nothing and all others have positive wealth.

4.2 Descriptives on expectations

The variables of interest in this paper are three indicators of policy uncertainty expectations, one for each potential new policy described in Section 3.1. The Pensionbarometer collects subjective probabilities for policy options B and C, i.e. the expectations regarding lower benefits in the future and a higher eligibility age for benefits in the future. The Dutch Central Bank Household's Savings Survey has gathered information on binary beliefs regarding policy option D, the expectation that those over 64 have to contribute to the PAYG system in the future.

The Pensionbarometer is collected mainly to produce longitudinal statistics for 'confidence' levels in the Dutch pension system. Its questionnaire includes questions on subjective probabilities of changes in first and second pillar pensions, but also questions on satisfaction with the system. CentERdata started to collect information for the Pensionbarometer in May 2006. Netspar, a Dutch research network on pensions, ageing and retirement, and Pensioenkijker.nl, a joint effort of pension funds to promote awareness around pensions, are the principals. Every month some respondents receive the digital questionnaire although every respondent only receives the questions once every three months. This is to be able to produce the 'confidence' statistics regularly, but not to overwhelm the respondents with questions. In this paper, I use the first nine waves of the Pensionbarometer. The last wave was enumerated in February, 2007. Table 13 in the appendix presents the number of observations per wave. It should be noted that a total of 2,298 individuals were interviewed. 397 individuals reply only once, whereas 991

individuals appear more than three times in the Pensionbarometer-dataset.

The Pensionbarometer measures expectations in terms of subjective probabilities assigned to certain possible changes in the pension system. Expectations regarding the level of AOW benefits and the AOW eligible age are enumerated, but also expectations regarding the level of second and third pillar pensions and the general retirement age. To obtain a more complete image of the given probabilities, the questionnaire asks four questions per possible change. In case of the lower benefits policy option, a respondent is supposed to give the probability the real level of benefits will go down within ten years, will go down by more than ten percent, will go up within ten years and will go up by more than ten percent. In case of the later benefits policy option, the same structure is applied albeit with two year instead of ten percent intervals.

Table 2 presents the average (over individuals and time) probabilities provided by respondents regarding the level of benefits. Table 3 presents the average probabilities respondents assign to changes in the eligibility age for first pillar pensions. More than half the respondents expect lower real benefit levels and a later eligibility age. Hence, pessimism prevails. Overall, respondents assign a higher probability to the increase of the eligibility age than to lower benefits and correspondingly assign a lower probability to the decrease of the eligibility age than to higher benefits. Note that the financial impact to the government budget of ten percent lower benefits is comparable to the impact of two year later benefits. Furthermore, the difference between the probability of ten percent lower benefits and lower benefits in general is larger than the difference between two year later benefits and later benefits in general. Not only do people believe an alteration to the eligibility age to be more likely, this change is also more likely to be large. Moreover, all standard deviations of the length of benefits probabilities are lower than those of the level of benefits probabilities. Apparently, there is more agreement on the issue of the eligibility age of AOW.

Figures 6 and 7 in the appendix shed some light on the development of the average subjective expectations over different waves of the Pensionbarometer. The averages of the expectations questions differ from month to month, although there is more variance in the averages of the level probabilities than in the averages of the eligibility age probabilities.

The empirical section of this paper focuses on the ten percent lower and two years later probabilities. The fact that these questions involve the most concrete events lead to this choice. The following descriptives hence highlight these variables.

The histograms (figure 2 and 3) provide more information on the distribution of answers. The answered probabilities are obviously quite diverse. Moreover, a clustering of answers around 50 percent is visible for both variables, whereas the ten percent lower benefits probability also clusters around zero. Respondents answer a fifty percent chance if the either identify the

Table 2: Average expectations regarding the future of the real level of AOW benefits within ten years (Source: Pensionbarometer all)

Benefit expectations	Obs.	Mean	St.Dev.
Prob. of ten perc. lower benefits	3,262	.38	.37
Prob. of lower benefits	3,277	.52	.33
Prob. of higher benefits	3,244	.15	.22
Prob. of ten perc. higher benefits	3,242	.09	.16

Table 3: Average expectations regarding the future of the AOW eligibility age within ten years (Source: Pensionbarometer all)

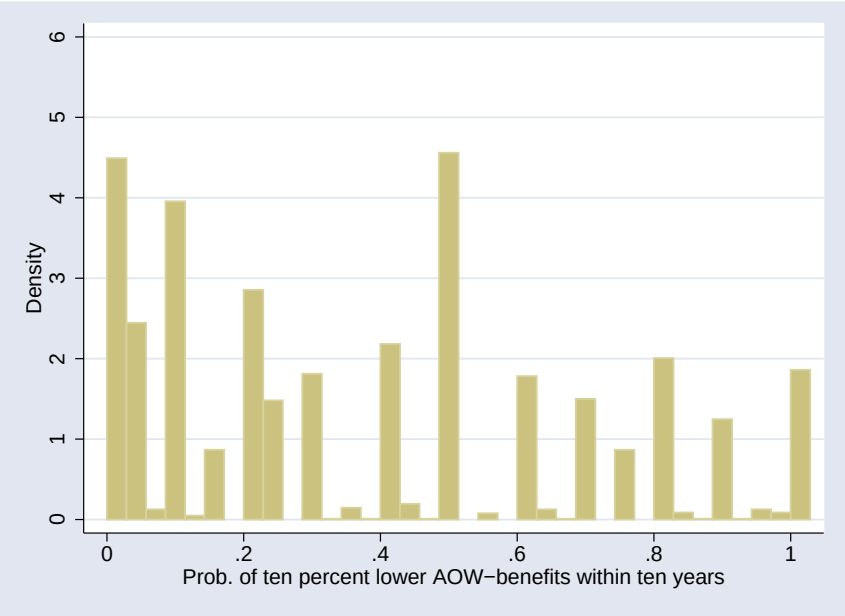
Eligibility expectations	Obs.	Mean	St.Dev.
Prob. of two years later benefits	3,299	.47	.31
Prob. of later benefits	3,304	.59	.31
Prob. of earlier benefits	3,298	.06	.14
Prob. of two years earlier benefits	3,296	.04	.13

probability to really be .50 or if they have no idea what probability to assign. It is impossible to identify what respondents are saying here. Clustering is more prevalent in the eligibility age question, indicating that respondents are perhaps more unsure of their expectations on receiving benefits later. Clustering could impact the empirical relationship I am trying to find in this paper. Empirical subsection 5 therefore features regressions that both include and exclude these .50 probabilities. It turns out that the results are comparable.

To gain some insight into the formation of subjective expectations, random effects GLS-regressions were run on the subjective probability variables using standard demographic regressors such as gross income, social class, age group, gender and education level. Not many demographics produced significant coefficients, except the following. Women assign a significantly higher probability to both lower benefits and the increase in the AOW eligible age within ten years. This is a standard finding in the subjective expectations literature. Middle-class and vocationally-trained individuals are furthermore more pessimistic towards the future of the level of benefits.

The regressions in Section 5 use probability variables that represent the averages of the probability answers of an individual over the monthly waves. This is done because the savings information from the DHS is only available on a yearly basis. The average probabilities are then appended to the yearly DHS-observations. Due to these data limitations each individual thus has time-invariant expectations regarding policy option B and C. Aggregating the individual probabilities over time averages out some of the extreme answers. The histograms on the actual probabilities used for the individuals in

Figure 2: Histogram prob. of ten percent lower benefits within ten years (Source: Pensionbarometer all, N=3,592)



the sample (figures 8 and 9 in the appendix) highlight this. The mean average probability respondents assign to ten percent lower real benefits within ten years is .39 (s.d. .30). The mean average probability respondents assign to two year later benefits within ten years is .48 (s.d. .28). These first moments are almost identical to the ones in tables 2 and 3.

The independent variable on expectations regarding policy option D, proportional contributions paid by the elderly, is a dummy taken from the DHS's of 2003 up to 2006. Table 4 shows the percentage of DHS-respondents that feature in the participation regressions who believed that the tax rates of those over 64 would converge towards the pre-65 tax rates in less than ten years time. It was made clear in the questionnaire that this could only result from the elderly contributing to AOW. As can be seen, a large proportion (about three quarters) of respondents believe that the tax system will be adapted within ten years to let elderly with an additional pension contribute to the PAYG system as well. Over time the proportion who believe that AOW-recipients will have to contribute to the PAYG pension system grows.

An RE probit is performed with the dummy of expecting contributions for the elderly as the dependent variable and variables such as household income, age group, gender and education level as independents. Like in the subjective probabilities regressions mentioned above, only a few significant

Figure 3: Histogram prob. of two years later benefits within ten years (Source: Pensionbarometer all, N=3,632)

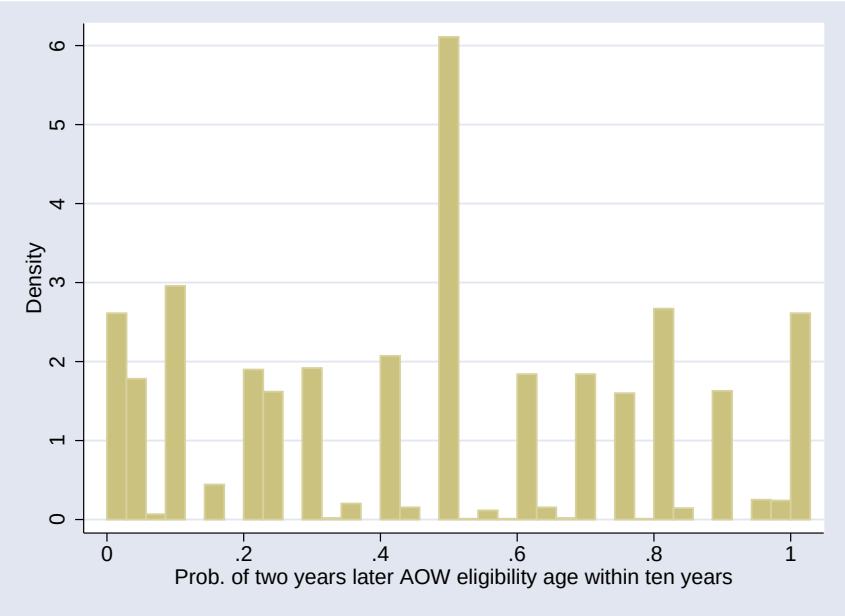


Table 4: Do you expect those over 64 to pay proportional AOW contributions within ten years? (Source: DHS sample)

Contributions expectations	2003	2004	2005	2006
Yes	71%	73 %	78%	79%
N	388	442	573	542

coefficients were found. As expected, women more often believe that those over 64 will have to pay AOW-contributions soon. The lowest standard errors however belong to the coefficients of the year dummies, indicating that the year in which this question is posed very significantly influences the contributions belief.

For the empirical part of my paper I do not use the simple answer to the contributions-question. Instead, I use a dummy representing whether over the years someone consistently believed in contributions paid by the elderly. This new dummy is subsequently appended to the DHS-observations. This means that each individual not only has time-invariant expectations regarding policy option B and C but also for option D. I do so for two reasons. First, this cancels out potential 'trembling' or 'mapping' errors. The binary answer to the belief question can be seen as the mapping of a probability into $\{0, 1\}$. However, the mapping of probabilities around 0.50 is likely to change from year to year although the latent probability doesn't change.

Therefore consistency is taken into account. Second, because of the 'averaged' dummy more years of savings data can be used, namely six instead of four datawaves.

Of the 837 individuals in the wealth regressions, 481 (57%) consistently believed that the tax rates of those before and after 65 would converge. 100 individuals consistently believed that this was not going to happen. The other respondents changed their minds once or multiple times: 57% of them became more pessimistic, 16% became more optimistic.

This subsection concludes with a small paragraph on the relationship between the various policy expectations. For all individuals in the wealth regression sample, the simple correlation-coefficient between the probability of lower benefits and the probability of later benefits is .41. The correlation between the probability of lower benefits and the consistent contributions for the elderly dummy is .12 and the correlation between the probability of later benefits and the contributions for the elderly dummy is .09. Hence, people see the policy options as complements rather than substitutes. This is in conflict with the theoretical assumption that the policy options are mutually exclusive. In the empirical part of this paper the probabilities are therefore treated as independent of each other; I assume multiple policy options can be chosen at the same time.

4.2.1 Understanding of probabilities

The concept of a probability can be a little daunting to respondents, that do not explicitly assign these on a regular basis. To test whether they knew what they were doing while answering Pensionbarometer questions this subsection looks at the 'rationality' of answers. Answers are rational in this context when they satisfy the basic properties of probabilities. As explained in the Introduction, this paper is not meant to say anything on the 'correctness' of the value of the probability. I will define two types of rationality here. A respondent has rational expectations of type I if he or she assigns lower or equal probabilities to specific events than to more general events that include the specific event. A respondent furthermore has rational expectations of type II if the sum of two mutually exclusive events does not add up to more than one.

The means of the probabilities assigned to the different possible changes in tables 2 and 3 seem rational of both type I and II. On average, a higher probability is assigned to the event of lower benefits than to the event of ten percent lower benefits, like a higher probability is assigned to higher benefits than to ten percent higher benefits (type I). The probabilities of lower and higher benefits do not add up to a number larger than one (type II). A higher probability is also assigned to the event of later benefits than to the event of two years later benefits, and the same goes for earlier benefits

(type I). The probabilities of later and earlier benefits add up to .65, which means that on average the probability of an equal eligibility age is .35 (type II).

However, these average indicators cover up for some irrational individuals. Nineteen percent of respondents in the Pensionbarometer ($N = 3,565$) are irrational of type I in matters of benefits levels (higher specific probabilities than general probabilities). Sixteen percent of respondents are irrational of type I in matters of eligibility age. Eight percent of respondents provide probabilities for two mutually exclusive events (higher and lower benefits) that add up to a number that is larger than one for benefit levels, whereas five percent of individuals violate the rationality of type II for the eligibility age probability. The percentages of respondents that violate both rationality of type I and II is one percent for both the level questions and for the eligibility age questions. All in all, respondents seem to understand the mathematical properties of probabilities reasonably well.

4.3 Methodology

My dataset has a panel character, i.e. multiple individuals are observed a number of times. The data will then be serially correlated by construction as the error terms will be correlated over t for given i. This problem is 'solved' by using random effect estimators. The error terms of the regressions are assumed to consist of a term that is randomly distributed over all observations and an individual-specific term that is randomly distributed over all individuals. I use a random effects (RE) probit model and RE generalized least squares model. I cannot apply a fixed effect estimator as the expectations variables are time-invariant. The following assumptions are made regarding the error terms.

$$\epsilon_{it} \sim \mathrm{N}(0, \sigma_\epsilon^2)$$

$$\epsilon_{it} \text{ indep. of } \alpha_i, x_{i1}, ..., x_{iT}$$

$$\alpha_i \sim \mathrm{N}(0, \sigma_\alpha^2)$$

$$\alpha_i \text{ indep. of } x_{i1}, ..., x_{iT}$$

In Section 5 I analyze the sign, significance and size of the coefficients pertaining to the expectations variables in the probit regression for participation in a voluntary pension scheme and in the GLS regression for the level of private wealth. Equation 22 displays the regression equation in case of the accumulated wealth regression. The probit regressions are identical, albeit that in that case a latent variable is estimates that is mapped into

either zero or one.

$$\begin{aligned} y_{it} = \beta_1 * (\text{Probability of ten percent lower benefits within ten years})_i \\ +\beta_2 * (\text{Probability of two years later benefits within ten years})_i \\ +\beta_3 * (\text{Dummy for consistently expecting contributions by the elderly})_i \\ +\alpha_i + \beta' \, \mathbf{x_{it}} + \gamma' \mathbf{z_i} + \epsilon_{it} \end{aligned} \tag{22}$$

Private wealth accumulation and decumulation depends on a wide spectrum of characteristics, preferences and circumstances. Several covariates are therefore included in the probit and GLS regressions. A list of these independent variables and their summary statistics are provided in the appendix (see table 12). Demographic information on age, marital status and sex is included. Also, the logarithm of permanent household income measured as the average per capita income of the household members over the available survey waves is one of the independent variables. Furthermore, education levels are taken into account as well as the degree of self-reported bad health to reckon with longevity. Moreover, the particular occupational pension fund an individual belongs to is included.

It should be noted too that I restrict my sample to household heads. This is done in order to improve the quality of the assets information. Secondary household members often provide less precise financial information.

One independent variable has to be highlighted here. To test whether respondents truly understand the Dutch PAYG system some regressions control for the expectations regarding the average age at which people will retire within ten years. If the marginal effect on savings of this subjective probability variable is negative and takes away (some of) the negativity of the marginal effect of the later benefits probability, it can be concluded that individuals confuse the AOW-eligibility with a retirement age. The descriptives regarding several retirement expectations can be found in table 5. Figure 10 in the appendix shows the development over time of these various retirement age probabilities. Respondents apparently have similar expectations regarding the retirement age and the AOW-eligibility age (compare with table 3). The simple correlation between the probability that the AOW-eligibility age will go up by two years and the probability that retirement age will go up by two years is .69.

Table 5: Average expectations regarding the future of the retirement age within ten years (Source: Pensionbarometer all)

Retirement expectations	Obs.	Mean	St.Dev.
Prob. of two years later retirement	3,297	.47	.29
Prob. of later retirement	3,301	.61	.29
Prob. of earlier retirement	3,296	.10	.16
Prob. of two years earlier retirement	3,296	.06	.14

5 Empirical results

This section discusses the results of the empirical analysis. Tables 6, 7, 8, 9 and 10 give an overview of selected coefficients and standard errors of the independent variables estimated in the different random effects regression models. The summary statistics of all dependent and independent variables can be found in tables 11 and 12 in the appendix.

5.1 Participation in voluntary pension schemes

To obtain a first impression of the relationship between subjective expectations regarding policy changes in old age social security and savings behavior, this subsection discusses participation in voluntary pension schemes. I have performed random effects probit regressions on the participation of individuals in designated voluntary pension schemes. The results are displayed in tables 6 and 7. In this setting, assets are defined as voluntary second pillar pension contributions and/or voluntary third pillar pension products (see section 4.1 for a description).

Table 6 presents coefficients and statistics for separate regressions of participation in a scheme on the three policy change expectations indicators. Note that all variables in table 12 are controlled for. All three expectations variables have positive marginal effects at the mean on participation in a voluntary pension scheme. The coefficients displayed for the lower and later benefits regressions are both large and significant. An individual's subjective probability of a two years higher eligibility age seems most influential, but this has to be checked in a regression including all three variables. The coefficient for the consistent-belief-in-contributions-dummy is small in size and insignificant.

Table 7 controls for the other expectations. The first column shows coefficients and standard errors of the model including all three expectations variables. The only difference between the second and first column is that the average probability variables used in the second column did not take into account the 0.50 probability answers. This regression was run to see whether excluding the 0.50 answers alters the results.

The results in the first column show that even conditional on the other

Table 6: Coefficients of RE probit regressions of participation in either voluntary second and/or third pillar pensions I

	(1) Part.	(2) Part.	(3) Part.
Prob. of ten percent lower benefits within ten years	0.719*		
	(0.339)		
Prob. of two years higher eligibility age within ten years		1.506***	
		(0.384)	
Dummy consistent belief contributions within ten years			0.0251
			(0.218)
N	1,892	1,892	1,892
aic	1748.9	1735.7	1748.6
chi2	147.0	.	149.0
rho	0.936	0.940	0.935

Standard errors in parentheses

* p<.05, ** p<.01, *** p<.001

All variables in table 12 are controlled for

expectations all expectations coefficients have positive values. The probability assigned to later benefits has the largest and most significant marginal effect at the mean on participation in a voluntary pension scheme. The coefficient belonging to ten percent lower benefits is also significant. The dummy for consistently believing in contributions is still insignificant when controlling for the other expectations. All coefficients are however larger in size than in table 6.

Excluding the .50 answers in compiling individual time-invariant probabilities doesn't alter the general analysis. The coefficients of all expectations indicators are again positive. An individual's probability of ten percent lower benefits when the .50 answers are excluded has a smaller and insignificant effect on participation when the .50 answers are included. The marginal effect at the mean of the probability of later benefits is also smaller but significant when the 0.50 answers are ignored. The coefficient of the dummy of a consistent belief in contributions by the elderly has changed substantially; It is larger and much more significant. This is surprising as the variable itself doesn't change.

This subsection hence presents initial evidence that individuals actually adapt their behavior concerning the participation in pension schemes according to their subjective expectations of changes in old age social security. Note that the percentage of the error term being explained by the

Table 7: Coefficients of RE probit regressions of participation in either voluntary second and/or third pillar pensions II

	(1) Participation	(2) Participation
Prob. of ten percent lower benefits within ten years	0.834*	
	(0.396)	
Prob. of two years higher eligibility age within ten years	1.688***	
	(0.381)	
Dummy consistent belief contributions within ten years	0.339	0.970***
	(0.193)	(0.214)
Prob. of ten percent lower benefits (without .50) within ten years		0.165
		(0.393)
Prob. of two years higher eligibility age (without .50) within ten years		0.989**
		(0.348)
N	1,892	1,647
aic	1739.1	1502.9
chi2	167.9	145.1
rho	0.941	0.949

Standard errors in parentheses

* p<.05, ** p<.01, *** p<.001

All variables in table 12 are controlled for

time-invariant α_i is very large: the rho is almost .95 is all RE probit regressions.

5.2 Accumulated savings

This subsection presents more conclusive evidence on the link between subjective expectations and the level of accumulated savings. The hypotheses presented in Section 3.3 will be tested here. The log of accumulated savings serves as the dependent variable in tables 8, 9 and 10. The first table presents the results of random effects GLS regressions of savings on the controls and a single expectation variable. Table 9 features models in which all expectations estimators are included. The regressions in the last table contain interaction effects between the subjective expectation variables and the income and age group an individual belongs to.

The coefficients in table 8 already illustrate plenty about the hypotheses from Section 3.3. Individuals that assign a higher probability to lower

benefits own more wealth than others. Hypothesis one thus seems to hold if I look at one policy option expectation at a time. Respondents who assigned a relatively high probability to the event that the AOW-eligibility age would go up, save less than others. This would suggest that hypothesis three holds. This hypothesis implies that the majority of respondents prefers to work beyond the age of 64 and currently mistakes the AOW-eligibility age for a mandatory retirement age. The size of the coefficient belonging to the dummy for a consistent belief in the elderly contributing to the PAYG system is small. Apparently the link between this belief and the level of private accumulated savings is weak. This is in consensus with hypothesis five, indicating that individuals indeed prefer to work beyond the age of 64. It must be noted however that none of the expectation coefficients in table 8 have a significance level above 5%.

So far, I have only looked at marginal effects at the mean of the expec-

Table 8: Coefficients of RE GLS regressions of accumulated savings I

	(1)	(2)	(3)
	Log wealth	Log wealth	Log wealth
Prob. of ten percent lower benefits within ten years	0.590		
	(0.529)		
Prob. of two years higher eligibility age within ten years		-0.649	
		(0.512)	
Dummy consistent belief contributions within ten years			0.100
			(0.291)
N	2,850	2,850	2,850
r2_o	0.152	0.151	0.150
r2_b	0.213	0.213	0.212
r2_w	0.0236	0.0237	0.0237
rho	0.694	0.694	0.695

Standard errors in parentheses

* p<.05, ** p<.01, *** p<.001

All variables in table 12 are controlled for

tations variables unconditional on other expectations. The first column of table 9 presents the regression results when the three uncertainty indicators are all taken into account. The regression results displayed in the second column additionally control for individuals' expectations regarding the general retirement age. This variable is incorporated to check whether its inclusion changes the marginal effect at the mean of the later benefits probability. If its inclusion diminishes the negative effect this could be seen as evidence for the supposition that Dutch individuals do not properly understand the old

age social security eligibility age. The independent variables in the third column are identical to those in the first column albeit it that the average probabilities no longer take into account answers of exactly 0.50. This is done to check the sensitivity of results to respondents who are potentially giving a random answer.

When all expectations variables are included in the same regression, the marginal effects at the mean in column one of the lower benefits probability and the later benefits probability grow in size and significance compared to table 8. The results indicate that, conditional on other expectations, an individual who is sure that benefits will be ten percent lower within ten years (probability is one) has 100 percent higher savings than a comparable individual who is sure that benefits will not be ten percent lower (probability is zero). Furthermore, a respondent who is certain that the eligibility age will shift upwards by two years has 105 percent less savings than an identical person who happens to be certain that the eligibility age will not go up by two years. These percentages are very large. The coefficient of the dummy on PAYG-contributions by the elderly is still small; there is only a wealth difference of 10 percent between believers and non-believers, ceteris paribus[4].

By including the probability that the average retirement age will increase by two years the marginal effects at the mean of the lower benefit probability and of the contributions-dummy do not change in sign, size and significance. The coefficient of the later benefits probability variable however is smaller in size and the pertaining standard error is larger than in column one. The later retirement expectations variable itself has a negative but insignificant coefficient. It seems as if the negative impact of the AOW-eligibility age expectations is indeed somewhat alleviated by also considering the expectations relating to the retirement age.

The analysis broadly doesn't change when I exclude 0.50 answers from the Pensionbarometer dataset in constructing the subjective probability variables. Column three shows coefficients of the predicted sign. The coefficient of the later benefits variable is positive but a little smaller than in column one. The marginal effect at the mean of the probability of later benefits is of the same sign and size as in the first column. As the standard error is a little smaller, the coefficient is even significant at the 5% level. The dummy for a belief in contributions paid by the elderly seems to have a larger effect on savings when the 0.50 answers are excluded from the probability variables. This was also found in the participation regressions in subsection 5.1.

The relationship between social security expectations and savings

[4]The percentage change in wealth of a change in the consistent-belief-in-contributions dummy variable is calculated by the formula $100 * \Delta wealth = 100 * \{exp(\beta_3) - 1\}$ as Halvorsen and Palmquist (1980) suggest.

Table 9: Coefficients of RE GLS regressions of accumulated savings II

	(1) Log wealth	(2) Log wealth	(3) Log wealth
Prob. of ten percent lower benefits within ten years	1.004 (0.577)	1.111 (0.590)	
Prob. of two years higher eligibility age within ten years	-1.048 (0.558)	-0.656 (0.713)	
Dummy consistent belief contributions within ten years	0.0916 (0.292)	0.0848 (0.292)	0.363 (0.311)
Prob. of two years higher retirement age within ten years		-0.671 (0.760)	
Prob. of ten percent lower benefits (without .50) within ten years			0.834 (0.584)
Prob. of two years higher eligibility age (without .50) within ten years			-1.051* (0.535)
N	2850	2850	2497
r2_o	0.156	0.157	0.155
r2_b	0.216	0.217	0.210
r2_w	0.0236	0.0236	0.0234
rho	0.694	0.694	0.692

Standard errors in parentheses

* p<.05, ** p<.01, *** p<.001

All variables in table 12 are controlled for

presumably depends on someone's personal situation. Table 10 therefore presents the results of regressions with income and age group interaction effects. Income was chosen for two reasons. First, the theoretical model developed in Sections 3.1 and 3.2 uses income as a proxy of preferences to work in older ages. Hence, it is interesting to see what role income plays in the real world. Second, a low income might generate liquidity constraints and hence could render it impossible to adapt savings according to an individual's policy uncertainty expectations. Age was chosen to investigate two hypotheses. First, the elderly are closer to or in retirement and will therefore have less to do with a possible new social security system. Their adaptation of savings behavior might hence be different. Second, the young could be less inclined to adapt savings as retirement is still far away and as they hence suffer most from myopia.

Column one of table 10 displays the regression with income group inter-

action, while column two displays the regression with age group interactions. The table only displays those interaction variables of which one of the coefficients has a t-value over 1.96. In both regressions the simple coefficients of the three expectations variables have the same signs as in the regressions without interactions.

When income groups interactions are allowed for, the simple coefficients of the lower and later benefits expectations variables are larger than in table 9, namely 1.9 and -3.4 respectively. The marginal effect at the mean of the expected eligibility age indicator is moreover significant at the 1% level. Two interaction terms have significant and positive coefficients: the probability of later benefits for the low income group and the same probability for the low middle income group. The other income interactions have no significant effect on savings. Individuals who assign a higher probability to a higher AOW-eligibility age whose household income falls in the bottom two income groups thus have higher overall savings. Individuals who are pessimistic about the AOW-eligibility age who belong to the upper three income groups however have lower overall savings. These results are exactly as predicted in the theoretical model in which individuals didn't properly understand the old age social security system. Low income individuals, who are assumed to have a higher preference for retirement, will not work beyond the age of 64 anyway and will hence save more to mitigate the potential income effect of not receiving benefits in the first period of retirement. High income individuals, who are assumed to have a preference for work, will choose to lower savings according to their eligibility age expectations only when they misunderstand the eligibility age as a mandatory retirement age.

In the regression that includes age group interactions not many significant indicators were found. The interaction effect of the belief-in-contributions-dummy for the youngest group of respondents is significant however. The marginal effect at the mean of the expectations variable for higher tax rates for those over 64 is negative and large for this group. This is not a prediction of the theoretical model.

I can now draw conclusions on the hypotheses written down in Section 3.3. It should be emphasized here that the presented explanations of observed behavior are suggestions rather than an inconclusive truth about the relationship between policy uncertainty in old age social security and savings behavior.

1. The first hypothesis cannot be rejected. The coefficients of the probability for lower benefits variables are positive and large in all the performed regressions. Hence, individuals that assign a higher probability to the occurrence of a decrease in benefit levels have higher savings. This is in accordance with rational, forward-looking behavior.

2. The second hypothesis cannot be rejected for low-income individuals.

Table 10: Coefficients of RE GLS regressions of positive accumulated savings with interaction effects

	(1) Log wealth, income	(2) Log wealth, age
Prob. of ten percent lower benefits within ten years	1.900	0.970
	(1.273)	(0.844)
Prob. of two years higher eligibility age within ten years	-3.383**	-0.635
	(1.255)	(0.810)
Dummy consistent belief contributions within ten years	0.296	0.545
	(0.634)	(0.427)
Low income group X prob. later	4.415*	
	(2.044)	
Low middle income group X prob. later	3.963*	
	(1.695)	
Agegroup 20/29 * contributions dummy		-3.199**
		(1.145)
	(0.910)	
Low income group	-2.438	-1.245*
	(1.257)	(0.603)
Low middle income	-1.539	-0.787
	(0.942)	(0.436)
High middle income group	0.660	1.161**
	(0.946)	(0.433)
High income group	0.182	1.467**
	(1.032)	(0.495)
Age group 20/29	-2.707***	1.961
	(0.561)	(1.399)
Age group 30/39	-1.324***	-0.236
	(0.344)	(0.766)
N	2,850	2,850
r2_o	0.163	0.167
r2_b	0.228	0.230
r2_w	0.0237	0.0287
rho	0.694	0.692

Standard errors in parentheses

* p<.05, ** p<.01, *** p<.001

All variables in table 12 are controlled for

As the regression with income group interactions indicates, low income individuals that assign a higher probability to the possibility of an upward shift in the eligibility age have higher savings. The theory developed in Section 3.2 suggests that this group could correspond to those individuals who would not choose to work in the 'second' period anyway.

3. The third hypothesis cannot be rejected either. All accumulated savings regressions show negative coefficients for the probability to later benefits variable. The very significant and large negative coefficient for middle to higher income individuals is in accordance with the theoretical predictions. This group is assumed to be most likely to work in older ages if they have the opportunity. Thus I conclude that individuals that assign a higher probability to the possibility of an upward shift in the eligibility age have lower savings because they would choose to work in the 'second' period if they have the opportunity and because they mistakenly perceive the eligibility age as a mandatory retirement age.

4. Weak evidence is found for hypothesis four; individuals who assign a higher probability to the occurrence of proportional contribution to the PAYG system by the elderly have higher savings. Although all coefficients found for the dummy representing a consistent belief in future contributions for the elderly are positive these are usually small.

5. More evidence is found in accordance with hypothesis five. As the coefficients for consistent-belief-in-contributions-paid-by-the-elderly dummy are never significant in the savings regressions and furthermore small in size, this hypothesis cannot be rejected. So, individuals that assign a higher probability to the occurrence of proportional contributions to the PAYG system by the elderly do not significantly adapt their savings to this probability. In the theoretical model this implies that older individuals would hence choose to work if they perceive they have the opportunity.

6 Conclusion and policy recommendations

This paper has presented empirical evidence that individuals adapt savings according to their subjective expectations of changes in the old age social security system. Which policy option is considered matters for the sign of the relationship. Individuals who assign a higher probability to the event that social security benefits will be lower in the future have accumulated higher savings. Individuals in lower income groups who assign a higher probability to the event that the benefits eligibility age will go up also have higher sav-

ings. However, individuals in middle and high income groups who assign a higher probability to this event actually have lower wealth than others.

A theoretical model is developed in this paper to explain this empirical phenomenon. The Dutch public seems to be confused about the true meaning of the benefits eligibility age. If individuals misinterpret this age as a mandatory retirement age, which it is not, they could perceive a shift in the eligibility age as additional time to earn a labor income in. If one would moreover choose to work in this period, savings should be lower for those that assign a higher probability to receiving benefits at a later age. Expectations regarding the policy option to let the elderly contribute to the PAYG system do not seem to have an impact on savings behavior.

Hence, the DHS and Pensionbarometer respondents adapt their accumulated savings to their policy uncertainty expectations in a sophisticated way although they do not completely understand the old age social security system. I don't believe individuals are making the exact calculations to decide on their savings behavior, but rather that some deep mechanism is at play like Feldstein (1974) already described it.

> "*The household's implicit evaluation of social security benefits is likely to reflect their perception of the current standard of living among social security annuitants and of the way in which this has changed in the past. Note that households may therefore be able to respond appropriately to changes in social security without being able to calculate or articulate the value of benefits.*" (Feldstein, 1974, p. 913)

Policy-makers and politicians can learn from the analysis in this paper. The public debate on the future sustainability of old age social security in the context of ageing influences individuals' expectations and these expectations subsequently relate to savings. Politicians have to be aware of these side-effects of putting ageing on the political agenda. Managing the expectations in a prudent way should be an element of responsible government. I furthermore hope policy-makers will take the differential impact of different policy options on the accumulation of savings into account when they eventually decide which policy option to choose to cope with the sustainability problem. Note that these differential effects do depend on the particular institutions in a country. Which policy option might decrease savings in The Netherlands, might not so in other places.

This paper should be seen as a first exploratory investigation into the area of expectations of policy changes in old age social security and savings. The theoretical model provides a potential explanation of the marginal effects of expectations on savings. More research has to be done however to validate this theory. For this, longitudinal expectations information is

needed as well as more reliable wealth data. The analysis should furthermore be expanded using second pillar pension data. In future, I hope to have access to more Pensionbarometer waves and to administrative wealth records. The economic literature would furthermore benefit from a a macroeconomic and/or macro-econometric analysis of the relationship between old age policy uncertainty and savings.

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A Summary statistics

Table 11: Descriptive statistics of dependent and important independent variables for all observations in the aggregate savings regression (N=2,850)

Variable	Mean	Std. Dev.	Min	Max
Participation in voluntary pension scheme (N=1,892)	0.395	0.489	0	1
Log wealth	10.471	4.728	-13.56	15.79
Prob. of ten percent lower benefits within ten years	0.364	0.269	0	1
Prob. of ten percent lower benefits within ten years (without 0.50) (N=2,497)	0.347	0.287	0	1
Prob. of two years higher eligibility age within ten years	0.435	0.282	0	1
Prob. of two years higher eligibility age within ten years (without 0.50) (N=2,497)	0.419	0.314	0	1
Prob. of two years higher retirement age within ten years	0.443	0.261	0	1
Dummy consistent belief in contributions paid by the elderly within ten years	0.552	0.497	0	1

Table 12: Descriptive statistics of control variables for all observations in the aggregate savings regression (N=2,850)

Variable	Mean	Std. Dev.	Min	Max
Log permanent household income	10.438	0.644	0	12.38
Low income group (0/18,566)	0.100	0.300	0	1
Low middle income group (18,598/ 27,513)	0.232	0.422	0	1
Middle income group (27,763/ 37,500) (omitted)	0.218	0.413	0	1
High middle income group (37,742/52,067)	0.240	0.427	0	1
High income group (52,101/237,340)	0.210	0.408	0	1
Female	0.180	0.384	0	1
Married (omitted)	0.640	0.480	0	1
Divorced	0.073	0.261	0	1
Living together	0.059	0.236	0	1
Widow	0.039	0.194	0	1
Never married	0.188	0.391	0	1
Agegroup 20/29	0.032	0.175	0	1
Agegroup 30/39	0.154	0.361	0	1
Agegroup 40/49	0.224	0.417	0	1
Agegroup 50/59 (omitted)	0.272	0.445	0	1
Agegroup 60/69	0.176	0.381	0	1
Agegroup over 69	0.144	0.351	0	1
Datawave 2001 (omitted)	0.094	0.291	0	1
Datawave 2002	0.129	0.336	0	1
Datawave 2003	0.162	0.369	0	1
Datawave 2004	0.181	0.385	0	1
Datawave 2005	0.217	0.412	0	1
Datawave 2006	0.216	0.412	0	1
Primary education (omitted)	0.028	0.164	0	1
Secondary education	0.329	0.470	0	1
Vocational education	0.184	0.388	0	1
Tertiary education	0.442	0.497	0	1
Other education	0.016	0.127	0	1
Average health status (1=very good, 5=very bad)	2.117	0.606	1	5
Partner	0.692	0.462	0	1
Pensionfund ABP (government)	0.306	0.461	0	1
Pensionfund PGGM (health care)	0.088	0.283	0	1
Pensionfund Bank	0.034	0.182	0	1
Pensionfund Multinational	0.068	0.251	0	1
Pensionfund Construction and Metal	0.126	0.332	0	1
Pensionfund Retail	0.029	0.168	0	1
Pensionfund other	0.349	0.477	0	1

B Tables and figures

Table 13: Number of observations in Pensionbarometer

Week and year	N
19-2006	1,355
23-2006	1,410
29-2006	436
33-2006	491
38-2006	649
42-2006	563
50-2006	587
2-2007	515
6-2007	523

Figure 4: Ageing and the relative cost of PAYG pensions (AOW) in The Netherlands (Source: SVB)

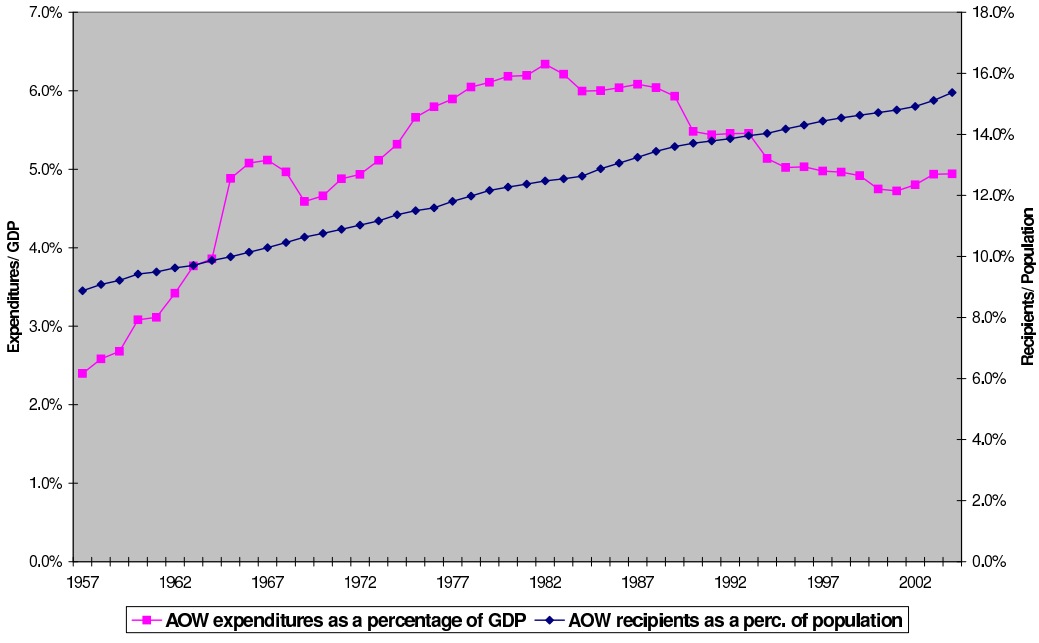

Figure 5: Histogram logarithm of aggregate savings (Source: DHS sample, N=2,850)

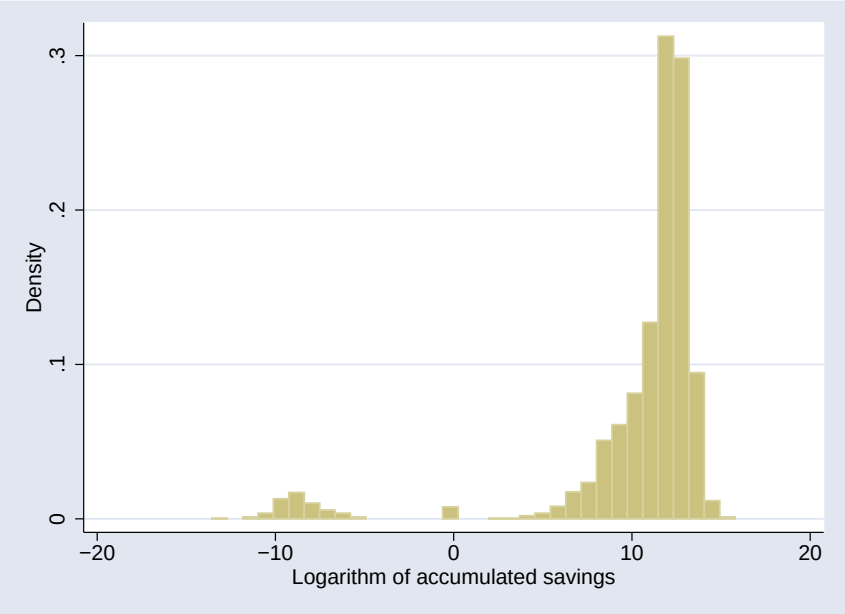

Figure 6: Average probability of changes in the level of AOW benefits within ten years (week 1-52: 2006, week 53-75: 2007)(Source: Pensionbarometer all)

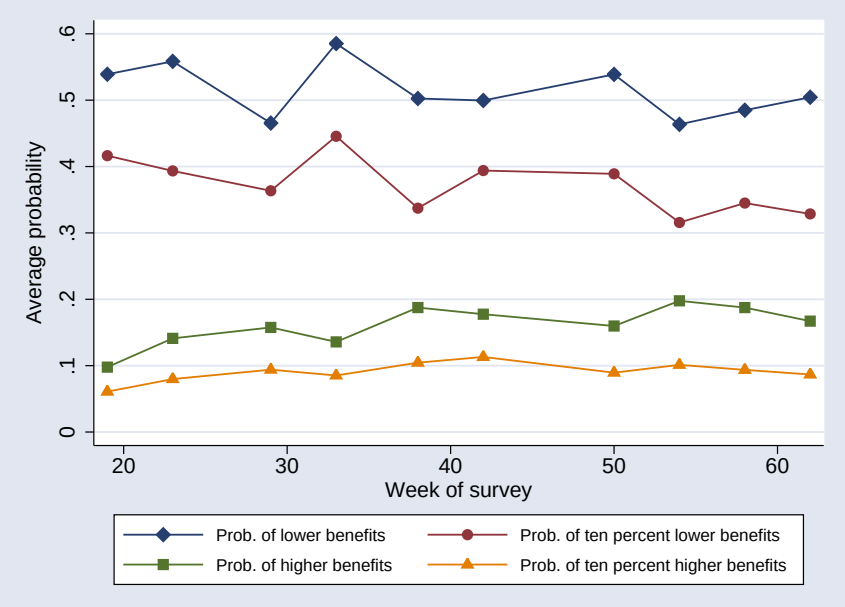

Figure 7: Average probability of changes in the AOW eligibility age within ten years (week 1-52: 2006, week 53-75: 2007) (Source: Pensionbarometer all)

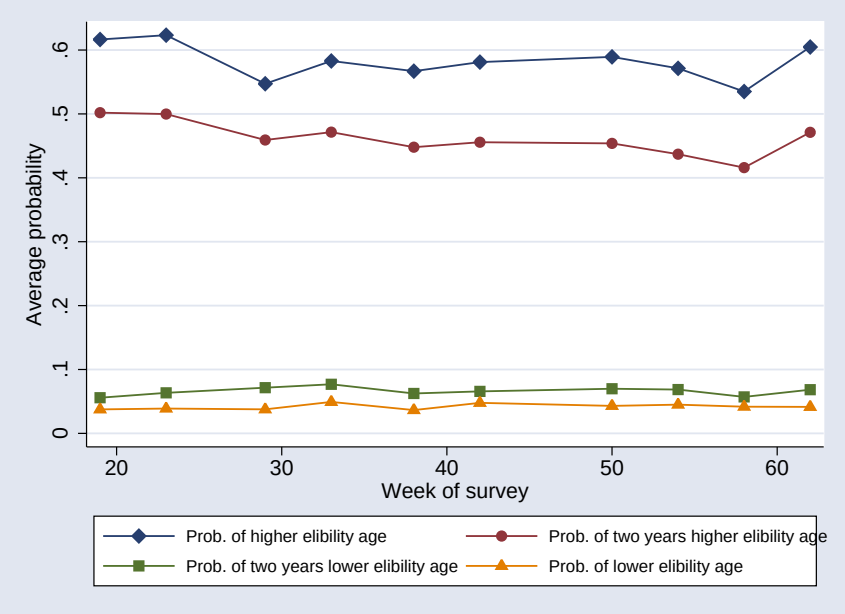

Figure 8: Histogram of averaged prob. of ten percent lower benefits within ten years (Source: Pensionbarometer sample, N=837)

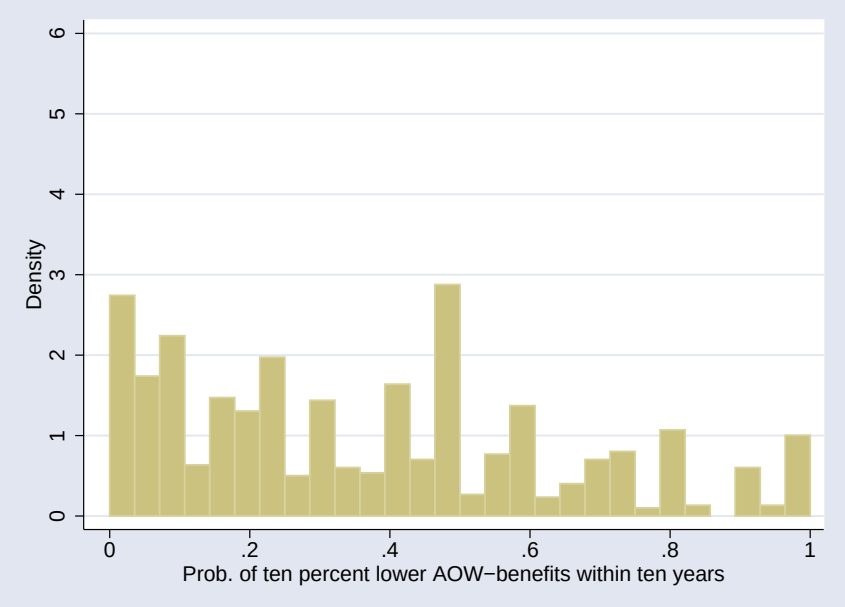

Figure 9: Histogram of averaged prob. of two years later benefits within ten years (Source: Pensionbarometer sample, N=837)

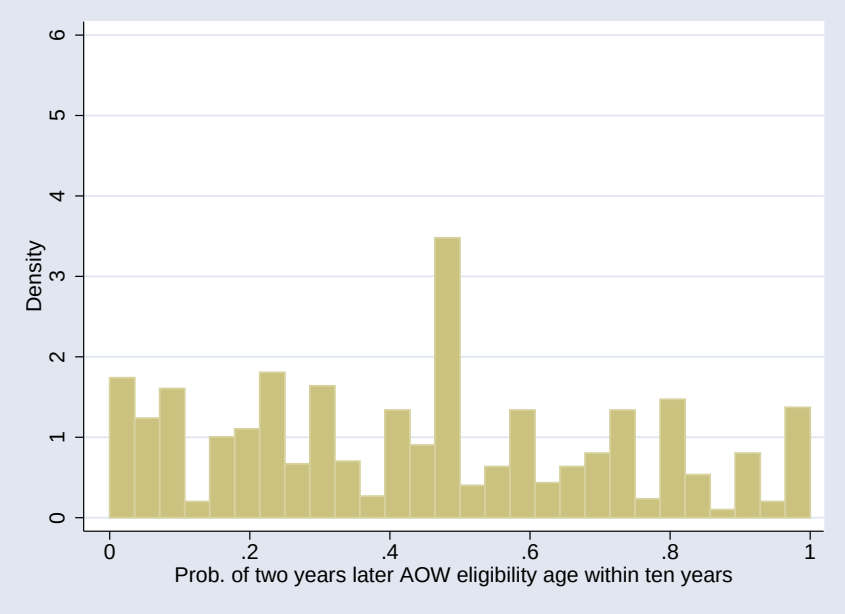

Figure 10: Average probability of changes in the retirement age within ten years (week 1-52: 2006, week 53-75: 2007)(Source: Pensionbarometer all)