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Abstract

This study examines the expected retirement replacement rates of several cohorts of Dutch employees at the time of their planned retirements. 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 ones we compute. Larger discrepancies are found for younger cohorts. We research the difference between the two replacement rates and find that the mismatch is related to poor institutional knowledge. We also show the role of assumptions on institutions and wage profiles in determining our results.

Keywords: replacement rate; expected retirement; Oaxaca decomposition

JEL code: J2; D84; D83

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 currently being discussed in many countries have already been implemented. Our results are based on surveying data on individuals' expectations about retirement replacement rates and comparing them 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.

Our findings suggest 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 current expected replacement rate correspond to future realizations? If not, where do the mismatches come from? And are these relevant enough to request policy intervention?

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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 for those who stop working young and higher replacement rates for those postponing retirement. In practice, this is implemented by shifting employees from a final wage system to an average wage system (like the reforms in Italy in 1993 or in The Netherlands in 2004) by introducing funded early retirement schemes (like in most northern European countries and the US) or incentivizing 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 might end up with lower-than-expected resources during their retirement. It is well documented that voluntary retirement savings are low in countries with a compulsory savings system because of the displacement effect (Alessie et al. (1997) show this for The Netherlands). But low retirement savings can also depend on the wrong financial planning of those expecting a post-retirement income that is higher than what they will actually receive (Jappelli et al. (2006) show that this is the case in Italy). In the Italian study, however, neither the causes of the mismatch nor the assumptions that deliver the finding have been researched. This could be a potentially important omission, which we will circumvent in this study.

Low retirement replacement rates in the future, or lower than currently expected, could be the result of higher than expected wage increases before retirement, bad institutional knowledge or uncertainty about the development of future wages between the current period and moment of retirement. Any of these explanations can be of interest to policymakers.

Studies from the US (Bernheim et al., 2001) and the UK (Banks et al., 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[2]. The first is that the pseudo-panels used in these studies are not adept at reaching such a conclusion (Hurd & Rohwedder, 2003). The second argument is more related to this study and states that it is the *expected consumption* outcomes that matter (Hurd & Rohwedder, 2003). If market consumption falls, this could have been anticipated. Such falls might also not apply to full consumption (Apps & Rees, 2001), because retirees spend more time producing goods at home.

From the discussion above, it follows that it should be of interest to examine expected retirement replacement rates because this measure is directly related to the anticipations of post-retirement income/consumption. In addition, this income measure abstracts from home production and exclusively focuses on the anticipations of market income. This is also the contribution of the current study to the literature, because we bring about new evidence that concerns a relevant variable so far hardly studied

[2]For a survey, see Hurst (2008).

empirically (an interesting exception is Jappelli et al. (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 on the public understanding of pension reforms.

As a preview of the results, we show that assumptions on institutional parameters can determine the results, which is not always taken into account in retirement studies. We find larger overestimations of the retirement replacement rate for the youth, whereas the elderly anticipate it better when closer to retirement. Lower replacement rates for youths are observed, both because of their willingness to retire before 65 and their prospective high pre-retirement income. Most of the mismatch between expectations and prospective realizations are because of an ignorance of pension institutions, rather than uncertainty about future outcomes (future wages for instance).

In Section 2, we introduce the DNB Household Survey (DHS). We devote Section 3 to the literature. Section 4 describes 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.

2 Data and descriptive analysis

The DHS, formerly known as the CentER Savings Survey, has been collected annually since 1993. We use 14 waves covering the period 1993–2006[3]. The survey focuses on savings but 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 on planned retirement age is asked in the first nine waves only to those aged over 50. This reduces the sample size. If we only look at income, which is the basis for the computation of pension benefits, we can use up to 26,000 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 DHS, which are formulated as follows:

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

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

In Figure 2.1, we plot replacement rate expectations against 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 relationship 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, because 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, whereas those retiring later might have had shorter careers (this being the reason for the longer planned participation) and, therefore, expect lower replacements.

Figure 2.1 Expected net retirement replacement rate over planned retirement age and its frequency
[Figure 2.1 here]
Source: DHS, own computations. Sample period 1993–2006; 4157 observations.

A second issue is that expectations of replacement rates are around 70% for all. This is not surprising because this is the target figure for the main Dutch pension funds and, therefore, this replacement rate is considered a sort of goal for their retirement by most employees (Van Els et al., 2004). Most funds have actually designed their contribution plans to reach 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 et al., 1999), up to 80–90%. This is because 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 Netherlands (CBS) reported retirement replacement rates for several segments of the population in 2005. It observed that replacement rates for male employees with median wages varied between 46% (first generation elderly immigrants) and 87% (middle aged Dutch natives)[4]. These numbers are lower for women[5]. This indicated that a substantial part of the Dutch population did not reach the target of 70% in 2005, and that only a selected group of the population, middle aged Dutch native men, complied with the high net replacement rate documented in the 1990s. The decline in 2005 is remarkable because both the shift to the middle wage system and the exemption from the payment of social security premiums (for above median income earners) had taken place shortly before. When these

[4] http://statline.cbs.nl/StatWeb/publication/?DM=SLNL&PA=71765ned&D1=8&D2=0&D3=2-10&D4=0&D5=1-3&D6=0&D7=1-4&D8=1-3&HDR=G7,G2,G3,G5,T&STB=G1,G4,G6&VW=T.

[5] http://www.cbs.nl/nl-NL/menu/themas/dossiers/vrouwen-en-mannen/publicaties/artikelen/archief/2008/2008-2498-wm.htm.

changes, together with the stricter rules for early retirement eligibility, become fully in place, the replacement rate is expected to fall even further.

If individuals are not aware of these institutional changes, these lower than historically observed replacement rates could indicate that they are ignoring taxes. Individuals might not be familiar with the tax treatment of their future pension benefit 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 respondents. If many individuals plan to retire before the normal retirement age, net replacement rates lower than 80% are definitely plausible since the reforms of the past decade have penalized early retirement.

[Table 2.1 about here]

Information on the pension system is also present in the DHS. 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. Three years after the introduction of the average earnings system, about one quarter still think that the previous regime is still in place.

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

Figure 2.2 Labor supply in hours over age of the head of the household
[Figure 2.2 here]
Source: DHS, own computations. Sample period 1993–2006; 17,000 observations.

3 Pension institutions and literature

As a great deal of this study is about correctly computing individual pension wealth, we first look at the Dutch retirement system. Everyone who reaches the age of 65 is entitled to a pay-as-you-go-funded social security benefit or AOW, which constitutes the first pillar. The AOW benefit is a flat benefit linked to the minimum wage. It is not linked to a person's employment history and varies only depending on the amount of years that an individual has been a resident of the country, whether they have a partner and the partner's income status. To make our measure of the AOW more realistic, we explicitly account for the 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 (accruals etc.) to these institutional changes. In Section 5, we formally show the relationship between these variables.

There are special arrangements for individuals that want to retire before the age of 65. Although these arrangements differ greatly among pension funds they have (from recently) a certain degree of actuarial fairness in common. We show in Section 5 how this institutional feature is incorporated into our computations. The first two pillars combined aim for 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 built 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 the subsequent indexation to prices and wages, these entitlements can grow 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 pillars of the Dutch pension system and will only glance at the data on private savings.

3.1 Literature and contribution of the 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 et al. (2001) showed that only a small group is well informed about 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 et al. (2002) (retirement age), Mastrogiacomo (2004) (post-retirement financial wealth) and Jappelli et al. (2006) (displacement between private and compulsory savings).

In a study in The Netherlands, Van Els et al. (2004) investigated what Dutch households know about their own pension provisions. They concluded that most households do not 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 et al. (2006) is most related to the present paper because it also exploits information about the expected replacement rate. We extend their study in two different directions. First, some groups tended to overestimate pension benefits in their data, but their study did not analyze the causes of this overestimation. Therefore, we will attempt a decomposition of the mismatches between expected and computed replacement rates because of the poor knowledge of institutions rather than any uncertainty about future income profiles. Second, the study by Jappelli et al. (2006) assumed a stylized employee (who retires at 60, with 35 years of contribution, has a fixed wage increase of 2% and is exposed to fixed GDP growth rates of 1.5%, which is also an element of the pension formula). Although this is functional to their analysis, we also enquire about 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 might seem irrationally optimistic, but could also be a rational expectation of those who believe that the pension reform will generate higher growth rates for the economy. Sensitivity analysis on these parameters is, therefore, relevant. There are an uncountable number of studies that compute pension wealth under simplifying assumptions on income profiles, indexation and institutional settings (see Gruber and Wise (2004) for references). We show how these simplifications can strongly affect results.

4 Multivariate analysis

One way to understand if the relationship 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 will write the pension formula for those planning to retire at 65, which is the simplest, highlighting two different time periods:

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

This is true for an individual who has worked both before and after 2004. This expression abstracts from discounting, because we assume that the interest rate and individual discount cancel out each other (see Ventura and Eisenhauer (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 expecting to retire before 65, we use a rule of thumb to proxy their early retirement benefit at the age at which they expect to retire (τ). The proxy is:

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

where j is the 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., 2005) 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 although 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, such as lowering r with tenure). These are derived from CBS mortality tables and survival projections for all cohorts of Dutch citizens. This proxy is very close to the actuarially fair computation carried out by the pension funds (as $\tau < 65$), but it is a proxy because some elements are excluded (such as the opt out option for survival benefits).

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

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

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

The nominator (pension wealth) is indexed only for 80% (because of the indexation rules of the retirement system) but the denominator is fully indexed. When the indexation increases the denominator increases more than the nominator, thereby RR decreases. A higher indexation also increases the difference in RR between young and old cohorts. The elderly are closer to τ and they index few years of employment and (partially) index many more years of retirement. The youth, on the contrary, (fully) index approximately the same amount of years before 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 that of the elderly. Notice that an indexation of pensions by 80% is a rule of thumb, because 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. Compared with pension funds we have extra information, namely $E(\tau_i)$, $E(RR_i)$ and some clues about $E(w_{t,i})$. Since we aim to compute $RR(E(\tau_i))$ we will assume that $E(\tau_i)=\tau_i$. We proceed as follows. We observe O_t and assume that respondents do not expect to change their labor supply. This means that each extra year separating the individual from $E(\tau_i)$ 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 $a_t=a_\tau$. This assumption is only problematic before 2004 because in the old system one could opt for a higher accrual in exchange for extra transfers into the pension fund. We have no data on those who exercised this option (which was not the default option). We have, therefore, fixed the accrual to the default level and recall the empirical evidence regarding default options in the pension domain (Van Rooij et al., 2007). Next the AOW_τ and f_τ are legislated amounts that are typically adjusted owing 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 do not need to make many assumptions on the way individuals form expectations of wages over the future. This is because individuals are directly asked what their expected future wage increase is in the short run and over the coming five years. We use the answer to the statement "*I do not expect any significant changes in household income in the next 12 months*", which we translate into 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}. Before 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 64-year-olds 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 five years?*". No specific wage information is available about the past. We reconstruct wages in the past using the panel, which in some cases results in wage information that goes back 12 years into the past. Unfortunately, such long wage histories are very rare in our data and we use two 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 abovementioned questions). However, we 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, in contrast to those studies that fix the indexation to *ad hoc* levels (Jappelli et al., 2006; Burkhauser et al., 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, because some individuals might 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 of unemployment in the future.

It is worth pointing out that two elements make the assumption of continuous careers less undesirable than it seems. First, it has also been commonly used in the studies we have referred to (Jappelli et al., 2006). Second, it seems to fit with the general 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 freedom of choice on the length and 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 are: 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 receive 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 receive 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 receive a pension of 85% of my last gross annual wage; or 4) Work until the age of 65.

The second option is reported more often, whereas the third, which 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 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 boundary of the real one.

5 Results for replacement rates

The study of replacement rates aims to understand whether there exist differences between the expected replacement rate and computed replacement rate when we mimic pension institutions. We have made some serious assumptions regarding past and future contributions into the system. This implies that we will not 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 formation of wage expectations.

[Table 5.1 about here]

Table 5.1 shows an overview of the scenarios 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 for an indexation rate as high as 5%. As an illustration we work with seven indexations, namely 0%, 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 also assume that individuals make ‘mistakes’ in computing their replacement rates.

These mistakes are meant to play around with two main variables: the size of the retirement benefit and length of the working career. We allow individuals to include the AOW of their spouse into the computation of the head replacement rate and to also apply the pension rules for retirement at 65 to those who retire early. For the first extension notice that it is debatable whether the total household AOW should be applied to single earner households. But it is undisputedly 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 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 is only for illustrative purposes since we will discuss one random entry in our sample. The first scenario is based on a wage equation (indexation 3%) and the second on current income (indexation 1%) to replace missing information on expected income growth. The random individual is a civil servant and expects a replacement rate of 65%.

[Table 5.2 about here]

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, which we computed as 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 because of the high pre-retirement income rather than a drop in post-retirement benefit.

We will not show the full set of results for each scenario. These are all hypothetical combinations aimed to show how results depend on the parameters assumed. We will, therefore, highlight some selected scenarios that allow us to describe qualitatively the effect of our assumptions on the replacement rate computations.

Table 5.3 shows the computed replacement rates under scenario types 2 and 5 at three different levels of indexation. We see that the youth will experience lower replacement rates on retirement relative to the elderly, whereas expectations vary little among cohorts. The table also shows that the approach we take in projecting future income strongly affects average figures, mostly for younger cohorts with a higher current income and given age relative to older cohorts (cohort/time effect). Again, a higher pre-retirement income enlarges the denominator of the replacement rate. The annual income of the youth is typically lower than that of the elderly (age/time effect), but here it is the expected pre-retirement wage that matters. The youth also expects to retire early and is, therefore, more penalized in the replacement rate by the actuarially fair correction. Because of the system reform, their younger age/lower incomes are included in the computation of the pension benefit, whereas that is not the case for the older cohorts.

[Table 5.3 about here]

The penalization of early retirement is larger for these younger cohorts because none of them will qualify for generous early retirement schemes. The corrections that pension funds have operated (on the accrual rate and free part of the wage used in the computation) are not enough to fully compensate all these negative effects.

As discussed in Section 5, higher indexations deliver lower replacement rates. As we account for mortality, indexation is in a sense age-dependent, although 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, whereas 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 might 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%.

To analyze the difference between the expected and computed replacement rates, we must relate it to the observed characteristics. Higher educated individuals or tenured workers might be better at forming correct expectations compared with poorly educated and inexperienced workers (Gustman & Steinmeier, 2001). Moreover, those with a good knowledge of pension institutions are more likely to form correct expectations.

[Table 5.4 about here]

Table 5.4 reports the results of four specifications of a model with the differences between expected and computed replacement rates as a dependent variable. To illustrate our results, we have chosen two specifications with indexation rates 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. The cohort indicators are also significant. There is a negative relationship between education and 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 though workers make larger mistakes as they get older. The life cycle effect that we expected is revealed by the cohort/time indicators, which 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 will use them further to decompose the mismatch derived from different sources.

5.1 Decomposition

In general, we find that the overestimation of the replacement rate for low indexations is larger than zero in almost all scenarios. 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 at a indexation of 5% the overestimation reappears for most cohorts. This result is less than ideal and not at all conclusive. In this descriptive analysis, we can only state some of the conditions that need to be fulfilled to gain to an overestimation rather than an underestimation of the replacement rate. The conditions for an overestimation are, however, much more likely to be met.

However, these results can be used for another purpose. It is interesting to know how a poor knowledge of pension institutions relative to the 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 (but not testable) assumptions we could estimate these effects. Let us, for instance, assume that we can identify those individuals who know pension institutions and 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 to us. This suggests that there is some room for experiment in an Oaxaca-Blinder decomposition where the well-informed group is separated from that ignorant about pension institutions. The effect of the difference in coefficients should pick up that part of the difference in replacement rates because of poor institutional knowledge.

We can identify the group of well-informed respondents using factor analysis[6]. The factors used are personality traits and the answer to questions related to the pension system. The analysis is used to score individuals on how likely they are to be well informed. Think, for instance, of the responses to questions or statements such as:

[6] We have also experimented with indicators that identify the well informed, such as the information contained in Table 2.1. Results are similar but can only be computed on a smaller sample where the information is not missing.

- "*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 needed 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 the exception of question 5) are answered by 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 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 can be used to identify those 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 about here]

Table 5.5 shows, as an illustration, the factor loadings for 2002. The analysis retains three factors. The percentage of variance for the variable not explained by the common factors (uniqueness) varies between 17% and 61%. These percentages are typical in the literature. We aim to create an index of 'likelihood to be well informed' or 'attitude towards financial planning', because we want to spot those likely to have gathered information about their post-retirement income. All the 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 an attitude, but are negative about interest in financial matters or thinking about the future, which are relevant for determining the attitude of being well informed about pension institutions.

The group with a good knowledge of institutions (group A) shows 'mismatches' (*M*) only because of 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 instances of the score's distribution' and results do not change qualitatively). The rest (group B) has mismatches that are both because of 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:

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

The difference in coefficients should reveal how much of the mismatch is exclusively because of 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 the same ‘mistakes’ in wage predictions as individuals with a poor institutional knowledge.

[Table 5.6 about here]

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 belongs to group A or B. One could speculate (and even test) whether individuals with a higher education are better informed about institutions. Oaxaca-Blinder decompositions do normally take gender into account. Gender is a purely exogenous characteristic, whereas being informed about institutions is evidently not. Stated differently, selection in group A and B might be endogenous. This is why we use factor analysis based on personality traits, because this allows an exogenous identification of the well informed and relaxes the concerns about the second assumption.

Table 5.6 reports some of the decompositions that are based on several specifications of the model that is in turn related to scenario types 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 indexations, coefficients and endowments contribute similarly to the total effect. When the indexation is higher coefficients increase their share of the total effect. Ignorance of pension institutions does then systematically enlarge the gap between the expected and computed replacement rates.

6 Discussion

One main remark about these results is that the expected replacement rate could internalize other income streams. If a reform reduces benefits to early retirees these people might freely save at present to increase 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 employers we should see a rise in the ownership of employer-sponsored accounts for those disadvantaged by the policy change in 2004. The ownership of these accounts has already been researched by Alessie et al. (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 find no 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 undertaken in studies on the displacement between private and compulsory savings (Jappelli et al., 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 Panel Study if Income Dynamics definition of active savings (Juster et al., 2006) and apply it to our data). Both methods have a number of interesting technical issues that make these variables particularly difficult to study (for example, the first definition does not include dissaving and the second needs the 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. Finally, in studies where the amount of retirement savings is directly asked, these seem to amount to about 20% of total savings in countries with lower levels of compulsory savings than The Netherlands (Horioka et al., 1997, 2000). This suggests that ignoring the third pillar of the pension system should not challenge our results.

7 Summary

We studied 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 analyzed The Netherlands because panel data were available for these variables and the institutional changes currently being discussed in many countries have already been implemented.

Jappelli et al. (2006) showed that Italians expect higher replacement rates than they will receive, but the authors do not research the causes of this overestimation. We showed that this is mostly also the case in The Netherlands, but that this result can be generated by *ad hoc* assumptions. Differently from the Italian study we checked the sensitivity of the results to assumptions about indexation, wage development and the institutional setting. We also showed that lower replacement rates can be both because of lower than expected pension benefits and higher than expected pre-retirement income. We found evidence that most of the overestimation is because of ignorance of pension institutions. The origin of the mismatch is relevant for deciding 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 does not need to be the case. Because we wanted to study how relevant assumptions are in determining the results, the pension benefit was computed under different scenarios. This was also needed because of the partial lack of wage records that must be imputed. We studied cases in which individuals correctly applied pension rules or made mistakes regarding the level of the intra-household allocation of the social security benefit or the early retirement rules. We noticed, for instance, that individuals tended to overestimate their replacement rate for low levels of indexation. The overestimation of the replacement rate was about 3% to 7% until the point we applied the correct pension formula. When the indexation rate was as high as 5% the net replacement rates that we computed were much lower than those expected. We gained results more in line with expectations when we allowed for 'mistakes' such as the inclusion of the spouse-dependent AOW in the head's benefit, or the prolongation of pension rights as if one was to retire at 65. In these two cases the replacement rates were also below expectations when the indexation was about 5%, but it was not below this level. In addition, these mistakes affected differently the different cohorts. The youth cohort most benefited by prolonging their working lives to 65.

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Tables

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.

Table 5.1 Overview of the scenarios 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 5.2 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 5.3	Computed and expected retirement replacement rates and planned retirement age, different scenarios									
	Wage equation				Current income				Expected RR	Planned retirement age
Indexatior	3%	4%	5%	N	3%	4%	5%	N	%	
Cohort year of birt										
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.

Table 5.4 Multivariate analysis

	Model A Indexation 3%		Model B Indexation 3%	
	coeff	t-val	coeff	t-val
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	

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
Can 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 5.6 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.

Figures

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