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**Can the Dutch Meet Their Own
Retirement Expenditure Goals?**

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October 24, 2014

Abstract

Population aging and the poor performance of financial markets during recent years put the sustainability of pension arrangements in many Western countries under pressure. In order to investigate whether the Dutch will be able to cope with possible cutbacks in the generosity of pensions, we analyze their preparedness for retirement in 2008, at the eve of the prolonged downturn. In contrast to previous efforts to measure preparedness for retirement, we disentangle the roles of variation in needs and accumulated resources by comparing annuitized wealth from administrative data with self-reports of minimal and preferred expenditures during retirement. In order to draw conclusions that are representative for the Dutch population we estimate a multivariate sample selection model and simulate pension annuities and consumption needs. The model takes into account that some people thought more about retirement than others and that some people found it more difficult than others to answer questions about retirement needs. We find that in the aggregate the Dutch can expect to retire quite comfortably, exceeding their expenditure floors and affording their preferred level of spending. However, both needs and resources vary widely across the sample and about a fifth cannot afford their minimal expenditures even if they would draw down housing wealth.

Keywords: Retirement; pensions; savings; aging

JEL-codes: D14; D31; H55; J14

*The authors thank Marcel Das, Edwin de Vet, Arjen Hussem, Bettina Lamla, Annette Scherpenzeel, Arjan Soede, Maarten van Rooij, Arthur van Soest, Rob Alessie, Frederic Vermeulen, Pierre-Carl Michaud, Mathijn Wilkens, and participants of the MESS conference 2012, the PHF-SAVE conference 2013 on Household Finances, Saving and Inequality: An International Perspective, the CPB Research Seminar 2013 at the Netherlands Bureau for Economic Policy Analysis, the ESPE 2014 conference, the EEA 2014 conference and the EALE 2014 conference for their help and useful comments. We thank Netspar for their financial contribution to this project.

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1 Introduction

The question whether people save enough for retirement is not a new one. Most research on retirement preparedness has focused on the US, because the US pension system places responsibility for securing an income after retirement with the individual. In the absence of generous, universal public pensions, one naturally worries about saving decisions and their implications for eventual retirement income. Pensions in the Netherlands, on the other hand, cover almost the entire population and have traditionally succeeded to ensure an adequate income during retirement. As for most Western countries, however, Dutch pensions are not immune to the combined forces of population aging and weak financial market performance. Maintaining sustainability of the system will necessitate a combination of raising the pension eligibility age¹, and cuts in pension payments. Against this backdrop, this paper investigates the retirement readiness of the Dutch in January 2008, at the eve of the downturn in the financial markets. Our aim is to describe whether the Dutch were sufficiently prepared according to their own standards, to identify vulnerable groups, and to examine the consequences of disappointing pensions and decreasing housing prices.

Our approach differs from previous efforts in that we adopt as our yardstick for savings sufficiency self-reported measures of the minimal and preferred level of expenditures during retirement. The rationale for this approach is that preferences and constraints are likely to vary across individuals and households. Measuring readiness against a single universal threshold fails to capture relevant differences in coping strategies. Life-cycle models are able to take into account differences between households, but may have difficulties to accurately reflect heterogeneous preferences. This makes an alternative and complementary analysis useful.

Simultaneously analyzing both aims and means also yields new policy implications. On the one hand there are groups that have a modest expected retirement income but also low perceived needs. These people will not change their saving behavior when confronted with a realistic assessment of their financial position. On the other hand, financial information can motivate changes in saving behavior of groups with high expected retirement incomes who also have high perceived needs.

Another distinguishing feature of this paper is our combined use of survey and administrative data. For the subjective assessments of minimal and preferred expenditure levels during retirement, we draw unique survey data from a representative sample of the Dutch population. Tax records and data from pension funds, on the other hand, allow us to construct a complete and precise measure of the resources available to households.

To deal with selection issues, we estimate a multivariate generalization to the classical univariate sample selection model (Heckman, 1979). We model assets and self-reported retirement goals simultaneously and allow for correlation between the underlying unobserved heterogeneity. To assess whether the Dutch can meet their retirement expenditure goals we simulate pension annuities and

¹Until 2013 the statutory retirement age in the Netherlands was 65. As of January 2013 the statutory retirement age has increased by one month, and it will gradually increase to 66 in 2019 and 67 in 2023.

consumption needs. Our method hinges on the degree to which people can reasonably predict their expenditure needs during retirement. We find that people provide reasonable answers compared to their current income level and that young people and retirees provide similar answers. Furthermore, our model controls for the fact that some individuals have thought about retirement more than others, and that some people found it more difficult than others to answer questions about consumption needs during retirement. Our focus on attaining consumption goals after retirement means that we do not take into account other reasons to save, such as precautionary or bequest motives. If such additional rationales exist, our analysis should be interpreted as an upper bound on preparedness.

We find that in the aggregate the Dutch were well prepared for retirement. The median difference between the after-tax annuity that can be obtained at age 65 and the individual-specific level of minimal expenditures is 25% if we consider public and occupational pensions. For preferred expenditures this is 5%. Still, there is a sizable minority of close to 20 percent of the sample for whom the annuity falls short of minimum expenditures even if we include private savings and housing wealth. The size of those deficits is large enough to be problematic, with a median shortfall of around 30%. A multivariate analysis reveals that variation in needs interacts with accumulated resources to produce interesting patterns. For instance, we find that the highly educated accumulate more wealth, but are even more demanding in terms of their minimal retirement income. As a result they are less likely to reach their goals. The self-employed and the divorced stand out as vulnerable groups with relatively modest pension entitlements.

The remainder of the paper is organized as follows. The next section provides a short overview of pension arrangements in the Netherlands. Section 3 presents a literature review on retirement readiness. Section 4 describes the data, after which section 5 explains our methodological approach. Section 6 shows the estimation results and analyzes who can and cannot look forward to comfortable retirement. The final section concludes.

2 The Dutch pension system

As in many European countries, the Dutch pension system consists of four pillars, all of which will be taken into account in this paper. The first pillar is a flat-rate public pension for all residents, financed by a pay-as-you-go scheme. This public pension aims to provide retirees with a subsistence income during retirement. Its level is set in relation to the minimum wage² and depends only on the number of years spent abroad during the accumulation period (payments are cut with 2 percent for each year spent abroad between the ages of 15 and 65). For people with a low pension income and almost no wealth, the first pillar is topped up with social assistance to guarantee the social minimum. The second pillar is that of occupational pensions that cover 90 percent of Dutch

²Single pensioners who have lived in the Netherlands between the ages of 15 and 65 receive 70% of the minimum wage. Couples receive 100% of the minimum wage.

workers (Bovenberg and Meijdam, 2001). The level of occupational pensions depends on the average or final wage of the individual worker throughout the accumulation phase. Though occupational pensions are mostly defined benefit, the possibilities of non-indexation and pension cuts introduce uncertainty in payments. Together the first two pillars of the pension system aim to replace 70 percent of the final or average wage. The third pillar offers saving vehicles such as life annuities. They are fiscally attractive for and especially used by the self-employed. In contrast to the first two pillars, third pillar pensions are voluntary and usually of the defined contribution type. The fourth pillar contains all other assets that individuals may decumulate to generate income during retirement, such as savings accounts and housing wealth. This paper takes into account these four pillars. Human capital (sometimes called the fifth pillar) is not taken into account. We investigate retirement savings adequacy with a fixed retirement age of 65.³

3 Literature

This paper compares available resources with self-reported minimal and preferred retirement expenditures to assess whether the Dutch are ready to meet their expenditure goals after retirement. It fits in with the large literature on retirement savings adequacy, which has focused mostly on the US. In the US responsibility for maintaining one's standard of living after retirement has long been allocated primarily to the individual, with social security replacing 40% of final income on average (Beshears et al., 2009). Research in the 1990s found that the introduction and growing importance of defined contribution personal savings accounts caused large increases in overall wealth available for retirement (Venti and Wise, 1996). However, Mitchell and Moore (1998) warn that the median US household at the verge of retirement has accumulated insufficient funds to sustain consumption close to the pre-retirement level for another 20+ years. Excluding housing wealth, Skinner (2007) argues that rising out of pocket medical expenses threaten even the affluence of households with post-graduate degrees. Engen et al. (1999) reach a more comforting conclusion. Comparing observed wealth data with optimal behavior in a lifecycle model, they show that more than half of their survey respondents have wealth-earnings ratios at or above the median optimal ratio for their socioeconomic characteristics. Furthermore, their simulation model underestimates the actual wealth among households with high ratios of wealth to earnings, suggesting that wealth accumulation is adequate for a majority of households. Scholz et al. (2006) compare optimal savings from a lifecycle model with household-specific wealth profiles. They find that their model explains 80 percent of the variation in wealth holdings, that fewer than 20 percent of the households have below optimal wealth and that wealth deficits are small.

In any case, Americans are not convinced that they will be able to afford retirement. Yakoboski and Dickemper (1997) document that while 69% of workers set aside some money for retirement, only 25 percent are very confident that their savings will allow them to live comfortably throughout

³Of course it is also possible to make the retirement age cohort-specific in the calculations.

retirement. Such worries persist into retirement, since 23% of retirees are not confident that their savings will allow comfortable living until death. With regard to maintaining savings adequacy after retirement, Haveman et al. (2007) find that a stable fraction of 34 percent cannot meet their own pre-retirement consumption levels and 5 percent does not meet the official US poverty standard during the first decade of retirement. However, at the household level large fluctuations do occur.

Brugiavini and Padula (2001) look at saving in Italy and provide interesting insight into the differences between the US and Europe. In Italy, as in the Netherlands, mandatory contributions for pensions are relatively high. In Italy this results in a replacement rate of about 60-70 percent of pre-retirement after tax income, so there is little need for additional savings. Other authors have focused specifically on the Netherlands. Alessie et al. (1997a) investigate the effect of social security and pensions on private savings and find no significant effect for pension wealth but some, less than perfect, replacement of private savings by social security. In other work, Alessie et al. (1997b, 1999) and Van Ooijen et al. (2014) document that a large fraction of Dutch households do not dissave during retirement, perhaps due to bequest motives. The study that is closest to ours in terms of focus and data is that by Knoef et al. (2014). They provide a detailed description of the wealth holdings in the Dutch population using a large administrative dataset. However, they do not have access to survey data on self-perceived retirement expenditures, so they cannot evaluate the sufficiency of savings using that heterogeneous reference point.

Previous papers mostly use one of three definitions for adequate retirement savings: ability to maintain pre-retirement consumption (or a fraction thereof); ability to meet some official poverty line; or ability to meet wealth holdings predicted by a lifecycle model. The literature shows that the choice of benchmark against which to measure retirement readiness is not without consequences. For the US, about a third of the retiring households may not be able to consume as much during retirement as they did while still working (Haveman et al., 2007). However, that need not be problematic, since consumption needs are likely to decline when individuals retire. Indeed, a much smaller fraction will drop below the poverty line, but income at the poverty threshold will not be satisfactory for individuals used to high consumption levels. If optimal savings are derived from lifecycle models, the picture changes to one in which US households are saving adequately. However, lifecycle models may not always accurately reflect the decision process and heterogeneous preferences of real individual households. Our approach to retirement readiness compares annuitized wealth with minimal and preferred expenditures reported by survey respondents. One important advantage of this method is that it allows consumption needs to differ at the level of the individual household, depending on preferences and constraints that are likely to be household-specific.

4 Data

As explained in the introduction, we combine survey data on minimal and preferred expenditures during retirement with tax data on assets to investigate whether the Dutch are sufficiently prepared

to meet their own goals. This section describes the survey data (4.1), the administrative data (4.2) and the linking of both datasets (4.3).

4.1 Survey data

Survey data are taken from the LISS panel (Longitudinal Internet Study in the Social Sciences), gathered by CentERdata.⁴ This panel is recruited through address-based sampling (no self-selection), and households without a computer and/or internet connection receive an internet connection and computer for free. This roughly nationally representative household panel (Van der Laan, 2009) receives online questionnaires each month, on different topics. When respondents complete a questionnaire they receive a monthly incentive. A variety of data is available from studies conducted in the LISS panel.

In this paper we use a single wave study on minimal and preferred pension expenditures. These data were elicited from LISS-respondents in January 2008 on the initiative of Johannes Binswanger and Daniel Schunk (see Binswanger and Schunk, 2012, for their analysis of a similar questionnaire distributed to the CentERpanel and Binswanger et al., 2011, for an analysis of panel conditioning that uses the same survey data we use).

The yardstick against which we measure retirement savings adequacy is the respondent's own subjective evaluation of what would be a minimal and preferred level of expenditure during retirement. After some questions about retirement planning and housing expenditures, subjective minimal levels of household expenditures were elicited by means of an open-ended question:

This question refers to the overall level of spending that applies to you [*and your partner/spouse*] during *retirement*. What is the minimal level of monthly spending that you would never want to fall below during retirement, at all costs? Please think of all your expenditures, such as food, clothing, housing, insurance etc. Remember, please assume that prices of the things you spend your money on remain the same in the future as today (i.e. no inflation).

... per month

don't know

The phrasing of this question helped respondents to keep in mind an inclusive view of their monthly budget by emphasizing the wide variety of expenditures that need to be covered. Housing is especially important in this respect, since the primary residence often is the most important discretionary asset held around retirement. The survey primes respondents to take this into account by first asking questions on housing before moving on to the questions about retirement expenditures. In the actual question the importance of housing is emphasized again. Out-of-pocket health care

⁴For more information, see <http://www.lissdata.nl/lissdata/>.

costs were negligible and not a concern at the time of the questionnaire. Therefore, self-reported minimal consumption levels do not include health consumption, making the question easier.

In contrast to minimal expenditures, preferred expenditures during retirement are elicited by means of one or two multiple-choice questions. Answers are anchored on current net household income in order to ensure that the answers are meaningful for the respondents. In each question the respondent is shown scenarios that consist of a certain level of expenditures during working life and during retirement, with replacement rates of 50, 64, 76, 88, 100, and 140 percent (the scenarios are roughly actuarially neutral). For example, the following questions were asked to a respondent with a household income of 3,500 euro per month⁵:

[Please assume that you are not retired yet]

Next you will find four options for how you could spend your money over your lifetime. For each option the first column indicates how much [*you* (if respondent has no spouse/partner) / *your household* (if respondent has a spouse/partner)] could spend on average per month from age 25 until retirement. Thus, this refers to your total (working) time from age 25 until retirement, [add only if not retired: *NOT just the remaining (working) time*]. The second column indicates how much [*you* (if respondent has no partner)/ *your household* (if respondent has a partner)] could spend during retirement. Please think of all your expenditures, such as food, clothing, housing, insurance, traveling etc. Assume that the numbers below show what you can spend after having already paid for taxes. Assume also that prices of the things you spend your money on remain the same in the future as today (i.e., no inflation). If you had a choice, which option would you like most?

- a. 3,000 during working life; 3,000 during retirement
 - b. 3,150 during working life; 2,750 during retirement
 - c. 3,300 during working life; 2,500 during retirement
 - d. 3,450 during working life; 2,200 during retirement
- don't know

If the respondent indicates that he or she would prefer one of the extreme options (a or d), a second question is asked in order to give respondents more choice without confusing them with too many options at once:

[If the answer is a.:]

⁵Consumption levels are chosen such that monthly consumption during working life in option D do not exceed current income. For retirees current income is divided by 0.85, to take into account the income drop due to retirement.

You chose option a [$3,000$] euro during working life and [$3,000$] euro during retirement. If you had a choice between this option and a further new option (z, see the table below), which one would you choose?

a. 3,000 during working life; 3,000 during retirement

z. 2,650 during working life; 3,700 during retirement

don't know

[If the answer is d.:]

You chose option d [$3,450$] euro during working life and [$2,200$] euro during retirement. If you had a choice between this option and a further new option (z, see the table below), which one would you choose?

d. 3,450 during working life; 2,200 during retirement

z. 3,650 during working life; 1,800 during retirement

don't know

The questionnaire includes two such sets of questions, one that assumes a real interest rate of 1% and another that assumes a 6% real interest rate. In this paper we only analyze preferred expenditures based on 1% real interest, because that scenario is closest to the current market conditions. Furthermore, the order of the scenarios is randomized across respondents: half see expenditures during working life in ascending order (as shown above) and the other half in descending order. Binswanger and Schunk (2012) provide a more detailed description of the questions. In this paper we standardize expenditures to single person households using the equivalence scale constructed by Statistics Netherlands (Siermann et al., 2004). This equivalence scale assumes that a couple without children needs 37% more income than a single person household to achieve the same standard of living.

The questionnaire on minimal and preferred expenditure levels during retirement was received by 2,405 LISS panel-members. Panel members that received the questionnaire were household heads and their spouses, with a reported net monthly income higher than 800 euros⁶ and age greater than or equal to 25. Out of these 2,405 individuals, 2,005 answered at least 1 question (83% survey response). However, a much smaller number of 1,483 and 1,289 respondents, 62 and 54% of the potential sample, answered the main questions about minimal and preferred expenditures during retirement, respectively. If the underlying selection process is related to consumption needs, such a large fraction of item non-response is problematic. We will discuss selection issues further in section 4.3.

The top panel of table 1 contains descriptive statistics for minimal expenditures during retirement. On average, respondents would like to spend at least 1,542 euro per month during their

⁶In this way students, for example, are excluded.

retirement. The median respondent would like to spend at least 1,460 euro per month. This is about 50% more than the public state pension, which aims to provide a basic subsistence level of income to all retired residents. In table 1 we also divide minimal individual assessed expenditures by current income. We find an average and median ratio of 74 percent. This is in line with the 70 percent replacement rate that is often mentioned as reasonable by financial planners and it is in line with the replacement rate that is targeted by Dutch pension funds.

Self-perceived preferred expenditures during retirement are somewhat higher, with a median of 1,606 euros per month. Across different age groups, we find that minimum expenditures are constant but median preferred expenditures are higher for middle aged respondents. The distribution of the underlying self assessed preferred replacement rates, however, is about the same for all age categories. Most people would like to have a replacement rate of 76 or 88%. However, a substantial percentage of 15% prefer a replacement rate of 100% or higher (and are willing to sacrifice consumption during working life to achieve such generous income after retirement). 9% prefers a replacement rate of 64% or lower. Together with the standard deviations of minimum and preferred expenditures this shows the added value of our subjective benchmarks compared to one-size-fits-all approaches (such as poverty lines or fixed replacement rates for everyone).

Table 1: Descriptive statistics of minimum expenditures during retirement and preferred replacement rates

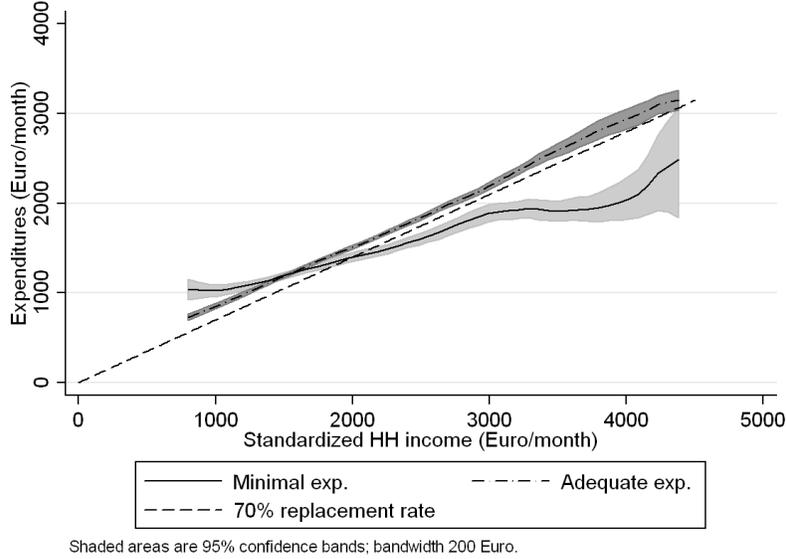
	All respondents						By age				
	N	Mean	p25	Mdn	p75	SD	25-34 Mdn	35-44 Mdn	45-54 Mdn	55-64 Mdn	65+ Mdn
<i>Self-assessed minimum retirement expenditures</i>											
Minimum exp. ^a	1,483	1,542	1,095	1,460	1,825	781	1,357	1,460	1,460	1,460	1,460
Min. exp. / current income	1,483	74.3	55.9	73.6	90.2	36.1	74.5	72.5	66.8	77.1	80.9
<i>Self-assessed preferred retirement expenditures</i>											
Preferred exp. ^{a,b}	1,289	1,889	1,277	1,606	2,044	3,725	1,460	1,569	1,715	1,642	1,606
Preferred exp./current income	1,289	78.1	71.2	78.6	83.9	10.7	77.8	77.8	78.1	79.2	84.5
<i>Distribution of self-assessed preferred replacement rates</i>											
Preferred RR 50% ^b	1,289	0.03	0	0	0	0.17	0.04	0.04	0.03	0.02	0.02
RR 64%	1,289	0.06	0	0	0	0.24	0.05	0.07	0.05	0.05	0.09
RR 76%	1,289	0.39	0	0	1	0.49	0.38	0.38	0.40	0.38	0.39
RR 88%	1,289	0.37	0	0	1	0.48	0.37	0.37	0.39	0.39	0.33
RR 100%	1,289	0.12	0	0	0	0.32	0.13	0.11	0.11	0.12	0.13
RR 140%	1,289	0.03	0	0	0	0.17	0.03	0.02	0.03	0.03	0.04

^a Retirement expenditures and current income are equalized to a one-person household.

^b Preferred expenditures are elicited using a 1% real interest rate.

Figure 1 shows kernel regressions of minimal and preferred expenditures during retirement on standardized household income. It includes a dashed line corresponding to a 70% replacement rate with regard to current income. Both expenditure levels increase with income but the overall gradient is steeper for preferred expenditures than for minimal expenditures. Preferred expenditures closely follow the 70% line, suggesting that a replacement rate of 70% is a good approximation for the

Figure 1: Kernel regressions of minimal and preferred expenditures during retirement on income (consumption floors and income are standardized to a one-person household)



average preferred consumption level. Minimum expenditures are larger than preferred expenditures only for respondents with monthly net household income below 1,700 Euro, probably because the latter are anchored on current income while the former are not. Since preferred expenditures are anchored to current income, people with higher minimal expenditures than preferred expenditures probably do not regard their current income sufficient to exchange it for a higher pension.

Respondents seem to give reasonable answers about their retirement needs during retirement. The average replacement rate is in line with the average needs of current retirees found by Soede (2012). Furthermore, minimal expenditures and preferred replacement rates are about the same for people younger and older than 65 (who already know how it is to be retired). Respondents, however, do find the questions on expenditures during retirement challenging. For instance, younger respondents have not thought much about retirement: of the respondents aged 25-34, 86% report having thought “only a little” or “not at all” about retirement. For the pre-retirees, age 55-64, this fraction is 51%. Furthermore, 35% of the individuals find it difficult to assess their expenditure needs during retirement. More details about the difficulty of the questions can be found in appendix A. In our model we control for the fact that poor-quality answers could be systematically higher or lower than others.

4.2 Administrative data

The quality of any evaluation of retirement readiness depends on the analyst’s ability to measure financial resources. Survey reports of assets are known to suffer from substantial non-response and under-reporting, in particular when it comes to ownership of categories like stocks and savings accounts (Johansson and Klevmarken, 2007; Bound et al., 2001).⁷ For these reasons we prefer to use more reliable administrative sources.

Administrative data are taken from the 2008 Complete Asset data of the Netherlands (CAD, CBS, 2008a), the 2008 Public Pension Entitlements data (PPE, CBS, 2008b), the 2008 Public Pension Benefits data (PUBLB, CBS, 2008c), the 2008 Occupational Pension Entitlements data (OPE, CBS, 2008d), and the 2008 Private Pension Benefits data (PRIVB, CBS, 2008e) all gathered by Statistics Netherlands.

The CAD consists of all households in the Netherlands and contains data about savings accounts, stocks, securities, property, business wealth and debt. Debt is categorized in mortgage and other debt. Although most of these data are derived from tax records, banks also provide information about bank accounts. Banks only have to report accounts with a balance of 500 euro or more (or 15 euro in interest payments), which means that we miss small amounts of money held in bank accounts.

PPE and OPE contain information about public and occupational pension entitlements for the whole Dutch population between the ages of 21 and 64. PPE is based on data from the organization that implements national insurance schemes in the Netherlands and OPE is based on data from pension funds. Finally, public and private pension benefits received by all retirees in the Netherlands are based on tax records and are available in PUBLB and PRIVB.

Third pillar pensions (e.g. life annuities) are, unfortunately, only observed in administrative data once they are claimed, because they are subject to taxation only in the payout phase. Therefore, we have to resort to the 2008 wave of the LISS Assets Survey to supplement the administrative data of pre-retirees with survey data on third pillar pension entitlements.

⁷Non-response is common in the LISS questionnaires on assets. Moreover, a comparison of administrative records with survey data reveals that many respondents wrongly indicate that they do not own savings accounts and investments (ownership rates are 10 percentage points lower in the survey compared to tax records). Homeownership, on the other hand, is reported accurately. Among those who indicate ownership, we find that the balance of savings accounts, the value of the primary residence and that of the corresponding mortgage are understated.

Table 2: Descriptive statistics of household assets and pension entitlements (ownership rates and mean and median amounts conditional on ownership)

	By age group												Total	Mean
	25-34		35-44		45-54		55-64		65+		Owner	Mdn		
	Owner	Mdn	Owner	Mdn	Owner	Mdn	Owner	Mdn	Owner	Mdn				
a. Assets														
<i>Financial assets</i>														
Saving accounts	0.91	12,033	0.93	16,206	0.96	20,519	0.95	25,228	0.98	23,395	0.94	19,223	39,939	
Stocks and bonds	0.20	6,075	0.34	14,911	0.38	19,575	0.36	21,666	0.38	26,339	0.34	16,976	64,629	
Business assets	0.07	14,951	0.08	19,081	0.08	11,441	0.04	8,706	0.01	18,636	0.06	15,118	45,893	
Other assets	0.01	64,397	0.03	2,831	0.04	6,352	0.06	32,944	0.08	125	0.04	8,000	165,887	
Debt (other than mortgage)	0.03	9,866	0.09	12,127	0.14	30,171	0.12	21,234	0.10	27,834	0.10	22,442	50,424	
Net non-housing wealth	0.92	13,569	0.95	20,857	0.97	23,431	0.95	32,960	0.98	23,395	0.95	22,751	66,747	
<i>Housing wealth</i>														
Residential real estate	0.75	214,857	0.81	250,572	0.80	253,973	0.78	283,453	0.55	325,403	0.76	253,973	295,442	
Non-residential real estate	0.10	199,000	0.04	165,000	0.12	135,000	0.07	169,760	0.09	115,866	0.08	165,000	197,488	
Mortgage debt	0.75	192,300	0.77	176,470	0.70	106,797	0.69	88,488	0.41	60,503	0.69	138,856	152,716	
Net housing wealth	0.76	22,185	0.81	82,233	0.81	164,399	0.79	193,868	0.57	250,042	0.77	142,860	174,077	
Mortgage/property		0.90		0.66		0.37		0.25		0.10		0.44	0.49	
b. Annuities														
<i>Gross pension entitlements (standardized annuities)</i>														
Public pensions	1.00	1,040	1.00	1,040	1.00	1,040	1.00	1,040	1.00	1,040	1.00	1,040	1,018	
Private pensions ^a	0.99	1,140	1.00	1,265	0.99	1,215	0.97	867	0.95	950	0.98	1,122	1,285	
Share of private pensions		0.52		0.55		0.54		0.46		0.48		0.52	0.49	
<i>Net standardized annuities</i>														
Pensions	1.00	1,764	1.00	1,887	1.00	1,837	1.00	1,601	1.00	1,652	1.00	1,749	1,838	
Percentage total		0.93		0.83		0.74		0.72		0.74		0.78	0.78	
Pensions + wealth	1.00	1,872	1.00	1,994	1.00	1,997	1.00	1,819	1.00	1,884	1.00	1,917	2,089	
Percentage total		0.98		0.89		0.80		0.79		0.84		0.85	0.84	
Pensions + wealth + housing	1.00	2,026	1.00	2,331	1.00	2,528	1.00	2,492	1.00	2,399	1.00	2,350	2,637	
N (HHs)	123		262		232		234		104		955			

^a Private pensions are the sum of forecasted occupational pensions and self-reported third pillar pensions for individuals who do not claim non-public pensions. For current claimers private pensions are the sum of all non-public pensions received.

4.2.1 Assets

Table 2a describes assets at the household level, for all panel members who received the questionnaire about retirement expenditures and for whom administrative data could be matched. Households are grouped based on the age of the head of the household. We observe large differences in ownership rates across asset types: saving accounts are held by almost every household in the sample while business wealth and non-residential real estate are only held by 6 and 8 percent, respectively. 10% of the households have non-mortgage debt. With a median of 22,442 euro (conditional on ownership) the size of those debts may be problematic. Up to age 55-64 we find that financial assets increase. The 65+ subsample is slightly less wealthy (these are combinations of age and cohort effects). Apart from pensions, the most important asset for most households is their house: 77 percent of the households own real estate and median net housing wealth is 142,860 euro. The median value of property conditional on ownership increases with age, from 214,857 euro in the 25-34 category to 325,403 for those respondents of age 65 and older. Furthermore, mortgages are relatively low in the oldest age groups: conditional on having a mortgage, the value of the mortgage relative to the value of the house declines from a median of 90 percent for respondents below age 35 to only 10 percent for the oldest respondents. Not only have older households paid off a larger part of their mortgage, but they also benefited from rising housing prices which have decreased their loan to value.

Actually, we underestimate net housing wealth, since about 30% of the mortgages in the Netherlands are endowment- or investment-based mortgages (Dijkhuizen et al., 2013). For these mortgages payments are not used to repay the debt directly, but instead are paid to an endowment insurance company or saved on a separate account for fiscal reasons. The debt is then paid off at once at the end of the mortgage contract. Since the savings held in such mortgage-specific accounts are not taxed, they are not available in our administrative data. Unfortunately, there is no additional survey information about them in the LISS panel either. Hence, when we take into account housing wealth, we underestimate retirement preparedness for households with mortgages of these types.

4.2.2 Annuities

Panel b of table 2 presents descriptive statistics of pension entitlements and after-tax annuities. We use three definitions of after-tax annuities: (1) annuities based on public and private pensions, (2) annuities based on pensions plus non-housing wealth, and (3) annuities based on all wealth, including housing wealth. To annuitize wealth we have to make a number of assumptions which we describe below, together with the descriptives.

Pensions, both public and private, form the main source of retirement income for the Dutch. Table 2b shows the monthly public pension benefits that people will receive at age 65 based on the assumption that respondents continue to live in the Netherlands until retirement. All households in the sample accumulate public pension rights and the gross median entitlement equals 1,040 euro per month (benefits have been standardized to a one-person household). With regard to occupational

pension rights we assume that people remain employed in their current job with their current wage rate until the age of 65.⁸ 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 full inflation adjustments. For the future we assume that adjustments will be made for 50% of the inflation and that inflation amounts to 2% per year. 98% of the households in the sample have built up some occupational pension entitlements, with a median of 1,122 euro per month. As expected, the distribution of private pensions is more skewed than the distribution of the flat-rate public pensions.

Since respondents are asked about their preferred consumption levels, we have to take into account tax pressures, which are relatively low for individuals aged 65 and over. To calculate net annuities we apply median tax pressures for elderly singles and couples per decile of gross income in 2008. Table 2b shows that the median net annuity from pensions is 1,749 euro per month (standardized to a one-person household). Pensions are by far the most important category of wealth for our sample: on average they account for 78 percent of the annuity that can be attained if households were to spend all their wealth. As expected, the share of private pensions is relatively high for young cohorts, because of the increased pension coverage (especially among women).

Households may deplete financial assets to finance their retirement. In view of this we annuitize private savings, using a real interest rate of 1% and mortality rates per gender and cohort predicted by Statistics Netherlands. For couples we assume that household wealth is divided equally, taking into account economies of scale and different life expectancies of spouses. Take, as an example, a 50 year old man and a 45 year old woman. When the man reaches the age of 65 he withdraws a fixed amount of money every year. After five years the wife also reaches the age of 65 and they both start to withdraw money out of their household wealth. Probably, the wife outlives her husband and after his death she continues to take money out of the account. We take into account that as a widow, she needs relatively more money to be equally well off as before, because she loses economies of scale.⁹ We allow for widowhood, but assume that couples stay together and that singles stay single. Also, we assume that remaining lifetimes of men and women are independent and we do not take into account differential mortality or any bequests. If households would annuitize all their non-housing wealth, the median monthly annuity would increase to 1,917 euro. Median annuities increase especially for the older cohorts: the median annuity for the youngest age group increases with 108 euros to 1,872 euro/month, while the median annuity for households in the age category 55-64 increases with 218 euros to 1,819 euro/month.

In our third definition we assume that households also deplete net housing wealth during retirement. We take into account that housing prices dropped around 20% on average in the period

⁸When we raise the gross private pension annuity of young highly educated individuals by 20%, because they are likely to experience a relatively high wage growth, the conclusions do not change.

⁹Knoef et al. (2014) explain the annuitization of household wealth in detail.

2008-2013. Moreover, we assume that real property prices remain constant after 2013. We assume an imputed rent of 4% of net capital accrued in property and an inflation of 2% (as mentioned before). Annuitizing housing wealth increases the median monthly annuity further to 2,350 euro per month. Housing wealth reverses the differences between age groups, since young households have a relatively low net housing wealth. The question arises, however, whether households are able and willing to deplete housing wealth (e.g. by moving to a rental house, or by taking out a reverse mortgage).¹⁰

The median annuities in table 2b are generous compared to the medians of minimal and preferred expenditures in table 1 (1,460 and 1,606 euro per month, respectively). Note, however, that we cannot simply use these descriptives to evaluate preparedness for retirement, since expenditure goals and resources are likely to be correlated and selection may play a role.

Figure 2: Kernel regressions of annuities on income and age of the household head (annuities and income are standardized to a one-person household)

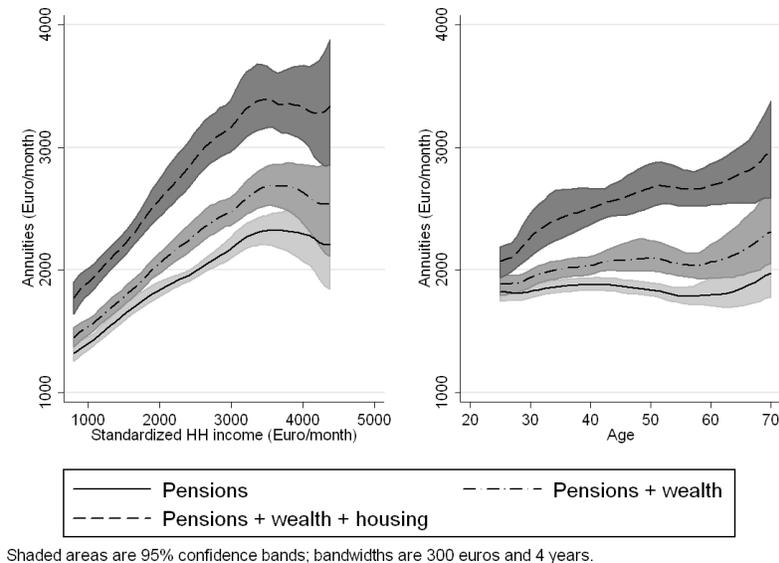


Figure 2 shows kernel regressions of standardized annuities, net of taxes, on standardized household income and on the age of the household head. The left panel shows that annuities increase with income and that this increase is somewhat stronger once we take private savings and housing wealth into account. The average pension annuity increases from 1,400 euro/month for an income of 1,000 euro to 2,300 euro/month for households with an income of 4,500 euro/month, while the

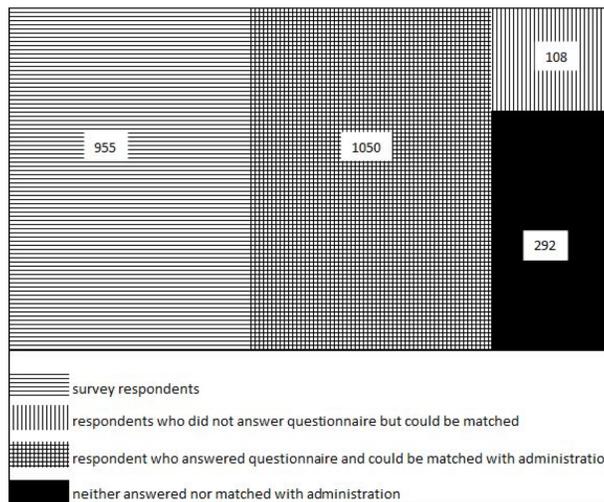
¹⁰Only 13% of the respondents between the ages of 55 and 64 are willing to move during retirement in order to lower housing costs. Reverse mortgages are rather expensive because of adverse selection and moral hazard concerns and are not often used in the Netherlands. This also holds for other countries with developed financial markets, like the US, the UK, Australia and Canada (Chiuri and Jappelli, 2010).

total annuity (including all wealth components) increases from 1,900 to 3,300. On average, pension annuities remain constant for households with an income of 3,500 euro/month or more, but the variance does increase. The right panel shows that older households have higher annuities, in particular when we take discretionary savings and housing wealth into account.

4.3 Selection issues

The previous two sections (4.1 and 4.2) describe the survey data and the administrative data, which are based on different subsamples from the potential sample of 2,405 respondents who received the questionnaire. Figure 3 presents the samples graphically. 2,005 (=955+1050) panel members responded to the questionnaire, and administrative records could be retrieved for 1,158 (=1050+108) individuals. 292 individuals did not answer the questionnaire and could not be linked to the administrative data either.

Figure 3: Survey response and merge with administrative records



Note: The potential sample consists of 2405 respondents (955+1050+108+292). In total we have 955+1050=2005 survey respondents and 1050+108=1158 panel members of the potential sample who could be matched with the administrative data.

Table 3 describes three samples: the potential sample, the survey respondents and the individuals of the potential sample that could be matched with administrative records. It is reassuring that the descriptives of the observed characteristics of the three samples are about the same. However, net personal income is relatively low in the matched sample.

In the remainder of this section we analyze selection issues with regard to the survey data and the administrative data. Though survey response to the retirement expenditures questionnaire is a satisfactory 83 percent, the response rate to the questions that actually elicit expenditures during retirement is only 62 percent for the question about minimal expenditures and 54 percent for preferred expenditures. This survey non-response and item non-response did not occur randomly

Table 3: Descriptive statistics (based on survey data)

	Potential sample ^a		Survey respondents ^b	Matched panel members ^c
	Mean	SD	Mean	Mean
<i>Demographics</i>				
HH head	0.58	0.49	0.58	0.60
Male	0.48	0.50	0.48	0.49
Birth year	1958	13.12	1958	1958
# children	0.92	1.11	0.87	0.91
Homeowner	0.77	0.42	0.78	0.75
Lives with partner	0.83	0.37	0.83	0.82
Married	0.71	0.45	0.71	0.70
Separated/divorced	0.08	0.28	0.08	0.10
Widowed	0.03	0.17	0.03	0.03
Never married	0.18	0.38	0.17	0.17
<i>Education</i>				
Primary	0.09	0.29	0.09	0.10
Intermediate secondary	0.26	0.44	0.26	0.24
Higher secondary	0.08	0.27	0.08	0.09
Intermediate vocational	0.25	0.43	0.25	0.26
Higher vocational	0.23	0.42	0.24	0.24
University	0.08	0.28	0.08	0.07
<i>Primary activity</i>				
Employed	0.58	0.49	0.57	0.58
Self-employed	0.08	0.28	0.07	0.07
HH work	0.12	0.32	0.12	0.11
Retired	0.15	0.36	0.17	0.17
Disabled	0.03	0.17	0.03	0.04
Other	0.04	0.19	0.04	0.03
Net personal income ^d	1818	6912	1862	1644
Has simPC	0.04	0.20	0.04	0.06
N	2,405		2,005	1,158

^a The potential sample contains all LISS panel-members that received the questionnaire on minimal and preferred expenditures during retirement.

^b The sample of survey respondents contains all respondents to the questionnaire on expenditures during retirement, regardless of item (non-)response.

^c The matched sample contains all panel members of the potential sample that could be matched with administrative records.

^d For income the sample sizes are 2381, 1988 and 1151.

across the potential sample (see appendix B.1, which shows that some groups are more likely to respond than others). However, for evaluating the retirement preparedness of the Dutch the vital question is whether these selection effects introduce endogeneity in equations that explain retirement expenditures. In order to test this, we collapse survey and item non-response into a single selection indicator per question and run 2-step Heckman selection models of the logs of the different measures of expenditures on the covariates listed in table 3. Our exclusion restrictions are measures of survey attitude taken from the 2008 personality questionnaire distributed to the LISS panel, supplemented with an indicator for respondents who failed to answer those questions. The items on survey attitude use a 7 point scale to measure the extent to which respondents enjoy answering survey questions; whether or not they think surveys are interesting in themselves or important for society; and whether surveys are useful as sources of knowledge. The explanatory power of those instruments in the selection equation is satisfactory: Wald tests for joint significance all convincingly reject the null at a significance level of 1 percent (test statistics are 227.83 for minimal expenditures and 132.66 for the measure of preferred expenditures against a critical value of 23.2 at a significance level of 1%). We do not find any evidence for significant selection issues with respect to retirement expenditures or income replacement rates (the inverse Mill's ratios are insignificant at the 10% level in all equations and remain insignificant when subsets of the instruments are considered). For both measures of expenditures during retirement the selection process is independent from expenditures, allowing us to model expenditures without correcting for sample selection through non-response.

To link administrative data to the panel members, an opt-out consent method was used for all panel members in September 2011 (Das and Couper, 2014). All panel members received an email asking whether they objected against matching their survey responses with administrative resources. Unfortunately, 1,113 (46%) of the potential sample of 2,405 respondents were not participating in the panel anymore in September 2011. For these people we have no consent and because of ethical considerations we could not link their survey answers to the administrative data. Of the remaining 1,292 individuals (54%) only a small group of 134 individuals objected against linkage, so that administrative data could be retrieved for 1,158 individuals.

Panel attrition is the main cause for not being able to link administrative data and is not random. Table 3 indicates that the matched subsample has a relatively low average income compared to the potential sample. Furthermore, we find that the self-employed are more likely to drop out of the sample and retirees, on the other hand, are less likely to drop out (appendix B.2 describes selective panel attrition and selective objections against linkage in more detail). This raises concerns with respect to endogenous selection in the annuity equations. Since our goal is to analyze the retirement readiness of a representative sample of the Dutch population, we correct for selectivity of administrative information in our model. Section 5 describes how we achieve this goal using a multivariate sample selection model.

5 Measuring retirement readiness

The purpose of this paper is to evaluate the retirement readiness of a representative sample of the Dutch population. Instead of using a universal threshold, such as the often used 70% of pre-retirement income, we use self-perceived minimal and preferred retirement expenditures to quantify retirement readiness. In this way we take into account that people have different preferences. Self-perceived minimal and preferred retirement expenditures may differ by gender, income (Binswanger and Schunk, 2012), and household characteristics. However, unobserved characteristics may also play a role. For example, conditional on observed characteristics, some people like to save more during their working life for (expensive) hobbies after retirement, whereas others can do with a relatively low expenditures level after retirement and prefer to spend more during working life. This may also influence the amount of accumulated wealth that we observe. Therefore, it is important to model assets and self-reported retirement goals simultaneously, to allow for correlation between the underlying unobserved heterogeneity. This section describes how we measure retirement readiness. Section 5.1 describes the model and section 5.2 describes the simulations that we use to judge retirement savings adequacy.

5.1 Model

To investigate how (pension) wealth and retirement goals interact we model self-perceived minimal expenditures and self-perceived preferred expenditures simultaneously with observed annuitized household wealth and a selection equation for observing wealth in the administrative data. Furthermore, whereas annuitized household wealth is the same for two members of a couple, self-perceived minimal and preferred expenditure levels may be different for men and women. Therefore, for couples we include an equation for men and women and allow for the fact that the error terms for spouses may be correlated.

The model for self-perceived minimal expenditures of men and women, and annuitized household wealth can be described as follows

$$\begin{aligned}M_i &= x'_{mi}\beta_m + \varepsilon_{mi} \\N_i &= x'_{ni}\beta_n + \varepsilon_{ni} \\W_i &= x'_{wi}\beta_w + \varepsilon_{wi} \\d_i^* &= z'_i\gamma + \varepsilon_{di}\end{aligned}$$

where M_i is the log of self-perceived minimal retirement expenditures reported by a man in household i and N_i is log self-perceived minimal retirement expenditures reported by a woman. For

singles only one of the equations is relevant. W_i is log annuitized household wealth and d_i^* represents a latent variable indicating whether administrative data could be linked or not. The observed counterpart of d_i^* is

$$d_i = \begin{cases} 1 & \text{if } d_i^* > 0 \text{ (household } i \text{ could be linked with wealth records)} \\ 0 & \text{if } d_i^* \leq 0 \text{ (household } i \text{ could not be linked with wealth records)} \end{cases}$$

We assume the error terms to be normally distributed with mean zero and covariance matrix Σ_M and we estimate the model using full information maximum likelihood (FIML). The specification of the log likelihood can be found in appendix C. For self-perceived preferred expenditures we estimate the same type of model, where we replace M and N by the preferred retirement expenditures of men and women, respectively. For our research goal it is important to take into account the correlation between annuitized wealth and self perceived retirement expenditures. For example, those individuals who wish relatively high expenditures after retirement (conditional on their observed characteristics), may also have saved relatively a lot already.

5.2 Simulation

To judge retirement savings adequacy we simultaneously simulate household-level annuitized wealth and minimal/preferred retirement expenditures for all individuals in those households. This approach allows us to take into account selectivity and correlations between wealth and self-perceived minimal and preferred expenditures. We simulate various moments of the joint distribution of assets and expenditures by means of a parametric bootstrap. First we draw a parameter vector from its estimated asymptotic distribution. For this given parameter vector β^R , we draw 50 vectors of error terms from the multivariate normal with covariance matrix Σ_M^R . We calculate our moments of interest, such as the fraction who cannot afford their minimal expenditures and the median difference between log annuity and log expenditures, across the expanded dataset. We repeat these steps 500 times, drawing 500 vectors β^R , to obtain confidence intervals.

6 Results

6.1 Estimation results

This section presents the estimation results of the models that form the basis for our simulations. In the main text we present estimation results from the equations for annuities and minimal and preferred expenditures. Estimates of the selection equations can be found in appendix D.

6.1.1 Annuities

Table 4 shows estimation results for the annuity equations of models pertaining to the minimal level of expenditures during retirement. We report estimates from three different measures of annuities: annuities based on public and private pensions; annuities that also include annuitized non-housing wealth; and finally annuities that include pensions, non-housing wealth and the annuitized value of all real estate net of mortgage.¹¹ The dependent variables are the logs of each of the annuities.

If we disregard the net value of real estate, we find no significant difference between the average standardized annuities accumulated by singles and couples. However, single males accumulate 19% higher standardized annuities on average relative to couples if we include real estate in the annuities. The difference between average annuities of single women and couples remains insignificant when we allow households to draw down their housing wealth. Households with older heads have slightly larger annuities on average if we take non-pension assets into account (the estimates vary between 0.45% per year if we do not take real estate into account and 0.93% if we do). The lack of a significant age effect in the equation for annuities from pensions alone in table 4 depends on the extent to which we assume future pensions will be corrected for inflation: for 50% indexation there is no covariation of average annuities with age, whereas zero indexation yields a significant yet small age gradient for pensions.¹² Furthermore, households with one child have 7% smaller pension entitlements on average. Homeowners accumulate more wealth than renters: their entitlements are 11% larger on average if we only look at pensions, 17% larger if we look at pensions and non-housing wealth and 45% if we also include net housing wealth. Income-rich households tend to accumulate larger annuities, the estimated elasticities are around 0.09-0.11. The small size of the income elasticities may reflect measurement error in the self-reports of household income. This measurement error in income may also underly some of the large differences between the average entitlements of various educational groups. Better educated households are much richer: if we look at pensions alone, households in which at least one adult member has a university degree can look forward to a 33% higher annuity streams on average compared to households in which neither spouse finished secondary school. In addition to measurement error in income, such that the education dummies capture part of the relationship between income and annuities, another complementary explanation for the large disparities between education groups is the distinction between transitory and permanent income. Education is likely to act as a proxy for permanent income since the highly educated can expect to earn more throughout their life. Households with at least one salary worker have 13% larger pension entitlements, but the inclusion of wealth reduces this gap to a statistically insignificant 4%. Households in which at least one adult is self-employed have 13% lower pension annuities and those for which all adult members are self-employed even have 33% lower pension entitlements compared to households without self-employed adults. Moreover, households for which

¹¹In order to save space, we do not report the corresponding estimates from models of preferred expenditures. Those are close to the estimates reported here and are available upon request.

¹²Estimates available on request.

Table 4: Joint models of annuities and minimal retirement expenditures - annuity equations

	Pensions		Pensions + Wealth		Pensions + Wealth + Housing	
Single	-0.0124	(0.0367)	0.0517	(0.0451)	0.187***	(0.0492)
Female × single	-0.0464	(0.0370)	-0.0762*	(0.0450)	-0.181***	(0.0492)
Age HH head	9.31e-04	(9.75e-04)	0.00445***	(0.00120)	0.00925***	(0.00131)
Any kids	-0.0885***	(0.0310)	-0.0745**	(0.0377)	-0.0856**	(0.0415)
Number children	0.0220*	(0.0133)	0.0153	(0.0162)	0.0354**	(0.0178)
Homeowner	0.109***	(0.0205)	0.165***	(0.0252)	0.451***	(0.0276)
Log HH income	0.109***	(0.0162)	0.106***	(0.0198)	0.0936***	(0.0217)
Inter. sec. ed. ^a	0.0202	(0.0387)	-6.94e-04	(0.0469)	0.0885*	(0.0515)
Higher sec. ed. ^a	0.105**	(0.0450)	0.0931*	(0.0543)	0.213***	(0.0596)
Int. vocational ed. ^a	0.143***	(0.0388)	0.155***	(0.0469)	0.203***	(0.0515)
Higher voc. ed. ^a	0.253***	(0.0385)	0.302***	(0.0467)	0.369***	(0.0512)
University ^a	0.331***	(0.0437)	0.435***	(0.0534)	0.451***	(0.0586)
1 salary worker	0.131***	(0.0329)	0.0341	(0.0399)	0.0441	(0.0438)
All salary workers	0.0806***	(0.0230)	0.0532*	(0.0282)	0.0211	(0.0309)
1 self employed	-0.126***	(0.0329)	-0.143***	(0.0404)	-0.0594	(0.0443)
All self employed	-0.201***	(0.0551)	-0.143**	(0.0673)	-0.185**	(0.0739)
1 retired	0.0858**	(0.0393)	0.0363	(0.0480)	0.0405	(0.0527)
All retired	0.0322	(0.0401)	-0.0326	(0.0487)	-0.0212	(0.0534)
1 disabled	-0.0834**	(0.0375)	-0.161***	(0.0454)	-0.128***	(0.0498)
All disabled	0.0668	(0.101)	0.0195	(0.122)	0.0237	(0.135)
Separated/divorced ^a	-0.0786**	(0.0336)	-0.149***	(0.0417)	-0.131***	(0.0457)
Widow ^a	0.0623	(0.0546)	0.0432	(0.0666)	0.0319	(0.0730)
Never married ^a	-0.0397	(0.0268)	-0.0517	(0.0332)	-0.0180	(0.0363)
Constant	6.236***	(0.131)	6.248***	(0.161)	5.981***	(0.176)
Sigma epsilon	0.239***	(0.00577)	0.291***	(0.00679)	0.317***	(0.00738)
Log likelihood	-2,072.156		-2,255,035		-2,339.662	
N	1,780		1,780		1,780	

^a The reference categories are *primary education* and *married*.

Dependent variables are logs of monthly annuities.

Annuities standardized to a one-person household; estimates taken from models of minimal expenditures.

Standard errors in parentheses.

*significant at 10%; **significant at 5%; ***significant at 1%

all adult members are self-employed have low annuities relative to households with no self-employed members even if we take non-housing wealth into account: their annuity is 28% smaller on average. The finding that households in which spouses are self-employed accumulate less (pension) entitlements is plausible, since the self-employed are not covered by mandatory occupational pensions. The estimates suggest that they compensate the missing occupational pensions only partly with private wealth. Since we rely on survey data to measure voluntary pension saving vehicles (like life annuities) for those who are not claiming their pensions, a part or perhaps all of the estimated gap may be due to underreporting rather than truly lower funds. Finally, we find little evidence for variation across groups with different marital status. Only separated and divorced individuals are relatively worse off, especially if we take non-pension wealth into account.

6.1.2 Minimal and preferred expenditures during retirement

Table 5 contains estimates from the expenditure equations of the joint models of annuities and expenditures. The left panel refers to minimal and the right panel to preferred expenditures, both sets of estimates are taken from models of annuities based on pensions and wealth other than real estate.¹³ We find that older respondents tend to report higher minimal and preferred expenditures (the only exception is that the correlation of minimal consumption with age is absent for men). For men both personal and household income are strongly positively associated with the minimal and preferred expenditure levels during retirement (the elasticities of minimal expenditures with regard to income are around 0.15 for both income measures and those of preferred expenditures are 0.16 for personal income and 0.35 for household income). For women, on the other hand, personal income does not affect minimal expenditures but household income does with an estimated elasticity of 0.48 (0.45 for preferred expenditures).

Higher educated men and women report significantly higher levels of minimal expenditures: male university graduates report 49% higher minimal expenditures compared to those who obtained no diploma beyond primary school (for women the corresponding difference is 39%). Note that these differences are even larger than those in annuities, so that highly educated individuals are more likely to feel inadequately prepared for retirement despite the fact that they are doing much better than their poorly educated counterparts in absolute terms. Better educated respondents also report higher preferred expenditures, but that difference is smaller (only 9% for men and 13% for women). One reason for the smaller size of the differences in preferred expenditures may be the different elicitation method that is used: respondents are guided much more in their answer to the preferred expenditures question compared to the item on minimal expenditures.¹⁴ However, note that the estimates reported in table 5 control for self-assessed question difficulty and understanding, variables

¹³Estimates are similar to those obtained for different definitions of the annuities. Those estimates are available from the authors on request.

¹⁴Preferred retirement expenditures are elicited by means of multiple choice scenarios that are designed to fit the personal situation of the respondent, while minimal expenditures are elicited through a single open-ended question.

which should reduce the impact of systematic biases in the response to these difficult questions. Alternatively, variation in the true subjective expenditures across education levels may well be larger for minimal than for preferred expenditures, since for a given level of current income the poorly educated may have more experience making ends meet in financially difficult times due to their lower permanent income. Descriptive statistics by educational groups tell us that the median of the minimal expenditures of the least educated is 1,168-1,200 euro per month, which is still well above the subsistence level provided by public pensions. The medians among the best educated, on the other hand, are in the 1,600-2,000 range, almost twice the level of the public pension. Hence, the data do not indicate that the poorly educated give implausible answers to the minimal expenditures question. Instead, it seems that the best educated are very conservative in their assessment of their consumption floor.

We find some evidence that the self-employed are relatively demanding in terms of their expenditure goals during retirement: self-employed men report 18% higher minimal expenditures than do wage workers and for women the difference in preferred expenditures is 15%. Also, female homemakers are ambitious in their preferred expenditure level, which is 8% higher than that of women in a wage job. We find little evidence for systematic differences along the lines of marital status, except that married women report lower standardized minimal expenditures than the other groups. Furthermore, self-reported salience of retirement is not significantly related to the reported consumption levels: none of the dummies for thinking about retirement enter the models significantly. This finding is interesting in the context of previous research on financial literacy. Using a sample from the Netherlands, Van Rooij et al. (2011) show that financial literacy causes people to think more about retirement. Our results emphasize that this additional attention paid to pensions and retirement does not necessarily translate into systematically different retirement expenditure goals.

The estimates in tables 4 and 5 reveal that resources and perceived needs vary across the sample in ways that are relevant for policymakers. For instance, the finding that less educated respondents are both less demanding and less wealthy suggests that providing them with accurate information on the status of their retirement funds might not result in substantial changes in savings behavior. Indeed, poorly educated people may be perfectly prepared to meet their own modest goals. In order to induce additional savings one would have to directly target their perception of their consumption needs after retirement. The self-employed, on the other hand, stand out as a group that is simultaneously demanding in terms of their post-retirement consumption and accumulates relatively little wealth. Hence, they might be an important target for information campaigns.

Table 6 shows the estimated correlations between the error terms of the models that explain minimal expenditures. We find that, conditional on covariates, annuitized assets and minimal expenditures are weakly positively correlated for men, and moderate positively correlated for women. Furthermore, the correlation between the expenditures levels reported by spouses is positive and statistically significant, but also relatively small at 0.13. Most importantly, the correlations between the error terms of the selection equation and the annuity equation are between -0.02 and 0.07 and

Table 5: Joint models of annuities and retirement expenditures – expenditure equations

	Minimal expenditures				Preferred expenditures			
	Men		Women		Men		Women	
Partner	-0.00667	(0.0792)	-0.164**	(0.0743)	-0.124***	(0.400)	0.0425	(0.0562)
Age	3.05e-04	(0.00268)	0.00484**	(0.00207)	0.00289**	(0.00116)	0.00588***	(0.00139)
HH head	0.0126	(0.0854)	-0.0940	(0.0591)	-0.105***	(0.0383)	0.00412	(0.0422)
Number children	-0.00221	(0.0230)	-0.0272	(0.0181)	0.0111	(0.0102)	-0.0176	(0.0126)
Homeowner	0.0215	(0.0571)	0.0954**	(0.0424)	0.119***	(0.0273)	0.0985***	(0.0316)
Log pers. income	0.173***	(0.0463)	-0.00149	(0.00954)	0.161***	(0.0222)	0.0125***	(0.00632)
Log HH income	0.158***	(0.0365)	0.481***	(0.0531)	0.347***	(0.0207)	0.448***	(0.0241)
Has simPC	0.00304	(0.117)	-0.00195	(0.0826)	-0.0784	(0.0658)	-0.119	(0.0781)
Inter. sec. ed. ^a	0.0390	(0.0860)	0.0842	(0.0643)	-0.0280	(0.0367)	0.0286	(0.0438)
Higher sec. ed. ^a	0.283***	(0.108)	0.246***	(0.0803)	0.0298	(0.0464)	0.146***	(0.0545)
Int. vocational ed. ^a	0.224***	(0.0861)	0.220***	(0.0691)	0.0619*	(0.0376)	0.128***	(0.0471)
Higher voc. ed. ^a	0.280***	(0.0863)	0.276***	(0.0696)	0.0537	(0.0371)	0.153***	(0.0479)
University ^a	0.494***	(0.100)	0.392***	(0.0921)	0.0938**	(0.0436)	0.131**	(0.0619)
Self-employed	0.177**	(0.0762)	0.0319	(0.0662)	0.0142	(0.0317)	0.149***	(0.0453)
Home maker	0.278	(0.286)	0.00155	(0.0584)	-0.0503	(0.133)	0.0804**	(0.0390)
Retired	0.109	(0.281)	-0.0600	(0.250)	-0.150	(0.0963)	0.215	(0.163)
Disabled	0.0278	(0.137)	-0.0562	(0.102)	-0.114*	(0.0647)	-0.0310	(0.0648)
Other primary act.	0.272*	(0.143)	0.0899	(0.0861)	0.0721	(0.0842)	0.0255	(0.0604)
Separated/divorced ^a	0.137	(0.0951)	0.151**	(0.0689)	0.0328	(0.0482)	0.0743	(0.0538)
Widow ^a	-0.153	(0.173)	0.204*	(0.113)	0.0726	(0.0789)	0.0504	(0.0873)
Never married ^a	0.0981	(0.0713)	0.107*	(0.0566)	0.0247	(0.0323)	0.0358	(0.0387)
Thought some	-0.0370	(0.0957)	-0.00956	(0.0856)	-0.00799	(0.0415)	0.0786	(0.0591)
Thought a little	-0.0709	(0.0953)	-0.0176	(0.0828)	0.0243	(0.0414)	0.0551	(0.0581)
Hardly thought	-0.134	(0.115)	-0.0334	(0.0899)	-0.0222	(0.0497)	0.0804	(0.0628)
No answer	0.0701	(0.292)	0.105	(0.260)	0.256**	(0.104)	-0.156	(0.171)
Constant	4.257***	(0.447)	3.183***	(0.431)	3.322***	(0.217)	3.338***	(0.222)
Sigma epsilon	0.545***	(0.0143)	0.414***	(0.0116)	0.255***	(0.00760)	0.323***	(0.00884)
Log likelihood	-2,255.035				-1,423.005			
N	1,780				1,780			

^a The reference categories are *primary education* and *married*.

Dependent variables are logs of monthly minimal and preferred expenditures.

Expenditures standardized to a one-person household; equations reported from models of annuity excluding housing wealth but including other savings.

We control for self-reported understanding of the questions (estimates available on request).

Standard errors in parentheses.

*significant at 10%; **significant at 5%; ***significant at 1%

statistically insignificant, implying that sample selection in annuities is exogenous.

Table 6: Error correlations for model of minimal expenditures

	Annuity	Min exp. men	Min exp. women	Selection (annuity)
a. Annuity from pensions				
Annuity	1			
Min exp. men	0.0740*	1		
Min exp. women	0.213***	0.128**	1	
Selection (annuity)	0.0685	-0.0620	-0.0840	1
b. Annuity from pensions and non-housing wealth				
Annuity	1			
Min exp. men	0.0611	1		
Min exp. women	0.278***	0.131**	1	
Selection (annuity)	-0.0245	-0.0375	-0.0747	1
c. Annuity from pensions and all wealth				
Annuity	1			
Min exp. men	0.0845*	1		
Min exp. women	0.170***	0.121**	1	
Selection (annuity)	-0.0149	-0.0386	-0.0685	1

*significant at 10%; **significant at 5%; ***significant at 1%

The estimated correlations for our models of preferred expenditures are reported in table 7. Similarly to table 6, the estimated correlations that capture selectivity in observed annuities are small. The most striking difference between these correlations and those for minimal expenditures is that conditional on covariates there seems to be much more agreement between spouses on what an preferred expenditure level is compared to minimal expenditures: we estimate the correlation between preferred expenditures to be around 0.87 (compared to 0.13 for minimal expenditures). Note, however, that this may reflect the very different modes of answering the questions: the agreement may be an artifact of the choice between no more than 6 different expenditure levels that respondents are presented with for the preferred expenditures question. Correlations between annuities and preferred expenditures are much stronger than between annuities and minimal expenditures: for men they range from 0.13 if we take all wealth into account to 0.19 if we drop housing wealth while for women they fall between 0.30 and 0.46. Note, finally, that the error term of the selection equation for annuities is significantly negatively correlated with the reported preferred expenditure levels of women. Hence, there are efficiency gains from keeping the selection equation for annuities in the model, despite the lack of evidence for endogenous sample selection.

6.2 Simulation results

We use the estimates presented in section 6.1 to simulate the extent to which individuals are able to realize their personal retirement expenditure goals. Recall that the questionnaire on consumption

Table 7: Error correlations for model of preferred expenditures

	Annuity	Preferred exp. men	Preferred exp. women	Selection (annuity)
a. Annuity from pensions				
Annuity	1			
Preferred exp. men	0.153***	1		
Preferred exp. women	0.303***	0.879***	1	
Selection (annuity)	0.0191	-0.0641	-0.147***	1
b. Annuity from pensions and non-housing wealth				
Annuity	1			
Preferred exp. men	0.189***	1		
Preferred exp. women	0.455***	0.858***	1	
Selection (annuity)	-0.105	-0.0875*	-0.157***	1
c. Annuity from pensions and all wealth				
Annuity	1			
Preferred exp. men	0.130***	1		
Preferred exp. women	0.390***	0.866***	1	
Selection (annuity)	-0.0787	-0.0857*	-0.145***	1

*significant at 10%; **significant at 5%; ***significant at 1%

during retirement was distributed to 2,405 individuals. Those individuals represent 1,900 households. We drop 120 households due to missing information regarding household income and carry out our simulations based on the remaining 1,780 households.

Table 8 presents our simulation results, which are based on 50 draws of the error terms. In addition to comparing annuities with reported minimal consumption levels (top panel), we also compare resources with a poverty line defined by Statistics Netherlands (second panel); with self-reported preferred expenditures (third panel); and with 70% of current standardized household income (bottom panel). Moreover, we run simulations for the annuities in the data (columns labeled “Baseline”) and carry out robustness checks for annuities with a 20% drop in private pensions (columns labeled “Pensions -20%”) and for annuities with a 20% drop in housing prices (columns labeled “Housing prices -20%”). The bootstrap confidence intervals are based on 500 draws of the parameters.

Looking first at the baseline estimates and self-reported minimal expenditures, we find that though the median individual can expect to exceed his/her minimal expenditures by 25% based on pensions alone, a sizable fraction of 33% will fall short of their minimum unless they fill the gap with private savings. The shortfall is not negligible, with a median of 31%. Non-pension wealth helps to fill the gap: the fraction that falls short drops to 26% once we take non-housing wealth into account. Net housing wealth further reduces the proportion with insufficient funds to 19%, showing that home ownership is rare among those who fall short of their minimum consumption level even if they would draw down non-housing wealth.

Table 8: Percentage differences between annuities and consumption floors

	Baseline		Pensions - 20%		Housing prices -20%	
	Median	Fraction <0	Median	Fraction <0	Median	Fraction <0
a. Heterogenous targets – minimal expenditures						
Pensions	25 (17, 33)	0.33 (0.29, 0.39)	16 (10, 24)	0.38 (0.33, 0.43)		
Pension + wealth	36 (29, 44)	0.26 (0.23, 0.32)	29 (22, 36)	0.30 (27, 36)		
Pensions + wealth + housing	53 (45, 63)	0.19 (0.16, 0.25)	47 (38, 56)	0.23 (0.19, 0.28)	40 (32, 48)	0.25 (0.22, 0.31)
b. Poverty line plus (917 euro/month)						
Pensions	62 (56, 67)	0.04 (0.03, 0.06)	54 (48, 58)	0.04 (0.03, 0.07)		
Pensions + wealth	73 (68, 78)	0.03 (0.02, 0.05)	65 (60, 72)	0.04 (0.03, 0.05)		
Pensions + wealth + housing	90 (84, 97)	0.03 (0.02, 0.05)	85 (78, 91)	0.04 (0.03, 0.06)	77 (72, 83)	0.05 (0.04, 0.06)
c. Heterogeneous targets – preferred expenditures						
Pensions	5 (0, 11)	0.46 (0.41, 0.50)	-3 (-8, 2)	0.53 (0.48, 0.58)		
Pensions + wealth	18 (12, 24)	0.35 (0.30, 0.40)	10 (5, 17)	0.41 (0.35, 0.46)		
Pensions + wealth + housing	33 (28, 40)	0.25 (0.21, 0.30)	27 (21, 34)	0.30 (0.25, 0.35)	21 (14, 27)	0.34 (0.29, 0.39)
d. 70% of current income						
Pensions	22 (17, 27)	0.29 (0.26, 0.34)	14 (10, 18)	0.36 (0.32, 0.40)		
Pensions + wealth	34 (29, 39)	0.22 (0.19, 0.26)	26 (21, 31)	0.28 (0.24, 0.32)		
Pensions + wealth + housing	50 (44, 56)	0.16 (0.14, 0.19)	43 (38, 49)	0.19 (0.17, 0.23)	37 (31, 43)	0.23 (0.20, 0.27)

Pensions include public and occupational mandatory savings, as well as private pensions.

Wealth includes all discretionary savings that are not automatically annuitized, except for property.

90% confidence intervals in parentheses, calculated by parametric bootstrap (500 replications).

Simulations are weighted to correct for over-representation of homeowners in the LISS-panel.

Comparing the second panel baseline simulations to the first, we notice that respondents report much higher consumption floors than the poverty line of 917 euro/month. While 33% will not be able to reach their minimal consumption level based on pensions alone, only 4% falls short of the basic poverty line. If we take into account all three types of wealth, the fraction that falls below the basic poverty line drops to 3%. The median shortfall is 11%

The third panel of table 8 compares annuitized wealth with the preferred levels of expenditures. Looking first at the baseline simulations, we find that 46% of the population is expected to fall short of their ideal consumption level if they would rely exclusively on their pension entitlement (the median difference is only 5%). However, if we also include wealth other than real estate, the fraction that falls short is reduced to 35% and the median individual exceeds his or her preferred level of expenditures by a comfortable 18%. Allowing households to decumulate housing wealth makes for an even more favorable picture: a quarter of the sample would be unable to afford their consumption goal and the median difference between annuities and preferred consumption is 33%. Those who fall short have a median shortfall of 26%.

The bottom panel of table 8 uses a universal threshold of 70% of current household income. Comparing the simulation results in the bottom two panels, the fraction that falls short is 9-17 percentage points lower when using the uniform replacement rate criterion compared to heterogeneous targets of preferred expenditures. Similarly, the median difference between the annuity and preferred expenditures is about 15 percentage points larger.

The middle columns of table 8 show that cuts in occupational pension benefits up to 20% have a limited influence on our conclusions: the fraction that cannot afford their minimal expenditures increases by no more than 7 percentage points while the median amount by which individuals exceed the various consumption floors drops by 5-9 percentage points. Note that around the poverty line we find households without any private pensions entitlement: the fraction of households that cannot afford the poverty line remains unchanged when we cut occupational pensions.

The rightmost columns of table 8 show that a drop of 20% in housing prices has a large effect on savings sufficiency for homeowners. The proportion that falls short with regard to the various consumption floors under the reduced housing prices scenario is close to that obtained if we disregard housing wealth altogether.

Table 9 illustrates the impact of variation in resources and goals on self-assessed retirement readiness. The upper panel presents the simulation results of the baseline scenario by education level. We see that university graduates are more likely to fall short of their minimal expenditure level than their less educated peers (46% versus and overall average of 33%). This difference does not, however, reflect poor preparation of the highly educated: when we set the education level of all respondents in the annuity equation to university, this reduces the incidence of insufficient preparation among those with no more than secondary school by a factor of 2 or more, depending on which assets we take into account. Instead, university graduates tend to set very high minimal expenditure levels: the third panel of table 9 shows that if all respondents would be as ambitious as

university graduates, the fraction that cannot afford their consumption floor after retirement would double for the lowest education categories. The retirement savings adequacy gap for university graduates could be due to the fact that we assume that individuals remain in their current job with their current wage rate. Young university graduates are likely to experience a relatively high wage growth. However, these patterns are robust to raising the gross pension annuity of highly educated individuals below the age of 40 by 20%.

Table 9: Simulated incidence of shortfalls w.r.t. minimal expenditures across education categories

	By education level						
	All respondents	Primary	Lower sec.	Higher sec.	Inter. voc.	Higher voc.	University
a. Data							
Pensions	0.33	0.29	0.30	0.40	0.31	0.34	0.46
Pensions + wealth	0.26	0.22	0.24	0.34	0.26	0.25	0.34
Pensions + wealth + housing	0.19	0.20	0.17	0.24	0.19	0.18	0.30
b. All annuities set to level of university graduates							
Pensions	0.24	0.15	0.16	0.29	0.21	0.30	0.47
Pensions + wealth	0.15	0.08	0.08	0.18	0.14	0.19	0.34
Pensions + wealth + housing	0.12	0.07	0.07	0.14	0.11	0.15	0.30
c. Minimal expenditures set to level of university graduates							
Pensions	0.50	0.58	0.56	0.52	0.45	0.46	0.46
Pensions + wealth	0.42	0.50	0.48	0.45	0.38	0.35	0.35
Pensions + wealth + housing	0.32	0.42	0.36	0.33	0.31	0.25	0.29

Simulations use 50 draws of the error terms.

Simulations are weighted to correct for over-representation of homeowners in the LISS-panel.

Financial wealth and housing wealth increase over the lifecycle. The younger cohorts in our study may also accumulate more wealth during their life and therefore as a sensitivity check we describe what happens to savings sufficiency if we set the age of all household heads to 50 in the annuity equations (details can be found in Appendix E). Simulations results are similar when we set the age of all respondents to 50: median excess savings increase by no more than 2 percentage points and the proportion of individuals who cannot afford to reach the various consumption levels decreases by the same amount. This illustrates that age does not play an important role in the estimated equations for annuities, which is reassuring in light of the simple extrapolation procedure that assumes the current labor market situation persists until retirement and the status quo of financial and housing wealth.

We also investigate the robustness of the simulation results to self-reported question difficulty. Therefore, in addition to the baseline results from table 8, we do the same simulation for which we set the understanding of the questions to the maximal level (details can be found in appendix E). Doing so reduces the median difference between the pension annuity and minimal consumption by 1-2 percentage points and increases the fraction with insufficient savings by 1-2 percentage points. We find larger discrepancies for self-reported preferred expenditures: the fraction that does not

have enough savings to finance their preferred expenditures increases by 3-7 percentage points and median excess savings are reduced by 6-7 percentage points.

7 Conclusion

Population aging together with the poor performance of financial markets during recent years have put pension systems around the world under severe pressure. As a result pensions have become less generous, shifting responsibility for maintaining an adequate standard of living during retirement to the individual. Against the backdrop of this changing environment, we investigate whether the Dutch can reasonably hope to accumulate sufficient resources to meet self-defined minimal and preferred expenditure levels.

In contrast to previous research, we evaluate retirement readiness by comparing the expected financial situation at age 65 with expenditure thresholds that are specified by the respondents themselves. The advantage of this method is that we allow needs to vary across individuals. We take these subjective expenditure needs from a survey that was distributed to the LISS-panel in January of 2008. This deviation from a one-size-fits-all yardstick for sufficiency of savings is found to be important: both minimal and preferred expenditures vary widely between households (levels as well as replacement rates). The variation in expenditures is related to factors such as education and type of employment, with higher educated and self-employed respondents indicating higher self-perceived expenditure needs during retirement compared to poorly educated and salary workers. Our analysis disentangles the roles of goals and resources and identifies groups who are at risk of accumulating insufficient assets to retire comfortably.

Another important facet of the paper is the use of administrative data on various asset categories such as savings, investments, housing wealth and public and occupational pensions. We take into account “automatic” saving in public and occupational pensions, by using pension funds’ best predictions of accrued entitlements at age 65 under continuation of the status quo. Such administrative data measure assets more precisely than would be possible using survey data alone. Subsidies (e.g. rent subsidies) are not taken into account. We investigate to what degree people are adequately prepared for retirement without compensations for certain costs.

Although we have a representative panel, we have to deal with nonresponse and households that could not be merged to the administrative data. Therefore, in order to be able to draw conclusions that are representative for the Dutch population, we estimate a multivariate generalization to the classical univariate sample selection model and simulate pension annuities and consumption needs.

Our method hinges on the degree to which people can reasonably predict their expenditure needs during retirement. The answers people give seem reasonable, also in relation to current household income. Furthermore, it is reassuring that the answers of the 65+ population (who are retired) are comparable to the answers given by young people. Finally, we also control for the fact that

some individuals thought about retirement more than others, and that some people found it more difficult than others to answer questions about consumption needs during retirement.

We show that wealth, especially as accumulated through public and occupational pensions, suffices for a majority of respondents to meet and exceed their own minimal and preferred expenditures. By age 65, the median respondent is likely to be able to afford 25% higher expenditures compared to his/her own personal minimal level based on pensions alone. If the households also consume out of non-pension savings, the median excess of annuities over minimal consumption rises to 36% if we do not include net housing wealth and 53% if we do. However, the affluence of the sample as a whole hides a sizable minority of 19 percent that will be unable to afford their minimal expenditures, even if they continue to accumulate pensions until age 65 and if we include housing in our measure of wealth. Self-reported minimal consumption is high compared with the official poverty line of 917 euro per month: less than 5% of the adult population falls short of that yardstick.

Joint models of annuitized wealth and subjective expenditures show that homeowners and the highly educated accumulate relatively much wealth, in pensions and (non-)housing savings, while households in which members are self-employed are on average 17-30% poorer. Both minimal and preferred expenditures are positively related to income and education, though we find that personal income matters much more for men than for women, whose expenditure wishes are correlated mostly with household income rather than personal income. The net effect is that we find that the highly educated are more likely to fall short of their own goals, since their goals are much more ambitious. Indeed, once we control for ambitiousness the highly educated are found to be less likely to fall short. For preferred retirement expenditures we find that income raises expenditure targets more than resources. We do not find any evidence to suggest that individuals who report thinking more about retirement set different consumption goals on average compared to those who have not thought about retirement yet.

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A Thinking about retirement and difficulty of the questions

Respondents find the questions on expenditure needs during retirement challenging. This appendix provides descriptive statistics about the extent to which respondents have thought about retirement and how they evaluated the difficulty of the questions.

A.1 Thinking about retirement

Table 10 shows that 71% of the sample has thought either “a little” or “hardly at all” about retirement. Retirement is clearly a more salient concern to pre-retirees: 86% of the respondents aged 25-34 have not yet thought about retirement compared to 51% of those aged 55-64 (65 was the public pension eligibility age in 2008).

In our model (section 6.1.2) we check for systematic differences in reported expenditures between respondents who have and haven’t thought about retirement. We find no evidence for such differences.

Table 10: Descriptives of thinking about retirement

	All respondents	By age				
		25-34	35-44	45-54	55-64	65+
	Mean	Mean	Mean	Mean	Mean	Mean
Thought a lot about retirement	0.06	0.02	0.03	0.05	0.13	0.07
Thought some	0.23	0.12	0.19	0.24	0.37	0.28
Thought a little	0.52	0.54	0.57	0.55	0.41	0.46
Thought hardly at all	0.19	0.32	0.22	0.15	0.10	0.19
N	1,671	289	486	507	335	54

A.2 Difficulty of the questions

Table 11 summarizes items that are related to the understanding of the questions. These questions allow us to investigate whether those who do not understand the questionnaire give systematically different answers. We find that our results are robust to questions difficulty (see table 13).

Table 11: Descriptives of self-reported question difficulty

	By age					
	All respondents	25-34	35-44	45-54	55-64	65+
	Mean	Mean	Mean	Mean	Mean	Mean
I generally do not like to think about old-age provision						
Definitely not = 1	0.20	0.16	0.17	0.19	0.24	0.26
2	0.20	0.15	0.22	0.21	0.20	0.20
3	0.33	0.39	0.36	0.32	0.29	0.25
4	0.19	0.23	0.18	0.21	0.18	0.16
Yes, definitely = 5	0.08	0.07	0.06	0.08	0.09	0.13
I find it very difficult to imagine how much money I would need during retirement						
Definitely not = 1	0.17	0.22	0.19	0.15	0.13	0.18
2	0.20	0.25	0.26	0.22	0.11	0.17
3	0.28	0.27	0.28	0.29	0.29	0.23
4	0.22	0.17	0.20	0.23	0.27	0.22
Yes, definitely = 5	0.13	0.09	0.07	0.11	0.20	0.20
I like to take some responsibility for my old-age provision						
Definitely not = 1	0.16	0.16	0.19	0.16	0.12	0.16
2	0.21	0.28	0.21	0.25	0.15	0.16
3	0.31	0.36	0.36	0.28	0.32	0.24
4	0.19	0.14	0.15	0.19	0.23	0.22
Yes, definitely = 5	0.13	0.06	0.08	0.13	0.18	0.23
Many questions didn't make sense to me						
Definitely not = 1	0.09	0.07	0.08	0.10	0.13	0.07
2	0.10	0.11	0.08	0.10	0.11	0.11
3	0.18	0.14	0.17	0.18	0.20	0.21
4	0.30	0.25	0.32	0.30	0.29	0.29
Yes, definitely = 5	0.33	0.43	0.34	0.32	0.26	0.31
Many questions were too abstract for me						
Definitely not = 1	0.09	0.08	0.10	0.08	0.08	0.12
2	0.23	0.28	0.26	0.21	0.19	0.20
3	0.29	0.30	0.29	0.29	0.30	0.29
4	0.24	0.24	0.23	0.25	0.25	0.21
Yes, definitely = 5	0.15	0.10	0.13	0.17	0.17	0.17
N	1,990	287	485	502	441	275

B Details on sample selection

B.1 Survey and item-nonresponse

Though survey response to the retirement expenditures questionnaire is a satisfactory 83 percent, the response rate to the questions that actually elicit self perceived minimal and preferred expenditures during retirement is only 54-62 percent. This appendix describes the processes of survey and item non-response in detail.

First we estimate a univariate probit model for response to the survey, comparing the 2,005 respondents with the 400 non-respondents.¹⁵ Older individuals are more likely to respond: an increase in age of 10 years is associated with a 9 percentage points higher probability of answering at least 1 question. Moreover, respondents with children are slightly less likely to answer, the difference being 2 percentage points per child. Education matters too: those who have completed at least intermediate vocational training are 5-7 percentage points more likely to answer. Unfortunately, being self-employed is associated with a 9 percent point lower probability to respond to the questionnaire. The sample of actual survey respondents is older, better educated, has less children and is less likely to be self-employed than the potential sample.

Second, we analyze item non-response conditional on answering at least 1 question of the survey. We allow for dependence between non-response to different items in the same survey by estimating a trivariate probit model with indicators for response to the question on minimal expenditures and both questions on preferred expenditures as dependent variables.¹⁶ Response to the question on minimal expenditures during retirement follows an inverted U-shaped pattern in age: respondents around the age of 46 are most likely to answer that question (response to the questions on preferred expenditures does not vary systematically with age). Also, household heads are 12 percentage points more likely to answer the minimal expenditures question, but equally likely as their spouses to answer the other questions. Homeowners are 7-9 percentage points more likely to provide an assessment of their preferred retirement expenditures. Conditional on answering to the survey, individuals who have completed higher vocational training or university are 8-10 percentage points more likely to answer the difficult questions, though this difference disappears for preferred expenditures under a high interest rate. Perhaps because they find it easier to answer, retirees are 14 percentage points more likely to answer the minimal expenditures question (but answer similarly often to the preferred expenditures questions). Non-response to the different retirement expenditures questions is not independent: the correlations between the error terms of the equation for response to the minimal expenditures question and those for preferred expenditures are 0.32 and 0.33, s.e. 0.04, and the correlation between the error terms of the two measures of preferred expenditures is 0.85, s.e. 0.02.

¹⁵Estimates available on request.

¹⁶Estimates available on request.

The conclusion from the previous paragraphs is that neither survey nor item non-response occurs randomly across the potential sample. However, for our purpose of evaluating retirement preparedness the vital question is whether these selection effects introduce endogeneity in equations that explain retirement expenditures. Section 4.3 shows that this is not the case.

B.2 Panel attrition and objections against linkage

As explained in section 4.3 the selection issue with respect to administrative data is primarily one of panel attrition with few active objections against the linkage of survey and administrative data.

First, we use a probit model to analyze how the sample of 1,292 respondents who were confronted with informed consent differs from the potential sample of 2,405 (based on their characteristics in 2008).¹⁷ The tendency to remain in the panel follows an inverted U-shape in age, with a maximum at age 48. As was the case for survey response, we find that the self-employed are 9 percentage points more likely to drop out of the sample altogether. Retirees, on the other hand, are 15 percentage points less likely to drop out. The strongest predictor of remaining in the sample is receiving a computer: respondents who were provided with a simple computer to complete the online questionnaires are 21 percentage points less likely to leave the sample between 2008 and 2011. We should be careful, however, not to interpret this large difference as a causal effect, since respondents who did not own a computer in 2008 are likely to differ from the other respondents in many other ways, some of which may be unobserved.

Second, we use a probit model to investigate how respondents who objected against linking their survey answers to administrative data differ from all respondents confronted with informed consent. We find that age is the only predictor that is significant at 5%.¹⁸ The tendency to object is non-linear in age, with a peak at 59.

Third, non-response in the retirement expenditures questionnaire, which determines whether we observe self perceived minimal and preferred expenditures, and attrition from the sample, which drives whether we observe assets, are likely to be related to one another. Indeed, bivariate probits of a successful linkage and response to the relevant questions reveal that the correlations between the error terms are in the range 0.19-0.25 (with standard errors close to 0.032). However, once we condition on survey attitude variables, which we use as exclusion restrictions in the selection models, the error correlations are reduced to 0.06-0.08 (with standard errors around 0.035). Hence, we model non-response and attrition separately.

¹⁷Estimates available on request.

¹⁸Estimates available on request.

C Likelihood function

This appendix describes the log likelihood function of the model explained in section 5.1. Recall that the model is given by

$$\begin{aligned}
 M_i &= x'_{mi}\beta_m + \varepsilon_{mi} \\
 N_i &= x'_{ni}\beta_n + \varepsilon_{ni} \\
 W_i &= x'_{wi}\beta_w + \varepsilon_{wi} \\
 d_i^* &= z'_i\gamma + \varepsilon_{di}
 \end{aligned}$$

where M_i is the log of self-perceived minimal retirement expenditures reported by a man in household i and N_i is log self-perceived minimal retirement expenditures reported by a woman. For singles only one of the equations is relevant. W_i is log annuitized household wealth and d_i^* represents a latent variable indicating whether administrative data could be linked or not. The observed counterpart of d_i^* is

$$d_i = \begin{cases} 1 & \text{if } d_i^* > 0 \text{ (household } i \text{ could be linked with wealth records)} \\ 0 & \text{if } d_i^* \leq 0 \text{ (household } i \text{ could not be linked with wealth records)} \end{cases}$$

We assume that the error terms follow a multivariate normal distribution with covariance matrix Σ_M , in which we normalize the variance of ε_{di} to one. The log likelihood for household i is

$$l_i = \begin{cases} \ln [P(d_i = 0)] & \text{(neither annuity, nor expenditures)} \\ \ln [f_1(W_i)P(d_i = 1|W_i)] & \text{(annuity only)} \\ \ln [f_1(N_i)P(d_i = 0|N_i)] & \text{(expenditures of man only)} \\ \ln [f_1(M_i)P(d_i = 0|M_i)] & \text{(expenditures of woman only)} \\ \ln [f_2(N_i, M_i)P(d_i = 0|N_i, M_i)] & \text{(expenditures of both man and woman)} \\ \ln [f_2(N_i, W_i)P(d_i = 1|N_i, W_i)] & \text{(annuity and expenditures of man)} \\ \ln [f_2(M_i, W_i)P(d_i = 1|M_i, W_i)] & \text{(annuity and expenditures of woman)} \\ \ln [f_3(N_i, M_i, W_i)P(d_i = 1|N_i, M_i, W_i)] & \text{(annuity and expenditures of both man and woman)} \end{cases}$$

where f_q represents a q -dimensional normal density and the last terms are probabilities from conditional normal density functions, both derived from the four-variate normal distribution of the error terms.

D Estimates of the selection equations

Table 12: Joint models of annuities and minimal retirement expenditures - selection equations

	Pensions		Pensions + Wealth		Pensions + Wealth + Housing	
Single	-0.105	(0.138)	-0.0240	(0.137)	-0.0242	(0.137)
Female \times single	0.0540	(0.140)	0.0450	(0.140)	0.0446	(0.140)
Age HH head	-0.00454	(0.00377)	-0.00437	(0.00376)	-0.00438	(0.00376)
Any kids	-0.146	(0.125)	-0.135	(0.125)	-0.135	(0.125)
Number children	0.0584	(0.0558)	0.0537	(0.0557)	0.0535	(0.0557)
Homeowner	-0.0374	(0.0798)	-0.00914	(0.0797)	-0.00892	(0.0797)
Log HH income	-0.0918	(0.0683)	-0.0984	(0.0672)	-0.0989	(0.0674)
Inter. sec. ed.	-0.266*	(0.153)	-0.295*	(0.153)	-0.295*	(0.153)
Higher sec. ed.	-0.277	(0.179)	-0.263	(0.179)	-0.264	(0.179)
Int. vocational ed.	-0.207	(0.156)	-0.204	(0.156)	-0.205	(0.156)
Higher voc. ed.	-0.220	(0.154)	-0.229	(0.154)	-0.229	(0.154)
University	-0.284*	(0.172)	-0.327*	(0.172)	-0.327	(0.172)
1 salary worker	0.284**	(0.126)	0.247**	(0.126)	0.247**	(0.126)
All salary workers	-0.0669	(0.0919)	-0.0803	(0.0918)	-0.0799	(0.0918)
1 self employed	0.0401	(0.129)	0.0121	(0.129)	0.0116	(0.129)
All self employed	0.0848	(0.211)	0.0504	(0.211)	0.0501	(0.211)
1 retired	-0.0728	(0.152)	-0.0956	(0.152)	-0.0969	(0.152)
All retired	0.115	(0.147)	0.113	(0.147)	0.114	(0.147)
1 disabled	0.434***	(0.163)	0.449***	(0.163)	0.449***	(0.163)
All disabled	-0.783**	(0.352)	-0.812**	(0.353)	-0.814**	(0.353)
Separated/divorced	0.0584	(0.131)	-0.0179	(0.131)	-0.0175	(0.131)
Widow	-0.132	(0.200)	-0.188	(0.200)	-0.188	(0.200)
Never married	-0.152	(0.104)	-0.209**	(0.104)	-0.209	(0.103)
Personality missing	-0.823***	(0.0803)	-0.810***	(0.0805)	-0.809***	(0.0805)
Constant	1.376**	(0.554)	1.398***	(0.546)	1.403***	(0.547)
Log likelihood	-2,072.156		-2,255.035		-2,339.662	
N	1,780		1,780		1,780	

Dependent variables are indicators equal to 1 if we observe the annuity. The reference categories are primary education and married.

Standard errors in parentheses.

*significant at 10%; **significant at 5%; ***significant at 1%

E Robustness analysis: question difficulty and forecasts of pension annuities

Table 13: Robustness w.r.t. question difficulty and extrapolation of pension entitlements

	Baseline simulations		Everybody understands questions		Annuities for age 50	
	Median	Fraction <0	Median	Fraction <0	Median	Fraction <0
a. Heterogenous targets – minimal expenditures						
Pensions	25 (17, 33)	0.33 (0.29, 0.39)	22 (6, 37)	0.35 (0.26, 0.46)	25 (18, 32)	0.33 (0.29, 0.38)
Pensions + wealth	36 (29, 44)	0.26 (0.23, 0.32)	35 (21, 50)	0.27 (0.19, 0.36)	36 (28, 44)	0.26 (0.23, 0.32)
Pensions + wealth + housing	53 (45, 63)	0.19 (0.16, 0.25)	50 (34, 66)	0.20 (0.15, 0.29)	53 (45, 63)	0.19 (0.17, 0.24)
b. Poverty line plus (917 euro/month)						
Pensions	62 (56, 67)	0.04 (0.03, 0.06)			62 (56, 67)	0.04 (0.03, 0.06)
Pensions + wealth	73 (68, 78)	0.03 (0.02, 0.05)			73 (67, 79)	0.03 (0.02, 0.05)
Pensions + wealth + housing	90 (84, 97)	0.03 (0.02, 0.05)			92 (84, 98)	0.03 (0.02, 0.05)
c. Heterogeneous targets – preferred expenditures						
Pensions	5 (0, 11)	0.46 (0.41, 0.50)	-2 (-11, 7)	0.52 (0.43, 0.60)	5 (0, 10)	0.46 (0.41, 0.51)
Pensions + wealth	18 (12, 24)	0.35 (0.30, 0.40)	12 (3, 22)	0.38 (0.29, 0.47)	18 (12, 24)	0.34 (0.29, 0.40)
Pensions + wealth + housing	33 (28, 40)	0.25 (0.21, 0.30)	27 (18, 37)	0.28 (0.21, 0.35)	34 (27, 41)	0.25 (0.21, 0.31)
d. 70% of current income						
Pensions	22 (17, 27)	0.29 (0.26, 0.34)			22 (17, 27)	0.29 (0.25, 0.34)
Pensions + wealth	34 (29, 39)	0.22 (0.19, 0.26)			34 (28, 40)	0.22 (0.19, 0.27)
Pensions + wealth + housing	50 (44, 56)	0.16 (0.14, 0.19)			51 (45, 56)	0.15 (0.13, 0.18)

Pensions include public and occupational mandatory savings, as well as private pensions. Wealth includes all discretionary savings that are not automatically annuitized, except for property. 90% confidence intervals in parentheses, calculated by parametric bootstrap (500 replications). Simulations are weighted to correct over-representation of homeowners in the LISS-panel.