

Cutting One's Coat According to One's Cloth –  
How did the great recession affect retirement resources and expenditure  
goals?

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**Preliminary and incomplete, please do not circulate**

**Abstract**

We evaluate the effect of the financial crisis and the subsequent recession on retirement preparedness in the Netherlands. As a benchmark for sufficiency we take survey reports of the minimum level of expenditures during retirement. Hence, our analysis takes into account both changes in the resources available in retirement and revisions in the goals that drive households' planning for retirement. Detailed administrative data on wealth and pension entitlements allow us to construct an accurate prediction of the resources at households' disposal. Our survey measures of consumption floors enables us to evaluate sufficiency at the level of the individual for a nationally representative sample from the Dutch population. We find that pension annuities decreased by 20% between January 2008 and December 2014 and consumption floors decreased by around 10%. The net effect of the crisis was to increase the fraction of individuals for whom their pensions will not be sufficient to afford their minimum consumption from 25% to 32%. If consumption floors would have been static, no less than half of the individuals would look forward to a shortage of financial resources.

**Keywords:** Retirement; pensions; savings; aging

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# 1 Introduction

In most Western countries the recent financial crisis had a detrimental impact on household wealth. Disappointing stock market returns and low interest rates had a detrimental impact on both the assets and liabilities of pension plans. They lowered the growth of pension fund assets, reduced the solvency position of defined benefit (DB) pension plans, and increased annuity prices in defined contribution (DC) pension plans. Moreover, during the crisis years residential property prices declined sharply. For example, in the United States home prices decreased by over 32% between 2006 and 2009 (Holt, 2009). In the Netherlands house prices dropped by about 20% on average between 2008 and 2013. Given that pension wealth and housing wealth are two very important components of household wealth, concerns have been expressed about retirement preparedness.

A standard life cycle model would predict individuals to smooth an exogenous wealth shock over their remaining life cycle. Unanticipated changes in wealth could therefore affect labor market and retirement behavior (current and future labor supply). Several studies examined the effect of exogenous wealth shocks on (planned) retirement behavior<sup>1</sup>. Most of these studies find no or only little evidence that house prices or share prices have influenced the timing of retirement.

People may also adjust their current and/or future expenditures after an unanticipated wealth shock. With regard to current expenditures, Christelis et al. (2015) find that for every loss of 10% in housing and financial wealth, household expenditures drop with about 0.6% and 0.9%, respectively. These order of magnitudes have also been found by Mian et al. (2013) and Angrisani et al. (2015), and are in line with a basic prediction from a lifecycle model (Poterba, 2001). In addition to the effect of wealth shocks on current expenditures, Banks et al. (2012) also estimate the effect of wealth shocks on expectations regarding future bequests (expenditures of heirs) and the adequacy of future resources in the UK. For the Netherlands, Bissonnette and van Soest (2015) find that pension expectations became more pessimistic between 2009-2012, in line with the crisis and pension reforms.

As far as we know, this is the first paper that investigates the effect of a wealth shock on future expenditures, namely, on minimal retirement expenditure goals. Minimal expenditure goals reflect

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<sup>1</sup>E.g. Coile and Levine (2006), Hurd et al. (2009), and Crawford (2013)

the minimum amount of money that people want to spend during their retirement (keeping all prices equal). We investigate how the crisis affected both resources and retirement expenditure goals, the combination of which determines retirement savings adequacy.

Another distinguishing feature of this paper is our combined use of survey and administrative data. For the subjective assessments of minimal retirement expenditure goals, we draw unique survey data from a representative sample of the Dutch population in January 2008 and December 2014. We match those surveys with tax records and data from pension funds, which allow us to construct a complete and precise measure of the resources available to households.

The methodology of this paper builds upon the analysis of De Bresser and Knoef (2015), who evaluated retirement preparedness before the financial crisis. They model assets and self-reported retirement goals in 2008 simultaneously and allowed for correlation between the underlying unobserved heterogeneity. We extend the joint model of goals and resources estimated by De Bresser and Knoef (2015) and include new data from January 2014. The new data from after the financial crisis allow us to evaluate changes in preparedness and to disentangle the roles of adjustments of goals and shocks to resources. We investigate how the crisis affected preparedness in the aggregate and whether it changed which groups are vulnerable. Moreover, we partly follow the same individuals over time, which opens the door to a within-subject analysis of the factors that led individuals to revise their consumption targets.

Our findings indicate that resources available for retirement declined by around 20% on average between 2008 and 2015. During that same period expenditure goals were lowered by approximately 10%. As a result, the fraction of individuals who are on track not to be able to afford their minimum consumption level in retirement increased from 25% to 32% if we only take pension wealth into account and from 10% to 16% if we allow individuals to liquidate all their assets, including their house. If individuals would not have revised their goals, around 50% would not have been able to finance their consumption floors based on pensions alone. Our analysis provides the first evidence to suggest that a shock to (pension) wealth affects planned future consumption, in addition to its well documented effect on current consumption.<sup>2</sup>

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<sup>2</sup>Note that, even though an appropriate decrease in retirement expenditure goals does result in better pension preparedness relative to those goals, it still implies that the individual endures a welfare loss. This means that there

The remainder of the paper is set up as follows. In Section 2 we will explain the Dutch pension system and the changes therein between 2008 and 2015. Then in Section 3 we present the data used for the analysis, followed by a description of the model in Section 4. Thereafter, the results of the analysis as shown in Section 5, before we conclude in Section 6.

## 2 Pension reforms and the crisis between 2008 and 2015

The Dutch pension system consists out of four pillars; (1) public pension (AOW) , (2) occupational pensions, (3) saving vehicles such as life annuities, (4) all other assets such as savings and housing wealth.

### 2.1 Public pensions

The first pillar consists of a public old age pension, financed through a pay-as-you-go system. The level of the public pension is tied to the minimum wage and depends on the years the recipient has lived in the Netherlands. For recipients with a fractional build up, due to living abroad, and insufficient extra funds, the public pension is supplemented with social assistance.

In 2008 every Dutch citizen over 65 was eligible for public pension. In 2012 an amendment was passed that described a stepwise increase of the eligibility age to 67 in 2023, after which it would be coupled to life expectancy. In 2015 another amendment was passed for a quicker stepwise increase in the eligibility age up to 67 in 2021 after which it is linked to life expectancies.

### 2.2 Occupational pensions

The second pillar consists of occupational pensions. Most occupational pensions are of the defined benefit type, but when the financial situation of the pension funds is bad, they are forced to cut pensions or to postpone inflation indexation of pension entitlements. To reach the aim of a 70% replacement rate (of public and occupational pensions together) with regard to the average salary, in 2008 the maximum yearly accrual rate was 2.25% of the average wage or 2% of the last earned wage

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is less need to worry about individuals adapting their plans appropriately to their new situation. It however does not mean that retirement incomes can decrease without any costs to the individual.

within the occupation pension plan. In 2014 the target age for occupational pensions was raised to 67, accompanied with a lowering of the maximum yearly accrual rate to 2.15%, respectively 1.9%. In 2015 the maximum accrual rates were lowered further to 1.875% and 1.657%, respectively. Where before the aim of the occupational pension plan was to reach a replacement rate of 70% of the last earned wage in 37 years at age 67, now the aim is to reach a replacement rate of 70% of the average wage earned over 40 years at age 67. Moreover, the maximum wage over which pensions can be accumulated was capped at €100,000 per year in 2015.

The pension entitlements that were built up before the target age for retirement was raised in 2014 are still targeted at age 65. Would one decide to work beyond that age, for example until the statutory retirement age in effect at that time, those pension entitlements will increase in value. Actuarial adjustments reflect that more gains can be accumulated on the capital and that the expected remaining life time at retirement is shorter.

The changes in the system in 2014 and 2015 are thus likely to lead to lower entitlements for younger individuals and higher entitlements for older individuals, conditional on individuals working until the statutory retirement age. Many pension funds were dealing with insufficient funds, due to disappointing investment returns and low interest rates, which necessitated pension cuts and suspension of indexation. The biggest pension fund in the Netherlands, ABP covering about 2.8 million individuals, for example has not been able to index pension entitlements and pension benefits since 2010 and on top of that had to cut pensions by 0.5% in 2013. (In total the forgone indexation between 2008 and 2014 amounts to 9.93%, source website ABP).

### **2.3 Private saving vehicles aimed at retirement**

Private insurance providing additional income during retirement, such as life annuities, plays a relatively minor role in the Netherlands. Such policies accounted for no more than 7 percent of retirement income around 2008. In contrast to the level of concentration observed for occupational pensions, third pillar schemes are offered by a large number of insurance companies and other providers of financial services. Also for voluntary private pension products, tax deductible accrual

rates are lowered. No large scale adjustments to benefits have been reported during the period covered by our analysis.

The changes with regards to the statutory retirement age make it more likely that individuals enter retirement later, and thus accumulate more wealth in saving vehicles. Moreover, with this wealth they need to cover a smaller amount of years after retirement, leading to an increase in the annuities.

## 2.4 Other assets

The downturn in the financial markets led to lower returns on risky assets such as stocks and bonds. Furthermore, interest rates on savings accounts, the most important component of financial wealth for most Dutch households, declined from around 2% between 2010 and 2012 to close to 1% by late 2014. Low returns and interest rates made it more difficult to accumulate discretionary wealth. However, a far larger shock to the wealth position of the majority of Dutch households that are homeowners was the decline in house prices by 20% on average. This drop in house prices will substantially lower the annuity that can be attained by affected households.

For a given level of wealth, the changes with regard to the statutory retirement age make it more likely that individuals enter retirement later, and thus accumulate more wealth in assets. Moreover, with this wealth they need to cover a shorter period after retirement, leading to an increase in the annuities.

## 3 Data

We combine survey data on minimal expenditures during retirement and tax data on assets to investigate how the financial crisis affected the pension preparedness of the Dutch.

### 3.1 Survey data

Survey data are taken from the LISS panel (Longitudinal Internet Study in the Social Sciences), gathered by CentERdata.<sup>3</sup> This panel is recruited through address-based sampling (no self-selection),

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<sup>3</sup>For more information, see <http://www.lissdata.nl/lissdata/>.

and households without a computer and/or internet connection receive an internet connection and computer for free. This roughly nationally representative household panel (Van der Laan, 2009) receives online questionnaires each month, on different topics. When respondents complete a questionnaire they receive a monthly incentive. A variety of data is available from studies conducted in the LISS panel.

We use a question regarding minimal pension expenditures elicited from LISS-respondents both in a single-wave study in January 2008, constructed by Johannes Binswanger and Daniel Schunk, and in a single-wave study in December 2014, constructed by the authors. In both studies the question is raised at the beginning of the survey, after a couple of items regarding housing costs during retirement. The question is phrased as follows:

*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 want during retirement? Please think of all your expenditures, such as food, clothing, housing, insurance etc. Remember, please assume that prices of the things you spend your money on remain the same in the future as today (i.e., no inflation).*

In 2008 it was safe to assume individuals did not take into account health care expenditures when answering this question, as at that time long term care costs were still almost fully covered. By 2014 this was no longer the case, so respondents were asked whether they accounted for health care costs in their answer. If so, they were subsequently asked what their minimal expenditures would be less of these costs. We analyze minimal expenditures net of health care costs to safeguard comparability.

Table 1 presents descriptive statistics of self-reported consumption floors in 2008 and 2014. When denoted in 2014 euros, the median consumption floor for 2008 was 1625 euros/month, with an inter-quartile range from 1218 to 2031 euros/month. By 2014 the median had dropped by 165 euros, or 10%, to 1460 euros/month. The first and third quartiles also decreased by approximately 10% between 2008 and 2014, indicating that the level of monthly expenditures that individuals would not want to fall below during retirement decreased across the distribution. The replacement rates of retirement income relative to current income shown in Table 1 reveal that these differences

**Table 1:** Descriptive statistics of minimum expenditures during retirement

	<b>a. Self-assessed minimum retirement expenditures</b>						2014					
	2008						2014					
	N	Mean	SD	p25	Mdn	p75	N	Mean	SD	p25	Mdn	p75
Minimum monthly expenditures	1,396	1,744	733	1,218	1,625	2,031	2,755	1,495	570	1,095	1,460	1,825
Min. exp./current income (%)	1,396	76	28	57	75	91	2,717	67	29	47	63	80
<b>b. Changes in self-assessed minimum retirement expenditures</b>												
	N	Mean	SD	p25	Mdn	p75						
Min. exp. 2014 - 2008	456	-267	640	-571	-227	79						
Min. RR 2014 - 2008 (%-points)	452	-11	30	-28	-11	5						

Retirement expenditures are equalized to a one-person household and denoted in 2014 euros.

cannot be explained by a decrease in current income. The median minimum replacement rate was 75% in 2008 and dropped to 63% in 2014. Both other quartiles also decreased by about 10%-points. Hence, individuals adjusted their spending goals in retirement downwards relative to current income.

The bottom panel of Table 1 describes the differences between reported expenditure levels and replacement rates in 2008 and 2014 for those individuals that we observe twice. Due to panel attrition the number of individuals who are in the sample in both years is relatively low: we retain around 450 individuals or one third of the 2008 sample. Among those that do remain in the sample, most revised their consumption floor downwards with a median of -227 euros/month. The median revision in the replacement rates is -11 percentage points. However, there is a lot of variation in the revisions, with 25% reducing their minimum consumption level by at least 571 euros/month, while another 25% increase their consumption floor by 79 euros or more. We find that consumption floors are fairly strongly correlated across the years: the correlation coefficient is 0.55 for levels and 0.29 for replacement rates.

Socio-economic characteristics of individuals and households that are used as independent variables in our models of expenditure goals and annuities are all taken from the so-called *household boxes* in the LISS. Household boxes provide monthly information on background characteristics of panel members. We use the boxes that correspond to December of 2007 and 2014. Descriptive statistics of all variables used can be found in Appendix A.

### 3.2 Administrative data

Administrative data are taken from the Complete Asset data of the Netherlands 2008 and 2013 (CAD, CBS, 2015e), the Public Pension Entitlements data 2008 and 2012 (PPE, CBS, 2015d), the Public Pension Benefits data 2008 and 2012 (PUBLB, CBS, 2015c), the Occupational Pension Entitlements data 2008 and 2012 (OPE, CBS, 2015a), and the Private Pension Benefits data 2008 and 2013 (PRIVB, CBS, 2015b), all gathered by Statistics Netherlands.

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

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

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

We use the administrative records from 2008 to match the survey answers provided in 2008. To match the survey answers provided in 2014 we use the most recent data available and, if possible, adjust these such that changes between the time of measurement and 2014 are accounted for. We annuitize all assets according to assumptions presented in Appendix B. We use three definitions of after-tax annuities: (1) annuities based on public and private pensions, (2) annuities based on pensions plus non-housing wealth, and (3) annuities based on all wealth, including housing wealth.

Panel a. of Table 2 presents descriptive statistics of various categories of assets and debt. The

most important types of assets in both years are saving accounts and owner-occupied real estate. On average saving accounts made up 27% of total assets in 2008 with a median value of 19.5 thousand 2014 euros. Owner-occupied housing made up close to two thirds of the 2008 assets portfolio on average and the median value of the home was 246 thousand euros. By 2014 the median house value dropped to 170 thousand euros and the average share in the assets portfolio had declined to 58%. Consequently, the relative importance of saving accounts increased to 36% of the portfolio despite a decrease in median savings to 14.2 thousand euros. Each of the other asset classes make up less than 5% of the asset portfolio in both years. As for debt, mortgage debt is by far the most important among the two types of debt that we observe: it accounts for 95% of total debt on average in both years. The median mortgage debt declined from 88 to 80 thousand euros between 2008 and 2014.

We use the data summarized in panel a. as input to calculate the wealth and real estate components of the annuities that are summarized in panel b. of Table 2. The median predicted annuity based on public and occupational pensions declined by 450 euros, or 21%, from 2122 to 1675 euros/month between 2008 and 2014. We observe similar declines of 19% in the first and third quartiles of the distribution of pension annuities, which dropped by 300 and 480 euros respectively. The smaller absolute decrease in the first quartile compared to the other quartiles can be explained by the fact that the flat rate public pension makes up a large share of entitlements for pension-poor households. This public pension tracks the minimum wage and has been adjusted for inflation during the period spanned by our sample. Pension-rich households, on the other hand, rely more on occupational pensions, many of which have not been indexed fully for inflation or have even been cut in nominal terms. Taking non-pension, non-real estate wealth into account does not change the pattern at the median: the median annuity based on all wealth other than real estate declined from 2262 to 1847 euro per month (a decrease of 415 euros or 18%). The first and third quartiles sustained similar percentage drops, suggesting that accumulation of discretionary wealth did not compensate much of the decline in pensions across the annuity distribution. The marked decrease in the value of owner-occupied real estate documented in panel a. of Table 2 is also reflected in the annuities based on all wealth (including real estate). The median monthly annuity according to this definition declined by 700 euros, 22%, from 3119 to 2423 euros/month. In relative terms the

**Table 2:** Descriptive statistics of assets, debt and annuities

<b>a. Assets and debt</b>												
	2008						2014					
	% portfolio <sup>a</sup>	Mean	SD	p25	Mdn	p75	% portfolio <sup>a</sup>	Mean	SD	p25	Mdn	p75
Saving account	27	41.4	59.4	6.3	19.5	47.2	36	41.5	76.4	3.5	14.2	45.4
Risky assets	4	24.3	133.0	0.0	0.0	5.9	3	22.9	169.7	0.0	0.0	0.1
Property	65	247.2	222.8	104.7	246.0	335.6	58	168.5	149.0	0.0	170.2	242.7
Other real estate	3	17.0	82.7	0.0	0.0	0.0	2	16.7	86.3	0.0	0.0	0.0
Business	1	2.4	33.7	0.0	0.0	0.0	1	4.4	63.6	0.0	0.0	0.0
Other assets	0	2.0	20.9	0.0	0.0	0.0	0	4.4	80.0	0.0	0.0	0.0
Mortgage debt	95	116.5	126.3	0.0	88.3	195.6	95	111.3	128.7	0.0	80.0	187.9
Other debt	5	5.2	28.1	0.0	0.0	0.0	5	7.2	61.8	0.0	0.0	0.0
N			890						3,429			
<b>b. Annuities</b>												
	2008						2014					
	N	Mean	SD	p25	Mdn	p75	N	Mean	SD	p25	Mdn	p75
Pensions	900	2,163	728	1,649	2,122	2,551	3,646	1,747	748	1,343	1,675	2,072
Percentage of total	890	72	18	61	71	83	3,429	73	33	60	73	93
Pensions + wealth	890	2,393	955	1,795	2,262	2,790	3,429	2,062	1,437	1,473	1,847	2,357
Percentage of total	890	78	16	68	76	92	3,429	80	20	69	80	100
Pensions + wealth + housing	890	3,267	1,630	2,263	3,119	3,924	3,429	2,740	1,936	1,703	2,423	3,207
<b>c. Changes in annuities between 2008 and 2014</b>												
	Absolute changes (2014 euros)						Percentage changes (%)					
	N	Mean	SD	p25	Mdn	p75	N	Mean	SD	p25	Mdn	p75
Pensions	630	-374	476	-551	-303	-114	630	-14	19	-22	-14	-6
Pensions + wealth	597	-319	777	-542	-288	-72	597	-11	25	-21	-13	-4
Pensions + wealth + housing	597	-528	1,386	-822	-475	-131	597	-13	25	-23	-15	-5

<sup>a</sup> Mean share of category in HH portfolio conditional on having non-negative total asset/debt. Assets and debt in thousands of 2014 euros. Monthly annuities in 2014 euros.

decline in the annuity that includes real estate is more pronounced at the first quartile (560 euros or 24%) than the third quartile (720 euros or 19%).

The bottom panel of Table 2 describes the distribution of changes in annuities between 2008 and 2014 for those households that we observe and could match to administrative data in both waves. Looking at changes over time yields a similar picture to the comparison of the two cross-sectional distributions: annuities declined between 2008 and 2014 for the vast majority of households and this decline is larger in absolute terms if we take owner-occupied housing into account. Though the drops for given households are smaller both in absolute and relative terms than the differences between the two cross-sections, they are still substantial. The median level change in the annuity from pensions alone is a decline of 300 euros, with a corresponding median percentage change of -14%. The situation is even more grim if we allow households to spend their wealth in real estate, in which case the median level change is a decline by 475 euros and the median percentage change

-15%. Note that the third quartile of the distribution of changes is negative for all definitions of annuities, implying that more than 75% of households experienced a decline in their annuities between 2008 and 2014.

The overall picture emerges that the crisis and subsequent recession substantially reduced the resources available to generate income during retirement. The median pension, public plus private, dropped by around 20% due to reductions in real occupational pension entitlements. This decrease was not compensated fully by the accumulation of additional discretionary wealth. Furthermore, annuities based on all wealth declined by a similar percentage as a result of a decline in house prices. Hence, preparedness for retirement decreased between 2008 and 2014 if we compare resources to a fixed absolute criterion such as a poverty line. However, Section 3.1 shows that survey respondents adjusted their expenditure goals downward between 2008 and 2014, leaving the net change in retirement preparedness ambiguous.

## 4 Model

To evaluate the preparedness for retirement of the Dutch population in 2008 and 2014 we cannot simply compare observed expenditure goals and annuities for the same individuals, because there is substantial non-response to the expenditure questions and incomplete data linkage with the administrative data from which we calculate annuities. Previous analysis shows that non-response and failure to match administrative records are correlated with covariates of consumption floors and annuities respectively, so conclusions drawn from the sub-sample for which we observe both goals and resources are not representative for the population (De Bresser and Knoef, 2015). However, selection into the sample is exogenous once we condition on those covariates. Given that there is little missing data for the background variables, our strategy is to estimate a joint model of annuities and consumption floors in both years and simulate goals and resources for all individuals for whom we observe background characteristics.

We choose our estimation approach to learn as much as possible about changes in consumption floors and annuities between 2008 and 2014 under the constraints imposed by the data. In particular, the fact that we only observe a relatively small group of individuals and households twice means

that any estimation strategy based solely on within-person variation neglects most information in the data. Instead, we estimate a seemingly unrelated regression model with separate equations for annuities and expenditures in 2008 and 2014. We allow the relationships between goals and resources on the one hand and background variables on the other to be different in 2014 compared to 2008. Moreover, we allow the error terms of the equations for expenditure goals and annuities to be correlated between individuals in a given household and across the waves in which the household participates.

The model consists of six equations:

$$M_i^{08} = \mathbf{x}_{m,i}^{08'} \boldsymbol{\beta}_m^{08} + \varepsilon_{m,i}^{08} \quad (1)$$

$$N_i^{08} = \mathbf{x}_{n,i}^{08'} \boldsymbol{\beta}_n^{08} + \varepsilon_{n,i}^{08} \quad (2)$$

$$W_i^{08} = \mathbf{x}_{w,i}^{08'} \boldsymbol{\beta}_w^{08} + \varepsilon_{w,i}^{08} \quad (3)$$

$$M_i^{14} = \mathbf{x}_{m,i}^{14'} \boldsymbol{\beta}_m^{14} + \varepsilon_{m,i}^{14} \quad (4)$$

$$N_i^{14} = \mathbf{x}_{n,i}^{14'} \boldsymbol{\beta}_n^{14} + \varepsilon_{n,i}^{14} \quad (5)$$

$$W_i^{14} = \mathbf{x}_{w,i}^{14'} \boldsymbol{\beta}_w^{14} + \varepsilon_{w,i}^{14} \quad (6)$$

where  $M_i^t$  is the log of self-perceived minimal retirement expenditures reported by a man in household  $i$  in wave  $t \in \{2008, 2014\}$  and  $N_i^t$  is log self-perceived minimal retirement expenditures reported by a woman. Note that all slope coefficients are allowed to vary between survey waves, so that different socio-economic groups are allowed to be affected differently by the recession. For singles only one of the equations for minimal expenditures is relevant for each year.  $W_i^t$  is log annuitized household wealth.

We assume that the error terms follow a 6-variate normal distribution with mean zero and covariance matrix  $\Sigma$  and estimate the model by maximum likelihood (see Roodman, 2011, for details on the CMP command that was used to estimate the model in Stata).

## 5 Results

### 5.1 Model estimates

#### 5.1.1 Annuities

Before simulating retirement preparedness, we first present estimates of the underlying model that was described in section 4. Table 3 presents estimates of the annuity equations for the three definitions of annuities considered: annuities from public and occupational pensions, from pensions and non-real estate wealth and from all wealth including real estate. The estimates for 2008 are mostly very similar to those reported in De Bresser and Knoef (2015). The only exceptions are the estimated coefficients on household income and on the education dummies. Our estimates of the elasticity of the annuities with respect to net household income are around 0.28, while De Bresser and Knoef (2015) report smaller estimates around 0.10. This difference stems from the use of another survey variable for household income: the variable we use has been augmented with imputations and responses to unfolding bracket questions, while the earlier paper used a less streamlined measure of income. This choice for a different income variable also reduces the differences in annuities between university graduates and the lowest education group from 33-45% to 25-30%, which confirms the interpretation that the large differences reported in that paper partly reflect measurement error in income (De Bresser and Knoef, 2015). All other estimates for the annuity equations in 2008 are qualitatively and quantitatively similar to those reported in the earlier paper.

Comparing the estimates for 2008 and 2014 we find intuitively plausible changes in some of the estimated coefficients. The income elasticity of the annuities decreases from 0.27 to 0.21, which may reflect cuts in occupational pensions that affect those with higher incomes more strongly. These pension cuts could also explain the narrowing gaps between households with and without wage workers and with and without self-employed adults. Similarly, the difference in the average annuity based on all wealth between homeowners and renters decreased from 43% in 2008 to 31% in 2014 due to the large decline in house prices that occurred on the Dutch market between 2008 and 2012.

The estimates in Table 3 are obtained from the complete sample that was selected for at least one of the questionnaires on retirement expenditures. We also estimated all models on the subsample

**Table 3:** Joint models of annuities and minimal retirement expenditures – annuity equations.

	Pensions				Pensions + wealth + housing			
	2008		2014		2008		2014	
Single	-0.010	(0.0310)	0.061***	(0.0171)	0.207***	(0.0417)	0.137***	(0.0294)
Female x single	-0.065**	(0.0305)	-0.055***	(0.0146)	-0.196***	(0.0405)	-0.037	(0.0249)
Age HH head	0.001	(0.0008)	0.004***	(0.0005)	0.009***	(0.0011)	0.014***	(0.0009)
Any kids	-0.098***	(0.0268)	-0.024	(0.0196)	-0.089**	(0.0358)	-0.071**	(0.0334)
Number children	0.027**	(0.0115)	-0.005	(0.0088)	0.032**	(0.0154)	0.023	(0.0149)
Homeowner	0.085***	(0.0178)	0.103***	(0.0109)	0.434***	(0.0241)	0.306***	(0.0187)
log HH income	0.266***	(0.0218)	0.209***	(0.0131)	0.280***	(0.0292)	0.228***	(0.0225)
Inter. sec. ed. <sup>a</sup>	0.020	(0.0349)	0.054**	(0.0229)	0.067	(0.0463)	0.105***	(0.0382)
Higher sec. ed. <sup>a</sup>	0.038	(0.0394)	0.065**	(0.0265)	0.148***	(0.0528)	0.151***	(0.0446)
Int. vocational ed. <sup>a</sup>	0.082**	(0.0346)	0.101***	(0.0229)	0.107**	(0.0460)	0.173***	(0.0384)
Higher voc. ed. <sup>a</sup>	0.170***	(0.0347)	0.195***	(0.0231)	0.246***	(0.0463)	0.263***	(0.0386)
University <sup>a</sup>	0.252***	(0.0398)	0.210***	(0.0253)	0.292***	(0.0535)	0.355***	(0.0425)
1 salary worker	0.117***	(0.0278)	0.070***	(0.0162)	0.062*	(0.0370)	0.014	(0.0275)
All salary workers	0.053***	(0.0199)	0.063***	(0.0143)	0.002	(0.0265)	0.024	(0.0244)
1 self employed	-0.125***	(0.0286)	-0.076***	(0.0189)	-0.098**	(0.0384)	0.010	(0.0324)
All self employed	-0.156***	(0.0480)	-0.113***	(0.0311)	-0.093	(0.0648)	-0.048	(0.0544)
1 retired	0.065**	(0.0325)	-0.015	(0.0198)	0.029	(0.0432)	-0.029	(0.0335)
All retired	0.047	(0.0329)	0.043**	(0.0186)	0.002	(0.0436)	0.055*	(0.0314)
1 disabled	-0.063**	(0.0318)	-0.043*	(0.0238)	-0.083*	(0.0431)	-0.029	(0.0402)
All disabled	0.099	(0.0790)	0.031	(0.0376)	0.033	(0.1046)	-0.001	(0.0643)
Separated/divorced <sup>a</sup>	-0.057**	(0.0283)	-0.038**	(0.0170)	-0.096**	(0.0386)	-0.100***	(0.0293)
Widow <sup>a</sup>	-0.028	(0.0453)	-0.002	(0.0225)	-0.012	(0.0594)	0.052	(0.0382)
Never married <sup>a</sup>	-0.043*	(0.0243)	-0.009	(0.0148)	0.016	(0.0330)	0.020	(0.0257)
Extremely urban	0.004	(0.0242)	0.041***	(0.0141)	0.049	(0.0327)	0.022	(0.0242)
Very urban	0.030	(0.0251)	0.053***	(0.0148)	0.069**	(0.0337)	0.084***	(0.0253)
Slightly urban	0.010	(0.0251)	0.054***	(0.0151)	0.096***	(0.0337)	0.089***	(0.0260)
Not urban	-0.010	(0.0279)	0.047***	(0.0166)	0.101***	(0.0374)	0.150***	(0.0285)
Constant	5.217***	(0.1585)	5.264***	(0.1012)	4.674***	(0.2147)	4.571***	(0.1734)
Sigma Epsilon	0.232***	(0.0064)	0.262***	(0.0031)	0.318***	(0.0079)	0.437***	(0.0053)
Log likelihood	-2336.361				-4320.756			
N	4,849				4,756			

<sup>a</sup> The reference categories are *primary education* and *married*.

Dependent variables are logs of monthly annuities.

Annuities standardized to a one-person household

Standard errors in parentheses.

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

of respondents between age 35 and 64, so as to select working age individuals who have started their career and have not yet reached the statutory retirement age. Most patterns are similar to those described above, with the exception of widows and widowers who have pension annuities that are on average 12-16% lower than married households when the sample is limited to working age. However, this difference is no longer significant once we take private wealth into account.<sup>4</sup>

### 5.1.2 Consumption floors

As was the case for the annuities, the estimates for the minimum expenditures equations for 2008 are mostly similar to those documented by De Bresser and Knoef (2015). The only difference is a stronger relationship between consumption floors reported by men and household income: our estimates imply that a 10% increase in the income of the husband increases his expected annuity by 4.8%, compared with 3.3% according to De Bresser and Knoef (2015). Moreover, this correlation is similar for the income of his wife, so that household income is an important covariate of expenditure goals of both men and women regardless of who brings it in. Though the differences in average reported consumption floors between education groups are smaller than in the earlier paper, they remain large and highly statistically significant with university graduates reporting 25-28% higher floors than primary school graduates.

We observe interesting changes in the relationships between certain demographics and consumption floors between 2008 and 2014, some of which parallel the patterns documented for annuities in the previous subsection. For instance, homeowners reported 6-9% higher minimal expenditures in 2008, but in 2014 that difference has disappeared. The aligning of aspirations between renters and homeowners mirrors the decline in house prices that is clearly visible in the annuities once we take housing wealth into account. Furthermore, the income elasticity of the consumption floors dropped from 0.48 to 0.35, while the elasticity of annuities decreased from 0.28 to 0.23. For other covariates the changes in goals and resources do not go in the same direction. Individuals in couples reduced their consumption floors relative to singles: while the difference was small and statistically insignificant in 2008, couples report 14-17% lower equivalized consumption floors in 2014. Though we found no evidence that differences in average annuities between education groups became smaller,

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<sup>4</sup>Estimates available on request.

we do observe that education-related differences in consumption floors shrank substantially for women. Similarly, self-employed men reported high consumption floors on average compared to wage workers in 2008 and that difference had disappeared by 2014, despite the finding that the gap in annuities between wage workers and the self-employed narrowed. The results presented in Table 4 are robust to limiting the sample to respondents in the prime of their working life, age 35-64.

**Table 4:** Joint models of annuities and retirement expenditures – expenditure equations.

	minimal expenditures 2008				minimal expenditures 2014			
	men		women		men		women	
Partner	-0.022	(0.0426)	-0.041	(0.0525)	-0.135***	(0.0313)	-0.169***	(0.0411)
Age	-0.002	(0.0015)	0.006***	(0.0015)	0.000	(0.0011)	0.002*	(0.0010)
HH head	-0.001	(0.0471)	0.003	(0.0446)	0.059	(0.0391)	-0.025	(0.0333)
Any Children	-0.060	(0.0518)	-0.047	(0.0484)	-0.083*	(0.0436)	0.032	(0.0423)
Number Children	0.010	(0.0232)	-0.002	(0.0217)	0.023	(0.0199)	-0.009	(0.0208)
Homeowner	0.058*	(0.0308)	0.091***	(0.0302)	0.006	(0.0236)	-0.013	(0.0232)
log pers. Income	0.015	(0.0166)	-0.005	(0.0066)	-0.032**	(0.0138)	-0.002	(0.0051)
Log HH income	0.466***	(0.0369)	0.478***	(0.0373)	0.355***	(0.0281)	0.350***	(0.0261)
Has simPC	-0.028	(0.0638)	-0.045	(0.0615)	-0.081*	(0.0432)	-0.039	(0.0397)
Inter. sec. ed. <sup>a</sup>	0.017	(0.0469)	0.043	(0.0462)	0.031	(0.0433)	-0.026	(0.0397)
Higher sec. ed. <sup>a</sup>	0.128**	(0.0604)	0.180***	(0.0580)	0.097*	(0.0500)	0.021	(0.0460)
Int. vocational ed. <sup>a</sup>	0.089*	(0.0467)	0.157***	(0.0507)	0.055	(0.0432)	0.004	(0.0418)
Higher voc. ed. <sup>a</sup>	0.118**	(0.0466)	0.181***	(0.0504)	0.122***	(0.0433)	0.046	(0.0417)
University <sup>a</sup>	0.252***	(0.0551)	0.271***	(0.0652)	0.177***	(0.0482)	0.104**	(0.0497)
Self-employed	0.112***	(0.0414)	0.000	(0.0479)	-0.006	(0.0361)	-0.003	(0.0412)
Home maker	0.114	(0.1547)	-0.041	(0.0415)	0.292*	(0.1570)	-0.026	(0.0342)
Retired	0.168	(0.1494)	0.041	(0.1864)	0.230	(0.1690)	0.086	(0.1661)
Disabled	0.036	(0.0727)	0.048	(0.0729)	0.004	(0.0563)	0.000	(0.0445)
Other primary act.	0.080	(0.0743)	-0.042	(0.0606)	-0.003	(0.0438)	0.017	(0.0343)
Seperated/divorced <sup>a</sup>	0.126**	(0.0514)	0.046	(0.0496)	0.023	(0.0365)	-0.015	(0.0384)
Widow <sup>a</sup>	-0.187**	(0.0937)	0.141*	(0.0781)	-0.029	(0.0500)	-0.073	(0.0463)
Never married <sup>a</sup>	0.001	(0.0389)	0.071*	(0.0415)	0.006	(0.0328)	-0.017	(0.0324)
Thought some	-0.054	(0.0515)	0.043	(0.0632)	-0.019	(0.0533)	-0.010	(0.0497)
Thought a little	-0.031	(0.0530)	0.007	(0.0628)	-0.040	(0.0545)	-0.036	(0.0478)
Hardly thought	-0.015	(0.0662)	0.002	(0.0697)	-0.044	(0.0599)	0.007	(0.0517)
No answer	-0.064	(0.1670)	0.132	(0.4047)	0.123	(0.2607)	0.050	(0.2324)
Extremely urban	0.098**	(0.0423)	-0.072	(0.0442)	0.051	(0.0319)	0.046	(0.0302)
Very urban	0.068**	(0.0324)	0.019	(0.0337)	0.021	(0.0254)	0.054**	(0.0251)
Slightly urban	0.042	(0.0324)	0.016	(0.0350)	0.011	(0.0257)	0.030	(0.0266)
Not urban	0.013	(0.0381)	-0.047	(0.0400)	-0.029	(0.0300)	-0.030	(0.0295)
Constant	3.633***	(0.3023)	3.226***	(0.3160)	4.710***	(0.2281)	4.523***	(0.2194)
Sigma epslion	0.305***	(0.0080)	0.310***	(0.0086)	0.341***	(0.0065)	0.323***	(0.0064)
Log likelihood	-3324.105							
N	4,759							

<sup>a</sup> The reference categories are *primary education* and *married*.

Dependent variables are logs of monthly minimal expenditures.

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

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

Standard errors in parentheses.

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

### 5.1.3 Error correlations

Table 5 reports the estimated correlations between the error terms of all equations for annuities and expenditures and for the selection equation for annuities in 2008. We find that the cross-sectional correlations between annuities and consumption floors are positive and significant in both years. Hence, individuals in households that can look forward to generous annuities given their demographic characteristics are also more ambitious regarding their minimal expenditures. However, the correlations are small in magnitude, ranging from 0.08 to 0.26. The cross-sectional correlations between consumption floors of partners within couples are much stronger, around 0.5 in both years, suggesting that partners agree on the minimal consumption level they should meet.

As for correlations between the years we find that annuities are highly persistent, even in times of economic turbulence and conditional on background characteristics: the correlations between the errors of the annuity equations in 2008 and 2014 are between 0.60 and 0.67. Consumption floors are inter-temporally correlated as well, but much less so with estimated correlations around 0.36. Confirming De Bresser and Knoef (2015) we find no evidence that failure to match survey respondents to administrative records led to endogenous sample selection for annuities in 2008. However, there is some support for efficiency gains from including that selection equation, since its error correlates significantly with that of the 2014 annuity.

**Table 5:** Error correlations.

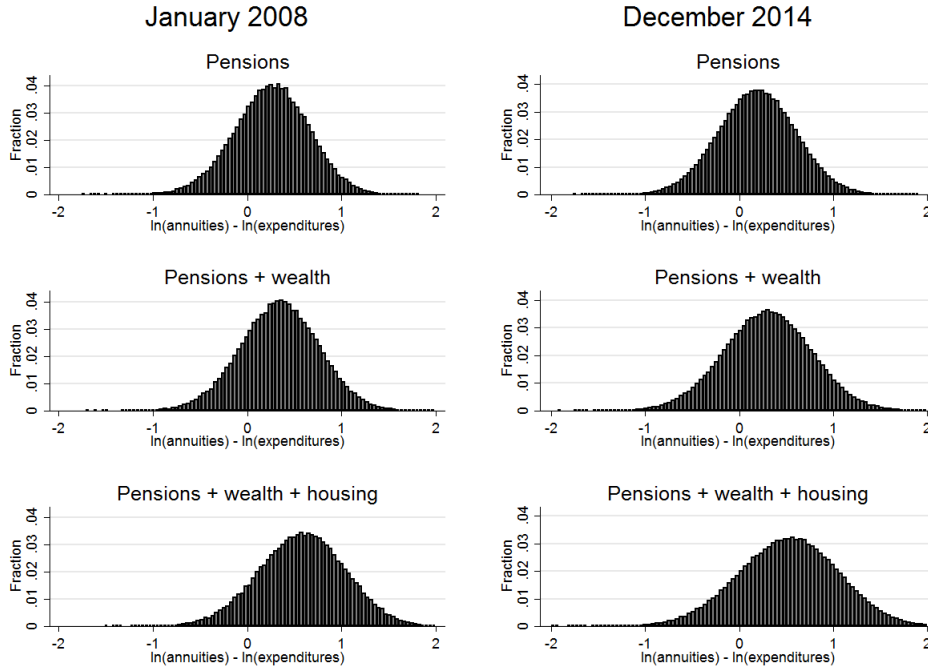
	Annuity 2008	Min exp. men 2008	Min exp. women 2008	Selection (annuity 2008)	Annuity 2014	Min exp. men 2014	Min exp. women 2014
<i>a. Annuities from pensions</i>							
Annuity 2008	1						
Min exp. men 2008	0.210***	1					
Min exp. women 2008	0.230***	0.463***	1				
Selection (annuity 2008)	0.148	-0.025	-0.068	1			
Annuity 2014	0.598***	0.059	0.076	0.205***	1		
Min exp. men 2014	0.150***	0.357***	0.029	0.123*	0.152***	1	
Min exp. women 2014	0.115**	0.205**	0.366***	0.104	0.150***	0.503***	1
<i>b. Annuities from pensions and non-housing wealth</i>							
Annuity 2008	1						
Min exp. men 2008	0.129***	1					
Min exp. women 2008	0.256***	0.470***	1				
Selection (annuity 2008)	0.081	-0.028	-0.057	1			
Annuity 2014	0.672***	0.068	0.144**	0.144***	1		
Min exp. men 2014	0.090*	0.354***	0.035	0.128*	0.140***	1	
Min exp. women 2014	0.073	0.212***	0.362***	0.121*	0.133***	0.508***	1
<i>c. Annuities from pensions and all wealth</i>							
Annuity 2008	1						
Min exp. men 2008	0.138***	1					
Min exp. women 2008	0.172***	0.465***	1				
Selection (annuity 2008)	0.033	-0.029	-0.053	1			
Annuity 2014	0.660***	0.046	0.003	0.122**	1		
Min exp. men 2014	0.058	0.356***	0.076	0.123*	0.084***	1	
Min exp. women 2014	0.090*	0.222***	0.365***	0.130*	0.081**	0.509***	1

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

## 5.2 Simulations

We use the estimates presented in section 5.1 to simulate annuities and consumption floors for all individuals in the sample. We do not evaluate preparedness by comparing observed resources and expenditure floors within the data, since missing data would compromise the representativeness of such direct comparison. However, conditional on covariates the dependent variables are missing at random, so the model estimates can be used to simulate preparedness in a way that is representative for the Dutch population.

Figure 1 presents the simulation results as histograms of the difference between simulated annuities and minimal expenditures (both in logs and at the level of the individual). The differences subtract minimal expenditures from annuities, so a positive difference means that the predicted annuity is sufficient to afford one's minimal expenditures and a negative difference implies insufficient funds. The graphs in the left column correspond to 2008 and those on the right to 2014,



**Figure 1:** Simulated differences between annuities and consumption floors

while different rows vary the scope of wealth from which annuities are computed. Comparing the columns, one notices that the locations of the distributions did not change much between 2008 and 2014. However, the spread increased slightly: the financial crisis increased inequality in retirement preparedness.

Descriptive statistics of the simulations are given in Table 6, which reports the median difference between annuities and minimum expenditures and the fraction for which that difference is negative (so that the annuities fall short of minimum consumption). Considering first the simulations for the full sample, panel a., we find that the median difference between pension annuities and consumption floors decreased from 27% to 20% between 2008 and 2014. Furthermore, the fraction of individuals who do not accumulate a sufficiently generous pension entitlement to afford their minimum expenditures increased from 25% to 32%. Based on pensions alone aggregate preparedness for retirement of the Dutch population declined only slightly during the period of the financial crisis and subsequent recession. A similar picture of modest decline in preparedness emerges if we include discretionary wealth and/or housing in the annuities: the median excess annuity declined by around 5 %-points and the fraction that will not have a sufficiently generous annuity increased by a similar amount.

**Table 6:** Aggregate simulation results: differences between annuities and consumption floors – specifications without variables for thinking about retirement and question understanding

	Median difference (%)		Fraction < 0	
	2008	2014	2008	2014
<b>a. Full sample</b>				
Pensions	27 (24; 29)	20 (18; 21)	0.25 (0.23; 0.27)	0.32 (0.30; 0.33)
Pensions + wealth	35 (32; 37)	31 (29; 33)	0.20 (0.19; 0.22)	0.26 (0.24; 0.27)
Pensions + wealth + housing	59 (57; 62)	53 (52; 55)	0.10 (0.09; 0.12)	0.16 (0.15; 0.17)
<b>b. Age 35-64</b>				
Pensions	29 (26; 32)	21 (19; 23)	0.23 (0.21; 0.26)	0.31 (0.29; 0.33)
Pensions + wealth	35 (32; 38)	31 (28; 33)	0.20 (0.18; 0.22)	0.25 (0.24; 0.27)
Pensions + wealth + housing	61 (58; 64)	56 (53; 58)	0.10 (0.08; 0.12)	0.14 (0.13; 0.16)

90% confidence intervals in parentheses. CIs are obtained by parametric bootstrap over the asymptotic distribution of the ML estimator (500 iterations). In each iteration we replicate the sample 50 times.

Simulations are corrected for over-representation of homeowners in the LISS panel.

The bottom panel of Table 6 shows that similar results are obtained for the subsample of families with a household head aged between 35 and 64.

### 5.3 Decomposition

The overall picture of modest decreases in preparedness is the net result of substantial countervailing changes in consumption goals and resources. To illustrate this, we follow two complementary approaches. The first is to keep subsets of the parameters fixed at their 2008 values while running the simulations, to reveal what would have happened if the relationships between covariates and annuities, expenditure floors or both would have remained constant. By keeping parameters fixed in the simulations, we can tease out the impact of changing goals and resources on the medians and proportions reported in Table 6. The top panel of Table 8a shows that while preparedness worsened slightly when we allow for changes in both annuities and consumption floors, the median difference between annuities and minimal expenditures would have increased by 13%-points if the level of annuities had remained constant conditional on covariates. In that case the fraction for

**Table 8a:** Decomposition of changes in retirement preparedness – *medians and fraction underprepared*

	Med. difference (%)		Fraction < 0	
	2008	2014	2008	2014
<b>a. Pensions</b>				
Baseline	27	20	0.25	0.32
Annuities fixed	27	40	0.25	0.18
Cons. floors fixed	27	0	0.25	0.50
Both fixed	27	21	0.25	0.32
<b>b. Pensions + wealth</b>				
Baseline	35	31	0.20	0.26
Annuities fixed	35	50	0.20	0.15
Cons. floors fixed	35	11	0.20	0.41
Both fixed	35	31	0.20	0.26
<b>c. Pensions + wealth + housing</b>				
Baseline	59	53	0.10	0.16
Annuities fixed	59	76	0.10	0.09
Cons. floors fixed	59	34	0.10	0.26
Both fixed	59	56	0.10	0.15

Simulations are corrected for over-representation of homeowners in the LISS panel.

whom pensions are insufficient to afford minimal expenditures would have been 7%-points lower in 2014 compared to 2008. The fact that such improvements are absent in the baseline simulations illustrates the extent to which pension annuities decreased over that period. On the other hand, if consumption floors would have remained constant between 2008 and 2014, the median excess annuity over consumption floor would have dropped by 27%-points to around zero and the fraction at risk of missing their floor would have increased to 50% (instead of 32% as in the baseline simulations). Finally, Table 8a also shows what would have happened if the parameters of both the annuity and expenditure equations would have remained constant, so any change in preparedness is caused by the composition of the samples. Developments in sample composition led to a decline of 6%-points in the median difference and a 7%-point increase in the fraction at risk of accumulating insufficient pension entitlements. The simulations in panel a. of Table 8a show that pension annuities decreased between 2008 and 2014 and that the sample composition also changed in ways that reduced preparedness. However, both adverse developments were largely compensated by substantial downward revisions in consumption floors.

Panels b. and c. of Table 8a shows that quantitatively similar forces were at work for annuities

**Table 8b:** Decomposition of changes in retirement preparedness – *averages*

	Pensions	Pensions + wealth	Pensions + wealth + housing
$\bar{\Delta}_{08}$ (%)	26	34	58
$\bar{\Delta}_{14}$ (%)	20	31	52
$\bar{\Delta}_{14} - \bar{\Delta}_{08}$ (%-points)	-6	-3	-5
a. Changing wealth (%-points)	-19	-18	-21
b. Changing cons. floors (%-points)	-19	-19	-19
c. Changing demographics (%-points)	-6	-4	-3
$\bar{\Delta}_{14} - \bar{\Delta}_{08} = \text{a.} - \text{b.} + \text{c.}$ (up to rounding)			

that include discretionary wealth and/or real estate, again resulting in a modest net decrease in preparedness.

The second approach is to decompose the *average* expected difference between log-pensions and log-consumption floors as follows:

$$\begin{aligned}
 \bar{\Delta}_{14} - \bar{\Delta}_{08} &= (\bar{W}^{14} - \bar{M}^{14}) - (\bar{W}^{08} - \bar{M}^{08}) \\
 &= (\bar{\mathbf{x}}_m^{14'} \boldsymbol{\beta}_m^{14} - \bar{\mathbf{x}}_w^{14'} \boldsymbol{\beta}_w^{14}) - (\bar{\mathbf{x}}_m^{08'} \boldsymbol{\beta}_m^{08} - \bar{\mathbf{x}}_w^{08'} \boldsymbol{\beta}_w^{08}) \\
 &= \bar{\mathbf{x}}_w^{14'} (\boldsymbol{\beta}_w^{14} - \boldsymbol{\beta}_w^{08}) - \bar{\mathbf{x}}_m^{14'} (\boldsymbol{\beta}_m^{14} - \boldsymbol{\beta}_m^{08}) \\
 &\quad + [\boldsymbol{\beta}_w^{08'} (\bar{\mathbf{x}}_w^{14} - \bar{\mathbf{x}}_w^{08}) - \boldsymbol{\beta}_m^{08'} (\bar{\mathbf{x}}_m^{14} - \bar{\mathbf{x}}_m^{08})]
 \end{aligned} \tag{7}$$

The first term at the right hand side of the decomposition denotes the change due to wealth shocks. The second term denotes the change due to adjusted retirement expenditure goals, the last term is the change due to a different composition of people.

Results of this decomposition are very similar to those obtained for the median difference between annuities and consumption floors and are presented in Table 8b. Reductions in average annuities and consumption floors in combination with small changes in demographics net out to zero or small declines in average preparedness regardless of the definition of annuities.

#### 5.4 Covariates of shortfalls

[TO BE ADDED]

## 5.5 Within-individual variation in consumption floors

[TO BE ADDED]

## 6 Conclusion

Much like previous research suggests that static benchmarks miss substantial heterogeneity in preferences in the cross-section (De Bresser and Knoef, 2015), our results show that a static benchmark for savings sufficiency does not do justice to the response of expenditure goals to a changing environment. During the great recession the Dutch experienced large, unanticipated wealth shocks. On average the predicted annuity in retirement, based on pension and/or other types of wealth, fell by around 20% between 2008 and 2015. Had expenditure targets remained unchanged, this would have doubled the fraction for whom pensions alone are not sufficient to meet their minimum consumption requirement from 25% to 50%. However, expenditure goals did adapt: they were lowered by 10% on average. The net effect of changing resources and goals is that the fraction who is project to fall short increased by 6 %-points to 31% (or 16% if we take all non-pension wealth into account).

Our paper provides evidence that shocks to wealth do not only affect consumption today, but are incorporated into individuals' projections of future consumption.

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## Appendix A Descriptive statistics of background variables

## Appendix B Calculating annuities

The latest administrative data available on pension entitlements is from 2011. Between 2011 and the end of 2014 several policy changes have taken place that will affect the pension entitlements. Furthermore, most pension funds have not been able to correct the DB entitlements for inflation, and some even had to cut entitlements on top of that.

The entitlement data consists out of two elements: (1) the accrued rights; (2) the rights to be accrued assuming income remains unchanged.

In the first step we set 2014 pension entitlements to equal 2011 entitlements, to account for the fact that the entitlements have not been adjusted for inflation. As a second step decrease the accrued rights by the amount equal to the cuts made in the fund that the respondent is a participant of. Unfortunately the administrative data does not show at which pension fund the pension rights are held. Therefore, we provided the survey respondents in 2014 a list with the .. biggest pension funds and let them indicate at which of those they had entitlements. Table 7 shows those pension funds that cut entitlements and the fraction of respondents in 2014 indicating they were a member of that fund.

In the third step we decrease the rights to be accrued by 17%. Maximal build up percentages have been decreased from 2.25% to 2.15% in 2014, and further to 1.875% in 2015. The total relative decrease is 16%. We assume that the actual build up percentages decrease to the same extent for all pension funds. (terminologie in Engels...)

In the fourth step we add 16% to the accrued pension rights (CHECK), to account for the fact that the 'pensioenrichtleeftijd' changed from 65 to 67 in .. . Then if the actual retirement rate is different from 67 total rights (already accrued and to be accrued) are adjusted by 8% per year.

Figure .. shows the effect of each step on pension entitlements, split up by age groups.

### 6.0.1 projection of wealth components

VOOR IN APPENDIX

- assumptions

**Table 7:** Cuts in major Dutch pension funds

Name fund	size and year of cut	fraction of respondents enrolled
ABP	0.5% in 2013	..
PME	5.1% in 2013	..
PMT	6.3% in 2013	..
Tandarts(specialisten)	3.2% in 2012 and 2.2% in 2013	..
Tandtechniek	7.0% in 2013 and 2.0% in 2014	..