CPB Discussion Paper

No 118

January 2009

Pension Plans and the Retirement Replacement Rates in the Netherlands

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ISBN 978-90-5833-390-2

Abstract in English

This study examines the expected retirement replacement rates of several cohorts of Dutch employees at the time of their planned retirement. It also imputes the actual replacement rates based on available pension records. We find that using reasonable indexation rates, the expected replacement rate is higher than the one we compute. Larger discrepancies are found for younger cohorts. We decompose the difference between the two replacement rates and find that the mismatch is related to poor institutional knowledge for the whole sample. We also show the role of assumptions on institutions and wage profiles in determining our results.

Key words: Replacement rate, expected retirement, Oaxaca decomposition

JEL code: J2, D84, D83

Abstract in Dutch

Dit paper onderzoekt voor verscheidene cohorten van Nederlandse werknemers de verhouding tussen het laatst verdiende loon en het pensioen. De auteurs berekenen die verhouding op basis van pensioengegevens die de individuele werknemers zelf hebben verstrekt. Gebruik makend van verschillende indexeringsvoeten voor de lonen blijkt deze verwachte verhouding van respondenten hoger uit te komen dan uit de berekeningen blijkt. De verschillen zijn groter bij jongere werknemers. Dit verschil heeft voornamelijk te maken met de geringe kennis over pensioenregels bij respondenten. Dit paper toont ook aan hoe gevoelig deze resultaten zijn voor onze aannames over indexatie en loonprofielen.

Steekwoorden: Replacement rate, verwachte pensionering, Oaxaca-decompositie

Contents

Summary

We study the relationship between individual expectations of retirement replacement rates at planned retirement age and the computed replacement rate at the same age. As a study case we analyze the Netherlands. We have chosen this country because panel data are available for these variables, and because institutional changes have already been implemented, which are currently being discussed in many countries.

Jappelli, Padula and Bottazzi (2006) show that Italians expect higher replacement rates relative to what they will receive, but they do not research the causes of this overestimation. We show that also for the Netherlands this is mostly the case, but we also show that this result can be generated by *ad hoc* assumptions. Differently from the Italian study we check the sensitivity of the results to assumptions concerning indexation, wage development and the institutional setting. We also show that lower replacement rates can be due both to lower then expected pension benefits, but also to higher than expected pre-retirement income. As to the causes we find evidence that most of the overestimation is due to ignorance of pension institutions. Evidently the origin of the mismatch is relevant to decide whether policy intervention is needed or not.

At first sight it seems plausible to expect a consistent relationship between retirement age and the replacement rate. Our computations show that this need not be the case.

As we want to study how relevant assumptions are in determining the results, the pension benefit is computed under different scenarios. This is also needed, due to the partial lack of wage records that must be imputed. We study the cases in which individuals apply correctly pension rules, mistake the level of the intra-household allocation of the social security benefit (AOW), or mistake early retirement rules with those applied at age 65.

We notice for instance that individuals tend to overestimate their replacement rate already for low levels of indexation. The overestimation of the replacement rate is about 3 to 7% point for the case in which we apply the correct pension formula. When the indexation rate is as high as 5% the net replacement rates that we compute are much lower than those expected. We get results more in line with expectations when we allow for ‘mistakes’ like the inclusion of the spouse-dependent AOW in the head’s benefit, or the prolongation of pension rights as if one would retire at age 65. Also in these two cases the replacement rates is below expectations when the indexation is about 5%, but it is not below this level. In addition these mistakes affect differently the different cohorts. The youth is the one cohort that most would benefit by prolonging working life to age 65.

1 Introduction

This study examines the expected and actual retirement replacement rates in the Netherlands. We have chosen this country because panel data are available for these variables, and because institutional changes have already been implemented, which are currently being discussed in many countries. Our results are based on survey data on individuals' expectations about retirement replacement rates that are then compared with 'actual' replacement rates. We compute the latter by applying all relevant institutional rules. Since this measure is imputed, we will check the sensitivity of our results to the different assumptions and scenarios that we make.

In this study we show that there is no clear relationship between planned retirement age and expected replacement rate. But should we expect a clear relationship between planned retirement age and expected replacement rate? And does the expected replacement rate correspond to perspective realizations? If not, where do the mismatches come from? And are these of such relevance to request policy intervention?

In many countries, policies aimed at inducing individuals to work longer are currently being implemented. Examples of these policies are the reduction of the replacement rate of those who stop to work young, or allowing higher replacement rates to postponed retirement. In practice, this is being implemented, by shifting employees from a final wage system to an average wage system (like in the reform in Italy in 1993), by introducing funded early retirement schemes (like in most Northern European countries and in the US) or by giving an incentive to third pillar savings (which get fiscal facilitation in almost all countries). If there is a mismatch between anticipated and realized replacement rates, these incentives could be ineffective and individuals may end up with lower-than-expected resources during their retirement. It is well documented that free retirement savings are low in those countries with a compulsory savings system, due to a displacement effect (Alessie et al 1997). But the low retirement savings may also depend on the wrong financial planning of those who expect a post retirement income that is higher than what they will actually receive (Jappelli, Padula, and Bottazzi 2006 show that this is the case in Italy). In the Italian study however the causes of the mismatch, nor the assumptions that deliver the finding, are being researched. We do so in this study.

Low retirement replacement rates in the future, or anyway lower than currently expected, could be the result of higher than expected wage increases prior to retirement, bad institutional knowledge or uncertainty about the development of future wages between the current period and the moment of retirement. Any of those explanations is of different interest to policy makers.

Studies from the US (Bernheim, Skinner, and Steven 2001) and from the UK (Banks, Blundell, and Tanner 1998) suggest that the commonly observed post-retirement dip in consumption comes as a surprise to many people. These results have been challenged by two main arguments[1]. The first is that the pseudo-panels used in these studies are not adapt to reach such a conclusion (Hurd and Rohwedder, 2006). The second argument is more related to this study and says that it is the *expected consumption* outcomes that matters (Hurd and Rohwedder, 2003). If market consumption falls, this could have been anticipated. Such falls may also not apply to full consumption (Apps and Rees, 2001), as retirees spend more time in producing goods at home.

From the discussion above, it follows that it should be of interest to examine expected retirement replacement rates, as this measure is directly related to the anticipations of post retirement income/consumption. In addition, this income measure abstracts away from home production and exclusively focus on the anticipations of market income. This is also the contribution of the current study to the literature, as we bring about new evidence that concerns a relevant variable, so far hardly studied empirically (an interesting exception is Jappelli, Padula, and Bottazzi 2006), without encountering the methodological problems that emerge when looking exclusively at consumption. As a by-product of the analysis, we contribute to the literature concerned with public understanding of pension reforms.

As a preview of the results, we show that assumptions concerning institutional parameters can determine the results, while retirement studies don't always take this into account. We find larger overestimations of the retirement replacement rate for the youth while the elderly anticipates it better when closer to retirement. For the youth, lower replacement rates are due both to their willingness to retire before age 65 and to their perspective high pre-retirement income. Most of the mismatch between expectations and perspective realizations are due to ignorance of pension institutions, rather than uncertainty about future outcomes (future wages for instance).

In Section 2, we introduce the DNB Household Survey. We devote Section 3 to the literature. Section 4 describes the Dutch retirement institutions. Our methodology is described in Section 5. The results will be discussed in Section 6. Section 7 discusses the results and Section 8 summarizes and concludes.

[1]For a survey see Hurst (2008)

2 Data & descriptive analysis

The DNB Household Survey (DHS), formerly known as the CentER Savings Survey is collected annually since 1993. We use 14 waves covering the period 1993-2006[2]. The survey focuses on savings but it also covers a wide range of topics such as household background characteristics, labor market conditions, health, income, and psychological concepts. We have about 4000 observations with non-missing item responses on the questions regarding income, expected retirement age and replacement rate. The question about planned retirement age is asked in the first 9 waves only to those above 50. This reduces the sample size. If we only look at income, which is the basis for the computation of the pension benefit, we can use up to 26000 observations. These observations are used in the wage model to predict future and past income. The focus of our paper is on the questions about expectations in the DNB Household Survey, which are formulated as follows:

1. At what age do you expect to retire, or to make use of the early retirement arrangement?
2. How much do you expect your net retirement pension (including general old-age pension) to be (in percentages) in relation to the net income you will have just before you retire?

Figure 2.1 Expected net retirement replacement rate over planned retirement age and its frequency

Source: DHS, own computations. Sample period 1993-2006; 4157 observations.

[2] For a detailed description of the survey see http://www.centerdata.nl/en/

In figure 2.1, we plot replacement rate expectations over planned retirement age, and show the unconditional distribution of expected retirement age (vertical axis on the right). The latter shows the usual peaks at certain ages, as found in most countries, due to pension and social security regulations.
There is no clear direction in the relation between planned retirement age and expected replacement rate. At this stage of the analysis it is not possible to tell whether this result is plausible. At the individual level, we would expect a positive relationship, as the new Dutch pension system rewards postponing retirement. Here, however, average figures are shown and it is possible that those planning to retire early have more attractive early retirement schemes, while those retiring later may have had shorter careers (this being the reason of longer planned participation) and therefore expect lower replacements.

A second issue is that expectations of replacement rates are around 70% for all. This is not very surprising as this is the target figure of the main Dutch pension funds, and therefore this replacement rate is considered as a sort of goal for their retirement by most employees (van Els, van den End, and van Rooij 2003). Most funds have actually designed their contribution plans in order to get to the 70% benchmark for a median career worker.
Notice, however, that this benchmark is related to gross income. Net replacement rates are typically much higher (Kerkhofs, Lindeboom, and Theeuwes 1999), up to 80-90%. This is due to the fact that retirees do not pay social security and pension premiums. This suggests that the expectations of net replacement rates in figure 2.1 are in general lower then realizations in the past. These are however more in line with current realizations. Statistics Netherland (CBS) reports retirement replacement rates for several segments of the population in 2005. Statistics Netherlands reports that currently replacement rates of male employees with median wages vary between 46 (first generation elderly immigrants) and 87% (middle aged Dutch natives). These numbers are lower for women. This indicates that a substantial part of the Dutch population does not reach the target of 70% already in 2005, and that only a selected group of the population, middle aged Dutch-native men, still comply with the high net replacement rate documented in the 90's. The decline in 2005 is remarkable as both the shift to the middle wage system and the exemption from the payment of social security premiums (for above median income) had taken place shortly before. When these changes, together with stricter rules for early retirement eligibility, will fully be in place, the replacement rate should be expected to fall even further.

If individuals are not aware of these institutional changes, these replacement rates lower than those historically observed may be due to the incidence of the tax system. Individuals may not be familiar with it and report a gross replacement rate when asked about a net one. If, on the contrary, individuals are familiar with pension institutions, these lower than expected replacement rates could be the result of a competent evaluation, based on the individual records of the respondents. If many individuals plan to retire before the normal retirement age, net replacement rates lower than 80% are definitely plausible as the reforms of the last decade have penalized early retirement.

Table 2.1 **Individual believes about current pension system participation**

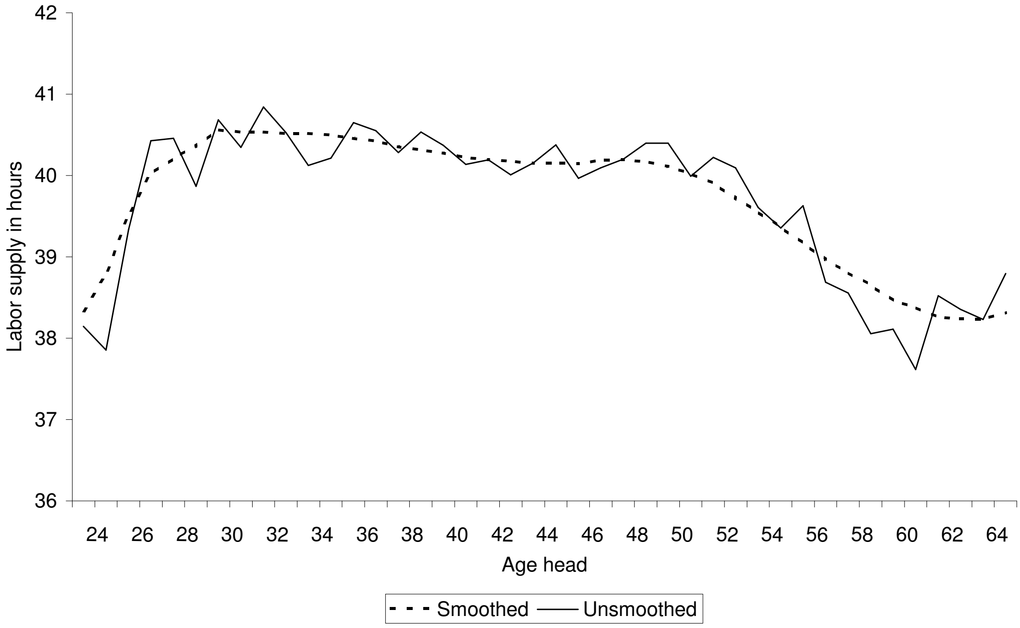
Year	Final wage	Average wage	Available premium	N
2003	81%	6%	12%	568
2004	43%	52%	5%	632
2005	29%	65%	5%	611
2006	22%	74%	5%	579

Source: DHS, own computations.

Information about knowledge of the pension system is also present in the DHS (DNB Household Survey). Respondents are asked whether their pension will be computed using the available premium, average earnings or final earnings. The latter system was abandoned by several large pension funds in 2004. Table 2.1 shows that this is not well understood by the members of these funds. About a quarter still thinks, 3 years after the introduction of the average earnings system that the previous regime is still into play.

The data also reveals that those heads of the household that are employed in our sample do not change their labor supply much over age (see figure 2.2) and still hold a full time job (at least 38 hours a week) prior to retirement. This suggests that labor supply explanations of our findings so far are not likely. Indeed lower pre-retirement wages due to reduced labor supply should generate higher, rather than lower, replacement rates.

Figure 2.2 Labour supply in hours over age of the head of the household



Source: DHS, own computations. Sample period 1993-2006; 17000 observations.

3 The Dutch pension institutions

As a great deal of this study is about correctly computing individual pension wealth, we first glance upon the Dutch retirement system. Everyone who reaches the age of 65 is entitled to a pay-as-you-go funded social security benefit or old-age pension (AOW), which constitutes the first pillar. The AOW benefit is a flat benefit linked to the minimum wage. It is not linked to one's employment history and varies only depending on whether one has a partner and the partner's income status. In order to make our measure of the AOW more realistic, we explicitly account for survival of both partners.

Besides the first pillar, an occupational pension is also available. This pension is exclusively based on final earnings (before 2004) or on a mixture of final earnings and average earnings (from 2004 onwards). We also adapt the institutional parameters (accrual etc…), to these institutional changes. In Section 5 we formally show the relationship among these variables. There are special arrangements for individuals that want to retire before the age of 65. While these arrangements differ greatly among pension funds they have (since recently) a certain degree of actuarial fairness in common. We show is Section 5 how this institutional feature is incorporated into our computations. The first two pillars combined aim at a replacement rate of about 70% of the final gross wage after about 40 years of contribution.

In the pension system based on the last wage it was more or less standard practice that pensions were fully indexed to prices or wages. Employees build up entitlements of 1.75% of the final wage each year for 40 years (up to a theoretical maximum of 70%). In the average wage system, employees build up entitlements as a percentage of their current wage. By subsequent indexation to prices and wages, these entitlements can grow up to a certain percentage of the average wages upon retirement (van Ewijk 2005).

Some individuals saved or bought annuities to finance their pension. These are third pillar private savings funded by the individual, such as mutual funds or life insurances. In this study we will concentrate on the first and second pillar of the Dutch pension system and will only glance on the data on private savings.

3.1 Literature and contribution of present study

There is a large literature on retirement expectations data. For a general survey, see Manski (2004). The degree of information concerning one's pension is analyzed for instance in the study on retirement age by Bernheim (1987) and retirement benefits by Gustman and Steinmeier (2001). Boeri, Bőrsch-Supan, and Tabellini (2001) shows that only a small group is well informed about the future pension treatment (middle aged, richer, more educated, tenured males). Matches between expectations and realizations are analyzed, for instance, by Hurd and Rohwedder (2003) (post retirement consumption), Dominitz, Manski, and Heinz (2002) (retirement age), Mastrogiacomo (2004) (post retirement financial wealth) Jappelli, Padula, and Bottazzi (2006) (displacement between private and compulsory savings).

In a study for the Netherlands, van Els, van den End, and van Rooij (2004) investigate what Dutch households know about their own pension provisions. They conclude that most households don't know how to compute their retirement income. This makes it interesting to examine whether individuals overestimate or underestimate their replacement rate.

The study by Jappelli, Padula, and Bottazzi (2006) is the one most related to the present paper, as it also exploits information about the expected replacement rate. We extend their study in two different directions. First, some of the groups in their data tended to overestimate their pension benefits, but the authors do not analyze the causes of this overestimation. We therefore attempt a decomposition of the mismatches between expected and computed replacement rates as due to poor knowledge of institutions rather then uncertainty about the future income profiles. Second, they assume a stylized employee (who retires at age 60, with 35 years of contribution, has fixed wage increase of 2% and is exposed to fixed growth rates of 1.5%). While this is functional to their analysis, we enquiry the sensitivity of our outcomes to these strong assumptions. In an actuarially fair system, retirement age is a strong determinant of retirement benefits. Notice further that a higher expected replacement rate after a restrictive reform may seem irrationally optimistic, but could also be a rational expectation of those who believe that the pension reform will generate higher growth rates. Sensitivity analysis on these parameters is therefore relevant. There is an uncountable number of studies that compute pension wealth under simplifying assumption concerning income profiles, indexation and institutional settings (see Gruber and Wise (2005) for references). We show how these simplifications can strongly affect results.

4 Multivariate analysis

One way to understand if the relation in figure 2.1 is consistent is to look at individual pension records and compute the retirement replacement rate. We need to apply the formula that is used to actually compute pension benefits. This differs depending on the pension regime. To appreciate the conceptual difference between the two regimes we write the pension formula for those planning to retire at age 65, which is the simplest, highlighting two different time periods:

$$\begin{cases} B_{65} = \left(O_{65} * a_{65}\right) * \left(w_{64} - f_{64}\right) + AOW_{65} & \text{if year} < 2004 \\ B_{65} = \sum_{t=2004}^{2004+65-age} \hat{a}_t * \left(w_t - \hat{f}_t\right) + AOW_{65} & \text{if year} \geq 2004 \end{cases} \tag{1}$$

and it is a combination of both if one has worked both before and after 2004. This expression abstracts from discounting, as we assume that the interest rate and the individual discount cancel out each other (see Ventura et al 2006 for a similar approach). *B* is the benefit at retirement age. *O* is the amount of years that one has contributed into the system and *a* is the accrual rate (which also differs according to the retirement system). Income enters the formula as the difference between the wage (*w*) and the exempted part of the wage (*f*, also system dependent). *AOW* is the flat old-age benefit. Finally *age* represents current age in each period and *t* is a time indicator.

It is helpful to shift to an age indicator to explain our computations further. For those who expect to retire before age 65, we use a rule a thumb to proxy their early retirement benefit at the age at which they expect to retire (τ). The proxy is:

$$B_{\tau} = \left(\frac{v * \sum_{j=\tau}^{64} e_{j,p} * w_{\tau-1} * \left(\frac{1}{1+r}\right)^{j-\tau+1} + \sum_{j=65}^{T} B_j * \left(\frac{1}{1+0.8r}\right)^{j-65+1}}{\left(T-\tau\right) * \left(\frac{1}{1+r}\right)^{j-65+1}} \right) * \left(1 - s_{j,c}\right) \tag{2}$$

where *j* is an age indicator. Some individuals are entitled to an early retirement benefit (*v=1*). The formula includes an age and pension fund (*p*) dependent replacement rate (*e*) computed for each main Dutch pension fund (Euwals et al 2004) that allows imputing the early retirement benefit using the last earned wage (*w*). Indexation (*r*), and survival probabilities (*s*), that are cohort (*c*) and age dependent are also included. This means that while *r* is not time dependent itself, we include this dependence by multiplying the survival probabilities into the formula (an alternative could be to use a rule of thumb, like lowering *r* with tenure). These are derived from mortality tables and survival projections of Statistics Netherlands for all cohorts of Dutch citizens. This proxy is very close to the actuarially fair computation that is carried out by the pension funds (as $\tau < 65$), but it is a proxy as some elements are excluded (like the opt out option for survival benefits).

The pension benefits are then used to compute the replacement rate (*RR*):

$$RR_i = \frac{B_{i,\tau}}{E_t\left(w_{i,\tau-1}\right)} \tag{3}$$

where both the benefit and the wage are expressed in net terms and *i* indicates the respondent. The expected wage in *t* is indexed to the year prior to expected retirement (τ-1) with the indexation *r* and using the survival probabilities *s*. Combining equations (2) and (3) we see what is the effect of *r* on *RR*.

The nominator (pension wealth) is indexed only for 80% (due to the indexation rules of the retirement system) but the denominator is fully indexed. When the indexation increases the denominator increases more than the nominator, therefore *RR* decreases. Also a higher indexation increases the difference in *RR* between young and old cohorts. The elderly is closer to τ relative to the youth and they index few years of employment and (partially) index many more years of retirement. The youth, on the contrary (fully) indexes approximately the same amount of years prior to retirement (which makes the denominator of the RR relatively larger as *r* increases) and after (with a lower index). As the indexation rate increases, the RR of the youth will become lower relative to the one of the elderly. Notice that an indexation of pensions by 80% is a rule of thumb, as pension indexation is not compulsory in the Netherlands.

None of the elements introduced above are known with certainty. This complicates the analysis and requires many sensitivity checks. Our approach is to mimic some elements of the computations performed by pension funds in their yearly prospects that they send to their members. We suppose that this is the most reliable information available to the individual. In these prospects pension funds give an estimate of *B* on the basis of guesses regarding τ. Relative to pension funds we have extra information, namely $E(\tau_i)$, $E(RR_i)$ and some clues about $E(w_{t,i})$. As we aim to compute $RR(E(\tau_i))$ will we assume that $E(\tau_i)=\tau_i$. We proceed as follows. We observe O_t and assume that respondents expect not to change their labor supply. This means that each extra year separating the individual from the $E(\tau_i)$ will increase seniority by one year. As figure 2.2 shows, this is not, on average, incorrect (most individuals keep on working full time). The accrual rate *a* is assumed to stay constant at the current level a_t=a_τ. This assumption is only problematic before year 2004 as in the old system one could opt for a higher accrual in exchange of extra transfers to the pension fund. We do not have data regarding those who exercise this option (which was not the default option). We have therefore fixed the accrual to the default level and recall the empirical (van Rooij, Kool, and Prast (2007)) evidence regarding default options in the pension domain. Further are the AOW_τ and f_τ legislated amounts that are typically adjusted due to several factors. These factors are indexations to either prices or wages or political decisions (minimum wage freezes for instance). In the sample period standard wage indexation picks up most of the evolution of these amounts over time and we have therefore conveniently indexed them at about 3% (2% indexation and 1% productivity).

The determination of the wage *E(w)* at the expected retirement moment is a more complex matter. Unlike most studies that use survey data we don't need to make many assumptions on the way individuals form expectations of wages over the future. This is due to the fact that individuals are directly asked what is their expected future wage increase in the short run and over the coming 5 years. We use the answer to the statement "*I don't expect any significant changes in household income in the next 12 months*", which we translate in a constant income for the next year, and to the question "*By what percentage do you think the total net income of your household will increase/decrease in the next year?*", which we use to determine w_{t+1}. Prior to retirement we use the answer to the question "*What will your net income per month be when you will be 65 years old?*", which we assign as the income of age 64 to those planning to retire at 65. For the period in-between we use information derived by the answer to the question "*By what percentage do you think the total net income of your household will increase/decrease in the next 5 years?*". No specific wage information is available about the past. We reconstruct wages in the past using the panel, which is some cases results into wage information that goes back 12 years in the past. Unfortunately such long wage histories are very rare in our data and we use 2 different approaches (that are often used in the literature) to determine missing past wages (and the future wages of those who did not answer some of the above mentioned questions). We however use information about unemployment spells in the past to get a reliable labor participation history for the past.

In the first approach we work with current income and combine this assumption with a spectrum of different indexations, as opposite to those studies that fix the indexation to ad hoc levels (Jeppelli et al. 2006, Burkhauser, Butler, and Gumus 2004) between 0% and 10% (these extremes are both not realistic, but indexations of 3 to 5% are used by most agencies of economic research, see OECD report 2008).
Next we estimate a range of wage equations and use the estimates to fit future wages, which are also indexed to productivity.

4.1 Continuous careers

We have corrected our wage profiles in the past to account for spells of unemployment that are reported in the data. We assume continuous careers for the future. This means that our computations will result in an overestimation of the replacement rate, as some individuals might still face some spells of unemployment in the future. This means that if we find an overestimation of the replacement rate, this will be actually less severe than it would be if we had accounted for spells on unemployment in the future.

It is worth to point out that two elements make the assumption of continuous careers less undesirable than it seems. First it is commonly used also in studies that we explicitly refer to (Jappelli, Padula, and Bottazzi (2006)). Second it seems to fit with general revealed preferences in our sample. These can be inferred both from figure 2.2 and from the survey using the answer to the following question.

Pension funds allow their participants more and more a freedom of choice on the length and the height of their pension. Often there is a possibility to pre-retire before the age of 65. Now follow four choices with regard to pensions. Which of those choices appeals to you most?
The choices were: 1) Work until the age of 59 and then pre-retire. Work until the age of 59. Receive a pre-pension of 50% of my last gross annual wage from the age of 59 to 65. From the age of 65 a pension of 70% of my last gross annual wage. 2) Work until the age of 61 and then pre-retire. Work until the age of 61. Receive a pre-pension of 78% of my last gross annual wage from the age of 61 to 65. From the age of 65 a pension of 70% of my last gross annual wage 3) Work until the age of 61, then work part time and partly pre-retire until the age of 65. Work until the age of 61. Receive a total income of 90% of my last gross annual wage from the age of 61 to 65. From the age of 65 a pension of 85% of my last gross annual wage 4) Work until the age of 65.

The second option is reported more often, while the third, that includes partial retirement, is most favored as a second option (after the above question respondents are asked to report a second and a third option as well). A comprehensive analysis of this kind of information is beyond the scope of this study. Sample frequencies suggest that full early retirement is favored relative to partial retirement until age 65. This is in line with our assumption and the evidence in figure 2.2. This does not diminish the strength of the assumption but suggests that our estimate of pension wealth (and therefore of the replacement rate) could be interpreted as an upper bound of the real one.

5 Results for replacement rates

The study of the replacement rates aims to understand whether there exist differences between the expected replacement rate and the computed replacement rate when we mimic pension institutions.

We have made some serious assumptions regarding the past and future contributions into the system. This implies that we won't be able to produce one result only concerning the difference between these two replacement rates. We will report a series of results and sensitivity checks depending on the assumptions regarding the indexation and the formation of wage expectations.

Table 5.1 Overview of the scenario's taken into account

Scenario	Future income	Institutions	Extra	Indexations (%)
Type 1	Grows at fixed rate	Final wage system		0, 1, 3, 4, 5, 7, 10
Type 2	Grows at fixed rate	Average wage system		0, 1, 3, 4, 5, 7, 10
Type 3	Grows at fixed rate	Average wage system	Adds AOW partner	0, 1, 3, 4, 5, 7, 10
Type 4	Grows at fixed rate	Average wage system	Planned retirement age to 65	0, 1, 3, 4, 5, 7, 10
Type 5	From wage equation	Average wage system		0, 1, 3, 4, 5, 7, 10
Type 6	From wage equation	Average wage system	Adds AOW partner	0, 1, 3, 4, 5, 7, 10
Type 7	From wage equation	Average wage system	Planned retirement age to 65	0, 1, 3, 4, 5, 7, 10
Type 8	Grows at fixed rate	Mixed system		0, 1, 3, 4, 5, 7, 10
Type 9	From wage equation	Mixed system		0, 1, 3, 4, 5, 7, 10

Table 5.1 shows an overview of the scenario's that we have taken into account. For each scenario-type we have checked the sensitivity to the indexation, and found that the most interesting results were reached already for an indexation rate as high as 5%. As an illustration we work with 7 indexations, namely zero, 1%, 3%, 4%, 5%, 7% and 10%. The table shows that we run 56 scenarios for each individual. Some of these depart from real institutions and assume also that individuals make 'mistakes' in computing their replacement rates.

These mistakes are meant to play around with two main variables: the height of the retirement benefit and the length of the working career. We allow therefore individuals to include the AOW of the spouse into the computation of the head's replacement rate and to apply the pension rules for retirement at age 65 also to those who retire early. For the first extension notice that it is debatable whether the total household AOW should be applied to one earner's households. But it is undisputed wrong to do so when the household has two earners. The second extension implies that individuals do not perceive the actuarial fairness of early retirement programs.

Table 5.2 Example of computation of replacement rates under two scenarios

Individual A (civil servant)

Year	2006	Expected retirement age	62
Year of birth	1956	Expected year of retirement	2018
Age	50	Expected replacement rate	65%
Current pension years	32		
Married	Yes	Year of birth partner	1952
Net wage 2006	17,433		
	Wage equation	Current income	
Computed net wage 2017	30,037	19,450	
Computed pension income 2018	18,726	14,103	
Computed replacement rate	62%	73%	

Income figures expressed in Euro (2006).

Table 5.2 shows that the computation of the replacement rate is sensitive to the scenario employed at the individual level. We show the two most extreme cases that we could compute for a random individual. The table has only an illustrative purpose as we discuss one random entry into our sample. The first scenario is based on a wage equation (indexation 3%), the second on current income (indexation 1%) to substitute for missing information concerning expected income growth. The random individual is a civil servant and expects a replacement rate of 65%.

For this individual, who only needs 12 more years to complete his career, the wage equation returns a much higher final wage relative to the current income case (to get to such a final income in this scenario we need a salary increase of 5% per year). This higher income lowers the replacement rate that we computed to 62%. When we use the current income scenario that delivers the highest replacement, we get a replacement rate of 73%. For this individual the low replacement rate is due to the high pre-retirement income rather then a drop in post retirement benefit.

We will not show the full set of results for each scenario. These are all artificially-made-up combinations of hypothesis aimed to show how results depend on the parameters assumed. We will therefore highlight some selected scenario's that allow us to describe qualitatively the effect of our assumptions on the replacement rate computations.

Table 5.3 shows the computed replacements under scenario types 2 and 5 at three different levels of indexation. We see that the youth will experience upon retirement lower replacement rates relative to the elderly while expectations don't vary much among cohorts. The table also shows that the approach we take in projecting future income does strongly affect average figures, mostly for younger cohorts that have higher current income, given age, relative to older cohorts (cohort-time effect). Again a higher pre-retirement income enlarges the denominator of the replacement rate. Income of the youth is typically lower than those of the elderly in each year (age-time effect), but here it is expected pre-retirement wage that matters. The youth also expects to retire early and is therefore more penalized the replacement rate by the actuarially fair correction. Due to the system reform, their young-age-lower-incomes are taken into the computation of the pension benefit while for the older cohorts this is not the case. The penalization of early retirement is larger for these younger cohorts, as none of them will qualify for generous early retirement schemes. The corrections that pension funds have operated (on the accrual rate and the free part of the wage used in the computation) are not enough to fully compensate all these negative effects.

Table 5.3 Computed and expected retirement replacement rates and planned retirement age, different scenarios

		Wage equation				Current income				Expected RR	Planned retirement
	Indexation	3%	4%	5%	N	3%	4%	5%	N	%	age
Cohort year of birth											
1972 - 1976		55	45	37	250	52	43	35	196	73	62.6
1967 - 1971		56	46	39	274	52	43	36	202	71	63.5
1962 - 1966		58	48	41	314	53	44	37	226	72	63.4
1957 - 1961		58	48	40	351	53	44	38	261	71	62.7
1952 - 1956		60	51	43	378	54	46	40	310	69	62.8
1947 - 1951		66	59	54	491	63	56	51	382	71	62.5
1942 - 1946		72	69	67	714	73	70	67	576	70	62.0
1937 - 1941		74	73	72	607	75	74	73	528	70	62.2
1932 - 1936		76	75	74	155	77	76	75	141	69	63.3
					3534				2822	68	66.8
Weighted average		65	59	54		64	58	54		70	

Replacement rates (RR) are computed on the basis of two approaches to estimate future income (wage equation and constant income increased by fixed percentage) and using 4 different indexations. The scenarios we report here are illustrative. We have also experimented with different wage equations and different definitions of current income. These are net replacements rate at the expected retirement age, relative to net wage the year prior expected retirement.

As discussed in Section 5, higher indexations deliver lower replacement rates. As we account for mortality, indexation is in a sense age dependent, though the indexation rate itself is held constant to the reported level (if present) or to the fixed rate. The results show that for an indexation as high as 3% the replacement rates are lower than expected, while results in line or above expectations are found with rates between 1 and 3%. Again, fixing the indexation ad hoc can determine whether we end up with an overestimation of *E(RR)* or not.

We have computed these replacement rates by thoroughly applying individual pension rules. However respondents may have a different idea of what a replacement rate is. We allow two ‘mistakes’ in the computation of the pension benefit. In the first we add the AOW of the spouse to the one of the head and in the second we apply the computations of age 65 also to early retirees. We find that the latter does not affect much the replacement rate of older cohorts, who already expect to retire close to age 65. It does have a very large effect for the young (about 10-15% point extra replacement rate when the discount is zero). This shows how early retirement affects the replacement rates of the youth. The inclusion of the AOW of the partner has a similar average effect as prolonging work until age 65. This effect is distributed differently over cohorts, and affects the very young and the very old less than the middle aged, relative to the previous ‘mistake’. This means for instance that if all respondents make the ‘mistake’ to add their spouse's AOW to their benefit or confuse their planned retirement age with age 65, both scenarios of Table 5.3 would return replacement rates above and around 70% for indexation rates below 3%.

Table 5.4 Multivariate analysis of expectations errors

	Model A Indexation 3% Coefficient	 T-value	Model B Indexation 3% Coefficient	 T-value
Age head	0.67	4.1	0.29	2.1
Cohort year of birth				
1972 - 1976	46.30	9.5	38.55	8.5
1967 - 1971	39.39	9.3	32.23	8.2
1962 - 1966	35.32	10.3	30.29	9.5
1957 - 1961	34.30	12.3	29.45	11.3
1952 - 1956	27.73	12.5	23.27	11.2
1947 - 1951	20.21	11.4	17.65	10.5
1942 - 1946	11.27	7.0	9.87	6.5
1937 - 1941	7.84	5.0	7.15	4.8
Education head	– 1.31	– 2.8	– 1.82	– 4.6
Sex head	– 1.92	– 1.5	– 2.10	– 1.9
Head civil servant	– 3.02	– 4.2		
Experience head	– 0.18	– 3.5		
Hours worked head	0.04	1.0		
Health head	0.22	0.2		
Home owner	0.94	1.1		
Shares ownership	– 0.38	– 0.4		
Bonds ownership	2.70	1.8		
Mutual funds ownership	0.05	0.1		
Private loan ownership	– 0.88	– 0.7		
Constant	– 42.35	– 4.3	– 21.28	8.7
N	2036		2489	

In order to analyze the difference between the expected and computed replacement rates, we relate this difference to observed characteristics (see Table 5.4). Higher educated individuals or tenured workers may be better in forming correct expectations compared to poorly educated and inexperienced workers (Gustman and Steinmeier 2001). Moreover, those with good knowledge of pension institutions should be more likely to form correct expectations.

Table 5.4 reports the results of four specifications of a model with the difference between expected and computed replacement rates as dependent variable. To illustrate our results, we have chosen two specifications with indexation rate equal to 3%. Education experience and age (these are not linearly related due to gaps in the career) are significantly related to the dependent variables in both models. Also the cohort indicators are significant. There is a negative relation between education as well as experience and the difference between the two replacement rates (which is a positive number in this example). These negative coefficients are consistent with the existence of a learning process. Age seems to have a counterintuitive positive effect, as if workers make larger mistakes when getting older, however the life cycle effect that we expected is revealed by the cohort-time indicators, that are negatively ordered as we expected. Older cohorts report lower discrepancies.

The extra variables added in models A and B are not always significant with the exception of the indicator for civil servants. These results are plausible and we use them further to decompose the mismatch as derived from different sources.

5.1 Decomposition

In general we find an overestimation of the replacement rate already for low indexations larger than zero in almost all scenario's. This overestimation increases with higher indexations and is as severe in the wage equation based scenarios as in those with contact income increases. When we allow for the two 'mistakes' described above the overestimation disappears for indexations up to 3%, but already at a indexation of 5% the overestimation appears again for most cohorts. This result is less than ideal and not at all conclusive. In this descriptive analysis we can only state some conditions that need to be fulfilled to get to an overestimation rather then to an underestimation of the replacement rate. The conditions for an overestimation are however much more likely to be met.

These results should however be used to another purpose. It is interesting to know how poor knowledge of pension institutions relative to uncertainty about the future affects the difference between the two replacement rates (expected minus computed). With the information available this question seems empirically impossible to answer. However if one is willing to make additional (and not-testable) assumptions we could attempt an estimate of these effects. Let us for instance assume that we can identify those who know pension institutions relative to those who do not. Well-informed respondents will only miscompute their replacement rate if they solve their uncertainty (for instance about future wages) in a different way relative to what we have done. This suggests that there is some room to experiment with an Oaxaca-Blinder decomposition where the group of well informed is separated from the group of those ignorant about pension institutions. The effect due to a difference in coefficients should pick up that part of the difference in replacement rates due to poor institutional knowledge.

We identify the group of well informed respondents using factor analysis. The factors used are personality traits and the answer to questions related to the pension system. The analysis is used to score individuals relative to how likely they are to be well informed. Think for instance to the reaction on questions or statements, such as:

- "*I think about how things can change in the future, and try to influence those things in my everyday life*"
- "*I am only concerned about the present, because I trust that things will work themselves out in the future*"
- "*I am very interested in financial matters (insurances, investments, etc.)* "
- "*Because of the social security system in our country, there is no need to save money* "
- "*If you would need it, could you call on one of your relatives for financial advice?*"
- "*Being careful with money is an important character trait*" .

All these questions (with exception of the fifth question) are answered choosing a value from 1 to 7, where 1 stands for "totally disagree" and 7 for "totally agree". These questions are asked in most waves, and in order to maximize the number of factors, we carry out the factor analysis separately each year.
Personality traits are exogenous individual characteristics (Borghans et al 2008) that could be used to identify those who are more likely to be informed about the complex financial mechanisms that will affect their future pension. Factor analysis is a useful data reduction tool in this case.

Table 5.5 Factor loadings year 2002

	Factor1	Factor2	Factor3	Uniqueness
Important to save a lot	0.65	0.15	0.04	0.55
Interested in financial matters	0.56	– 0.32	– 0.20	0.54
Savers are successful in life	0.72	– 0.01	0.04	0.48
Saving for social security unnecessary	0.02	0.09	0.91	0.17
Knows amount of savings on checking account	0.08	0.81	0.04	0.33
Kan ask financial advise to family	0.08	0.51	– 0.36	0.61
Thinks about the future and tries to affect it now	0.62	– 0.03	0.10	0.61

Table 5.5 shows, as illustration, the factor loadings for year 2002. The analysis retains 3 factors. The percentage of variance for the variable that is not explained by the common factors (uniqueness) varies between 17% and 61%. These percentages are not unusual in the literature. We aim to create an index of 'likelihood to be well informed' or an 'index of the attitude towards financial planning', as we want to spot those who are likely to have gathered information about their post retirement income. All variables we use should therefore be positively related to the factor. For the first factor all factor loadings are positive, so we have indeed obtained the attitudinal factor that we were looking for. Factors 2 and 3 also indicate such attitude, but are negative about interest in financial matters or thinking about the future, which are relevant in determining the attitude to be well informed about pension institutions.

The group with good knowledge of institutions (lets' call them group A) shows `mismatches' (*M*) only due to uncertainty about future outcomes. Good knowledge is identified by selecting the top decile of the scores predicted by the factor analysis (we have experimented with other moments of the scores distribution and results do not change qualitatively). The rest (group B), has mismatches that are due both to ignorance of institutions and uncertainty. Let us further assume that the uncertainty effect is the same across the two groups and that each mismatch can be modeled as:

$$Y_A = X_A \beta_A + \varepsilon_A \qquad \text{(uncertainty about future oucomes)}$$
$$Y_B = X_B \beta_B + \varepsilon_B \qquad \text{(uncertainty about future oucomes and institutions)}$$

where Y_A and Y_B respectively represent the mismatches of group A and B, and X are exogenous characteristics. If $E(\varepsilon_A) = E(\varepsilon_B) = 0$, the mean outcome difference between the two groups can be decomposed using an Oaxaca-Blinder decomposition, such that:

$$M = X_A \beta_A - X_A \beta_A = (X_A - X_B)\beta_B + \underbrace{X_B(\beta_A - \beta_B)}_{\text{effect institutions}} + (X_A - X_B)(\beta_A - \beta_B) \qquad (4)$$

The difference in coefficients should reveal how much of the mismatch is exclusively due to poor institutional knowledge.

Two implicit assumptions are being made. The first is that the wage-related mismatch in group A can be `subtracted' from group B. There is no reason to think that those who know pension institutions make `mistakes' in wage predictions that are the same as those made by individuals with poor institutional knowledge.

The second assumption requires that $E(\varepsilon_A) = E(\varepsilon_B) = 0$. There are a number of reasons to doubt this assumption. An easy example is that observable characteristics, education for instance, could be related to whether one owns to group A or B. One could speculate (and even test) whether individuals with higher education are better informed about institutions. Oaxaca decompositions do normally take gender into account. Gender is a purely exogenous characteristic, while being informed about institutions is evidently not. Stated differently: the selection in group A and B may be endogenous. This is why we use factor analysis based on personality traits, this allows an exogenous identification of the well informed and relaxes the concerns about the second assumption.

Table 5.6 Oaxaca Blinder decomposition of the difference between expected and computed replacement rate

	Wage equation			
Indexation (%)	Endowment	Coefficient	Interaction	Total effect
0	– 0.52	0.46	1.16	1.10
1	– 0.32	1.57	1.19	2.44
3	– 0.36	0.84	0.84	1.32
5	0.18	3.31	0.67	4.17
	Current income			
	Endowment	Coefficient	Interaction	Total effect
0	– 0.58	– 0.56	1.57	0.42
1	– 0.30	– 0.28	1.17	0.59
3	0.14	2.85	1.21	4.20
5	0.70	4.81	1.25	6.75

Explanatory note: The two sets of results are an illustrative sub-sample of specifications based on a wage equation (upper panel) or current income (lower panel), to fit missing income records. We interpret the difference in coefficients as the effect due to poor knowledge of pension institutions.

Table 5.6 reports some of the decompositions that are based on several specifications of the model that is in turn related to scenario type 2 and 5. The total effect returns the difference between the two replacement rates at different levels of indexation. The interesting result is that for low level of indexations, coefficients and endowments contribute in similar fashion to the total effect. When the indexation is higher coefficients increase their share in the total effect. Ignorance of pension institution does then systematically enlarge the gap between the expected and the computed replacement rate.

6 Discussion

One main remark about these results is that the expected replacement rate could internalize also other income streams. If a reform reduces benefits to early retirees these may freely save at present to increment income in the future. In the Netherlands this can be done either using employer sponsored accounts or through personal savings. We explore briefly both possibilities. If the extra savings are arranged through the employer we should observe a rise in the ownership of employer sponsored accounts for those disadvantaged by the policy change in 2004. Ownership of these accounts was already researched by Alessie, Hochguertel, and van Soest (2006), who concluded that it is not clear why individuals do not subscribe to these accounts more often. In line with their findings we also do not find clear evidence that the ownership of these accounts has risen.

We have also looked at the relationship between private savings and imputed pension wealth. This is usually done also in studies that enquiry the displacement between private and compulsory savings (Jappelli, Padula, and Bottazzi (2006)). Voluntary active savings are defined in two ways. First as the answer to the question "How much money did you put aside in the last 12 months?". The second way to derive active savings is to look at financial wealth and how it increases over time, deducting capital gains and losses and other forms of passive savings (for those familiar with American literature we borrow the PSID definition of active savings (Juster, Lupton Smith, and Stafford 2006) and apply it to our data). Both methods have a number of interesting technical issues that make these variables particularly difficult to study (just to mention a couple: the first definition does not include dissaving and the second needs imputation of returns on assets for several households).

We have run an OLS regression of both these dependent variables on a number of characteristics, including imputed pension wealth. Hardly any of the coefficients turned out significantly different from zero. We have therefore found no support for the speculation that active savings have increased to those whose pension wealth has decreased. This suggests that ignoring the third pillar of the pension system should not challenge our results.

References

Alessie, R., S. Hochguertel, and A. van Soest, 2006, Participation in Tax-Favored Savings Plans: Are Household Portfolios Optimal?, *Journal of Economic Psychology*, 27(4), pp. 483-501.

Alessie Rob J.M. , Arie Kapteyn and Frank Klijn, 1997, Mandatory Pensions and Personal Savings in The Netherlands, *De Economist*, Volume 145, Number 3, pp. 291-324.

Banks, J., R. Blundell, and S. Tanner, 1998, Is there a retirement-savings puzzle?, *American Economic Review*, 88(4), pp. 769-788.

Berben, R. P., K. Bernoth, and M. Mastrogiacomo, 2006, Households Response to Wealth Changes, Do Gains or Losses make a Difference?, DNB working paper 90.

Bernheim, B. D., 1987, The Timing of Retirement: A Comparison of Expectations and Realizations, NBER Working Paper 2291.

Bernheim, B. D., J. Skinner, and W. Steven, 2001, What accounts for the variation in retirement wealth among U.S. households?, *American Economic Review*, 91, pp. 832-857.

Boeri, T., A. Bőrsch-Supan, and G. Tabellini, 2001, Would you like to shrink the welfare state? A survey of European citizens, *Economic Policy*, 16(32), pp. 7-50.

Borghans, L., A. Duckworth, J.J. Heckman and B. ter Weel, 2008,The Economics and Psychology of Personality Traits, NBER Working Paper W13810.

Bovenberg, A., 2005, Balancing work and family life during the life course, *De Economist*, 153(4), pp., 399-423.

Burkhauser, R.V., J.S. Butler and G. Gumus, 2004, Dynamic Programming Model Estimates of Social Security Disability Insurance Application Timing, *Journal of Applied Econometrics*, 19.

Dominitz, J., C.F. Manski, and J. Heinz, 2002, Social Security Expectations and Retirement Savings Decisions, NBER Working Paper 8718.

Ewijk van, C., 2005, Reform of Occupational Pensions in the Netherlands, *De Economist*, 153(3), pp. 331-347.

Gustman, A. L., and T. L. Steinmeier, 2001, Imperfect Knowledge Retirement and Savings, NBER Working Paper 8046.

Gruber, J. and D. Wise (Eds.), 2004, Social Security Programs and Retirement Around the World: Micro Estimation, University of Chicago Press.

Hurd, M.D. and S. Rohwedder, 2003, The Retirement-Consumption Puzzle: Anticipated and Actual Declines in Spending at Retirement, NBER Working Paper 9586.

Hurst, E., 2008, The Retirement of a Consumption Puzzle, NBER Working paper 13789.

Jappelli, T., M. Padula, and R. Bottazzi, 2006, Retirement expectations, pension reforms, and their impact on private wealth accumulation, *Journal of Public Economics*, 90 (12), pp. 2187-2212.

Juster, F., J. LuptonSmith and F. Stafford, 2006, The decline in household saving and the wealth effect, *Review of Economics and Statistics*, 88(1), pp. 20-27.

Kerkhofs, M., M. Lindeboom and J. Theeuwes, 1999, Retirement, financial incentives and health, *Labor Economics*, 6, pp. 203-227.

Manski, C. F., 2004, Measuring Expectations, *Econometrica*, 72(5), pp. 1329-1376.

Mastrogiacomo, M., 2004, Retirement: Expectations and Realizations, Essays on the Netherlands and Italy, Ph.D. thesis, Tinbergen Institute and University of Amsterdam.

Mundlak, Y., 1978, On the Pooling of Time Series and Cross Section Data, *Econometrica*, XXVII(46), pp. 69-85.

OECD Economic Outlook No. 84 - Netherlands, *OECD*, November 2008, Paris.

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

Els, P.J.A. van, W.A. van den End and M.C.J. van Rooij, 2004, Pensions and public opinion: a survey among Dutch households, *De Economist*, 152, pp. 101-116.

Ventura Luigi and Joseph G. Eisenhauer, 2006, Prudence and Precautionary Savings, *Journal of Economics and Finance*, Volume 30 Number 2 , pp. 155-168