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

Jochem de Bresser   Marike Knoef
Tilburg University   Leiden University
                           Centerdata
                           Netspar

January 2, 2013

Abstract

Population aging and poor performance of financial markets put the sustainability of pension arrangements in many Western countries under pressure. In order to investigate whether the Dutch population 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 that persists until today. In contrast to previous efforts, we disentangle the roles of variation in perceived needs and accumulated resources by comparing annuitized wealth from administrative data with self-reports of minimal and adequate expenditures during retirement. We take into account public pension rights and non-discretionary savings in occupational pension schemes by assuming that respondents will continue to live in the Netherlands until the age of 65 and will continue to work in their current job. In addition, we take into account third pillar pension rights, housing wealth and private savings. We find that in the aggregate the Dutch can expect to retire quite comfortably, meeting and exceeding both their minimal and adequate expenditure levels. 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 (preliminary!). Among the groups that are at risk are the self-employed, the divorced and the disabled. Current retirees are relatively well off.

1   Introduction

The question of whether people save enough for retirement is not a new one. Fuelled by the observations made by Banks et al. (1998) about how consumption drops at retirement, many researchers have used different angles to describe whether workers can afford to retire comfortably. The USA have long been a particularly interesting country for studies of retirement preparedness, because of the emphasis its pension system places on individual responsibility. In the absence of

---

generous, universal public pensions one naturally worries about the savings decisions of Americans and their implications for eventual retirement incomes. Pensions in the Netherlands, on the other hand, cover almost the entire population and have traditionally succeeded to ensure an adequate income during retirement. However, unfortunately, 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 age of eligibility, lower or no adjustments for inflation, and perhaps even cuts in pension payments. Against this backdrop, we investigate 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, and to identify vulnerable groups.

When thinking about the Dutch system of income provision during retirement, it is convenient to distinguish between four different categories or pillars. The first pillar consists of public pensions that cover everybody who lived in the Netherlands between the ages of 15 and 65. This public pension, or AOW in Dutch, aims to provide retirees with a subsistence income during retirement. Its level is set in relation to the minimum wage 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 age 15 and 65). The second pillar is that of occupational pensions that cover 90 percent of Dutch workers (Bovenberg and Meijdam, 2002). The level of occupational pensions depends on the final or average wages of the individual worker throughout the accumulation phase. Though occupational pensions are mostly defined benefit, the possibility of incomplete adjustment for inflation introduces some uncertainty in payments. Together the first two pillars of the pension system replace on average 70 percent of gross final income (Bovenberg and Meijdam, 2002). The third pillar offers saving vehicles aimed specifically at generating additional retirement income, such as life annuities. Aimed at the self-employed and those who do not accumulate (enough) occupational pensions, third pillar pension arrangements are fiscally attractive. In contrast to the first two pillars, such 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.

Our approach differs from previous efforts in that we adopt as our yardstick for savings sufficiency self-reported measures of the minimal and adequate 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. Moreover, allowing required expenditures to vary between individuals provides insight into how goals and resources interact to determine whether individuals are financially prepared for retirement. Simultaneously analyzing both aims and means yields new policy implications, because it tells us whether groups that accumulate relatively modest wealth would change their saving behavior when confronted with a realistic assessment of their financial position. If we find that poorer groups also expect to be able to make

do with less, provision of accurate financial information by itself cannot be expected to motivate households to accumulate more savings.

Another distinguishing feature is our combined use of survey and administrative data. We draw on the LISS-panel for subjective assessments of minimal and adequate expenditure levels during retirement 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. Previous research on measurement error in survey data on assets, the conclusions of which are confirmed in our own data, leads us to prefer administrative wealth data where available. However, up until retirement, tax records miss those saving vehicles that are taxed only during the payout phase. Such accounts are likely to be especially important for individuals who are not covered by occupational pensions, notably the self-employed. Hence, we supplement administrative records with specific survey items that measure tax-exempt savings to characterize accumulated assets.

Our data on pensions include nominal benefits that can be attained by each worker at age 65, conditional on a continuation of the current employment situation. Since saving through public and occupational pensions is non-discretionary, it is important to be able to take future accruals into accounts, especially for the younger cohorts.[1]

Preliminary: We find that in the aggregate the Dutch are 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 55-60% if we ignore housing wealth, and the median difference relative to adequate expenditures is 40%. Though such favorable statistics suggest all is fine, 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 housing wealth. The size of those deficits is large enough to be problematic, with a median shortfall of 35% (even if we include housing wealth). Multivariate analysis reveals that variation in needs and desires interacts with accumulated resources to produce interesting patterns. For instance, we find that the highly educated both accumulate more wealth and are more demanding in terms of their minimal retirement income. As a result they are more likely to reach their goals only if we control for the level of their needs. The disabled and the divorced also stand out as vulnerable groups, while current retirees are doing well both relative to their own standards and in absolute terms.

The remainder of the paper is organized as follows. The next section provides a short literature review on retirement readiness. Section 3 describes the survey data we use to define expenditure needs during retirement and our administrative data on assets. Section 4 discusses sample selection and introduces the models that we use that takes selectivity into account. Section 5 com-

---

[1]Since the forecasts assume a continuation of the current employment status, they are conservative for younger respondents. Their career development will likely lead to larger contributions at later ages, which our estimates do not yet take into account. However, our simulations indicate that these crude extrapolations do not affect our results substantially.

bines the data and analyzes who can and cannot look forward to comfortable retirement. The final section concludes and the appendix provides more detailed information on selectivity issues.

2   Literature

This paper compares available resources with self-reported minimal and adequate 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 USA. 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 had lead to large increases in overall wealth available for retirement (Venti and Wise, 1996). However, in an influential article Banks et al. (1998) show that consumption drops around retirement, a finding that goes against the consumption smoothing implications of lifecycle models and that cannot be explained fully by changes in labor supply. Instead, it suggests that households are surprised to find their savings inadequate to maintain consumption. Similarly, 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 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 doesn't 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 to the welfare state account for a large fraction of savings. In return, severance pay and social security are generous, the latter replaces 60-70 percent of pre-retirement after tax income, so there is little need for additional saving. Despite that institutional framework, the authors find no discretionary dissaving at any age. The only decumulation of capital that does occur takes the form of drawing a public pension. Other authors have focused specifically on the Netherlands. Alessie et al. (1997a) look at 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 social security by private savings. In another study, Alessie et al. (1997b) document that a large fraction of Dutch households doesn't 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. (2012). They use a much larger sample of the same administrative dataset on assets that we use and provide a detailed description of the wealth holdings in the Dutch population. However, they do not have access to survey data on desired retirement expenditures, so they cannot evaluate the sufficiency of savings using that 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 predicted wealth holdings 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. 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. If optimal savings are derived from lifecycle models, the picture changes to one in which households are saving adequately. However, such models may not accurately reflect the decision process and preferences of real households. Our approach to retirement readiness compares annuitized wealth with minimal and adequate 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. Section 3.2.1 describes how respondents are encouraged to think about options for reducing their expenditures when evaluating their minimal needs.

3 Data

As explained in the introduction, we combine survey data on expenditures during retirement with tax data on assets to investigate whether the Dutch are sufficiently prepared to meet their own goals. Survey data are taken from the LISS panel (Longitudinal Internet Study in the Social Sciences), gathered by CentERdata. This panel is recruited through address based sampling (no self-

selection), and households without a computer and/or internet 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 adequate 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 data that we use).

Administrative data are taken from the 2008 Complete Asset data of the Netherlands (CAD, Integraal-Vermogensbestand, CBS 2008a), the 2008 Public Pension Entitlements data (PPE, Pensioenaansprakenstatistiek, CBS 2008b), the 2008 Occupational Pension Entitlements data (OPE, Pensioenaansprakenstatistiek, CBS 2008c), the 2008 Public Pension Benefits data (PUBLB, AOW-jaarbedrag, CBS 2008d) and the 2008 Private Pension Benefits data (PRIVB, Pensovjaarbedrag, CBS 2009e) all gathered by Statistics Netherlands.

The CAD consist of all households in the Netherlands and contains data about financial wealth (savings accounts, stocks, and securities), property, wealth from business 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 from the whole Dutch population between the age of 21 and 64. PPE is based on data from the organization that implements national insurance schemes in the Netherlands (SVB) and OPE is based on data from pension funds. Finally, public and private pension benefits received by all retirees in the Netherlands are available in PUBLB and PRIVB.

Third pillar pensions (e.g. life annuities) are, unfortunately, only observed once they are claimed, because they are subject to taxation only in the payout phase. The same principle of delayed taxation applies to the "fiscal old age reserve" (FOR) that allows the self-employed to set aside part of their profits to provide additional income during retirement. Third pillar pensions and FOR accounts are likely to be important for those groups that cannot rely on occupational pensions. Therefore, we need to take them into account if we are to credibly assess retirement preparedness. In order to construct a complete picture of the resources available to each household, we supplement the tax data of pre-retirees with information on third pillar pensions and FOR accounts from the 2008 wave of the LISS Assets Survey. We thus use administrative data where possible and add survey data only for the third pillar and the FOR, that are missing in the administrative data.

In the remainder of this section we describe the sample (3.1) and show descriptives of self-perceived minimal and adequate retirement expenditures, wealth, and retirement planning (3.2).

3.1 Sample selection

In January 2008, 2,405 LISS panel-members received the questionnaire on minimal and adequate expenditure levels during retirement. Panel members that received the questionnaire were household heads and their spouses, with a reported net monthly income higher than 800 euro's and age greater 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 1,300-1,500 respondents, 54-62% of the potential sample, answered the questions about their expenditures. If the underlying selection process is related to consumption needs, such a large fraction of item non-response is problematic.

To link the administrative data to the survey data, informed consent was obtained for all panel members in September 2011. Unfortunately, part of the panel members that answered the pension questionnaire in January 2008 were not participating in the panel anymore in the fall of 2011. For these people we have no informed consent and because of ethical considerations these survey answers are not linked to the administrative data. This leads to a substantial loss of data. Of the 2,405 respondents in our potential sample, 1,292 (54%) were still in the LISS panel in September 2011 and could be informed about the match with administrative data. Only 134 objected and administrative records could be retrieved for the remaining 1,158 individuals. Figure 1 gives a graphical representation of the sample.

Table 1 describes the three samples: the potential sample, the survey respondents and the 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. Since our goal is to analyze the retirement readiness of a representative sample of the Dutch population, section 4 describes sample selection in more detail.

3.2 Descriptives

3.2.1 Retirement expenditures

The yardstick against which we measure resource adequacy is the respondent's own subjective evaluation of what would be minimal and adequate levels 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
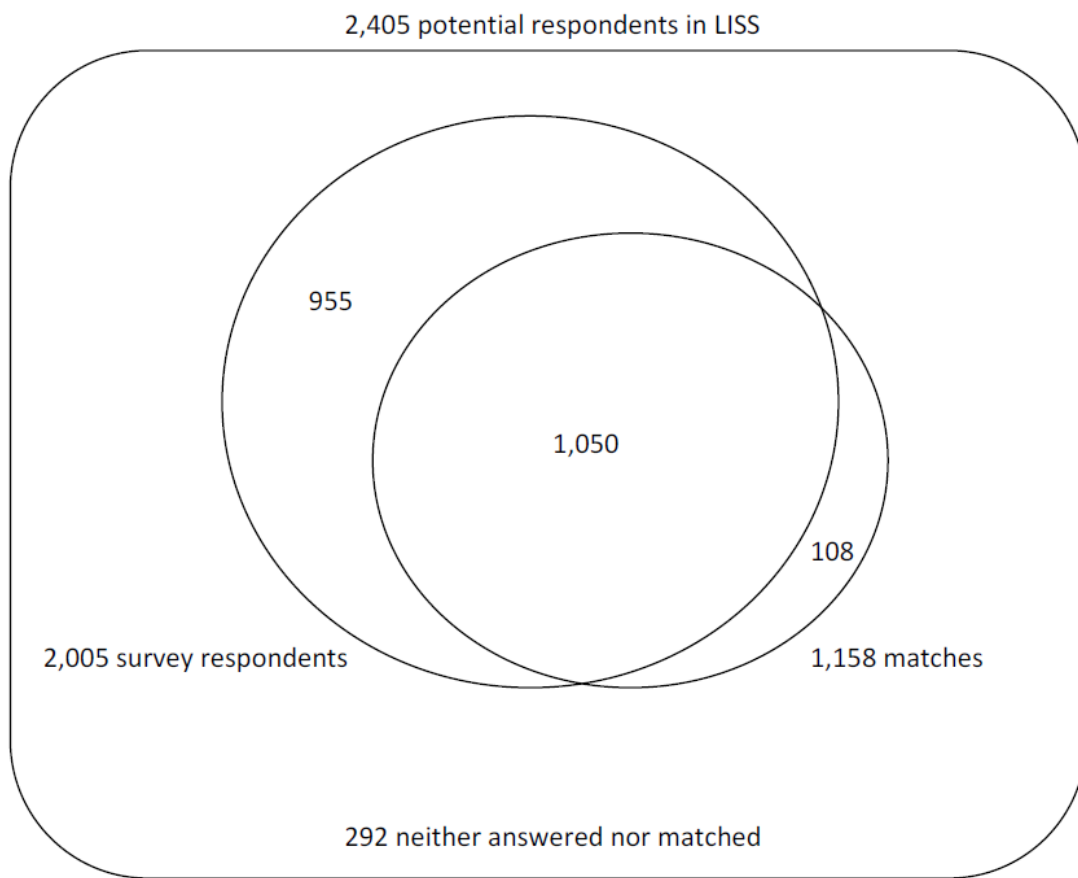
2,405 potential respondents in LISS

955

1,050

108

2,005 survey respondents

1,158 matches

292 neither answered nor matched

Figure 1: Survey response and merge with administrative records

Table 1: Descriptive statistics

	Potential sample[a]		Survey respondents[b]	Matched[c]
	Mean	SD	Mean	Mean
Demographics				
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[d]	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
Education				
Primary[d]	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
Primary activity				
Employed[d]	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[e]	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 adequate 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] Baseline for categorical variables.

[e] For income the sample sizes are 2381, 1988 and 1151.

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 presenting questions on housing before moving on to retirement expenditures and continues to emphasize the importance of housing in the actual question.

In contrast to minimal expenditures, adequate expenditures during retirement are anchored on current net household income in order to ensure that the answers are meaningful for the respondents. Moreover, instead of answering a single open-ended question, respondents are guided to their answer by means of 1 or 2 multiple choice questions. In each question the respondent is presented with 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 posed to a respondent with a household income of 3,500 euro per month:

[*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 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.:*]

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 adequate expenditures based on 1% real interest, because that scenario is closest to reality. 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.

The top panel of Table 2 contains descriptive statistics for minimal expenditures during retirement. Expenditures are standardized to 1-person households using the equivalence scale constructed by Statistics Netherlands (which is equal to 1.37 for a 2-person household without children living at home). The question is answered by 1,487 respondents (out of the 2,405 respondents that received the questionnaire). The median of the minimal subjective expenditures equals 1,460 euro/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.

As can be seen in the second panel of Table 2, the median minimal level of expenditures is close to the median adequate expenditure level, which is 1,606 euros for 1% real interest. Across

different age groups, we find that minimum expenditures are constant but median adequate expenditures are higher for middle aged respondents. Both types of expenditures are dispersed, but there appears to be much more agreement on minimum compared to adequate expenditures (the s.d. of the former is 800 while that of the latter is 3,700). This may reflect differences between the survey items, since adequate expenditures are anchored on current income while minimal expenditures are not. Within-respondent comparisons of minimum and adequate expenditures reveal that 58 percent of the respondents to both questions report minimum expenditures below adequate expenditures for 1% real interest. Since adequate expenditures are anchored to current income, probably people with higher minimal expenditures than adequate expenditures do not regard their current expenditures as sufficient enough for retirement.

Table 2: Descriptive statistics of minimum expenditures during retirement and adequate replacement rates

					By age				
	All respondents				25-34	35-44	45-54	55-64	65+
	N	Mean	Median	SD	Mdn	Mdn	Mdn	Mdn	Mdn
	Self-assessed minimum and adequate retirement expenditures								
Minimum exp.[a]	1,487	1543	1460	781	1412	1460	1460	1460	1460
Adequate exp.[a, b]	1,293	1891	1606	3720	1450	1533	1715	1679	1606
	Distribution of self-assessed adequate replacement rates								
Adequate RR 50%[b]	1,293	0.03	0	0.17	0.04	0.04	0.02	0.03	0.02
RR 64%	1,293	0.06	0	0.24	0.07	0.07	0.05	0.05	0.09
RR 76%	1,293	0.39	0	0.49	0.37	0.39	0.41	0.37	0.38
RR 88%	1,293	0.37	0	0.48	0.35	0.38	0.39	0.38	0.34
RR 100%	1,293	0.12	0	0.32	0.14	0.10	0.11	0.12	0.13
RR 140%	1,293	0.03	0	0.17	0.03	0.02	0.02	0.04	0.04
	Minimum and adequate expenditures divided by current income								
Minimum exp. / income	1,487	74.2	73.5	36.1	74.5	72.1	66.7	77.1	80.9
Adequate exp. / income	1,293	78.1	78.6	10.7	77.8	77.8	78.1	79.2	84.5

[a] Retirement expenditures are equivalized to 1-person household without children.
[b] Adequate expenditures are elicited using a 1% real interest rate.

In the bottom panel of Table 2 we divide minimal and adequate individual assessed expenditures by current income. The median of the minimum ratio's is 74 percent. This is in line with the 70 percent that is often mentioned as reasonable by financial planners and with the average replacement rate provided by the first two pillars of the Dutch pension system (Bovenberg and Meijdam, 2002). If possible, however, respondents would prefer a higher replacement rate of 79 percent. Minimum replacement rates tend to be lowest when income is highest: for the 45-54 age category. Interestingly, more than half of the oldest respondents indicate that their income is above what would be adequate expenditures, with a median adequate replacement rate of 85 percent. As for variation, the pronounced difference between relatively concentrated minimum expenditures
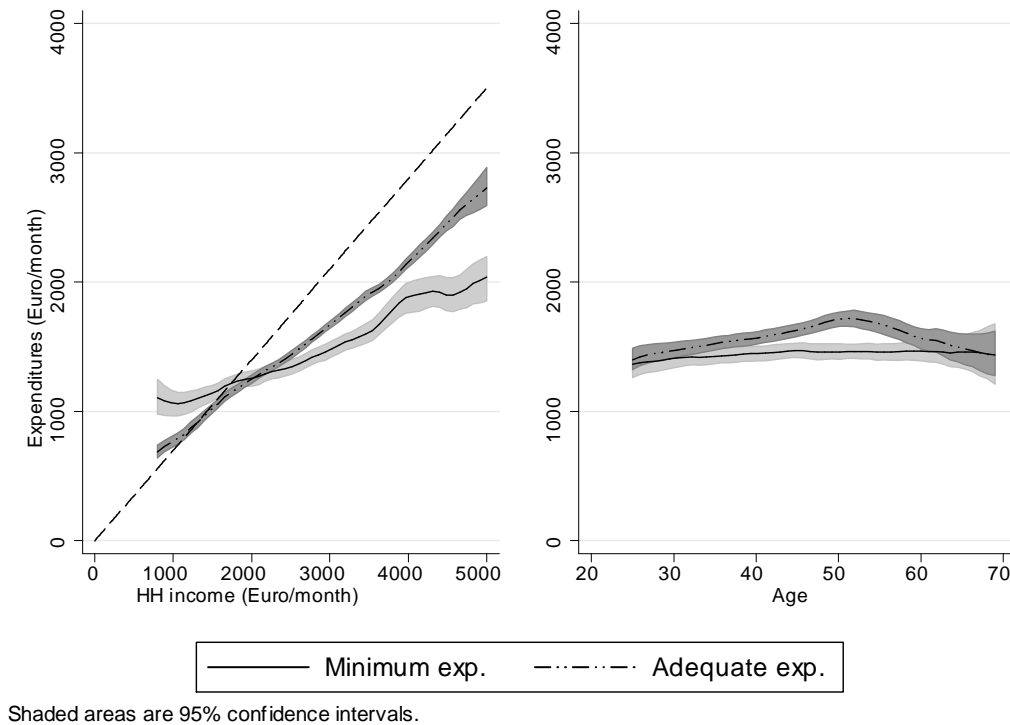
Shaded areas are 95% confidence intervals.

Figure 2: Kernel regressions of minimal and adequate expenditures during retirement on income and age.

and dispersed adequate expenditures is reversed when we standardize by current income: replacement rates are more variable for minimal, s.d. 36, than for adequate, s.d. 11, expenditures. The fact that both measures of expenditures during retirement vary across the sample even when we correct for current income indicates the added value of our subjective benchmarks compared to the one-size-fits-all approach of external benchmarks (such as poverty lines or even fixed replacement rates).

Kernel regressions of minimal and adequate expenditures during retirement on income and age are shown in Figure 2. The left panel contains the regressions on household income and includes a dashed line correponding to a 70% replacement rate w.r.t. current income. Both expenditure levels increase with income but the gradient is much steeper for adequate expenditures compared to minimal expenditures. However, both are flatter than the 70% line, lying above it for low incomes and substantially below it for the highest ones. Neither expenditure measure simply reflects current income or expenditures. Minimum expenditures are larger than adequate expenditures only for respondents with monthly net household income below 1,700 Euro, perhaps because of the latter are anchored on current income while the former are not.

The right panel of Figure 2 shows that minimal expenditures are constant across ages, at a level close to 1,400 Euro/month. Adequate expenditures follow a hump-shape, with a peak at 1,800 Euro/month around age 50. Table 1 tells us that this hump in adequate expenditures is due to income differences, since the adequate replacement rate is constant across age groups. The level of adequate expenditures around ages 25 and 70 is very similar to that of minimal expenditures.

Respondents are likely to find the questions on expenditures during retirement challenging. For instance, younger respondents haven't thought much about retirement: of the respondents aged 25-34, 86% indicates having though "only a little" or "not at all" about retirement. For the pre-retirees, age 55-64, this fraction is 51%. In addition to questionable salience of retirement to young respondents, 63% of individuals find the questions difficult to answer and 35% find it difficult to assess their expenditure needs during retirement. As a result our measures of expenditures may be noisy. In our models we analyze expenditures as dependent variables, so random measurement error will not bias our coefficient estimates or our simulations. However, if poor-quality answers tend to be systematically higher or lower than others, our simulations of the extent to which the Dutch can meet their goals will be affected. The survey items on question salience and difficulty allow us to control for these factors. Descriptives of these questions can be found in Appendix B.

3.2.2 Assets

The quality of any evaluation of retirement readiness depends on the analyst's ability to measure financial resources. However, survey reports of assets 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).[2] For these reasons we prefer to draw on more reliable administrative sources.

Table 3 shows descriptives of financial assets at the household level, for all panel members that received the questionnaire about pension expenditures and could be matched to the administrative data. We observe large differences in ownership rates across the various categories of financial assets: savings accounts are held by almost every household in the sample while securities, non-residential real estate and business wealth are only held by 5-8 percent. Disregarding pensions, the single most important asset for most households is their house: 75 percent of the sample consists of homeowners and for them their house is by far the largest component of their non-pension wealth, with a median net housing wealth equal to 137,000 euro. Actually, this is an underestimation, since there are quite some households in the Netherlands that own an endowment mortgage or an investment-based mortgage. For these mortgages payments are not used to repay the debt

---

[2]Non-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 don't own savings accounts and investments (ownership rates are 10 percentage points lower in the survey compared to tax records). Home ownership, 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.

directly, but instead are paid to the endownment insurance company or saved on separate account for fiscal reasons. The entire 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, and unfortunately, there is no additional survey information about them. Hence, we underestimate retirement preparedness for those who own these kind of mortgages, probably mostly younger cohorts. Non-mortgage debt is owned by 10% of the households. With a median of 21,000 euro the size of those debts may be problematic for the households that own them.

Pensions, both public and private, form the main source of retirement income for the Dutch. Public pensions in the Netherlands involve a flat rate benefit for all residents as from the statutory retirement age of 65 onwards. The level of the public pension is linked to the net minimum wage and depends on the number of years residing in the Netherlands. Between the age of 15 and 65 2% of the full public pension benefit is built up every year. In 2008 the full net flat rate benefit was 980 euro for singles. Table 3 shows the percentage of the full benefit that people will receive at age 65 based on the assumption that respondents continue to live in the Netherlands up to the age of 65, and hence continue to build up their public pension rights, until retirement.

For second pillar occupational pensions we report both the currently accumulated nominal rights and those raised to the level that will be reached at age 65 if the employment situation remains unchanged.

We find that X percent of the sample reports owning non-zero funds in third pillar accounts (with median holdings equal to X). FOR accounts are only held by 1 percent of respondents, which is expected since they are available only to the self-employed (median holdings equal to 21,515). Speaking for the sample as a whole, non-public pensions consist mostly of second pillar occupational pensions.

In Table 4 we show asset holdings, debt and pension entitlements for different age groups in our cross-section. We omit the asset categories that are held least frequently. Older age groups hold more assets in savings accounts and in the form of stocks compared to younger respondents. The incidence of home ownership is roughly the same for the different cohorts, around 77 percent, except for the oldest respondents of whom only 55 percent owns a house. The median value of property conditional on ownership increases with age, from 217,700 euro in the 25-34 category to 318,600 for those respondents of age 65 or older. We find that the oldest group has mostly paid off their mortgage: conditional on having a mortgage, the value of the remaining mortgage relative to the value of the house declines from a median of 92 percent for respondents below age 35 to only 19 percent for the oldest respondents. Probably, the oldest age group paid off a larger part of their mortgage, but also increasing housing prices have decreased their loan to value.

Table 3: Descriptive statistics of household assets and pension entitlements in 2008.

	N (HHs)	Ownership	Conditional on ownership		Unconditional		
			Mean	Median	Mean	Median	SD
Financial assets							
Checking and saving accounts	927	0.94	39,592	19,113	37,413	17,387	56,380
Securities	927	0.05	63,174	22,608	2,862	0	28,975
Stocks	927	0.33	59,001	16,374	19,667	0	109,360
Property	927	0.75	296,507	253,690	222,620	221,093	200,423
Real estate other	927	0.08	195,906	164,137	14,793	0	72,971
Wealth from business	927	0.08	27,242	7,662	2,145	0	29,750
Other assets	927	0.04	42,460	6,352	1,695	0	18,444
Mortgage debt	927	0.69	152,960	139,311	104,778	79,412	113,244
Other debt	927	0.10	46,478	21,593	4,613	0	25,125
Net housing wealth	927	0.76	156,056	130,426	117,842	72,641	180,849
Mortgage/property	P.M.						
Total financial assets	P.M.						
Pension entitlements (standardized annuities), preliminary							
Public pension entitlements[a]	821	1.00	97	100	97	100	13
Second pillar (currently)[b]	890	0.90	5010	2923	4520	2555	5922
Second pillar (continued employment)[a]	890	0.90	11991	10402	10818	9278	9824
Third pillar[c]	P.M.						
FOR accounts[c]	P.M.						
Private pension benefits[d]	P.M.						

[a] These are the public pension entitlements observed for people younger than 65. They are presented as the percentage of the full state pension that households will receive.

[b] Pension entitlements are only observed for people younger than 65.

[c] Third pillar pension entitlements and FOR accounts are not available in the administrative data and are derived from a LISS questionnaire on assets.

[d] For people of age 65 and older we observe the sum of 2nd and 3th pillar pension benefits.

Table 4: Assets for different age groups (conditional on ownership)

| | By age group | | | | | | | | | | Total | |
| | 25-34 | | 35-44 | | 45-54 | | 55-64 | | 65+ | | Total | |
	Owner	Mdn	Owner	Mdn	Owner	Mdn	Owner	Mdn	Owner	Mdn	Owner	Mdn
Financial assets												
Saving accounts	0.92	12,175	0.93	16,206	0.96	19,706	0.95	25,990	0.98	23,431	0.94	19,113
Securities	0.00	-	0.04	5,195	0.05	33,882	0.04	23,083	0.10	28,084	0.05	22,608
Stock	0.20	4,250	0.34	14,880	0.35	19,058	0.36	21,392	0.36	34,647	0.33	16,374
Property	0.75	213,156	0.80	252,840	0.77	253,973	0.77	284,184	0.54	325,970	0.75	253,690
Wealth from own buss.	0.09	7,662	0.10	13,293	0.10	6,641	0.05	4,046	0.02	-15,793	0.08	7,662
Mortgage debt	0.76	185,250	0.77	178,164	0.69	108,112	0.67	85,457	0.41	60,210	0.69	139,311
Other debts	0.04	8,129	0.09	12,254	0.13	27,825	0.11	21,756	0.10	27,834	0.10	21,593
Net housing wealth	0.76	14,684	0.80	75,251	0.78	160,570	0.77	193,269	0.54	252,275	0.76	130,426
Mortgage/property		0.92		0.71		0.43		0.28		0.19		0.54
Total financial assets	P.M.											
Pension entitlements (standardized annuities)												
Public pensions	P.M.											
Second pillar (currently)[a]	0.99	1162	0.98	2259	0.96	4371	0.94	5601				
Second pillar (continued employment)[a]	0.99	12378	0.98	11491	0.96	11165	0.94	7380				
Third pillar pensions[b]	P.M.											
FOR accounts[b]	P.M.											
Private pension benefits[c]	P.M.											

[a] Pension entitlements are only observed for people younger than 65.
[b] Third pillar pension entitlements and FOR accounts are not available in the administrative data and are derived from a LISS questionnaire on assets.
[c] For people of age 65 or older we observe the sum of 2nd and 3th pillar pension benefits.

As expected, currently accumulated pension rights for non-public pensions increase with age from XXX for the youngest age group to XXXX for ages 55-64. The difference between the accumulated rights is smaller if we assume maintenance of the status quo until age 65, but we still find that the rights of those aged 55-64 are more than twice as large as those aged 25-34. That remaining difference reflects the fact that the extrapolation of pension entitlements by Statistics Netherlands does not allow for career development. Contributions to occupational pensions are usually a fixed percentage of salary, so that younger employees with lower salaries contribute less than employees at the end of their career. Hence, the extrapolations underestimate the pension entitlements that will be accumulated in second pillar pensions by younger cohorts. In a later version of this paper we may take into account wage increases to take this into account.

4 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 preretirement income (e.g. Haveman et al., 2007), we use self-perceived minimal and adequate retirement expenditures to qualify retirement readiness. In this way we take into account that people may have different preferences. Self perceived minimal retirement expenditures and self perceived adequate replacement rates may differ by gender, income (Binswanger and Schunk, 2012), and household characteristics. However, also unobserved characteristics may 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 not to save that much during working life. This may also influence the amount of 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. In this section we describe how we measure retirement readiness. First we describe how we compute annuities from observed household wealth (4.1). Secondly, we consider representativeness (4.2) which determines which selection equations we have to use in the model (4.3). Finally, section 4.4 describes the simulations that we use to judge retirement savings adequacy.

4.1 Annuities

To measure retirement readiness we confront self perceived minimal and adequate expenditures with annuitized wealth. To annuitize wealth we have to make a number of assumptions. To begin with, we assume a retirement age of 65, a real interest rate of 1% and an inflation of 2%. We use mortality rates per cohort predicted by Statistics Netherlands (latest version: 17 December 2010). For couples we assume that household wealth is divided equally, taking into account economies of

scale and different life expectancies of spouses. Assume, for example, that a 50 year old man and a 45 year old woman have a total household wealth of 50.000 euros. 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 lives longer than the man and after the death of the man we let her still take money out of the account. We take into account that as a widow, she needs relatively more money to be equally well of as before, because she looses economies of scale. Knoef et al. (2012) explain the calculations in detail. We assume that couples stay together and that singles stay single. Also, we assume that remaining lifetimes of men and women are independent and we take not into account differential mortality or any bequests. Finally, the replacement rates chosen in the questionnaire represent net replacement rates. We have to take this into account when computing predictions of retirement income, since the tax pressure is lower for persons aged 65 and over. They face different marginal tax rates in the first two brackets of the income tax system and do not pay premia for social insurance and social security.

4.2 Representativeness

To be able to draw representative conclusions about retirement readiness item nonresponse and selection of the households that can be linked with the administrative data are important. 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 54-62 percent. Such low rates of item response are typical for these kind of questionnaires and probably due to the difficulty of the questions. Indeed, 33 percent of survey respondents agree that many questions are difficult for them to answer, even though only 13 percent find it very difficult to imagine how much money they would like to have during retirement. Neither survey response, nor item non-response occurred randomly across the potential sample. 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 1. Our exclusion restrictions are measures of survey attitude taken from the 2008 personality questionnaire distributed to the LISS panel, supplemented with a dummy that indicates respondents who failed to answer to any of the yearly personality questionnaires in the 2008-2011 period. 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 and 147.86 for the measures of adequate expenditures against a critical value of 23.2 at a significance level of 1%). Despite the relevance of the instruments, 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 10% in all equations and remain insignificant when subsets of the instruments are considered). For all 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.

As described in section 3.1 not all of the 2,405 potential respondents to the expenditures questionnaire could be linked to the administrative data. The main cause for this is panel attrition. Panel attrition is not random. For example, 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. We indeed find selectivity in the financial assets that we observe. It appears that financial assets are somewhat lower among the households for which we can link administrative data (probably wealthy households have a higher attrition rate). This finding is consistent with the fact that average income is lower for the subsample that could be matched to administrative records compared to that which could not be matched (see Table 1). We have to take this into account in our analysis and therefore we include a selection equation in our model to correct for selection with regard to the possibility to link administrative data.

4.3 Model

To investigate how (pension) wealth and retirement goals interact we model self perceived minimal income and self perceived adequate replacement rates simultaneously with observed annuitized household wealth and the 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 adequate expenditure levels may be different for men and women. Therefore, 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

$$
\begin{aligned}
M_i &= x'_{mi}\beta_m + \epsilon_{mi} \\
N_i &= x'_{ni}\beta_n + \epsilon_{ni} \\
W_i &= x'_{wi}\beta_{w1} + \epsilon_{w1i} \\
d^*_{1i} &= z'_i\gamma_{w1} + \epsilon_{d1i},
\end{aligned}
\tag{1}
$$

where M is self perceived minimal retirement expenditures reported by a man and N is self perceived minimal retirement expenditures reported by a woman. W is annuitized household wealth and d^*_i represents a latent variable indicating whether administrative data could be linked

or not. The observed counterpart of d_{1i}^* is

$$d_{1i} = \begin{cases} 1 & \text{if } d_{1i}^* > 0 \\ 0 & \text{if } d_{1i}^* \leq 0 \end{cases}$$

We assume the error terms to be normally distributed with mean zero and covariance matrix Σ_M. For our research goal it is important to take into account correlation between annuitized wealth and self perceived adequate 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.

With regard to adequate income, respondents are asked to choose between 6 replacement rates. Whereas replacement rates are continuous, we observe the choice between 6 ordered replacement rates. We model this choice for men and women using two ordered probits.

$$\begin{aligned} R_i^* &= x_{ri}'\beta_r + \epsilon_{ri} \\ S_i^* &= x_{si}'\beta_s + \epsilon_{si} \\ W_i &= x_{wi}'\beta_{w2} + \epsilon_{w2i} \\ d_{2i}^* &= z_i'\gamma_{w2} + \epsilon_{d2i} \end{aligned} \qquad (2)$$

describes the latent model. R is the replacement rate chosen by the man and S is the replacement rate chosen by the woman. We assume the error terms to be normally distributed with mean

zero and covariance matrix Σ_R. The observed counterparts for R_i^*, S_i^* and d_{2i}^* are

$$
R_i = \begin{cases}
50 & \text{if } R_i^* \leq \alpha_{r1} \\
64 & \text{if } \alpha_{r1} < R_i^* \leq \alpha_{r2} \\
76 & \text{if } \alpha_{r2} < R_i^* \leq \alpha_{r3} \\
88 & \text{if } \alpha_{r4} < R_i^* \leq \alpha_{r4} \\
100 & \text{if } \alpha_{r4} < R_i^* \leq \alpha_{r5} \\
140 & \text{if } R_i^* > \alpha_{r5}
\end{cases}
$$

$$
S_i = \begin{cases}
50 & \text{if } S_i^* \leq \alpha_{s1} \\
64 & \text{if } \alpha_{s1} < S_i^* \leq \alpha_{s2} \\
76 & \text{if } \alpha_{s2} < S_i^* \leq \alpha_{s3} \\
88 & \text{if } \alpha_{s3} < S_i^* \leq \alpha_{s4} \\
100 & \text{if } \alpha_{s4} < S_i^* \leq \alpha_{s5} \\
140 & \text{if } S_i^* > \alpha_{s5}
\end{cases}
$$

$$
d_{2i} = \begin{cases}
1 & \text{if } d_{2i}^* > 0 \\
0 & \text{if } d_{2i}^* \leq 0
\end{cases}
\tag{3}
$$

4.4   Simulation

To judge retirement savings adequacy we simulate for all 1,779 households for whom we observe all covariates annuitized wealth and subjective adequate retirement expenditures, taking into selectivity and taking into account correlations between wealth and self-perceived minimal and adequate replacement rates (e.g. persons that prefer a high replacement rate probably also have saved relatively more wealth).

For every individual we do several simulations, with different drawings from the error terms, and for all simulations we confront annuitized wealth with self assessed minimal expenditures. Furthermore, we confront annuitized wealth with adequate expenditures, computed with the simulated replacement rates and current income. Instead of current income, later we may estimate average income during working life, to take into account income trajectories over the life cycle.

In addition to simulating various moments of the joint distribution of assets and expenditures, we also construct confidence intervals for those moments by means of a parametric bootstrap over the asymptotic distribution of our estimates. Using this approach we have to assume normality of the unobserved heterogeneity terms. On the other hand, it helps us to draw representative conclusions about the retirement readiness of the Dutch population.

5 Results

5.1 Estimation results

Before simulating retirement readiness, we first present estimation results from the models that form the basis for the simulations. As explained in the previous section, initial analyses indicated that sample selection is a relevant concern for our assets data but not for the subjective measures of minimal and adequate retirement expenditures. Therefore, the models reported here correct only for selectivity in assets.

5.1.1 Annuities

Table 5 shows estimation results for the selection and annuity equations of models pertaining to the minimal level of expenditures during retirement. The left panel shows estimates from the model that analyzes assets net of housing wealth, while the right panel includes housing wealth in the measure of assets.[3] As explained in section 3.1, failure to observe assets is primarily driven by attrition from the LISS panel during the period between filling out the questions in January of 2008 and requesting consent for the match to administrative records in the fall of 2011 (among those that remained in the sample only few actively objected to the merge). The estimates from the selection equation for annuities, shown in the leftmost column of Table 5, indicate we are slightly less likely to observe assets for older respondents. Respondents with a simPC, on the other hand, are much more likely to be included in our sample of administrative records. Importantly, the indicator for not responding to the personality questionnaires of 2008-2011, our instrument for sample selection in this specification, enters with the expected negative sign and is significant (the relevant t-statistic is about 10 in absolute value). Hence, our exclusion restriction has considerable explanatory power in the selection equation. As can be seen by comparing the first columns of the two panels of Table 5, estimates for the selection equations in the models of annuities including and excluding housing wealth are very similar.

The next column in Table 5 contains estimates from the equation for the log of the household-level annuity that does not include housing wealth (and which has been standardized to a 1-person household without children). Households with an older head are found to have accumulated higher annuities: an increase in age of 1 year is associated with an increase in the annuity of about 1 percent. As explained in section 3.2.2, this is likely to be partly due to the extrapolation of occupational pensions based on continuation of the present employment situation. Homeowners are entitled to a 16% higher annuity on average, even if we exclude housing wealth from our wealth measure. If we do take housing wealth into account, the difference between the average annuities of homeowners and non-owners increases to 39% (right panel). The elasticity of the annuity with

---

[3]In order to save space, we do not report the corresponding estimates from models of adequate expenditures. Those estimates are close to those reported here and are available upon request.

Table 5: Joint models of annuities and minimal retirement expenditures - selection and annuity equations

	Excluding housing				Including housing			
	Selection		Annuity		Selection		Annuity	
Single	0.190	(0.136)	0.161*	(0.0855)	0.208	(0.136)	0.248***	(0.0865)
Female single	0.0232	(0.139)	-0.112	(0.0846)	0.0139	(0.140)	-0.177**	(0.0859)
Age HH head	-0.00972***	(0.00379)	0.0117***	(0.00244)	-0.0100***	(0.00380)	0.0167***	(0.00247)
Any kids	-0.219*	(0.125)	-0.0427	(0.0747)	-0.210*	(0.125)	-0.0332	(0.0759)
Number children	0.147***	(0.0557)	-0.0290	(0.0324)	0.136**	(0.0555)	-0.0125	(0.0329)
Homeowner	-0.0140	(0.0799)	0.160***	(0.0496)	-0.0296	(0.0797)	0.393***	(0.0503)
Log HH income	-0.0662	(0.0611)	0.110***	(0.0378)	-0.0508	(0.0616)	0.0756**	(0.0385)
Has simPC	0.389**	(0.161)	-0.292***	(0.0916)	0.414***	(0.161)	-0.293***	(0.0928)
Inter. sec. ed.	-0.134	(0.153)	0.157*	(0.0942)	-0.154	(0.152)	0.229**	(0.0955)
Higher sec. ed.	0.00856	(0.179)	0.186*	(0.108)	-0.0287	(0.178)	0.239**	(0.109)
Int. vocational ed.	-0.0839	(0.156)	0.264***	(0.0950)	-0.111	(0.155)	0.296***	(0.0964)
Higher voc. ed.	-0.0958	(0.154)	0.375***	(0.0945)	-0.115	(0.154)	0.415***	(0.0958)
University	-0.0298	(0.172)	0.388***	(0.105)	-0.0633	(0.171)	0.423***	(0.107)
1 salary worker	0.185	(0.125)	0.177**	(0.0778)	0.202	(0.124)	0.166**	(0.0786)
All salary workers	-0.153*	(0.0915)	0.0102	(0.0551)	-0.146	(0.0913)	-0.00927	(0.0560)
1 self employed	-0.00261	(0.127)	-0.101	(0.0799)	0.00639	(0.127)	-0.0563	(0.0811)
All self employed	0.178	(0.211)	0.171	(0.130)	0.191	(0.210)	0.0288	(0.131)
1 retired	0.116	(0.157)	0.323***	(0.0987)	0.0751	(0.156)	0.309***	(0.100)
All retired	0.144	(0.157)	-0.0354	(0.105)	0.186	(0.157)	-0.0327	(0.106)
1 disabled	0.454***	(0.159)	-0.203**	(0.0900)	0.434***	(0.158)	-0.207**	(0.0915)
All disabled	-0.835**	(0.343)	0.269	(0.217)	-0.794**	(0.342)	0.264	(0.220)
Separated/divorced	0.0281	(0.132)	-0.136*	(0.0814)	0.0124	(0.132)	-0.152*	(0.0826)
Widow	-0.247	(0.198)	0.0933	(0.126)	-0.251	(0.198)	0.0435	(0.128)
Never married	-0.179*	(0.103)	0.0109	(0.0631)	-0.191*	(0.102)	0.0377	(0.0639)
Thought some	-0.0734	(0.179)	-0.0699	(0.107)	-0.0855	(0.178)	-0.0537	(0.109)
Thought a little	-0.00850	(0.169)	-0.0759	(0.101)	-0.00691	(0.169)	-0.0786	(0.102)
Hardly thought	-0.0608	(0.181)	0.0142	(0.109)	-0.0810	(0.181)	0.0310	(0.110)
No answer	0.395**	(0.185)	-0.0578	(0.114)	-0.391**	(0.185)	-0.109	(0.115)
Personality missing	-0.703***	(0.0752)			-0.685***	(0.0739)		
Constant	1.206**	(0.540)	5.892***	(0.332)	1.131**	(0.543)	5.856***	(0.337)
Sigma epsilon			0.620***	(0.0236)			0.631***	(0.0230)
Log likelihood		-2,641.882				-2,647.400		
N		1,779				1,779		

Dependent variables are logs of monthly annuities and indicator equal to 1 if we observe the annuity.
Annuities standardized to 1-person household; estimates taken from models of minimal expenditures.
Standard errors in parentheses.
*significant at 10%; **significant at 5%; ***significant at 1%

respect the household income is about 0.1 and more educated households, measured by the highest education level of the spouses, are better prepared for retirement. These differences between education levels are large: households in which at least one partner has finished vocational training have accumulated on average 27% more assets compared to households in which neither spouse went beyond primary school and for the higher educated the difference is close to 40 percent. In terms of the activities of household members, we find that having at least 1 spouse work for a wage is associated with 17% higher annuities compared to households in which neither spouse works, probably because of the occupational pensions that cover 90% of workers. Moreover, households with at least 1 retiree have on average 31 percent higher annuities. This difference partly reflects the fact that our administrative measures only include third pillar pensions for those who claim them. For current workers we rely on survey data on third pillar pensions which may suffer from substantial under-reporting (see section 3.2.2). However, given the comprehensive nature of public and occupational pensions and the fact that relatively few people need to supplement their retirement income with private pensions, we do not expect measurement error to play a large role here. In contrast to families with retirees, we find that having at least one household member who cannot work due to disabilities is associated with 20% lower annuities. Finally, the separated or divorced are also less well prepared: their annuity is on average 14% lower compared to married respondents.

5.1.2 Minimal and adequate expenditures during retirement

Table 6 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 adequate expenditures, both sets of estimates are taken from models of annuities without housing wealth.[4] We find that for men both personal and household income are strongly positively associated with the minimal level of expenditures they find necessary during retirement (the elasticities of expenditures w.r.t. income are around 0.15 for both income measures). For women, on the other hand, personal income doesn't affect minimal expenditures but household income does with an elasticity of 0.51. Higher educated men and women report significantly higher levels of minimal expenditures: male university graduates report 53% 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. Men who are self-employed report 17% higher minimal expenditures on average compared to wage workers. Finally, women who

---

[4]Estimates are similar to those obtained when housing wealth is included in the annuities. Those estimates are available on request from the authors.

are divorced are pickier: they require 15 percent higher expenditures than do their married peers (for men the difference is equally large, but estimated relatively imprecisely).

The right panel of Table 6 shows analogous estimates for adequate expenditures. Compared to minimal expenditures, household income is a much stronger covariate of desired expenditures for men but not for women (the elasticity is 0.35 compared to 0.16 for minimal expenditures). We find that the level of adequate expenditures varies much less with education than does the level of minimal expenditures: university graduates report only 11% higher adequate expenditures compared to primary school graduates (the difference in minimal expenditures is 39% for women and 53% for men). One reason for the smaller size of the differences in adequate expenditures may be that they are measured more precisely, because respondents are guided much more in their answer to the adequate expenditures question compared to the item on minimal expenditures (for the former they answer by means of multiple choice scenarios that are designed to fit the personal situation of the respondent, while the latter is elicited in a single open-ended question). However, note that the estimates reported in Tables 5 and 6 control for self-assessed question difficulty and understanding, variables 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 adequate expenditures, since for a given level of current income the poorly educated may have more experience making ends meet in financially difficult times. 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 100 euro 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, or 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 minimal requirements.

The estimates in Tables 5 and 6 reveal that resources and perceived needs vary across the sample in ways that are relevant for policymakers. For instance, the finding that lowly educated respondents are both less demanding and poorer suggests that providing them with accurate information on the status of their retirement funds might not result in substantial changes in the savings behavior. Indeed, the poorly educated may be perfectly prepared to meet their own modest goals. In order to induce additional savings one would have to directly target the goals.

Table 7 shows the estimated correlations between the error terms of the model explaining minimal expenditures and annuities net of housing wealth.[5] We find that, conditional on the covariates, annuitized assets and minimal expenditures are positively correlated for men but not for women. Also, the correlation between the expenditures levels reported by spouses is positive and marginally significant, but relatively small at 0.12. Most importantly, the correlation between the error terms of the selection equation and the annuity equation is -0.81 and highly statistically signifi-

---

[5]Estimates for the model of annuities including housing wealth are similar and available on request.

Table 6: Joint models of annuities and retirement expenditures - expenditure equations

	Minimal expenditures				Adequate expenditures			
	Men		Women		Men		Women	
Partner	-0.0220	(0.0790)	-0.181**	(0.0745)	-0.130***	(0.0398)	0.0323	(0.0576)
Age	0.00104	(0.00267)	0.00442**	(0.00208)	0.00316***	(0.00115)	0.00606***	(0.00143)
HH head	0.00948	(0.0843)	-0.0990*	(0.0596)	-0.104***	(0.0378)	0.0197	(0.0431)
Number children	-0.00849	(0.0229)	-0.0256	(0.0182)	0.00899	(0.0101)	-0.0166	(0.0128)
Homeowner	0.0216	(0.0568)	0.0926**	(0.0426)	0.116***	(0.0271)	0.106***	(0.0321)
Log pers. Income	0.146***	(0.0460)	0.000406	(0.00969)	0.145***	(0.0220)	0.0113*	(0.0065)
Log HH income	0.163***	(0.0363)	0.509***	(0.0528)	0.352***	(0.0204)	0.466***	(0.0241)
Has simPC	-0.0324	(0.116)	-0.0372	(0.0839)	-0.0789	(0.0659)	-0.166**	(0.0830)
Inter. sec. ed.	0.0664	(0.0848)	0.0909	(0.0649)	-0.0138	(0.0358)	0.0374	(0.0443)
Higher sec. ed.	0.316***	(0.106)	0.237***	(0.0811)	0.0375	(0.0456)	0.145***	(0.0559)
Int. vocational ed.	0.238***	(0.0848)	0.213***	(0.0702)	0.0737**	(0.0368)	0.141***	(0.0481)
Higher voc. ed.	0.300***	(0.0851)	0.256***	(0.0702)	0.0697*	(0.0364)	0.154***	(0.0491)
University	0.525***	(0.0991)	0.385***	(0.0927)	0.114***	(0.0432)	0.119*	(0.0622)
Self employed	0.170**	(0.0758)	0.0255	(0.0667)	0.0368	(0.0311)	0.141***	(0.0463)
Home maker	0.315	(0.283)	0.0287	(0.0587)	-0.0509	(0.133)	0.110***	(0.0394)
Retired	0.0978	(0.277)	0.0231	(0.255)	-0.186*	(0.0970)	0.331*	(0.171)
Disabled	0.0262	(0.136)	-0.0295	(0.103)	-0.123*	(0.0635)	0.0119	(0.0672)
Other primary act.	0.259*	(0.141)	0.0854	(0.0870)	0.0226	(0.0838)	0.0173	(0.0616)
Separated/divorced	0.152	(0.0945)	0.154**	(0.0693)	0.0353	(0.0481)	0.0593	(0.0546)
Widow	-0.135	(0.171)	0.218*	(0.114)	0.0550	(0.0774)	0.0616	(0.0882)
Never married	0.0974	(0.0709)	0.110*	(0.0570)	0.0258	(0.0321)	0.0338	(0.0395)
Thought some	-0.0487	(0.0949)	0.000308	(0.0867)	-0.0256	(0.0414)	0.0694	(0.0603)
Thought a little	-0.0652	(0.0944)	0.00221	(0.0836)	0.0223	(0.0414)	0.0635	(0.0591)
Hardly thought	-0.134	(0.114)	-0.0263	(0.0909)	-0.0217	(0.0496)	0.0887	(0.0644)
No answer	0.0447	(0.288)	0.0541	(0.265)	0.276***	(0.106)	-0.254	(0.179)
Constant	4.386***	(0.445)	3.012***	(0.265)	3.392***	(0.217)	3.200***	(0.223)
Sigma epsilon	0.547***	(0.0145)	0.411***	(0.0113)	0.256***	(0.00763)	0.322***	(0.00883)
Log likelihood	-2,641.882				-1,815.800			
N	1,779				1,779			

Dependent variables are logs of monthly minimal and adequate expenditures.
Expenditures standardized to 1-person household; equations reported from models of annuity excluding housing.
We also 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%

cant, implying that the sub-sample of respondents for whom we have administrative records have accumulated relatively few assets compared to the sample as a whole. It is important to take this selection effect into account if we want to assess how well the Dutch are prepared to meet their own goals.

Table 7: Error correlations for model of minimal expenditures (annuity net of housing wealth)

	Annuity	Min exp. men	Min exp. women	Selection (annuity)
Annuity	1			
Min exp. men	0.204***	1		
Min exp. women	0.0746	0.120*	1	
Selection (annuity)	-0.813***	-0.0187	-0.0709	1

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

The estimated correlations for the model of adequate expenditures and annuities excluding housing are reported in Table 8. Most correlations are similar to those in Table 7, in particular the estimated correlation that causes selectivity in observed annuities is -0.81. 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 adequate expenditure level is compared to minimal expenditures: we estimate the correlation between adequate expenditures to be 0.89 (compared to 0.12 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 adequate expenditures question.

Table 8: Error correlations for model of adequate expenditures (annuity net of housing wealth)

	Annuity	Adequate exp. men	Adequate exp. women	Selection (annuity)
Annuity	1			
Adequate exp. men	0.187***	1		
Adequate exp. women	0.270***	0.885***	1	
Selection (annuity)	-0.812***	-0.0547	-0.133**	1

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

5.2 Simulations

We use the estimates presented in the previous subsections to simulate the extent to which individuals were able to reach their personal retirement expenditure goals. Table 9 presents our simulation results, the top panel refers to minimal and the bottom panel to adequate expenditures. The leftmost columns contain summary statistics of the percentage difference between resources

and expenditure goals for the estimation sample. They illustrate that, before the financial crisis, the Dutch could generally expect to exceed their personal minimum by a comfortable margin: 56% if we don't take housing wealth into account and 74% if we do. However, there is a sizeable minority of about 23% of the population that cannot expect to meet even their minimal requirements. These households do not own substantial wealth in housing, since including housing wealth as a resource for retirement only reduces the fraction that falls short to 18%. Moreover, those who have accumulated inadequate resources tend to fall short by a wide margin: the median shortfall is 35 percent regardless of whether we take housing wealth into account.

Table 9: Simulated percentage differences between annuities and minimum/adequate retirement expenditures.

	Simulations based on observed data				Everybody understands questions			Annuities for age 50		
	Median	SD	Fraction < 0	Med. shortfall	Median	Fraction < 0	Med. shortfall	Median	Fraction < 0	Med. shortfall
Annuity minus minimum expenditures										
Excl. housing - men	57	81	0.24	-38	62	0.22	-36	59	0.23	-38
	(48, 67)	(77, 91)	(0.20, 0.29)	(-47, -35)	(36, 87)	(0.14, 0.33)	(-45, 32)	(50, 70)	(0.19, 0.29)	(-47, -34)
Excl. housing - women	56	77	0.23	-35	47	0.27	-37	57	0.23	-34
	(47, 65)	(75, 84)	(0.21, 0.28)	(-40, -34)	(27, 64)	(0.21, 0.37)	(-45, -34)	(48, 66)	(0.21, 0.27)	(-39, -33)
Incl. housing - men	75	85	0.19	-37	79	0.17	-35	76	0.18	-35
	(66, 85)	(81, 95)	(0.16, 0.24)	(-47, -34)	(55, 104)	(0.11, 0.26)	(-44, -31)	(67, 88)	(0.15, 0.23)	(-45, -32)
Incl. housing - women	73	81	0.18	-34	64	0.22	-36	75	0.18	-33
	(63, 81)	(79, 88)	(0.16, 0.22)	(-39, -32)	(49, 84)	(0.16, 0.28)	(-42, -33)	(65, 84)	(0.16, 0.21)	(-38, -32)
Annuity minus adequate expenditures[a]										
Excl. housing - men	36	70	0.30	-36	33	0.32	-36	38	0.29	-35
	(30, 43)	(67, 76)	(0.27, 0.34)	(-41, -34)	(22, 44)	(0.27, 0.38)	(-41, -33)	(31, 45)	(0.26, 0.33)	(-39, -32)
Excl. housing - women	30	73	0.34	-40	21	0.38	-38	31	0.33	-39
	(23, 37)	(68, 82)	(0.30, 0.38)	(-48, -36)	(7, 35)	(0.31, 0.46)	(-44, -35)	(24, 38)	(0.30, 0.37)	(-48, -36)
Incl. housing - men	54	75	0.23	-36	51	0.24	-35	55	0.22	-33
	(48, 61)	(72, 81)	(0.21, 0.27)	(-40, -33)	(39, 62)	(0.21, 0.30)	(-39, -32)	(49, 62)	(0.20, 0.25)	(-37, -33)
Incl. housing - women	46	77	0.27	-39	38	0.30	-35	49	0.26	-37
	(40, 53)	(72, 86)	(0.24, 0.31)	(-47, 34)	(25, 52)	(0.24, 0.36)	(-41, -33)	(43, 56)	(0.22, 0.30)	(-47, -33)

[a] Adequate expenditures are elicited using a 1% real interest rate.

90% confidence intervals in parentheses, calculated by parametric bootstrap over distribution of the estimates (500 replications).

A similar picture of affluence emerges when we compare annuitized wealth with desired expenditures (bottom panel of Table 9). For the sample as a whole, the median individual exceeds his adequate expenditures by 30-36% (46-54% if we include housing wealth). A third of the sample will be unable reach their ideal expenditure level without eating into their estate and around 25 percent would fall short even if they would. The median shortfall remains large at 35-40 percent.

The middle columns of Table 9 investigate the robustness of the results with respect to question understanding. In those columns we set self-reported understanding to the highest level in the equations for minimal and adequate resources. Doing so lowers the median percentage difference between resources and goals by 9 percentage points for women, while it raises the median by 5 percentage points for men. Similarly, the simulated fraction of the male population that falls short increases by 2 percentage points, while the fraction of women that fall short increases by 4 percent point (with median shortfalls unchanged around 35 percent). For adequate expenditures too we find that systematic differences in answers are more pronounced for women than for men: the median decreases by 3 percentage points for men and by 8 percentage points for women. Though controlling for understanding the questions changes our results slightly, all changes are well within the 90% confidence intervals of the orginial simulations. Therefore, we conclude that our results are robust in this regard.

As mentioned in section 3.2.2, pension funds assume a continuation of the present employment situation when they forecast annuities to be attained at age 65, an assumption that is restrictive especially for those at the beginning of their carreer. The positive and significant coefficient on age in the wealth equation of our models partly reflects this underestimation of second pillar pensions for young respondents. In order to assess the effect of the assumption of a continuation of the status quo on our results, we set the age of all respondents in the annuity equation to 50 and run the same simulations. Doing so reduces the simulated fraction that cannot afford to retire on their own terms by no more than 1 percentage point. The median shortfall among those who do fall short falls by no more than 3 percentage points and the median difference over the entire sample also increases by no more than 3 percentage points. Hence, the simplifying assumption of a continuation of the present labor market situation up to retirement does not exert a heavy influence on our conclusions.

Finally, we find that sample selection in annuities should be taken into account when computing these statistics: the fractions that fall short in the subsample for whom we observe assets are about 10 percentage points higher than those reported in Table 9.[6] The sign of those differences is consistent with the negative correlation we estimate between the error terms of the assets and selection equations: we observe wealth for a relatively poor subsample of the LISS.

Table 10 illustrates the impact of variation in resources and goals on self-assessed retirement readiness. The upper panel shows simulations based on the actual data, where we see that university graduates are more likely to fall short of their ambitions than are their less educated peers

---

[6]Estimates available on request.

(about a third fall short compared to 20% of those who haven't obtained a degree beyond secondary school). This difference does not, however, reflect poor prepation of the highly education: when we set the education level of all respondents in the annuity equation to university, this cuts the incidence of insufficient preparation among those with no more than secondary school by a factor of 2. Instead, university graduates tend to set very high minimal expenditure levels: the third panel of Table 10 shows that if all respondents would be as ambitious as university graduates, the fraction that cannot afford their retirement would double for the lowest education categories.

Table 10: Simulated incidence of shortfalls w.r.t. minimal expenditures across education categories

| | All respondents | By education level | | | | | |
		Primary	Lower sec.	Higher sec.	Inter. voc.	Higher voc.	University
		Data					
Excl. housing	0.24	0.21	0.19	0.28	0.24	0.23	0.35
	[-37]	[-36]	[-34]	[-40]	[-35]	[-36]	[-42]
Incl. housing	0.18	0.18	0.14	0.23	0.19	0.18	0.30
	[-37]	[-37]	[-34]	[-38]	[-36]	[-35]	[-43]
		All annuities set to level of university graduates					
Excl. housing	0.20	0.12	0.13	0.22	0.20	0.23	0.35
	[-34]	[-30]	[-30]	[-34]	[-33]	[-34]	[-42]
Incl. housing	0.15	0.10	0.10	0.18	0.16	0.17	0.30
	[-34]	[-31]	[-31]	[-34]	[-33]	[-33]	[-43]
		Minimum expenditures set to level of university graduates					
Excl. housing	0.34	0.39	0.34	0.36	0.34	0.31	0.35
	[-42]	[-47]	[-42]	[-43]	[-41]	[-40]	[-43]
Incl. housing	0.28	0.34	0.27	0.30	0.27	0.24	0.30
	[-40]	[-45]	[-40]	[-42]	[-39]	[-38]	[-42]

Median negative percentage differences between annuities and expenditures in brackets.
Simulations use 50 draws of the error terms.

6 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 expenditure requirements for subsistence and for adequate living.

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, allowing needs to vary across the sample. 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 adequate expenditures vary widely between households. The variation in expenditures is related to factors such as education and type of employment, with higher educated and self-employed respondents indicating higher expenditures compared to the 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. However, tax records necessarily miss saving vehicles that are subject to delayed taxation for those who are not yet drawing annuities. Therefore we rely on administrative data where possible and supplement with information from the LISS assets survey where necessary to construct a complete picture of the resources available to households.

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 adequate expenditures. By age 65, the median respondent is likely to be able to afford 56% higher expenditures compared to his/her own personal minimal level and 30-36% euro/month more compared to adequate expenditures (74 and 50 percent respectively if we include housing in our definition of wealth). However, the affluence of the sample as a whole hides a sizeable minority of 18 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. Joint models of annuitized wealth and subjective expenditures show that homeowners and the highly educated accumulate relatively much wealth, both housing and non-housing, while households in which members suffer from work disabilities are on average 20% poorer. Both minimal and desired expenditures are positively related to income and education, though we find that personal income matter much more for men than for women (who's expenditure wishes are correlated mostly with household income rather than personal income). The net effect is that we find no differences in goal attainment across education groups, since the highly educated report more ambitious expenditure goals. Indeed, once we control for those goals the highly educated are found to be less likely to fall short. For desired retirement expenditures we find that income raises expenditure targets more than it raises resources. The generation of current retirees stand out as particularly well off, both in comparison to their standards and in absolute terms.

References

Alessie, R., Kapteyn, A., and Klijn, F. (1997a). Mandatory pensions and personal savings in the Netherlands. *De Economist*, 145(3):291–324.

Alessie, R., Lusardi, A., and Aldershof, T. (1997b). Income and wealth over the life-cycle: evidence from panel data. *Review of Income and Wealth*, 43(1):1–32.

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

Beshears, J., Choi, J. J., Laibson, D., and Madrian, B. C. (2009). The importance of default options in retirement savings outcomes: evidence from the United States. In Brown, J., Liebman, J., and Wise, D. A., editors, *Social security policy in a changing environment*, pages 167–195. Univ. of Chicago Press, Chicago.

Binswanger, J. and Schunk, D. (2012). What is an adequate standard of living during retirement? *Pension Economics and Finance*, 11(2):203–222.

Binswanger, J., Schunk, D., and Toepoel, V. (2011). Panel conditioning in difficult attitudinal questions. Working paper.

Bound, J., Brown, C., and Mathiowetz, N. (2001). Measurement error in survey data. In Heckman, J. and Leamer, E., editors, *Handbook of Econometrics*, volume 5, pages 3705–3843. Elsevier, North Holland.

Bovenberg, A. L. and Meijdam, L. (2002). The Dutch pension system. In Borsch-Supan, A. H. and Miegel, M., editors, *Pension reform in six countries*. Springer, New York.

Brugiavini, A. and Padula, M. (2001). Too much for retirement? saving in Italy. *Research in Economics*, 55(1):39–60.

Engen, E. M., Gale, W. G., Uccello, C. E., Carroll, C. D., and Laibson, D. I. (1999). The adequacy of household saving. *Brookings Papers on Economic Activity*, 1999(2):65–187.

Haveman, R., Holden, K., Romanov, A., and Wolfe, B. (2007). Assessing the maintenance of savings sufficiency over the first decade of retirement. *International Tax and Public Finance*, 14(4):481–502.

Johansson, F. and Klevmarken, A. (2007). Comparing register and survey wealth data. Uppsala University working paper.

Knoef, M., Been, J., Alessie, R., Caminada, K., Goudswaard, K., and Kalwij, A. (2012). Retirement savings adequacy in the netherlands. Progress report for the OECD.

Mitchell, O. S. and Moore, J. F. (1998). Can americans afford to retire? new evidence on retirement saving adequacy. *The Journal of Risk and Insurance*, 65(3):371–400.

Scholz, J. K., Seshadri, A., and Khitatrakun, S. (2006). Are Americans saving optimally for retirement? *Journal of Political Economy*, 114(4):607–643.

Skinner, J. (2007). Are you sure you're saving enough for retirement? NBER, Cambridge.

Van der Laan, J. (2009). Representativity of the liss panel. Statistics Netherlands Discussion paper (09041).

Venti, S. F. and Wise, D. A. (1996). The wealth of cohorts: retirement saving and the changing assets of older americans. NBER, Cambridge.

Yakoboski, P. and Dickemper, J. (1997). Increased saving but little planning: results of the 1997 retirement confidence survey. *EBRI Issue Brief*, (191):1–23.

A More details on sample selection

A.1 Survey and item non-response

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 54-62 percent. Such low rates of item response are typical for the questionnaire and probably due to the difficulty of the questions. Indeed, 33 percent of survey respondents agree that many questions are difficult for them to answer, even though only 13 percent find it very difficult to imagine how much money they would want during retirement. Next we describe the processes of survey and item non-response in detail.

First we estimate a univariate probit for response to the survey, comparing the 2,005 respondents with the 400 non-respondents.[7] Older individuals are more likely to respond: an increase in age of 10 years is associated with a 9 percentage point 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.

We also 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.[8] 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 adequate 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 adequate 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 adequate 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 adequate 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 adequate expenditures are 0.32 and 0.33, s.e. 0.04, and the correlation between the error terms of the two measures of adequate expenditures is 0.85, s.e. 0.02.

---

[7]Estimates available on request.
[8]Estimates 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 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 1.[9] Estimation results from the level equations for expenditures and replacement rates are discussed in section 3.2.1, here we limit our discussion to sample selection. Our exclusion restrictions are measures of survey attitude taken from the 2008 personality questionnaire distributed to the LISS panel, supplemented with a dummy that indicates respondents who failed to answer to any of the yearly personality questionnaires in the 2008-2011 period. 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 and 147.86 for the measures of adequate expenditures against a critical value of 23.2 at a significance level of 1%). Despite the relevance of the instruments, 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 10% in all equations and remain insignificant when subsets of the instruments are considered). For all 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.

A.2   Linking the LISS to administrative data

The match between the LISS survey and the tax records of assets and earnings was made during the first months of 2012. All individuals who participated in the LISS panel at that moment received an E-mail asking whether they objected against matching their surveys with administrative sources. Because of ethical considerations, respondents who had dropped out of the LISS and hence did not give their permission were not matched. Of the 2,405 potential respondents to the retirement expenditures questionnaire 1,292 individuals, or 54%, remained in the panel at the time of the merge and were asked for permission. A small group of 134 actively did not allow for their data to be matched, so that 1,158 survey records could potentially be combined with administrative data. Hence, the selection issue with respect to assets records is primarily one of panel attrition with few active objections against the combination of survey and administrative data.

First we describe how the sample of 1,292 respondents who received the request for the merge differs from the potential sample of 2,405 (based on their characteristics in 2008).[10] The tendency to

---

[9]We disregard the correlations between non-response to different questions, because joint modeling of the selection processes would rely on joint normality assumptions. We opt for robustness and carry out estimation in 2-steps. Estimates are available on request.

[10]Estimates available on request.

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 owning a simPC: 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 2012. 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.

Only 10 percent of the respondents who remained in the panel objected against linking their survey records to administrative data. Comparing those objectors to all other respondents who were still in the panel by 2012, we find that age is the only predictor that is significant at 5%.[11] The tendency to object is non-linear in age, with a peak at 59.

Non-response in the retirement expenditures questionnaire, which determines whether we observe desired expenditures, and attrition from the sample, which drives whether we observe assets, are likely to be related to one another. Indeed, bivariate probits of successful merges 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 the survey attitude variables used 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 feel safe to model non-response and attrition separately and estimate bivariate Heckman selection models to assess selectivity in assets.

Heckman selection models indicate that the subsample for which we observe assets is not random: individuals from households with few assets are more likely to be retained in our estimation sample ($r = -0.7/-0.8$). The finding of selectivity in assets motivates our model in section 4.3.

---

[11]Estimates available on request.

B   Measurement error in subjective expenditures

We expect that giving an indication of the expenditures one needs or desires during retirement is a challanging task for respondents. The fact that only 1,300-1,500 of the 2,005 survey-respondents answer the particular questions on minimal and adequate expenditures suggests that those questions are difficult. In this appendix we use additional information from the LISS questionnaire to investigate the effect of question difficulty, and presumably measurement error, on the analysis.

B.1   Thinking about retirement

One reason why respondents may not be able to give a good indication of their expenditures during retirement is that they may not have thought about retirement yet. As mentioned in Section 3.2.1, our data include a self-assesment of the extent to which respondents have thought about retirement, so we can test whether those who have given retirement a lot of thought give different answers compared to those who haven't. Table 11 shows that 71% of the sample has thought either "a little" or "hardly at all" about retirement, which may be a problem when answering questions on expenditures during retirement. Moreover, 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 eligibility age for the public pension in 2008).

As reported in the text, we check for systematic differences in reported expenditures between respondents who have and haven't thought about retirement by adding dummies corresponding to the categories in Table 11 to the equations for minimal and desired expenditures. We find no evidence for such differences.

Table 11: 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	0.18	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	1,675	289	488	509	335	54

B.2   Difficulty of the questions

In addition to the salience of retirement, we also want to control for the extent to which respondents understand the questions. Self-reported question difficulty and understanding allow us to

investigate whether those who do not understand the questionnaire give systematically different answers. Moreover we correct for variation in understanding and find that our results are robust (see Table 9). Table 12 summarizes the items that measure understanding and difficulty of the questions.

Table 12: Descriptives of thinking about retirement and question difficulty

	All respondents	By age				
		25-34	35-44	45-54	55-64	65+
	Mean	Mean	Mean	Mean	Mean	Mean
Many questions didn't make sense to me						
Definitely not = 1	0.09	0.07	0.08	0.10	0.12	0.08
2	0.10	0.11	0.08	0.10	0.12	0.10
3	0.18	0.14	0.17	0.17	0.20	0.22
4	0.30	0.26	0.31	0.30	0.30	0.29
Yes, definitely = 5	0.33	0.42	0.35	0.33	0.26	0.31
Many questions were too abstract for me						
Definitely not = 1	0.09	0.07	0.09	0.09	0.08	0.11
2	0.23	0.28	0.26	0.22	0.19	0.20
3	0.29	0.29	0.29	0.28	0.30	0.30
4	0.24	0.26	0.23	0.24	0.25	0.22
Yes, definitely = 5	0.15	0.10	0.13	0.16	0.18	0.17
I generally do not like to think about old-age provision						
Definitely not = 1	0.20	0.17	0.17	0.19	0.23	0.26
2	0.20	0.16	0.21	0.20	0.21	0.20
3	0.32	0.37	0.36	0.34	0.30	0.25
4	0.19	0.24	0.19	0.19	0.18	0.16
Yes, definitely = 5	0.08	0.07	0.07	0.08	0.08	0.13
I find it very difficult to imagine how much money I would want to have during retirement						
Definitely not = 1	0.17	0.21	0.20	0.15	0.14	0.18
2	0.20	0.26	0.25	0.22	0.14	0.16
3	0.28	0.27	0.27	0.30	0.27	0.26
4	0.22	0.18	0.21	0.22	0.26	0.21
Yes, definitely = 5	0.13	0.08	0.07	0.11	0.19	0.20
I like to take some responsibility for my old-age provision						
Definitely not = 1	0.16	0.16	0.19	0.16	0.13	0.15
2	0.21	0.28	0.22	0.25	0.15	0.16
3	0.31	0.38	0.35	0.28	0.32	0.25
4	0.19	0.13	0.16	0.19	0.22	0.23
Yes, definitely = 5	0.13	0.05	0.08	0.12	0.18	0.22
N	1,994	245	485	490	466	305