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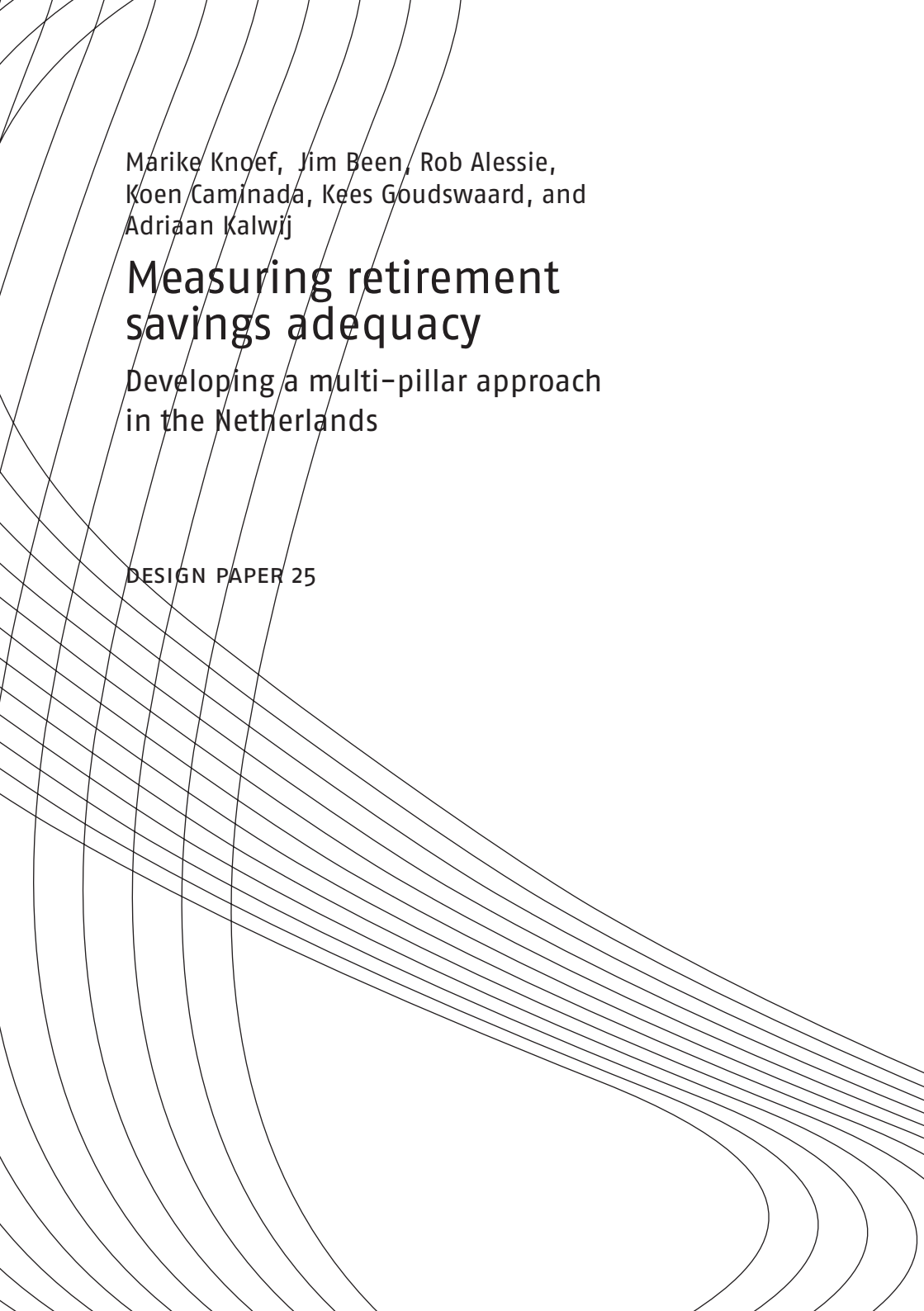
Netspar DESIGN PAPERS

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Measuring retirement savings adequacy

Developing a multi-pillar approach
in the Netherlands





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PREFACE

Netspar seeks to stimulate debate on the effects of aging on the behavior of men and women, (such as what and how they save), on the sustainability of their pensions, and on government policy. The baby boom generation is approaching retirement age, so the number of people aged 65 and over will grow fast in the coming decades. People generally lead healthier lives and grow older, families have fewer children. Aging is often viewed in a bad light since the number of people over 65 years old may well double compared to the population between 20 and 65. Will the working population still be able to earn what is needed to accommodate a growing number of retirees? Must people make more hours during their working career and retire at a later age? Or should pensions be cut or premiums increased in order to keep retirement benefits affordable? Should people be encouraged to take personal initiative to ensure an adequate pension? And what is the role of employers' and workers' organizations in arranging a collective pension? Are people able to and prepared to personally invest for their retirement money, or do they rather leave that to pension funds? Who do pension fund assets actually belong to? And how can a level playing field for pension funds and insurers be defined? How can the solidarity principle and individual wishes be reconciled? But most of all, how can the benefits of longer and healthier lives be used to ensure a happier and affluent society? For many reasons there is need for a debate on the consequences of aging. We do not always know the exact consequences of aging. And the consequences that are nonetheless clear deserve

to be made known to a larger public. More important of course is that many of the choices that must be made have a political dimension, and that calls for a serious debate. After all, in the public spectrum these are very relevant and topical subjects that young and old people are literally confronted with.

For these reasons Netspar has initiated Design Papers. What a Netspar Design Paper does is to analyze an element or aspect of a pension product or pension system. That may include investment policy, the shaping of the payment process, dealing with the uncertainties of life expectancy, use of the personal home for one's retirement provision, communication with pension scheme members, the options menu for members, governance models, supervision models, the balance between capital funding and pay-as-you-go, a flexible job market for older workers, and the pension needs of a heterogeneous population. A Netspar Design Paper analyzes the purpose of a product or an aspect of the pension system, and it investigates possibilities of improving the way they function. Netspar Design Papers focus in particular on specialists in the sector who are responsible for the design of the component.

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MEASURING RETIREMENT SAVINGS ADEQUACY

Abstract

This paper investigates the adequacy of Dutch household retirement savings. To take account of the varying composition of pension savings across households, the paper analyzes not only public and occupational private pension rights, but also annuity insurances, housing wealth and private savings. This is important, since different forms of assets may act as substitutes for one another. In order to compare housing wealth and private savings with pension rights, we approximate imputed rent and annuitize wealth components. Replacement rates and absolute levels of pension annuities indicate to what extent households save adequately for retirement.

Summed over all age- and socioeconomic groups, a median gross replacement rate of 83% and a net replacement rate of 101% are found. Public and occupational pensions each account for more than 35% of total pension annuities. Private non-housing assets account for 14% and imputed rental income from net housing wealth accounts for about 10%. If households were to deplete housing wealth, gross median replacement rates would increase by about 5%-points.

Taking into account all components that provide income during retirement, 31% of all households face a gross replacement rate that is lower than 70% of current income. Assuming that a 70% gross replacement rate is the norm, pension income for these people can be said to be inadequate in financing retirement.

Potentially vulnerable groups such as first-generation immigrants, single women and recipients of unemployment and disability benefits have relatively low replacement rates and low absolute levels of retirement income. Among self-employed households relatively low replacement rates are also found— but these are accompanied by high absolute levels of retirement income, although differences are large within this group.

Conclusions regarding the adequacy of retirement savings are sensitive to different future scenarios, with young generations benefiting most from an optimistic scenario but also suffering more from a pessimistic scenario, compared to older generations.

Policy implications

1. This paper provides insight into the adequacy of retirement savings of Dutch households. This is highly relevant for policymaking, for at least three reasons. First, the pension reforms that have been implemented in recent years and those still to come (such as the new pension contracts) will have a substantial impact on the financial position of future retirees. Second, the costs of healthcare are rising rapidly and there is a tendency to increase the share of individual private financing of these costs. The elderly may be faced with rising costs and rising coinsurance payments for long-term care. But are (future) pensions high enough to cover these costs? The third reason has to do with worries about the pensions of specific groups, such as the self-employed, who do not participate in collective second-pillar pension schemes.
2. It is important for policymakers to develop a more comprehensive view on pensions. Not only first and second pillar pensions, but also third pillar benefits, private savings and housing wealth are important determinants of the financial wellbeing of the elderly. The paper takes this into account and annuitizes all wealth components.
3. Policymakers can choose several standards against which to judge savings adequacy. A usual approach is that people should save enough to maintain their standard of living after retirement to a large extent. This does not imply that income after retirement should be equal to income before retirement, because consumption requirements are likely to fall with age. An often-used benchmark in the literature is having a retirement income of at least 70% of previous gross earnings. This standard is also widely accepted in the Netherlands. A

gross replacement rate of 70% is approximately equivalent to a net replacement rate of 80% in the Netherlands (depending on income). It should be noted that high replacement rates do not necessarily reflect adequate incomes during retirement. Therefore, it is also important to look at absolute levels of pensions in relation to the social minimum.

4. Summed over all age and socioeconomic groups, a median gross replacement rate of around 80% is found, when all wealth components are included. About half of the households have a total gross replacement rate between 66% and 103%. The median net replacement rate is around 100%, and about half of the households have a total net replacement rate between 81% and 124%. Housing wealth contributes substantially to the replacement rates, especially for older generations.
5. About 24% of all households face a net replacement rate that is lower than 80%. Assuming that an 80% net replacement rate is the norm, it can be said that for these households pension income is inadequate for financing retirement. Obviously, replacement rates are much lower when account is taken only of first- and second-pillar pension income. In that case we find that 32% of all households face net replacement rates below 80%.
6. There is much variation across households in terms of savings adequacy. Median (or average) replacement rates are high enough to maintain the standard of living after retirement. But there are several groups with low financial resources and/or low expected replacement rates. Among the self-employed, median gross replacement ratios are about 50% when only first and second pillar pensions are taken into account (compared to 71% for all households), and 74% when all wealth components

are included (compared to 83% for all households). In terms of replacement rates, the self-employed can be considered as a vulnerable group with regard to pensions, although the variation in replacement rates within this group is high. The absolute level of pension annuities is, on average, higher among the self-employed than among the general population, but also here the variation is large. Other potentially vulnerable groups such as first-generation immigrants, single women and recipients of unemployment and disability benefits have relatively low replacement rates and low absolute levels of future retirement income.

7. Conclusions regarding retirement savings adequacy are sensitive to different future scenarios with regard to indexation, housing prices and real rates of return. Young generations benefit most from an optimistic scenario, but also suffer more from a pessimistic scenario, compared to older generations. If households were to deplete housing wealth, this would increase their replacement rate by about 5%– points. It should be mentioned, however, that households may face difficulties in accessing their housing wealth. Also, a substantial percentage of households (35%) has no property.
8. For policymakers, these results provide insights into which groups of households are not well prepared for retirement. This could provide a motive for specific measures directed at these groups. For example, the government could stimulate and support the realization of second pillar pension arrangements for the self-employed, one of the obvious vulnerable groups. Pension funds and insurance companies may use these results in developing a comprehensive picture of various forms of pension savings of different groups, which may be useful for their communication with clients and for product development.

1. Introduction

The aging of the population confronts society with a growing number of dilemmas regarding the sustainability of public finances and collective arrangements. In OECD countries, pension and healthcare systems are affected by demographic aging (OECD, 2011), and in several countries reforms have been implemented or proposed that make healthcare and (public) pension benefits less generous.¹ Therefore, it is important to examine the extent of the resources people have available for future consumption, including healthcare consumption. This paper provides a much-needed integrated approach to public and private pension rights, housing wealth and private savings.² The paper addresses the following key questions:

*Are Dutch households saving enough for retirement?
Which pension components are important, and what
are the vulnerable groups?*

This paper uses micro data to scrutinize the resources that households of different generations have built up to finance retirement. To analyze the adequacy of total savings, we predict the financial resources available during retirement, and compare these resources with current income. This research is part of an OECD project that investigates whether people in OECD countries

- 1 In a European perspective, Van Vliet et al. (2012) show that shifts from public to private pensions do not necessarily have consequences for income inequality and poverty among retirees in the period 1995–2007. Results are, however, sensitive to the countries and time period analyzed.
- 2 Knoef et al. (2013b) simulate household income of the elderly in 2020. Compared to Knoef et al. (2013b), we add analyses about private savings, housing wealth and the composition of pension entitlements. Knoef et al. (2013a) precluded this project.

save enough for their retirement. Since definitions and methods will be coordinated across countries at a later stage, it will be possible in the future to compare the results in this paper to the data of other countries, such as the US, Germany and Chile.

The structure of the paper is as follows. Section 2 describes how we can judge savings adequacy. Section 3 describes the Dutch pension system and section 4 introduces the data. Section 5 shows descriptive statistics of income and wealth in 2008 and section 6 predicts financial resources during retirement and replacement rates. Section 7 focuses on several vulnerable groups, such as self-employed households, immigrants and households on social assistance. Section 8 analyzes the sensitivity of the results with regard to assumptions about indexation, real rates of return, housing prices and the depletion of housing wealth. Finally, section 9 concludes.

2. Adequate retirement savings

The key question of the OECD project is whether people save enough for retirement. This question can be answered by comparing (expected) old-age incomes with reference incomes. But what are adequate resources for retirees? A variety of standards can be chosen against which to judge adequacy.

The Life Cycle Hypothesis (LCH) is the main theoretical framework for assessing the adequacy of savings (Banks et al., 1998). In this model, consumption is not determined by current income, but by (expected) lifetime resources. According to the LCH, it is optimal for individuals or households to save (or borrow) to the extent that, after discounting, the marginal utility of consumption is smoothed over the life cycle. However, the model does not provide straightforward predictions on how much people save in various stages of their lives. Households with identical lifetime incomes might choose different levels of savings for a number of reasons—including uncertainty over future incomes and over future needs, different degrees of risk aversion, variations in time preference rates, the possible existence of liquidity constraints and bequest motives. The model is therefore consistent with a substantial degree of inequality in saving.

Several studies have used the life cycle model to analyze retirement readiness. Bernheim et al. (2001) found empirical results that are inconsistent with the life cycle model in the US. They found a decline in consumption at retirement that is highly correlated with the household income replacement ratio. Households appear to discover that their resources after retirement are insufficient to maintain their standards of living, and adjust their consumption downward accordingly. In other words, people do not save enough to smooth their consumption.

Engen et al. (1999) argued that the existence of an under-saving problem depends crucially on what is considered to be optimal saving behavior. They define a household to be saving adequately if it is accumulating enough wealth to be able to smooth its marginal utility of consumption over time. Smoothing marginal utility of consumption may have a different impact on saving behavior than smoothing consumption as such. They developed a stochastic life cycle model in which people save both for retirement and as a precaution for uncertainties, including uncertain lifespan. They conclude that, judged against their benchmark, inadequate saving is not a problem. Scholz et al. (2006) developed an extensive stochastic life cycle model that also incorporates government transfers and taxes, as well as medical expenses. They found that the model provides a good representation of households' savings behavior in the US. Fewer than 20% of the households save less than their optimal levels, and the extent of under-saving is generally small.

A common element of these approaches is that people should save enough to maintain their living standards after retirement. This does not imply that consumption after retirement should be equal to consumption before retirement. Consumption requirements are likely to fall when people retire (Scholz et al., 2006: 637). The most commonly used measure of relative well-being after retirement is the income replacement rate. This is the ratio of some post-retirement income (from pensions, annuitized wealth holdings and so forth) to some pre-retirement income (such as earnings during the years preceding retirement, or average earnings during the career). Replacement rates are an important indicator of pension systems; they are shown in *OECD Pensions at a Glance* (2011). Boskin and Shoven (1987) argued that a replacement rate of less than unity is consistent with the

life cycle theory. Haveman et al. (2007) indicated that a widely accepted standard in the literature is having a retirement income equal to or greater than 70% of previous earnings. This is regarded as the income necessary to maintain preretirement consumption. In this study we also use (expected) replacement rates as a key indicator of savings adequacy and retirement readiness. The standard is set at 70%, but we can also show the results for alternative replacement rates. We can compute replacement rates for both average previous earnings and for earnings just before retirement.

A second approach is to set a social standard for adequacy. In this approach, retirement income is considered adequate when it is equal to or greater than poverty levels of income (Haveman et al., 2007). There are three ways of setting the poverty line: an absolute standard, a relative standard and a subjective standard (Caminada et al., 2012). The US poverty line is based on an absolute standard, which remains fixed over time in real terms. The EU-agreed relative poverty line is set at a fixed percentage of the median income in each country. The at-risk-of-poverty rate is defined as the share of persons with an equivalized disposable income below 60% of the national median equivalized disposable income. In several OECD studies the poverty line is set at 50% of the median equivalized disposable income. The subjective poverty line is based on respondents' answers to questions regarding what they consider to be an adequate standard of living. Binswanger and Schunk (2011) investigated minimum acceptable income replacement rates using surveys in the US and the Netherlands, and found that these rates range from 95% to 45% across income quintiles in the US, and from 75% to 60% across income quintiles in the Netherlands. Walker (1987) criticized the reliance on survey methodology, as respondents

were asked to directly answer complex questions concerning subjective wealth, which they might not have considered before. Walker therefore introduced the consensual budget standards method, where members of the public together with some experts reach agreement (consensus) about what people need as a minimum and then draw up budgets to meet those needs. Hoff et al. (2009) applied this method for the Netherlands and found, for example, that in 2008 a single man of age 75 needed about 800 euro per month.

Another issue is that resource adequacy at the time of retirement does not necessarily mean that incomes are adequate throughout a person's remaining lifetime. Resources may increase during retirement— due to additional asset accumulation, bequests and so forth. But resources may also deteriorate during retirement— due to cuts in pension benefits, for example, or bad investments or increasing uncovered health costs. Haveman et al. (2007) therefore examined the resource adequacy at two points in time: at the time of retirement and ten years later.

VanDerhei and Copeland (2010) also measured retirement readiness at several points in time. They argued that replacement rate measures are useful, but that it is difficult to accurately integrate the concepts of longevity risks, post retirement investment risks and uninsured healthcare risks. They follow an approach in which a household is considered to run short of money if its resources are not sufficient to meet minimum retirement expenses plus uncovered expenses from the nursing home and healthcare. Expenses are derived from the Consumer Expenditure Survey, based on actual observed expenditure of the elderly for different family sizes and income levels. This approach has its advantages, but the problem is that observed consumption patterns of retirees are constrained by their resources. If their

resources fall short, their observed expenses may not reflect their real needs in retirement. Consequently, the method used by VanDerhei and Copeland cannot provide the (only) benchmark against which to judge the adequacy of resources. This paper therefore compares predictions of financial resources during retirement with current income of households in the Netherlands.

3. The Dutch pension system

As in many European countries, the Dutch pension system consists of three pillars. The first is a pay-as-you-go system and involves a flat-rate public pension benefit for all residents as from the statutory retirement age of 65 onwards. The level of the public pension is linked to the net minimum wage and depends on the number of years that a person has resided in the Netherlands. Couples who have lived in the Netherlands between the ages of 15 and 65 each receive 50% of the minimum wage, and single pensioners receive 70% of the minimum wage. For people with a low pension income and almost no wealth, the first pillar is topped up with social assistance to guarantee a social minimum.

Several OECD countries have recently increased their statutory pension age, or will do so in the coming decades (OECD, 2011). In the Netherlands, the statutory retirement age increased by one month as of January 2013, and will gradually increase to 66 in 2019 and 67 in 2023. It has been proposed to increase the statutory retirement age more rapidly: to 66 in 2018 and 67 in 2021.

The Dutch second pillar consists of capital-funded occupational pensions, of which the primary responsibility lies with employers and employees. Occupational pensions in the Netherlands have a mandatory nature, such that 90% of all employees have a pension scheme with their employer. Occupational pensions mainly consist of defined-benefit pension plans. Until the beginning of the 21st century, most pension plans aimed to pay a pension income of 70% of final gross wage from the age of 65 onwards if an employee had worked fulltime for at least 40 years. From 2003 onwards, pension funds have lowered their ambition, and they now aim to pay 70% of the average career salary, instead of 70% of the final gross salary (including public pension

benefits). The recent financial crisis has shown that the Dutch pension system is vulnerable to shocks in financial markets. Many pension funds have had difficulties achieving their indexation ambitions, and several funds recently were even compelled to cut nominal pension rights. Also, tax-favored pension accruals have been reduced from 2.25% to 2.15% of the average salary, and proposals have been made to reduce it further to 1.75% (the 'Witteveenkader'). Furthermore, the age that forms the basis for the determination of the pension premiums will increase from 65 to 67 as of 2014 ('pensioenrichtleeftijd'). Early retirement will consequently become financially less attractive, and the pension income of future retirees is likely to become less generous.

The third pillar is formed by private individual pension products (such as life annuities) and other private savings. Until a major tax reform in 2001, everyone could buy life annuities at tax beneficial terms up to a certain limit (e.g. premiums up to 2,808 euro were fiscally attractive in the year 2000). After the tax reform, this limit was reduced in 2002 to 1,069 euro, and only the self-employed and individuals with a gap in their pension entitlements were allowed to buy life annuities at fiscally attractive terms up to higher amounts. Other pillars are housing wealth or an extension of working life on a part-time or fulltime basis. People who have paid off part of their mortgage benefit from lower housing costs during retirement. Although it is not commonly done by the current generation of elderly, people may move or use reverse mortgages to deplete housing wealth.

4. Data

To estimate the extent of financial resources available to the current labor force upon entering retirement, we combine administrative data with assumptions as to what will happen from the time of observation until the day of retirement. This section describes the data that are used, which combine as many wealth components as possible in evaluating the retirement readiness of the Dutch population:

- public pension rights (PAYG),
- occupational pension rights,
- annuity insurances,
- housing wealth, and
- private savings (non-housing wealth)

The most recent data about occupational pension rights come from 2008. Therefore, a representative sample of households in 2008 forms the basis of all of our data.

To assess the pension rights accumulated in public old-age pensions, we took administrative data from the 2008 'Dutch statistics on public pension entitlements' (in Dutch: Algemene Ouderdomswet aanspraken totaal, AOWA). These data contain information about the public pension entitlements that have been built up by people between the ages of 15 and 64. The entitlement depends on the number of years that people have been living in the Netherlands, as from the age of 15.

Concerning occupational pensions, we made use of the 2008 'Dutch statistics on occupational pension entitlements' (in Dutch: Pensioenaansprakenstatistiek, PA). These data provide information about the occupational pension entitlements that have been built up by people between the ages of 15 and 64.

This information is gathered by Statistics Netherlands from occupational pension funds in the Netherlands. Pension funds deliver data to Statistics Netherlands about the annuity or capital that each participant has built up (i.e., the annuity that they would receive in case they remain employed in their current job with their current wage rate until the statutory retirement age of 65 is available in the data).³ Not all pension funds have provided data to Statistics Netherlands, but the aggregate amount of pension entitlement in the Netherlands is available from the Dutch Central Bank (DNB), and Statistics Netherlands used this information, together with employment data, to correct the individual pension entitlements (Eenkhorn and Zijlmans, 2010). After a divorce, occupational pension benefits are often partly paid out to the ex-partner.⁴

To assess information about income and other wealth assets that may be available, administrative data were taken from the 2008 Dutch Income Panel data (Inkomenspanelonderzoek, IPO), with wealth information from the tax office, banks and social security administrations. Banks have to deliver data about savings accounts that exceed 500 euro or yield interest of more than 15 euro a year. Checking accounts are not included. Furthermore, the data contain information on stocks, bonds and wealth from an own business. With regard to housing, the data include information about the value of the house and the mortgage, the

3 For this calculation we used the individual number of hours worked, the average franchise and the average accrual percentage in the Netherlands.

4 Either an ex-partner receives part of the occupational pension benefits when the ex-husband or ex-wife becomes 65, or entitlements are converted directly after the divorce into two separate entitlements for both members of the divorced couple. Then, for example, the benefits can start at different moments in time. Conversions are included in the data but there is no information regarding pensions that are partly paid out to ex-partners when the participant becomes 65.

value of secondary houses and some moveable properties such as houseboats.

Whereas the AOWA and PA dataset contain information about the entire Dutch population, IPO contains a representative sample of Dutch households that are followed over time. We therefore merge AOWA and PA to the IPO sample. Major advantages of these administrative data are a very low attrition rate and a high level of representativeness. Attrition takes place only because of immigration or death. Another advantage of administrative data is that the observed variables are measured with a high degree of accuracy. In this progress report we merged only the 2008 data, since this is the most recent year for which AOWA and PA are available.

The data have some shortcomings. They do not, for example, provide information about assets accumulated in personal defined-contribution pension plans (third pillar). Data is available, however, regarding contributions made to third pillar pension plans as from 1989, which provides information about the wealth accumulated in third pillar pension plans (Caminada, 2000). Furthermore, young generations in the Netherlands often seek to avoid taxes through an endowment mortgage (in Dutch: spaarhypotheek) or an investment-based mortgage (in Dutch: beleggingshypotheek). This means that the mortgage is not paid off during the term of the mortgage. Instead, money is paid to an insurance company or a bank, such that (part of) the mortgage can be paid off at the end of the term. The money accumulated at the insurance company or at the bank is not observed by the tax office, and is not available in the data.⁵ Also, we do not know which households own an endowment or investment-based mortgage.

5 In 2008, about 30% of the mortgages were endowment- or investment-based mortgages (Belastingcommissie, 2013).

5. Descriptive analysis

This section describes current income (5.1) and wealth (5.2) observed for several age groups.

5.1 Income

Table 1 describes gross equivalized household income of a representative sample of Dutch households in 2008. Income is measured in 2010 euros using the consumer price index. In order to standardize household income to a single-person household, we use the equivalence scale provided by Statistics Netherlands (Siermann et al., 2004), which assumes that two adults need 37% more income than a single adult to achieve the same welfare level.⁶ The households' key person, who is randomly drawn from the Dutch population and who is followed over time in the IPO dataset, determines the age category of the household.

As expected, labor income is the most important income component and is highest for people between the ages of 50 and 54. Average disability and unemployment benefits increase until the statutory retirement age of 65. This growth is a combination of age, period and cohort effects, which cannot be distinguished. Furthermore, older individuals have longer unemployment durations on average, which lead to higher unemployment benefits per year. Public pension benefits are received as from the age of 65, so before the age of 65 we only observe public pension benefits of household members that are 65 or older (e.g. partners or parents in the same household). In the age group 60–64, early retirement income becomes important and seems to replace labor income at least partly. Non-labor income includes

⁶ Kalmijn and Alessie (2008) found that the modified OECD scale and the equivalence scale of Statistics Netherlands yield very similar results.

Table 1. Income composition of households, 2008^a

Age group	35-49	50-54	55-59	60-64	65-69	70+	All
Income: average							
Labor income	32,332	35,776	31,767	15,992	4,388	1,507	22,908
Disability insurance	696	1,534	2,121	2,769	611	92	1,106
Unemployment insurance	294	382	667	843	204	26	353
Public pension (AOW)	206	220	365	1,545	10,853	12,545	3,495
Private pension	451	1,264	3,623	13,342	13,276	9,263	5,027
Non-labor income	-2,242	-642	176	1,344	2,092	2,657	-129
Profit from business	3,974	4,091	3,816	3,392	1,435	306	3,028
Social assistance	538	582	595	606	192	149	458
Child- and study allowances	732	487	185	49	27	13	376
Other transfers ^b	268	287	239	277	280	461	304
Gross income	37,249	43,980	43,854	40,160	33,357	27,019	36,926
Disposable income	24,968	28,892	28,623	26,965	25,194	21,788	25,502
Income: median							
Labor income	29,808	33,603	28,661	4,286	0	0	18,019
Disability insurance	0	0	0	0	0	0	0
Unemployment insurance	0	0	0	0	0	0	0
Public pension (AOW)	0	0	0	0	13,001	13,033	0
Private pension	0	0	0	6,377	8,699	5,333	0
Non-labor income	-1,823	-578	-25	11	289	469	0
Profit from business	0	0	0	0	0	0	0
Social assistance	0	0	0	0	0	0	0
Child- and study allowances	718	0	0	0	0	0	0
Other transfers ^b	0	0	0	0	0	0	0
Gross income	32,208	38,332	37,472	32,581	26,361	21,288	30,769
Disposable income	22,542	26,169	25,484	22,918	21,360	18,465	22,349
Frequency (fraction)							
Labor income	0.91	0.90	0.84	0.60	0.30	0.11	0.67
Disability insurance	0.10	0.17	0.21	0.23	0.09	0.01	0.12
Unemployment insurance	0.07	0.08	0.09	0.08	0.03	0.01	0.06
Public pension (AOW)	0.03	0.03	0.05	0.18	1.00	1.00	0.30
Private pension	0.09	0.16	0.29	0.67	0.93	0.87	0.40
Non-labor income	0.92	0.92	0.92	0.92	0.91	0.88	0.91
Profit from business	0.17	0.16	0.14	0.12	0.07	0.02	0.13
Social assistance	0.07	0.07	0.07	0.06	0.04	0.03	0.06
Child- and study allowances	0.67	0.41	0.16	0.04	0.02	0.01	0.34
Other transfers ^b	0.34	0.28	0.14	0.11	0.15	0.24	0.25
Gross income	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Disposable income	1.00	1.00	1.00	1.00	1.00	1.00	1.00
# Observations	22,245	6,645	6,277	6,479	4,620	10,299	56,565

a Equalized household income in 2010 euros. The age of the key person in the households determines the age category of the household.

b Rental house allowance, home owner grant, alimony and study costs allowance.

interest received from bank accounts, dividends from stocks, income from bonds, imputed rent, mortgage interest, and income from other property such as second houses. By using imputed rent (as defined in IPO) and mortgage interest, we take into account that those who paid off their mortgage take advantage of low housing expenses. Mortgage interest explains the negative values for non-labor income in the young age groups. Among the 70+ population, total gross income is relatively low, which may be related to cohort effects. Finally, since the income distribution is positively skewed, mean income is higher than median income, which means that higher deciles earn a proportionally larger share of total income.

5.2 Wealth

Table 2 presents average household wealth, median household wealth and ownership rates of several wealth components in 2008. Wealth is measured in 2010 euros using the consumer price index.

The results indicate that wealth in savings accounts increases with age, at least until the age of 70. Debts other than mortgage are owned by somewhat more than 10% of the sample and are highest in the 55–59 age category. Stocks from a substantial holding are relatively high, but only owned by not more than 1% of the sample. Securities, however, are owned by more than 25% of the sample, and increase on average from about 11,638 euro in the age category 35–49 to 25,641 euro in the 70+ age category.

Property is owned by 65% of the sample. Most of them (78%) also have a mortgage. The proportion of homeowners with a mortgage is high in the 35–49 age category (67/72=93%), but also in the 70+ category 41% of the homeowners still have a mortgage. Net housing wealth (property value minus the

Table 2. Wealth composition of households, 2008^a

Age group	35-49	50-54	55-59	60-64	65-69	70+	All
Wealth: average							
Savings account	33,836	41,911	51,498	60,199	60,441	57,215	46,194
Debt other than mortgage	16,036	17,729	21,777	18,992	16,905	8,065	15,830
Stocks substantial shareholders	22,764	22,523	33,633	41,561	22,072	11,526	23,992
Securities	11,638	19,802	22,294	23,933	24,427	25,641	18,782
Mortgage	144,295	103,716	85,120	64,963	42,896	14,676	91,992
Property	248,294	270,271	272,856	271,029	248,363	160,313	240,192
Business assets	5,468	6,849	6,017	5,670	5,163	989	4,874
Net housing wealth	103,999	166,555	187,736	206,066	205,467	145,637	148,200
Ratio mortgage / value property	0.63	0.43	0.37	0.27	0.20	0.10	0.43
Total wealth	161,669	239,910	279,401	318,437	300,664	232,943	226,211
Wealth: median							
Savings account	9,378	11,452	17,922	21,232	24,115	24,175	14,987
Debt other than mortgage	0	0	0	0	0	0	0
Stocks substantial shareholders	0	0	0	0	0	0	0
Securities	0	0	0	0	0	0	0
Mortgage	117,420	64,049	39,760	8,100	0	0	23,251
Property	227,579	234,051	229,736	222,186	201,693	0	211,401
Business assets	0	0	0	0	0	0	0
Net housing wealth	40,604	108,895	125,952	142,433	136,797	0	66,220
Ratio mortgage / value property	0.63	0.37	0.28	0.21	0.13	0.00	0.36
Total wealth	70,826	136,023	155,577	181,251	173,095	68,523	105,828
Frequency (fraction)							
Savings account	0.87	0.89	0.91	0.92	0.94	0.94	0.90
Debt other than mortgage	0.11	0.13	0.14	0.13	0.11	0.06	0.11
Stocks substantial shareholders	0.02	0.02	0.02	0.02	0.01	0.01	0.02
Securities	0.27	0.28	0.28	0.28	0.26	0.20	0.26
Mortgage	0.67	0.63	0.58	0.51	0.41	0.18	0.53
Property	0.72	0.72	0.7	0.68	0.62	0.44	0.65
Business assets	0.15	0.13	0.11	0.09	0.05	0.01	0.10
Total wealth	0.92	0.92	0.94	0.94	0.96	0.95	0.93
# Observations	22,245	6,645	6,277	6,479	4,620	10,299	56,565

- a Wealth in 2010 euros. The age of the key person in the households determines the age category of the household.
- b 7% of the households do not have any wealth according to the IPO data. These households may only own checking accounts (with unlimited amounts of money) and/or savings accounts that do not exceed 500 euro (or yield interest of more than 15 euro).

mortgage) is substantial and varies over age categories: it is lowest in the 35–49 age category and highest in the 60–64 age category, with an average of 206,066 and a median of 142,433 euro. The relatively high levels of net housing wealth among older generations can be explained by repayments of mortgages but also by home price increases before 2008. Between the beginning of the 1990s and 2008 home prices increased substantially, with an increase of about 180% between 1995 and 2008. This was at least partly due to decreasing mortgage interest rates and reduced borrowing constraints (before the 1990s, income from second earners was only taken into account for five years, and this became 30 years). The share of homeowners decreases after the age of 65; therefore, also average net property value decreases after the age of 70. A possible explanation for this is that people's health or the death of a partner forces them to move to a nursing home or a smaller house. In addition, cohort effects may play a role (homeownership is relatively low in old cohorts). Due to fiscally attractive mortgage constructions, described in section 4, we underestimate housing wealth. Housing wealth is rather illiquid, however, and is therefore often excluded in empirical studies on savings adequacy (Venti and Wise, 1991). People in the Netherlands strongly prefer to stay in their own home as long as possible (De Graaf and Rouwendal, 2011). Reverse mortgages could be used to access a portion of home equity, but are still rare in the Netherlands. Nevertheless, housing wealth is very important in saving for retirement. Persons owning a house, given that they have repaid most of the loan on the house, need less income to finance their necessary expenses than persons who live in a rental house.

6. Financial resources during retirement

This section predicts financial resources during retirement for future generations of retirees. Section 6.1 describes how we predict financial resources during retirement and explains the assumptions that we make. Section 6.2 presents the results. We compare predicted financial resources during retirement with current gross and net income (6.3 and 6.4), and investigate poverty during retirement as an indicator of how well households are prepared for their retirement (section 6.5).

6.1 Method and assumptions to predict future retirement income

To investigate pension savings adequacy we sum public pension rights, occupational pension rights, annuity insurances, annuitized private savings and imputed rent on the household level. We analyze all pension savings as from the age of 65.⁷

First pillar pension entitlements are derived from the AOWA data described in section 4. An individual's public pension benefits depend on the number of years of residence in the Netherlands between the ages of 15 and 65. We assume that people stay in the Netherlands as from 2008 until the age of 65. We use the full gross public pension benefit level of 2008, measured in 2010 euros (13,033 euro per year for singles and 17,993 euro per year for couples) to compute the public pension benefit that households receive. We include social assistance benefits that are used to guarantee a social minimum (e.g. for

⁷ The baseline scenario analyzes all pension components as from the age of 65. Section 8 shows the results when all components are computed as from the age of 64 and 67. We do not differentiate the retirement age between cohorts, although young cohorts may be better equipped to work longer than older cohorts are.

immigrants), and we assume that public pension benefits will be indexed. Finally, the public pension eligibility age is higher for future generations of retirees. To be able to compare public pensions across generations, we compute public pension benefits for everyone as if they are received as from the age of 65, using an actuarially neutral reduction rate for young generations that have a public pension eligibility age higher than 65.⁸

Regarding occupational pensions, we use the data of Statistics Netherlands about occupational pension rights, which assume that people remain employed in their current job with their current wage rate until the age of 65. In future research we will test how robust the results are with respect to this assumption by estimating and simulating wage profiles and labor market transitions, taking into account part-time work and stochastic non-employment spells. For the moment, we have to bear in mind that we do not take into account wage growth for younger workers and that we do not take into account unemployment and early retirement for this group (not all people will be working until the age of 65). In general, occupational pension entitlements in the Netherlands are nominal rights with price indexation conditional on the financial situation of the pension fund. Because of the poor financial situation of most pension funds in the Netherlands in recent years, pension funds have been unable to make inflation corrections. For the future we assume that 50% of the inflation will be corrected and that

8 In reality, the Dutch public pension system has no flexible public pension retirement age. However, since in this paper we analyze all pension components as from the age of 65, we also compute public pensions as from the age of 65, as if households can borrow against their future public pension income. In this way, all results are based on the same retirement age.

inflation amounts to 2% per year.⁹ Furthermore, we make the rather optimistic assumption that no pension cuts take place. For 65+ individuals we do not observe second pillar pension entitlements, but we do observe the amount of second and third pillar pension benefits that they receive. Unfortunately, we cannot distinguish between second and third pillar benefits for 65+ individuals.

To approximate wealth accumulated in third pillar pension plans, we use the yearly contributions made to third pillar pension products as from 1989 and add a fictitious real return of 1% (after tax) per year. For the future we assume that, until the age of 65, people deposit the same amount into the pension product every year as they did on average during 2006–2010 (in real terms). We assume a future real rate of return of 1% (after tax) per year.¹⁰

In addition to income received from the first three pillars, people may deplete wealth to finance their retirement (saving accounts, stocks, bonds and business assets). In view of this, we annuitize private savings, taking into account mortality differences between men and women and between cohorts. We do not consider differential mortality by income (Kalwij et al., 2013). Whereas pension rights and annuity insurances are observed at the individual level, private savings and housing wealth are observed at the household level. Therefore, in the annuitization process of the wealth components in table 2, we take into account age differences between members of a couple

9 We assume an indexation of 50% in the baseline scenario. Section 8 shows calculations with no indexation (pessimistic scenario) and full indexation (optimistic scenario).

10 We assume a yearly real rate of return of 1% in the baseline scenario. Section 8 shows the calculations with 0% (pessimistic scenario) and 2% (optimistic scenario).

and economies of scale. First, our annuitization process is most easily explained for a single man or woman. Suppose a single man of age 50 has 50,000 euro available, and he puts the money into a savings account where he receives an interest of 1% after tax. When the man reaches the age of 65, the total amount on the savings account is the initial investment plus accumulated interest compounded over 15 years ($50,000 \times (1.0115) = 58,048$), as from the age of 65 the man takes a fixed amount of money out of his savings account each year until he dies (in between, he still receives interest). Given his mortality rate, this fixed amount is the annuity A explained in equation 1 of appendix A. For the man in this example, the annuity A is 3521.13 euro. This calculation takes into account the fact that the man may also die between the ages of 50 and 65.

The example becomes somewhat more complicated for couples, since the members of a couple are often of different age and do not die at the same moment in time. Assume that the 50-year-old man described above has a wife of age 45, and that together they have 50,000 euro. The man reaches the age of 65 and takes a fixed amount of money out of their savings account every year. After five years the wife also reaches the age of 65, and they both start to take money out of their account every year. The wife probably lives longer than the man, and after his death she still takes money out of the account. We reckon that as a widow, she needs to take relatively more money out of their savings account to be equally well off as before, since she loses economies of scale. Appendix A explains in detail the calculations for couples. For the annuitization of private savings we use an

annual real rate of return of 1% after tax,¹¹ and the most recent mortality rates per cohort predicted by Statistics Netherlands (December 17th 2010).¹² As for the future, we assume that no additional private savings are being made to finance retirement.

With regard to housing, we assume an average yearly drop in real property prices of 1%. This means that an individual of age 40 in 2008 experiences a drop in the real value of his house of 22% between now and the age of 65.¹³ Homeowners who have paid off part of their mortgage have relatively low housing costs. We take this into account by a small percentage (4%) of the net capital accrued in property (imputed rent). With an inflation of 2% we have an imputed rent in real terms of 2% (4%-2%). Until the age of 65, imputed rental income increases net housing wealth (e.g. by paying off the mortgage). It can be seen as a return on housing wealth.

To standardize household income we use the equivalence scale provided by Statistics Netherlands (Siermann et al., 2004), described above. We assume that no additional private savings and mortgage repayments will be made between 2008 and the year in which people reach the age of 65. Thus, for the present we look only at current savings to determine pension savings sufficiency, and we compare current savings with current income. Also, we assume that retirement is the only savings motive for households, although other motives may exist, such as bequests (Van Gilst et al., 2008). We also assume that children have left the

11 We assume the discount rate to be the same as the real rate of return. We vary this annual real rate of return over different scenarios in section 8. An annual real interest rate of 0% is used in the pessimistic scenario and 2% in the optimistic scenario.

12 We assume that remaining lifetimes of couples are independent.

13 We know that between 2008 and the present the average drop in housing prices was already 20% (real).

household at the time the key person of the household reaches the age of 65. Furthermore, we allow for widowhood, but assume that couples stay together and singles remain single.

6.2 Results future retirement income

Table 3 shows that— for most households— public pension benefits and occupational pensions are the most important sources of income after retirement. These components together provide 65% of the average total annuitized wealth. Second pillar pension entitlements are highest in the two youngest age categories. There are several reasons for this. First, the pension coverage for young cohorts is higher than for old cohorts (especially among women). Second, we assume that people keep their current job until the age of 65, while older people have had more time to run into a gap, caused by a period of part-time employment or unemployment. Also, they may already have retired early, which decreases the occupational pension they receive as from the age of 65. If we would take into account the possibility that young cohorts will also run into unemployment, disability and/or early retirement, then their occupational pension would also be lower. Finally, current reforms in the 'Witteveenkader', which especially influence younger cohorts, have not yet been taken into account.

The mean and median occupational pension benefits show that the distribution of occupational pension entitlements is skewed to the right (private pensions are distributed unequally such that high deciles receive a proportionally larger share of total private pensions). The distribution of public pension entitlements, however, is evenly distributed (most people receive a full state pension that consists of a flat rate).

Table 3. Predicted yearly retirement income (annuitized wealth)^a

Age group	35-49	50-54	55-59	60-64	65-69	70+	All
Wealth: average annuity							
Public pension ^b	11,141	11,233	12,107	12,817	12,533	12,955	11,895
Occupational pension ^c	14,431	13,474	12,107	8,806	669	73	9,678
Voluntary pension products ^d	779	915	917	752	47	5	606
Net savings account	873	1,120	1,235	1,692	1,973	5,578	1,982
Stocks substantial shareholders	1,048	1,021	1,373	1,649	952	820	1,101
Securities	547	955	983	962	1,086	2,905	1,164
Business assets	255	299	250	223	211	72	219
Imputed rent	2,584	3,789	4,061	4,252	4,037	2,601	3,202
<i>Private pension benefits 65+ ^e</i>	22	150	375	2,159	12,685	9,254	3,036
Total pension annuities	31,680	32,955	33,408	33,313	34,193	34,263	32,884
Wealth: median annuity							
Public pension ^b	11,426	11,426	12,384	13,033	13,075	13,033	11,426
Occupational pension ^c	12,485	11,026	9,306	5,377	0	0	6,333
Voluntary pension products ^d	0	0	0	0	0	0	0
Net savings account	379	421	626	719	973	2,020	656
Stocks substantial shareholders	0	0	0	0	0	0	0
Securities	0	0	0	0	0	0	0
Business assets	0	0	0	0	0	0	0
Imputed rent	1,035	2,472	2,735	2,947	2,679	0	1,558
<i>Private pension benefits 65+ ^e</i>	0	0	0	0	8,293	5,352	0
Total pension annuities	27,926	28,511	28,109	26,990	27,442	24,416	27,275
Frequency (fraction)							
Public pension ^b	1	1	1	1	1	1	1
Occupational pension ^c	0.97	0.95	0.94	0.87	0.16	0.02	0.71
Voluntary pension products ^d	0.44	0.49	0.49	0.41	0.04	0.00	0.33
<i>Private pension benefits 65+ ^e</i>	0.00	0.01	0.03	0.02	0.92	0.86	0.26

- a Pension annuities in 2010 euros. Income is adjusted for differences in household composition by applying equivalence scales. The age of the key person in the households determines the age category of the household.
- b We assume that persons reside in the Netherlands at least until the age of 65.
- c For persons younger than 65 we observe the annuity that participants would receive in case they remain employed in their current job with their current income until the age of 65 (no career/income developments).
- d Pension rights accumulated in the third pillar are approximated using yearly contributions as from 1989.
- e For persons of age 65 and older we do not observe occupational pension rights and the amount of wealth accumulated in voluntary pension products, but we do observe the sum of actual private pension income.

Annuitized wealth from net savings accounts and securities is relatively high among the 70+ population because their remaining life expectancy is relatively low. Note that in this paper we assess whether current savings are adequate. We make no predictions about the extent of resources available to individuals at age 65, but estimate how much they would have in light of their current resources. We have to keep in mind that younger generations have more time to supplement their private savings. Also, private savings are probably higher especially for those persons who have an occupational pension gap.

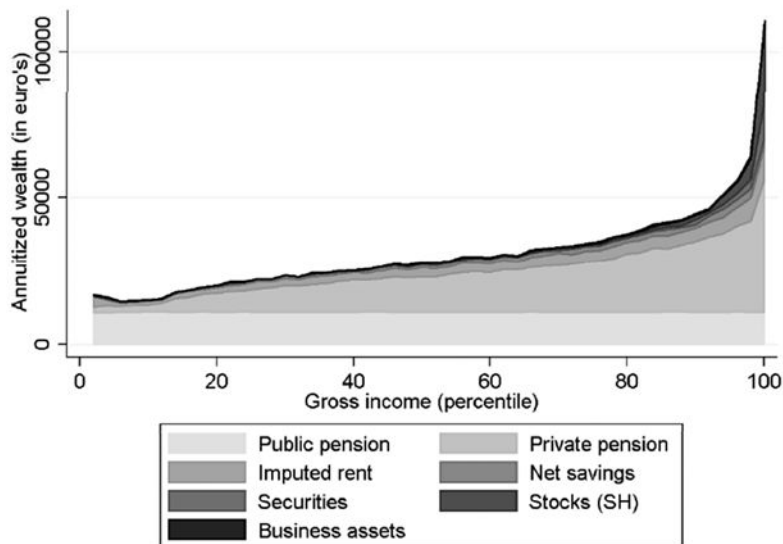
Total pension annuities can be interpreted as the total pension annuity when people retire at the age of 65 and use private wealth to bridge the gap until their public pension eligibility age (they “borrow” private wealth against their future public pension income).

Figure 1 shows the average annuitized wealth components over the income distribution, where households are sorted from low- to high gross income. As expected, public pensions are flat over the entire income distribution. All other wealth components increase with gross income, with a large peak at the higher end of the income distribution. The share of net savings accounts and securities in total pension annuities increases at the higher end of the income distribution.

6.3 Gross replacement rates

As a first measure of pension savings adequacy, we divide predicted retirement income by gross current income. This gives a replacement rate for households, using their current income, their current wealth, and the assumption that people keep their current job with their current wage and do not build up more capital (other than first and second pillar entitlements).

Figure 1. Composition of pension annuities over the income distribution^a



a Annuitized wealth in 2010 euros and equivalized with respect to household composition. Households are sorted from low to high gross income.

Basically, we indicate to what extent current savings can replace current income conditional on the current job and wage, which is assumed to stay equal until the age of 65.

Table 4 shows three different replacement rates. The first replacement rate only takes into account public and occupational pension benefits. The second includes voluntary pension products and other financial wealth, and the third also includes the imputed rental income of net housing wealth. These three replacement rates indicate the importance of different wealth components and provide insight into the replacement rates when

Table 4. Gross replacement rates, 2008^{a,b}

Age group	35-49	50-54	55-59	60-64	All
Ratio 1st and 2nd pillars / current gross income					
ratio p25	0.61	0.50	0.49	0.50	0.55
ratio p50	0.76	0.63	0.64	0.68	0.71
ratio p75	0.91	0.77	0.78	0.87	0.87
Ratio 1st and 2nd pillars and private wealth / current gross income					
ratio p25	0.66	0.55	0.55	0.59	0.61
ratio p50	0.82	0.69	0.70	0.77	0.77
ratio p75	0.98	0.84	0.85	0.96	0.94
Ratio Total pension annuities/ current gross income					
ratio p25	0.70	0.60	0.62	0.66	0.66
ratio p50	0.87	0.76	0.77	0.84	0.83
ratio p75	1.06	0.93	0.95	1.08	1.03

- a The three replacement rates in this table give an impression of the importance of 1st and 2nd pillar pensions, privately saved wealth and property to finance retirement. However, it should be noted that the ratios cannot be compared mutually, because of the rearranging of the quartiles with respect to the wealth components that are taken into account in calculating the replacement rates.
- b The table reports three quartiles (p25, p50 and p75) of the distribution of the replacement rates. At the bottom, 25% of the households have a replacement rate below the first quartile (p25). p50 indicates the median replacement rate. At the top, 25% of the households have a replacement rate higher than p75.

households do or do not deplete financial wealth.¹⁴ Table 4 shows that the total median gross replacement rate is 83% (p50). Half of the sample has a total gross replacement rate between 66% and 103% (p25 and p75, respectively). The ratio is relatively high for the youngest age category as well as for the category 60-64. This can partially be explained by the fact that current income is relatively low among these households, as observed in table 1. If we only take into account wealth in the first and second pension

¹⁴ Net housing wealth can also be depleted by moving to a smaller or rental house or by a reverse mortgage. Among current retirees this is not very common but it may become more common in the future. Section 8.2 describes the scenario in which households deplete housing wealth.

Table 5. Share of households below 70% and 100% gross replacement rates, 2008

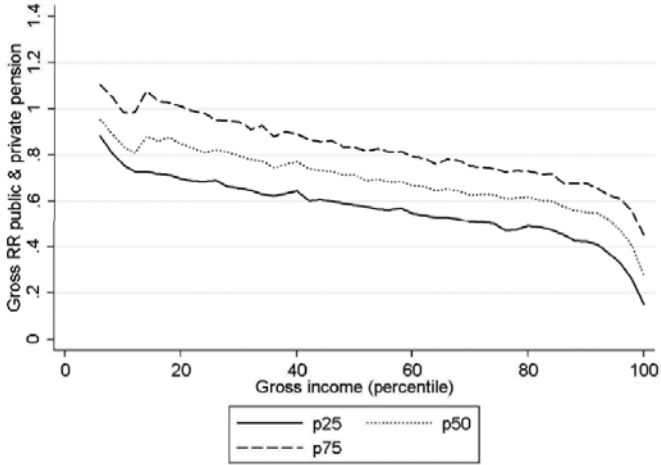
Age group	35-49	50-54	55-59	60-64	All
Share below 70% gross replacement rate					
1st and 2nd pillars	0.40	0.63	0.61	0.52	0.49
Idem, including private wealth	0.31	0.52	0.50	0.41	0.39
Total pension annuities	0.26	0.41	0.38	0.30	0.31
Share below 100% gross replacement rate					
1st and 2nd pillars	0.85	0.94	0.93	0.85	0.87
Idem, including private wealth	0.77	0.89	0.88	0.78	0.81
Total pension annuities	0.68	0.81	0.80	0.68	0.72

pillars, replacement rates become substantially lower in all age categories. This substantial contribution of non-pension wealth, including housing, to retirement income is also found by Crawford and O'Dea (2012), who performed a comparable analysis for the UK.

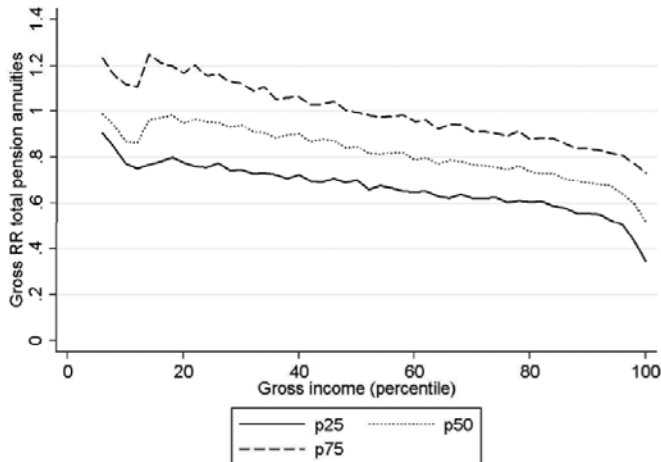
Table 5 shows that when account is taken only of public and occupational pensions, a considerable share of the households (49%) has a gross replacement rate below 70%. When account is taken of the third pillar, private wealth and imputed rental income from net housing, this percentage decreases to 31%. On the other hand, 28% (=100%–72%) of the households can replace at least their current income using the total of their pension annuities.

Figure 2 presents the development and variation of the gross replacement rate over the income distribution. Figure 2a focuses on the ratio of public and private pensions to gross current income. Here, it should be noted that high replacement rates of about 100% for low gross incomes are institutionally determined with the 'social minimum'. The replacement rate declines over the income distribution from a median replacement rate of 95% at the lower end of the income distribution to a median

Figure 2. Replacement rates over the income distribution
 a: Ratio pension annuities first and second pillar / current gross income



b: Ratio total pension annuities / current gross income



Note: These figures show the 25th percentile, the median and the 75th percentile of the replacement rate. In (a) only public and occupational pensions are included. (b) includes all wealth components. On the x-axis, households are sorted by their equivalized current gross income.

replacement rate of 34% at the top of the income distribution. Figure 2b shows the ratio of total pension annuities compared to current gross income. Comparison of figures 2a and 2b reveals that wealth from voluntary pension products, private savings and property has a substantial positive effect on replacement rates; as from the 25th income percentile, replacement rates are approximately 15%-points higher when taking into account voluntary pension products, private savings and property. The replacement rate even increases by about 25%-points for the top quartile of the replacement rate (the dashed line) because of including private savings and housing wealth. The increase in the replacement rate is less substantial (about 8%) for the bottom quartile (the solid line). Finally, the decline in replacement rates over the income percentiles is lower when we take into account private wealth and housing. As might be expected, the replacement rates that include total pension annuities show a larger variation than the replacement rates that only take into account first- and second pension pillars.

6.4 Net replacement rates

The analysis thus far has focused on gross income and gross replacement rates, and has not considered the Dutch labor income tax and benefits system. However, net replacement rates that take into account the taxes and benefits system may give a better indication of the extent to which households are adequately prepared for their retirement. Individuals above the statutory retirement age face lower marginal tax rates in the first two brackets of the income tax system and do not pay premiums for social insurance and social security. This means that net replacement rates are in general higher than gross replacement rates.

Total disposable income (the denominator of the net replacement rate) is easily determined by summing primary income minus taxes plus transfers in the IPO database. To compute net pension annuities (the numerator), we compute the average tax burden of 65+ singles, couples, homeowners and renters in different income deciles. The appendix describes the tax burdens found in IPO, which are reasonably comparable to those found in Microtax (CPB, 2008). We apply these tax burdens to the sum of predicted pension annuities in the first, second and third pillar. We do not tax annuities from financial wealth and housing wealth (actually, they were already taxed at the moment they were received as income). Wealth taxation is 1.2% of the financial wealth above the threshold of 20,000 euro per person. We do not take into account wealth taxation explicitly, but implicitly: when we use a real rate of return of 1% we assume that this is net of taxes.

Table 6 shows net replacement rates. Whereas the median replacement rate of first and second pillar pensions was 71% in gross terms (table 4), this is 84% in net terms, indicating that the majority of households are able to replace 84% of their current disposable income with net public and occupational pension benefits. The median net replacement rate increases to 92% when we take into account voluntary third pillar pensions and private wealth, and to 101% when we also add the imputed rental income of net housing.

Table 7 shows that only 24% of the households face a net replacement rate that is lower than 80% when all pension annuities are taken into account. When we only take into account first and second pillar pensions, this percentage is substantially higher (43%). Furthermore, table 7 indicates that 51% of all

Table 6. Net replacement rates, 2008^a

Age group	35-49	50-54	55-59	60-64	All
Ratio 1st and 2nd pillars / current disposable income					
ratio p25	0.73	0.62	0.62	0.63	0.67
ratio p50	0.90	0.76	0.78	0.82	0.84
ratio p75	1.06	0.91	0.92	1.00	1.01
Ratio 1st and 2nd pillars and private wealth / current disposable income					
ratio p25	0.79	0.68	0.70	0.73	0.75
ratio p50	0.97	0.84	0.86	0.92	0.92
ratio p75	1.15	1.01	1.02	1.12	1.11
Ratio Total pension annuities / current disposable income					
ratio p25	0.84	0.76	0.79	0.83	0.81
ratio p50	1.04	0.94	0.96	1.03	1.01
ratio p75	1.27	1.15	1.16	1.28	1.24

- a The age of the key person in the households determines the age category of the household.

Table 7. Share of households below 80% and 100% net replacement rates, 2008^a

Age group	35-49	50-54	55-59	60-64	All
Share below 80% net replacement rate					
1st and 2nd pillars	0.35	0.57	0.53	0.47	0.43
Idem, including private wealth	0.26	0.43	0.39	0.33	0.32
Total pension annuities	0.21	0.31	0.26	0.22	0.24
Share below 100% net replacement rate					
1st and 2nd pillars	0.67	0.85	0.84	0.75	0.74
Idem, including private wealth	0.55	0.74	0.73	0.61	0.61
Total pension annuities	0.45	0.59	0.56	0.46	0.49

- a The age of the key person in the households determines the age category of the household.

households are able to fully replace current disposable income with net pension annuities.

For international comparison, Crawford and O'Dea (2012) find that 53% of the individuals have a replacement rate below 80% in the UK in 2008, taking into account pension income alone.

If the authors take into account all sources of wealth, only 21% of UK individuals fall below a replacement rate of 80%. Based on households, for the Netherlands we find that 43% (first and second pillars) and 24% (total pension annuities) fall below the 80% replacement rate in the Netherlands in 2008. Both calculations are based on a nominal interest rate of 3%.

6.5 Poverty

Whereas sections 6.3 and 6.4 focused on replacement rates, high replacement rates do not necessarily reflect high incomes during retirement. For example, low-income households may face relatively high replacement rates because public pensions and social security benefits provide almost everyone with a social minimum. On the other hand, relative poverty may be high among them.

Unlike the relative poverty thresholds used by the EU, the Netherlands uses an absolute poverty line as official poverty indicator. The official poverty line in the Netherlands is the absolute *social minimum* proposed by the Netherlands Institute for Social Research (SCP). The social minimum implies that a single person aged 65 or over is in poverty if the person's income is lower than 928 euro (net, excluding holiday allowance) a month in 2008. Pensioners have a low probability to fall in official poverty, since a full public pension equals the social minimum. An individual who has not lived in the Netherlands all of the years between age 15 and 65 may have an incomplete public pension, but in the event that household income is lower than the social minimum and household wealth is lower than 5,325 euro per person, he is supplemented with social assistance benefits up to the social minimum (homeowners may own an additional amount of wealth of 44,950 euro). Due to these supplements up

Table 8. Predicted share of households that need a social assistance supplement during retirement

Age group	35-49	50-54	55-59	60-64	All
All households (35-64)	0.04	0.04	0.04	0.03	0.04
First-generation immigrants	0.30	0.39	0.40	0.40	0.34

to the social minimum there are almost no elderly households living in absolute poverty. Only if someone has not lived in the Netherlands all of the years between the age of 15 and 65 and his income or wealth is above these thresholds, or if someone does not possess the Dutch nationality or if that person is in detention he will not receive social assistance to supplement income to the social minimum. Furthermore, the take-up rate of these social assistance supplements is not 100%. Those who do not take-up the social assistance supplement live in poverty.

Our predictions of retirement income indicate that approximately 4% of all households that are currently in the age group 35-64 will need social assistance when they are retired, in order to top up public pension benefits to the social minimum (table 8). Among first-generation immigrant households, about 34% will need social assistance. Those who do not take up social assistance will live in poverty. Furthermore, low-income but wealthy households who do not receive a complete public pension may live in poverty according to the *social minimum* income definition, because they do not receive a social assistance supplement. Considering their wealth, however, these households may not really be said to live in poverty. Finally, some low-income households with relatively high mortgage rents and low imputed rents may fall into poverty according to the *social minimum* income definition.

Official poverty lines of the EU are based on 60%, 50% and 40% of median equivalized household income (MEI). For the Netherlands, these EU indicators of poverty imply that households fall into poverty when they have a yearly income lower than 12,003, 10,003 or 8,003 euro¹⁵ for a poverty line based on 60%, 50% and 40% of MEI, respectively. These EU poverty thresholds are lower than or about the same as the social minimum. This means that only the above-mentioned households who do not take up social assistance, who have a low income but a high wealth level, or those with relatively high mortgage rents, may fall into poverty according to the EU definitions.

15 In 2010 euros. Non-deflated poverty lines for 2008 as reported by EU-SILC are 11,713, 9,761 and 7,809 euro respectively.

7. Vulnerable groups

Whereas previous sections of this paper investigated retirement readiness of the Dutch population, this section focuses on several potentially vulnerable groups. First, we study households with self-employment, since self-employed individuals do not have to participate in a pension fund (in contrast to most Dutch paid workers). Section 7.2 studies the vulnerability of other groups such as immigrants and households that faced unemployment or disability for at least two years between 1989 and 2008. Here, the information we use is not only of the year 2008, but also of the years 1989–2007, so as to construct a more robust indicator of vulnerable groups. Year-to-year movements in and out of social insurance, for example, are substantial.

7.1 Self-employed households

Table 9 describes the income of self-employed households, defined as households in which at least one person has been self-employed for more than 1,225 hours per year or at least one person is a director-shareholder for at least two years in the period 1989–2008. Under this definition, about 15% of the total population of households is classified as being a self-employed household. First of all, we find that both mean and median household income are higher among the self-employed than in the general population of table 1 (which includes also inactive households). A second interesting observation is that self-employed households receive a substantial amount of labor income in addition to profits from business. About 80% of the self-employed households in the age group 35–59 receive labor income, and both the mean- and median income from labor are

higher than the mean and median profits from business. Only for the age group 60–64 are profits higher than labor income.

The combination of substantial profit and labor income may arise from the fact that persons may combine self-employment with part-time employment, or because partners of self-employed individuals are wage-employed, or because persons were self-employed at least two years between 1989 and 2007 and were wage-employed in 2008. Either way, household income risk from owning a business is reduced by having substantial labor income upon which to rely.

Table 11 indicates that second pillar pension wealth is substantially lower among self-employed households than among the general population described in table 2 (both in terms of mean- and median wealth), although participation in the second pillar is comparable to that of the general population. Self-employed households may therefore face a serious deterioration in income after retirement. However, tables 10 and 11 also indicate that self-employed households own more non-pension wealth, such as property, and third pillar pensions. Compared to the general population in table 3, participation rates, average and median values of voluntary third pillar pension wealth are higher in all age categories.

Table 12 shows replacement rates of self-employed households, which are generally lower than the replacement rates of the total population (table 4).¹⁶ Taking into account only first and second pillar pensions, the median self-employed household is expected to replace only 50% of current income (this is 71% for

16 We do not present net replacement rates in this section. The self-employed have extensive tax facilities such as the 'Zelfstandigenaftrek' and the 'MKB vrijstelling'. Compared to the wage employed they have a relatively low tax pressure.

Table 9. Income composition of self-employed households, 2008^a

Age group	35-49	50-54	55-59	60-64	All
Income: average					
Labor income	25,296	31,372	29,076	19,481	26,164
Disability insurance	547	1,053	1,413	1,708	880
Unemployment insurance	168	257	521	398	257
Public pension (AOW)	185	183	351	1,265	330
Private pension	368	834	2,422	9,386	1,744
Non-labor income	-1,930	500	3,466	6,275	135
Profit from business	20,492	23,250	23,805	25,990	22,024
Social assistance	84	81	147	115	96
Child- and study allowances	895	590	255	73	664
Other transfers ^b	181	175	65	42	148
Gross income	46,286	58,294	61,521	64,732	52,442
Disposable income	30,982	38,160	39,808	42,771	34,710
Income: median					
Labor income	16,479	22,129	18,894	7,173	16,668
Disability insurance	0	0	0	0	0
Unemployment insurance	0	0	0	0	0
Public pension (AOW)	0	0	0	0	0
Private pension	0	0	0	0	0
Non-labor income	-2,509	-1,362	0	356	-1,639
Profit from business	13,653	13,242	12,666	12,423	13,347
Social assistance	0	0	0	0	0
Child- and study allowances	927	278	0	0	577
Other transfers ^b	0	0	0	0	0
Gross income	37,756	47,840	48,917	45,523	41,596
Disposable income	27,162	33,317	34,172	33,046	29,505
Frequency (fraction)					
Labor income	0.85	0.88	0.81	0.64	0.82
Disability insurance	0.10	0.15	0.18	0.19	0.13
Unemployment insurance	0.05	0.05	0.06	0.05	0.05
Public pension (AOW)	0.03	0.03	0.05	0.17	0.05
Private pension	0.08	0.13	0.21	0.47	0.15
Non-labor income	0.98	0.99	0.98	0.99	0.98
Profit from business	0.77	0.78	0.73	0.75	0.77
Social assistance	0.02	0.02	0.02	0.02	0.02
Child- and study allowances	0.82	0.52	0.23	0.06	0.60
Other transfers ^b	0.35	0.29	0.11	0.04	0.27
Gross income	1.00	1.00	1.00	1.00	1.00
Disposable income	1.00	1.00	1.00	1.00	1.00
# Observations self-employed in 2008	2,219	652	529	459	3,859
# Observations	3,648	1,041	847	706	6,695

a Equivalized household income in 2010 euros. The age of the key person in the households determines the age category of the household. We exclude 65+ households, since we do not know for all of them whether they were self-employed before retirement or not.

b Rental house allowance, home owner grant, alimony and study costs allowance.

Table 10. Wealth composition of self-employed households, 2008^a

Age group	35-49	50-54	55-59	60-64	All
Wealth: average					
Savings account	58,941	69,783	99,147	121,968	73,333
Debt other than mortgage	70,754	71,220	99,646	95,136	77,510
Stocks substantial shareholders	115,997	111,293	185,845	225,620	137,089
Securities	30,631	34,930	78,509	79,491	43,371
Mortgage	225,820	172,816	141,261	134,298	195,154
Property	424,024	507,823	547,810	602,560	474,990
Business assets	30,857	39,990	40,784	46,759	35,526
Net housing wealth	198,205	335,007	406,549	468,263	279,836
Ratio mortgage / value property	0.59	0.39	0.36	0.25	0.48
Total wealth	363,876	519,783	711,188	846,963	491,645
Wealth: median					
Savings account	18,157	17,765	39,369	41,148	22,301
Debt other than mortgage	0	0	0	0	0
Stocks substantial shareholders	0	0	0	0	0
Securities	0	0	0	0	0
Mortgage	163,988	120,443	82,357	72,372	134,794
Property	327,189	377,501	406,623	392,601	350,537
Business assets	1,677	0	1,338	444	1,112
Net housing wealth	118,759	213,575	282,333	289,191	168,305
Ratio mortgage / value property	0.56	0.32	0.23	0.19	0.41
Total wealth	173,968	302,689	373,203	430,629	236,005
Frequency (fraction)					
Savings account	0.94	0.95	0.95	0.95	0.94
Debt other than mortgage	0.30	0.33	0.38	0.38	0.33
Stocks substantial shareholders	0.08	0.09	0.09	0.10	0.08
Securities	0.38	0.42	0.42	0.43	0.40
Mortgage	0.77	0.74	0.64	0.64	0.73
Property	0.87	0.90	0.88	0.90	0.88
Business assets	0.70	0.65	0.63	0.64	0.68
Total wealth	0.99	0.99	0.99	0.99	0.99
# Observations	3,648	1,041	847	706	6,242

a Wealth in 2010 euros. The age of the key person in the households determines the age category of the household.

Table 11. Predicted yearly retirement income (annuitized wealth) of self-employed households, 2008^a

Age group	35-49	50-54	55-59	60-64	All
Wealth: average annuity					
Public pension ^b	11,214	11,284	12,105	12,805	11,527
Occupational pension ^c	12,251	11,172	9,828	8,012	11,263
Voluntary pension products ^d	2,004	2,587	2,737	2,272	2,231
Net savings account	-501	-9	-182	1,045	-201
Stocks substantial shareholders	5,222	4,998	7,438	8,672	5,876
Securities	1,369	1,502	3,525	3,050	1,874
Business assets	1,403	1,676	1,644	1,803	1,527
Imputed rent	4,913	7,618	8,783	9,665	6,427
<i>Private pension benefits 65+ ^e</i>	21	127	363	2,246	337
Total pension annuities	37,897	40,954	46,240	49,571	40,860
Wealth: median annuity					
Public pension ^b	11,426	11,426	12,333	13,095	11,426
Occupational pension ^c	7,411	7,820	5,687	3,376	6,733
Voluntary pension products ^d	388	773	700	570	485
Net savings account	498	403	838	960	538
Stocks substantial shareholders	0	0	0	0	0
Securities	0	0	0	0	0
Business assets	78	0	53	20	50
Imputed rent	2,968	4,850	6,171	5,917	3,973
<i>Private pension benefits 65+ ^e</i>	0	0	0	0	0
Total pension annuities	28,365	31,629	33,564	34,340	30,016
Frequency (fraction)					
Public pension ^b	1	1	1	1	1
Occupational pension ^c	0.97	0.93	0.90	0.82	0.93
Voluntary pension products ^d	0.59	0.65	0.68	0.63	0.62
<i>Private pension benefits 65+ ^e</i>	0.00	0.01	0.03	0.12	0.02

a in 2010 euros.

b We assume that persons reside in the Netherlands from now until the age of 65.

c We assume that persons stay in their current job with their current wage rate until the age of 65. Unemployed individuals remain unemployed.

d Pension rights accumulated in the third pillar are approximated using yearly contributions from 1989.

e For persons of age 65 and older we do not observe occupational pension rights and the amount of wealth accumulated in voluntary pension products, but we do observe the sum of actual private pension income.

Table 12. Gross replacement rates self-employed household, 2008

Age group	35-49	50-54	55-59	60-64	All
Ratio 1st and 2nd pillars /current gross income					
ratio p25	0.37	0.30	0.28	0.28	0.33
ratio p50	0.56	0.44	0.40	0.43	0.50
ratio p75	0.77	0.62	0.60	0.62	0.72
Ratio 1st and 2nd pillars and private wealth / current gross income					
ratio p25	0.46	0.38	0.40	0.40	0.43
ratio p50	0.68	0.55	0.56	0.60	0.63
ratio p75	0.92	0.80	0.80	0.84	0.89
Ratio Total pension annuities / current gross income					
ratio p25	0.53	0.47	0.50	0.52	0.52
ratio p50	0.77	0.69	0.68	0.75	0.74
ratio p75	1.05	0.96	1.00	1.05	1.03

Table 13. Share of self-employed households below 70% and 100% gross replacement rates, 2008

Age group	35-49	50-54	55-59	60-64	All
Share below 70% gross replacement rate					
1st and 2nd pillars	0.67	0.82	0.82	0.82	0.73
Idem, including private wealth	0.53	0.66	0.67	0.62	0.58
Total pension annuities	0.43	0.51	0.53	0.45	0.46
Share below 100% gross replacement rate					
1st and 2nd pillars	0.90	0.93	0.93	0.93	0.91
Idem, including private wealth	0.80	0.85	0.85	0.83	0.82
Total pension annuities	0.71	0.77	0.75	0.72	0.73

the total population). Adding third pillar pensions, private wealth and imputed rental income from net housing reduces the gap in the gross replacement rate between self-employed households and the general population. Adding these components allows the median self-employed household to replace 74% of their current income after retirement (compared to 83% for the total population). The spread around this median replacement rate is larger for the self-employed than for the general population. Half of the self-employed households have a replacement rate

between 52% and 103%, compared to 66% and 103% for the general population.

Table 13 shows that 46% of the self-employed households have a gross replacement rate lower than 70%, when taking into account all annuities. This is only 31% for the general population (table 5). So, the self-employed are less likely to maintain their current income. Note, however, that current income is on average also substantially higher among self-employed households. Finally, we find that 2% of the self-employed households that are currently in the age group 35–64 will need social assistance when they are retired, to top up public pension benefits to the social minimum (compared to 4% in the total population, section 6.5). These are immigrant households with incomplete public pension entitlements.

7.2 Other potentially vulnerable groups

This section distinguishes several potentially vulnerable groups, namely first-generation immigrants, single women and households that faced unemployment, disability or social assistance for one or more years between 1989 and 2008. Clearly, there is a large overlap between these groups. For example, 36% of the households with at least one first-generation immigrant and 14% of the single women received social assistance for at least one year between 1989 and 2008. This percentage is even higher for households with a single female first-generation immigrant (44%).

First-generation immigrants may be vulnerable since they have not fully accumulated public pension entitlements. Furthermore, single women may be potentially vulnerable because of small or non-existent occupational pensions due to part-time work and providing care to their children. Recipients of unemployment

insurance or social assistance may be vulnerable, since in general they do not accumulate occupational pension rights.¹⁷ For persons in disability insurance this is different. In nearly all pension funds individuals in disability insurance build up occupational pension rights as if the person still works in his previous job, with a dispensation from paying occupational pension premiums. Finally, households renting a house are in general low-income households. This means that they do not build up housing wealth (relatively tax beneficial), which adds to their vulnerability.

Table 14 presents median pension annuities and gross median replacement rates of the potentially vulnerable groups under consideration. The first column of the table indicates that most of the potentially vulnerable groups have a relatively low retirement income from pensions, private wealth and housing. The lowest retirement income is observed among households that experienced at least one year of social assistance. Among these households, retirement income is generally not much higher than the basic public pension. The table also indicates that retirement income is relatively low among households without homeownership (and that this difference is not completely due to the nonexistence of housing wealth).

The second column shows median gross replacement rates. We see that all potentially vulnerable groups have a replacement rate that is close to or above 70%, indicating that current income can to a large extent be maintained after retirement. Note, however,

17 For persons who received unemployment benefits before January 2004 and who passed the age of 40, there is the possibility to make use of the *Stichting Financiering Voortzetting Pensioenverzekering* (FVP). This option allows persons to build up the same amount of occupational pension rights as they did in their last job, given that their yearly labor income did not exceed 49,954 (in 2010 euros). If yearly labor income did exceed the amount of 49,954 pension rights are built up only partially, depending on the exact amount of labor income earned in the previous job.

Table 14. Median annuities and gross replacement rates (GRR) of potentially vulnerable groups, 2008^a

Age group	Median pension annuity	Median gross replacement rate
First generation immigrants		
1st and 2nd pillar	13,818	0.72
Idem, including private wealth	14,190	0.74
Total pension annuities	14,524	0.76
Persons with no homeownership		
1st and 2nd pillar	16,622	0.72
Idem, including private wealth	17,410	0.75
Total pension annuities	17,453	0.75
Single women		
1st and 2nd pillar	15,209	0.73
Idem, including private wealth	16,471	0.77
Total pension annuities	17,540	0.80
At least two years experience of unemployment		
1st and 2nd pillar	20,180	0.67
Idem, including private wealth	21,732	0.72
Total pension annuities	24,105	0.78
At least two years experience of disability		
1st and 2nd pillar	18,168	0.64
Idem, including private wealth	19,872	0.69
Total pension annuities	22,138	0.75
At least one year experience of social assistance		
1st and 2nd pillar	12,048	0.81
Idem, including private wealth	12,164	0.81
Total pension annuities	12,185	0.82
All households (35–64)		
1st and 2nd pillar	22,699	0.71
Idem, including private wealth	25,006	0.77
Total pension annuities	27,905	0.83

a in 2010 euros.

b Renters cannot deplete housing wealth; some renters, however, own real estate in the form of a holiday home or a houseboat.

that high replacement rates among these groups are caused by relatively low current income levels, such that receiving public pensions may already be sufficient to replace current income. This seems to be especially the case for households that received at least one year of social assistance.

By comparing three types of replacement rates, table 14 shows the amount of private and housing wealth, relative to income, that is accumulated by the potentially vulnerable groups. First-generation immigrants and households on social assistance have barely accumulated non-pension wealth, while those in unemployment or disability insurance have accumulated non-pension wealth.

8. Scenario analyses

This section analyzes the sensitivity of pension savings adequacy to the assumptions made. In addition to the baseline scenario presented in the previous sections, section 8.1 presents an optimistic and a pessimistic scenario in which we vary the indexation of occupational pensions, the real rate of return on non-housing wealth, the real return on property, and the retirement age. In the optimistic scenario, all factors are set optimistically. The opposite is the case in the pessimistic scenario. Hence, the two scenarios provide upper- and lower bounds on the resources available at retirement that actual outcomes are likely to fall into.

Section 8.2 uses the parameters of the baseline scenario again, but we show the effect of housing wealth depletion after retirement (instead of only taking into account the imputed rental income from net housing).

8.1 Optimistic and pessimistic scenarios

Table 15 shows the parameters of the baseline, pessimistic and optimistic scenarios. Several assumptions remain constant across the scenarios. In all three scenarios we assume an inflation rate of 2%, a nominal imputed rent of 4% and real return on past third pillar payments of 1% after tax.

Other assumptions vary by scenario. The pessimistic scenario assumes no indexation of occupational pensions, such that the real value of occupational pension rights declines 2% every year due to inflation. The baseline scenario assumes 50% indexation. Real occupational pension rights are not reduced in the optimistic scenario, where full indexation takes place.

Table 15. Assumptions in the pessimistic, baseline and optimistic scenario

Scenarios	Pessimistic	Baseline	Optimistic
Inflation	2%	2%	2%
Indexation	0%	50%	100%
Real return assets (after tax)	0%	1%	2%
Real return property (after tax)	-2%	-1%	0%
Imputed rent	4%	4%	4%
Past real return 3rd pension pillar	1%	1%	1%
Future real return 3rd pension pillar	0%	1%	2%
Retirement age	64	65	67

We assume a real return of 0%, 1% and 2% in the pessimistic-, baseline- and optimistic scenarios, respectively. Furthermore, the average real return on property from 2008 until retirement is -2%, -1% and 0% in the pessimistic-, baseline- and optimistic scenarios, respectively. This means that in the pessimistic scenario, an individual of age 40 in 2008 experiences a drop in the real value of his house of almost 40% between now and the age of 65; in the optimistic scenario, the drop is 0% (which entails a positive average real rate of return on property as from 2012 until the age of 65, since real housing prices have decreased between 2008 and 2012).

Finally, we assume different retirement ages in the three scenarios. A relatively low retirement age has a negative effect on retirement income and is, therefore, assumed in the pessimistic scenario. On the other hand, a relatively high retirement age has a positive effect on retirement income, and this is assumed in the optimistic scenario. People stop working and start using their pension annuities as from the age of 64 in the pessimistic scenario, 65 in the baseline scenario and 67 in the optimistic scenario. We adjust accumulated pension rights in an actuarially neutral way, using the factors of CPB (2009). This means that we

Table 16. Median pension annuities in the pessimistic- and optimistic scenarios^a

Age group		35-49	50-54	55-59	60-64	All
<i>Pessimistic</i>	Public pension	10,573	10,573	11,530	12,186	10,573
	Occupational pension	9,027	8,826	7,748	4,690	8,246
	Voluntary pension products	0	0	0	0	0
	Net savings account	256	313	492	594	332
	Stocks substantial shareholders	0	0	0	0	0
	Securities	0	0	0	0	0
	Business assets	0	0	0	0	0
	Imputed rent	812	2,178	2,519	2,849	1,456
	<i>Private pension benefits 65+</i>	0	0	0	0	0
	Total pension annuities	22,508	24,293	24,829	24,727	23,380
<i>Optimistic</i>	Public pension	13,134	13,134	14,091	14,728	13,134
	Occupational pension	18,530	14,831	11,945	6,598	14,954
	Voluntary pension products	0	0	0	0	0
	Net savings account	592	599	850	926	676
	Stocks substantial shareholders	0	0	0	0	0
	Securities	0	0	0	0	0
	Business assets	0	0	0	0	0
	Imputed rent	1,360	2,930	3,067	3,158	2,147
	<i>Private pension benefits 65+</i>	0	0	0	0	0
	Total pension annuities	37,170	35,410	33,712	31,059	35,432

a in 2010 euros

cut occupational pension rights by 8% when the retirement age is 64, and increase occupational pension rights by 2 x 8=16% when the retirement age is 67. For public pensions we use an actuarially fair adjustment rate of 6.5% per year, and private savings are annuitized at age 64 in the pessimistic scenario and at age 67 in the optimistic scenario.

Table 16 shows median pension annuities in the pessimistic and optimistic scenarios. The table shows that the different assumptions have the highest impact on occupational pensions and imputed rent (induced by the indexation assumption, the retirement age, and the assumed development of housing prices).

The pessimistic scenario is most harmful to the young cohorts, since they have a longer period without indexation and with decreasing housing prices until they reach retirement. Older cohorts, who are closer to retirement, are relatively well-off in the pessimistic scenario compared to the households in the 35–49 age category. On the other hand, in the optimistic scenario, young cohorts have a relatively long period until retirement in which they can benefit from returns on investments and housing wealth.

Compared to the baseline scenario presented in table 3, older cohorts perform relatively well in the pessimistic scenario, young cohorts perform relatively well in the optimistic scenario, while the baseline scenario is slightly in favor of the younger age groups. This relatively good position of the younger age group can primarily be explained by relatively high occupational pensions. We may, however, overestimate the occupational pension accumulation of the young due to the assumption that individuals remain in their current job until the age of 65 (64 or 67 in the other two scenarios). In practice, however, it is observed that persons tend to reduce working hours as from the age of 50 (women) or 55 (men), and to retire or become unemployed before the age of 65.

Table 17 presents gross replacement rates in the pessimistic and optimistic scenarios, and shows similar patterns as table 4. As expected, median replacement rates including all components are lower in the pessimistic scenario (0.70) and higher in the optimistic scenario (1.04) relative to the baseline scenario (0.83) presented in table 4. Replacement rates are lower for young cohorts compared to the older cohorts in the pessimistic scenario, while the reverse is true for the baseline and optimistic scenarios. All in all, we can conclude that results regarding retirement savings adequacy are sensitive to different future scenarios.

Table 17. Gross replacement rates in the pessimistic- and optimistic scenarios

Age group		35-49	50-54	55-59	60-64	All
<i>Pessimistic</i>	Ratio 1st and 2nd pillars / current gross income					
	ratio p25	0.50	0.43	0.44	0.46	0.47
	ratio p50	0.62	0.54	0.56	0.63	0.60
	ratio p75	0.75	0.67	0.70	0.80	0.74
	Ratio 1st and 2nd pillars and private wealth / current gross income					
	ratio p25	0.54	0.47	0.48	0.53	0.51
	ratio p50	0.66	0.58	0.61	0.69	0.65
	ratio p75	0.79	0.72	0.75	0.88	0.79
	Ratio Total pension annuities / current gross income					
	ratio p25	0.57	0.52	0.55	0.60	0.56
	ratio p50	0.71	0.65	0.68	0.77	0.70
	ratio p75	0.86	0.80	0.84	0.99	0.86
	<i>Optimistic</i>	Ratio 1st and 2nd pillars / current gross income				
ratio p25		0.79	0.62	0.58	0.58	0.68
ratio p50		0.99	0.78	0.76	0.80	0.89
ratio p75		1.21	0.95	0.93	1.00	1.11
Ratio 1st and 2nd pillars and private wealth / current gross income						
ratio p25		0.86	0.68	0.67	0.68	0.76
ratio p50		1.08	0.86	0.85	0.89	0.97
ratio p75		1.31	1.05	1.02	1.11	1.21
Ratio Total pension annuities / current gross income						
ratio p25		0.91	0.75	0.74	0.76	0.82
ratio p50		1.15	0.94	0.92	0.98	1.04
ratio p75		1.42	1.16	1.13	1.24	1.32

Young generations benefit most from an optimistic scenario but also suffer more from a pessimistic scenario, compared to older generations.

8.2 Depletion of housing wealth

Throughout the paper the assumption has been made that households receive an imputed rental income on net housing wealth, but that households do not deplete housing wealth. So, households neither move to a smaller house or rental house, nor use reverse mortgages to finance retirement with housing wealth.

Table 18. Median pension annuities when housing wealth will be depleted^a

Age group	35-49	50-54	55-59	60-64	All
Net housing annuities	1,976	4,795	5,278	5,729	3,339
Total pension annuities	29,825	31,637	31,270	30,337	30,340

a in 2010 euros

Table 19. Gross replacement rates when using the house as retirement income

Age group	35-49	50-54	55-59	60-64	All
Ratio Total pension annuities / current gross income					
ratio p25	0.72	0.64	0.66	0.71	0.69
ratio p50	0.91	0.81	0.83	0.91	0.88
ratio p75	1.14	1.03	1.04	1.20	1.12

This section assumes that net housing wealth will be depleted after retirement. At the retirement age people buy an annuity from their net housing wealth, in the same way as we assumed for private wealth (explained in section 6.1). Thus, households still receive an imputed rental income, but also 'eat up' their housing wealth. Compared to table 3, table 18 shows that the total median pension annuity is substantially higher when net housing wealth will be depleted. This holds especially for older generations, who have a relatively high net housing wealth. For the age category 60-64, the median total pension annuity increases more than 3,000 euro per year.

The higher total pension annuities due to the depletion of housing wealth also translate into higher gross replacement rates (table 19). Taking into account also the depletion of housing wealth instead of only taking into account the imputed rent increases the median replacement rate from 0.83 to 0.88, indicating that the median household can replace about 90% of

current gross income during retirement if one takes into account pensions, private wealth and the depletion of housing wealth. Half of the households have a gross replacement rate between 69% and 112%.

9. Summary and conclusions

This study is part of the OECD Retirement Savings Adequacy (RSA) project and analyzes retirement savings adequacy in the Netherlands. The study uses detailed administrative data about income, pension entitlements, private wealth and housing wealth in order to estimate the financial resources of future generations of retirees.

The paper first reviewed the literature about retirement savings adequacy. There are several ways to judge retirement savings adequacy, and this study focuses on absolute pension amounts in relation to the social minimum and replacement rates. The absolute pension amount measures financial resources available during retirement, whereas the replacement rate indicates to what extent current income can be replaced during retirement.

Our results show that equivalized financial resources during retirement are on average about 33,000 euro per year and have a median of 27,000 euro per year. Young generations own relatively more occupational pension rights, whereas older generations have accumulated more private wealth and housing wealth. Private wealth and housing wealth raise median replacement rates substantially. Whereas the median gross replacement rate from public and private pensions is 71%, this increases to 83% when account is taken of all pension annuities.

The large-scale administrative data used in this study make it possible to focus on several vulnerable groups, such as households with self-employment. Self-employed households have relatively low occupational pension rights, but relatively high voluntary pensions, private savings and net housing wealth. Total pension annuities are on average about 41,000 euro per year and have a median of about 30,000 euros. This is somewhat higher

than the pension annuities in the total population, however, which also includes inactive households. Replacement rates of the self-employed are relatively low, with a median of 74% for all pension components together. Other vulnerable groups include first-generation immigrants, single women and households that have faced unemployment, disability and/or social assistance. Whereas households with first-generation immigrants and households with social assistance rely almost fully on public pensions (and potentially a supplement from social assistance), households with unemployment or disability often own private wealth, which increases their median replacement rate by more than 10%-points.

Assumptions about indexation, housing prices and the retirement age influence the results. Occupational pension rights decrease dramatically when no indexation takes place between now and retirement, and developments in housing prices influence the imputed rental value of households' net housing wealth. Median total pension annuities vary from 23,000 euro in our pessimistic scenario to 35,000 euro in our optimistic scenario. Associated median replacement rates vary between 70% and 104%. If people were to deplete net housing wealth, the median pension annuity in the baseline scenario would increase by about 3,000 euro per year, which implies an increase in the median gross replacement rate of about 5%-points.

This study represents a first step in the assessment of retirement savings adequacy. There are several important issues to bear in mind when interpreting the results. First, we use the data of Statistics Netherlands about occupational pension rights, which assume that people stay employed in their current job until a fixed retirement age. This means that we are likely to overestimate the occupational pension rights of the young generation. A

natural next step might involve taking into account how future wages and labor force participation will evolve. With regard to future research, our data would provide good opportunities to estimate life-cycle earnings dynamics and the participation and number of hours of work simultaneously by extending the panel selection method of Rochina-Barrachina (1999). These estimates could be used to implement predictions of future earning paths and earning risks in the simulation model, such that more credible estimates of future second pillar pension entitlements can be computed. Also, adjustments in the 'Witteveenkader', such as a decline in the accrual rate, can then be simulated.

Second, we currently assume that no additional private savings will be made. In reality, private savings may increase, especially when households know that the second pillar will become less generous. For example, Alessie et al. (2011) suggested that social security wealth and pension wealth partly displace private savings, and Jia and Zhu (2012) found that this displacement is higher among high-income households than among low-income households. So, cuts in occupational pensions will partly be compensated by private savings, especially among high-income households. Structural models can be estimated to explain private saving behavior of Dutch households, and these models can be used in policy simulations.

Third, wealth accumulated in investment-based mortgages is not taken into account, since data on this wealth are not made available by the tax office ('spaar- en belegginshypotheek'). Future analyses on the basis of survey data from the 'Woningbehoefteonderzoek' may offer opportunities to explore the way in which different cohorts use investment-based mortgages and the degree to which we underestimate accumulated wealth.

Fourth, this study focuses on retirement income at the retirement age. Pension cuts after that age are not taken into account. Decreasing home prices after retirement, on the other hand, are taken into account in the scenario where people deplete housing wealth.

Fifth, we do not take into account that life expectancies differ substantially among income classes. Remaining life expectancy at age 65 is on average 2.5 years shorter for a low-income individual compared to a high-income individual (Kalwij et al. 2013). This means that on average annuitized private savings will be higher for low-income groups and lower for high-income groups.

Finally, whereas current simulations show deterministic outcomes, they are surrounded by uncertainty. In addition to existing uncertainty in future earnings, uncertainty in second pillar pension benefits will increase because risk of return and increases in life expectancy (macro longevity risk) will be deferred to participants of second pillar pension schemes. This is an interesting track for future research.

In the near future more data will become available about accumulated pension rights in 2009, 2010 and 2011. This information is important because of the heterogeneous financial position of pension funds, which results in diverse indexation and pension cuts across households. Given the pension- and long-term care reforms still to come, we argue that it is important to extend this research to convincingly evaluate the effect of several policy-relevant scenarios on a wide variety of households.

References

- Alessie, R., Angelini, V., Van Santen, P., 2011. Pension wealth and household saving in Europe: evidence from SHARELIFE, Netspar Discussion Paper, no. 10/2011-088.
- Banks, J., Blundell, R., Tanner, S., 1998. Is there a retirement-savings puzzle? *American Economic Review* 88(4), 769-788.
- Bernheim, B., Skinner, J., Weinberg, S., 2001. What accounts for the variation in retirement wealth among US households? *American Economic Review* 91 (4), 832-857.
- Belastingcommissie inkomstenbelasting en toeslagen (Commissie Van Dijkhuizen), 2013.
- Binswanger, J., Schunk, D., 2011. What is an adequate standard of living during retirement? *Journal of Pension Economics and Finance* 11 (2), 203-222.
- Bos, W., 2012. Vrijwel altijd extra inkomsten naast de AOW, webmagazine, March 22, 2012.
- Boskin, M., Shoven, J., 1987. Concept and measurement of earnings replacements during retirement, NBER Working Paper, no. 1360. Cambridge MA.
- Caminada, K., 2000. Pensioenopbouw via de derde pijler. beschrijving van de ontwikkeling, omvang en verdeling van premies lijfrenten volgens de inkomensstatistiek, Department of Economics Research Memorandum 2000.01, Leiden University.
- Caminada, K., Goudswaard, K., Koster, F., 2012. Social income transfers and poverty: A cross country analysis for OECD countries. *International Journal of Social Welfare* 21, 115-126.
- CPB, 2008. Microtax 2008. www.cpb.nl/sites/default/files/node/9616/mtax0911.xls. Centraal Planbureau.
- CPB, 2009. Actuarieel neutrale korting bij vervroegde opname AOW. CPB notitie.
- Crawford, R., O'Dea, C., 2012. The adequacy of wealth among those approaching retirement, *Institute for Fiscal Studies Reports*, October 2012.
- Duleep, H., 1986. Measuring income's effect on adult mortality using longitudinal administrative record data. *Journal of Human Resources* 21 (2), 238-251.
- Eenkhoorn, E., Zijlmans, G., 2010. Normen voor de pensioenaansprakenstatistiek. Netspar NEA paper 29.
- Engen, E., Gale, W., Uccello, C., 1999. The adequacy of retirement saving, *Brookings Papers on Economic Activity*, vol. 30, 2, 65-187.
- Friedman, M., 1957. *A Theory of the Consumption Function*. Princeton University Press.
- Gilst, J. van, Nijboer, H., Caminada, K., 2008. De successiebelasting vanuit economisch perspectief, *Weekblad Fiscaal Recht*, 18 december 2008, 1423-1429.

- De Graaf, M., Rouwendal, J., 2012. The demand for mortgage debt and the elderly home equity puzzle, paper presented at Netspar Pension Workshop, January 2012.
- Haveman, R., Holden, K., Romanov, A., Wolfe, B., 2007. Assessing the maintenance of savings sufficiency over the first decade of retirement. *International Tax and Public Finance* 14, 481–502.
- Hoff, S., Van Gaalen, C., Soede, A., Lutén, A., Vrooman, C., Lamers, S., 2009. Genoeg om van te leven: Focusgroepen in discussie over de minimale kosten van levensonderhoud, Sociaal en Cultureel Planbureau. SCP-special 35.
- Jia, Z., Zhu, W., 2012. The effect of pension wealth on private savings, Statistics Norway Research Department Discussion Papers, no. 697.
- Kalmijn, M., Alessie, R., 2008. Life course changes in income: An exploration of age- and stage effects in a 15-year panel in the Netherlands, Netspar Panel Paper nr. 10.
- Kalwij, A., Alessie, R., Knoef, M., 2013. The association between individuals income and remaining life expectancy at the age of 65 in the Netherlands, *Demography*, 50(1), 181–206.
- Knoef, M., Been, J., Alessie, R., Caminada, K., Goudswaard, K., Kalwij, A., 2013a. De toereikendheid van pensioeninkomens in Nederland; een meerpijlerbenadering, in: W. Asbeek Brusse en C. van Montfort (red), *Wonen, zorg en pensioenen. Hervormen en verbinden*, Den Haag: Wetenschappelijke Raad voor het Regeringsbeleid, 2012/2013, 83–116.
- Knoef, M., Alessie, R., Kalwij, A., 2013b. Changes in the income distribution of the Dutch elderly between 1989 and 2020: a dynamic microsimulation, *Review of Income and Wealth*, 59(3), 460–485.
- Mensonides, J., Frijns, J., 2011. Begrenzing marktwaardering pensioenverplichtingen, *Economisch Statistische Berichten* 96, 430–433.
- OECD, 2011. *Pensions at a glance 2011: Retirement-income systems in OECD and G20 countries*, OECD publishing, www.oecd.org/els/social/pensions/PAG.
- Osler, M., Prescott, E., Grønbaek, M., Christensen, U., Due, P., Engholm, G., 2002. Income inequality, individual income, and mortality in Danish adults: analysis of pooled data from two cohort studies. *British Medical Journal* 324, 13–16.
- Rochina-Barrachina, M., 1999. A new estimator for panel data sample selection models, *Annals of Economics and Statistics* 55/56, 153–181.
- Scholz, J., Seshadri, A., Khitatrakun, S., 2006. Are Americans saving 'Optimally' for retirement? *Journal of Political Economy* 114 (4), 607–643.
- Siermann, C., Van Teeffelen, P., Urlings, L., 2004. Equivalentiefactoren. Statistics Netherlands.
- Van Vliet, O., Been, J., Caminada, K., Goudswaard, K., 2012. Pension reform and income inequality among the elderly in 15 European countries. *International Journal of Social Welfare* 21 (s1), s8–s29.

- VanDerhei, J., Copeland, C., 2010. The EBRI retirement readiness rating: Retirement income preparation and future prospects, EBRI Issue Brief, no. 344.
- Venti, Wise, 1991. Ageing and the income value of housing wealth. *Journal of Public Economics* 44 (3), 371-397.
- Walker, R., 1987. Consensual approaches to the definition of poverty: Towards an alternative methodology. *Journal of Social Policy* 16, 213-226.

Appendix A: Annuitizing wealth

This appendix describes the process of annuitizing wealth to income streams in retirement for single and couple households. For singles, the annuitization of savings is easy: we compute the annuity as from the statutory retirement age of 65 associated with the present value of savings. Formally, for single women we annuitize private savings by

$$A = K / \sum_{n=65-a}^{99-a} {}_n p_a \frac{1}{(1+r)^n} \quad , \quad (1)$$

where K is the amount of capital needed for annuity A as from the age of 65. a is age and ${}_n p_a$ is the probability that a woman of age a is still alive after n years. The maximum age in the mortality table of Statistics Netherlands is 99, and in the computation we therefore have to assume that people do not become older than 99. For single men we use the same expression as in (1); however, we replace ${}_n p_a$ by ${}_n q_a$, which is the probability that a man of age a is still alive after n years.

To annuitize personal savings of couples, we need more assumptions, since we observe savings on the household level and we do not know how the members of a couple divide their wealth over each other. To determine pension savings adequacy we assume that couples smooth their wealth over time and over each other.

Often members of a couple are of different age and do not die at the same moment in time. For example, when we have a man and a woman, with an age difference of five years, we want to take into account that the man becomes 65 five years earlier than the woman and that, probably, the woman lives longer than the man. Also, we want to take into account economies of scale, since

multi-person households need less resources per person in order to be equally well off. To take both economies of scale and the age difference between members of a couple into account, we distinguish between the period where only the oldest member of the couple is 65 years or older and the period where both members are 65 or older. When the man is older than the woman we compute the annuity as follows:

$$A = K / \left(\sum_{n=\max(65-a_m, 1)}^{64-a_f} \left((1 - {}_n p_{a_f}) {}_n q_{a_m} + 0.5 \times E \times {}_n p_{a_f} {}_n q_{a_m} \right) \frac{1}{(1+r)^n} + \sum_{n=65-a_f}^{99-a_f} \left({}_n p_{a_f} (1 - {}_n q_{a_m}) + (1 - {}_n p_{a_f}) {}_n q_{a_m} + E \times {}_n p_{a_f} {}_n q_{a_m} \right) \frac{1}{(1+r)^n} \right), \quad (2)$$

where a_m is the age of the man, a_f is the age of the woman, and E reflects the equivalence scale (how much extra income a two-person household needs to be as well-off as a one-person household). We standardize the annuity to a one-person household. The first term of equation (2) reflects the period in which the man already reached the age of 65 and the woman is younger than 65. In case the woman is no longer alive, the man needs an annuity A ; in case the woman is still alive, we assume the man needs $0.5 \times E$ of an annuity, because of the economies of scale. The second term of equation (2) reflects the period in which both the man and the woman are of age 65 or older. In case only the man or only the woman is alive, the household needs annuity A . In case both are alive they need $E \times A$. The other way around, when the woman is older than the man, we use

$$A = K / \left(\sum_{n=\max(65-a_f, 1)}^{64-a_m} \left((1 - {}_nq_{a_m}) {}_np_{a_f} + 0.5 \times E \times {}_np_{a_f} {}_nq_{a_m} \right) \frac{1}{(1+r)^n} \right. \\ \left. + \sum_{n=65-a_m}^{99-a_m} \left({}_nq_{a_m} (1 - {}_np_{a_f}) + (1 - {}_nq_{a_m}) {}_np_{a_f} + E \times {}_np_{a_f} {}_nq_{a_m} \right) \frac{1}{(1+r)^n} \right). \quad (3)$$

When both men and women have the same age we only keep the second term of equation (2) or (3), because there is no period in time where one of the members is 65 or older and the other member has not yet reached the age of 65 in this situation.

Appendix B: Gross-to-net profiles

Based on the difference between gross and net income of households whose key person is currently aged 65+, we compute tax pressures per stratum of gross income (from p10 up to p90), and distinguish singles and couples households with and without homeownership. The results can be observed in Table B.

The information in table B is used to compute net from gross income in retirement of future retirees. Given the sum of the gross amount of first, second and third pillar pension income, we compute net pension income by multiplying the sum of first, second and third pillar pension income by one minus the tax pressure (given p10–p90 and household composition) and adding non-pension wealth (after tax). Non-pension wealth is not taken into account in the tax pressure in table B since it is not part of the income that is taxed as labor income.

Table B. Median tax pressure for retirees per decile of gross income, 2008^a

Gross household income (equivalized) percentile	p10	p20	p30	p40	p50	p60	p70	p80	p90
Income level (max)	15,514	19,846	25,111	30,228	35,362	40,915	47,150	55,544	70,014
Median tax pressure single 65+ households (house)	0.12	0.11	0.14	0.17	0.20	0.23	0.25	0.27	0.30
Median tax pressure single 65+ households (no house)	0.12	0.10	0.14	0.18	0.21	0.25	0.26	0.28	0.30
Median tax pressure couples 65+ households (house)	0.12	0.11	0.13	0.17	0.20	0.23	0.25	0.27	0.29
Median tax pressure couples 65+ households (no house)	0.11	0.11	0.14	0.18	0.21	0.24	0.27	0.27	0.29

a in 2010 euros.

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Measuring retirement savings adequacy

This paper by Marike Knoef (UL), Jim Been (UL) Rob Alessie (RUG), Koen Caminada (UL), Kees Goudswaard (UL) and Adriaan Kalwij (UU) investigates the adequacy of Dutch household retirement savings. To take account of the varying composition of pension savings across households, they analyze not only public and occupational private pension rights, but also annuity insurances, housing wealth and private savings. Conclusions regarding the adequacy of retirement savings are sensitive to different future scenarios, with young generations benefiting most from an optimistic scenario but also suffering more from a pessimistic scenario, compared to older generations.