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de Bresser, Jochem; Kools, Lieke; Knoef, M.G.

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

Jochem de Bresser*
Tilburg University†
Netspar

Marike Knoef
Leiden University‡
Netspar

Lieke Kools
Leiden University§
Netspar

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Abstract

Pension and housing wealth fell substantially during the Great Recession in many industrialized countries. This raised questions about the development of retirement savings adequacy. Using a unique combination of survey and administrative panel data from before and after the Great Recession in the Netherlands, we investigate co-movements between wealth and retirement expenditure goals. We separate 'pure' wealth effects from macro factors such as general pessimism. The estimates show that a shock in annuitized pension wealth of 100 euros reduced retirement expenditure goals with 23-33 euros. Whereas pensions drive the revision of goals for older individuals, the results indicate that individuals between the ages of 25 and 49 are more sensitive to housing wealth. Furthermore, while other studies find that the reaction of *current* consumption to financial shocks is relatively strong for low-income households, we document that *long term* expenditure goals are adjusted more by high-income households. Simulations show that the fraction of individuals falling short with regard to their own retirement expenditure goal would almost have doubled during the Great Recession if individuals would not have adjusted their retirement expenditure goals downward.

Keywords: Retirement; pensions; savings; aging

JEL-codes: D14; D31; H55; J14

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†J.R.deBresser@uvt.nl, P.O. Box 90153, 5000 LE Tilburg, The Netherlands, tel. +31 13 466 9111.

‡M.G.Knoef@law.leidenuniv.nl, P.O. Box 9500, 2300 RA Leiden, The Netherlands, tel. +31 71 527 4856.

§L.Kools@law.leidenuniv.nl, P.O. Box 9500, 2300 RA Leiden, The Netherlands, tel. +31 71 527 7825.

"Wealth consists not in having great possessions,

but in having few wants"

- Epictetus

1 Introduction

The recent Great Recession had a detrimental impact on household wealth in Western countries. Disappointing stock market returns had a negative effect on wealth accumulated in funded pension plans and austerity measures increased public pension eligibility ages. Moreover, during the crisis residential property prices declined sharply. This rapid decline of wealth raised a host of questions for economic analysis, such as: what is the effect of a wealth shock on consumption, on labor supply, and on retirement behavior? Since household portfolios in Western countries are dominated by pension and housing wealth, concerns have also been expressed about the adequacy of retirement resources.

The life cycle model of household spending, developed by Modigliani and Ando (1960) and Ando and Modigliani (1963), predicts that individuals smooth exogenous wealth shocks over their remaining lifetime. Furthermore, the original life cycle model predicts that the effects of wealth shocks are the same for all asset types. Modern models, however, differentiate between asset classes, since pension and housing wealth differ in many dimensions. For example, there may be transaction costs related to borrowing against illiquid assets such as housing equity. Households may also develop 'mental accounts' that dictate that certain assets are more appropriate to use for current expenditure and others for long-term saving (Thaler, 1990).

There is a large body of literature on the effect of wealth shocks on consumption, investigating different types of wealth shocks, and using different periods, types of data and methods. Several studies find evidence for a substantial causal effect of wealth on consumption,[1] while others find only small effects (e.g. Disney et al., 2010, and Browning et al., 2013), or conclude that co-movements in consumption and wealth are not generated by a causal relationship, but by third factors such as general optimism or pessimism (Attanasio et al., 2009). Christelis et al. (2015) find that for every

[1] Paiella (2009) provides an overview of the literature.

loss of 10% in housing and financial wealth, current household expenditures drop by about 0.6% and 0.9%, respectively. Such order of magnitude was also found by Mian et al. (2013) and by Angrisani et al. (2015), and is in line with the prediction of a life cycle model (Poterba, 2000). Most studies examining the effect of wealth on retirement behavior find little or no evidence that wealth shocks have a causal effect on the (planned) timing of retirement (e.g. Coile and Levine, 2006; Hurd et al., 2009; Goda et al., 2011; Goda et al., 2012 and Crawford, 2013).

This paper contributes to our understanding of wealth effects on household behavior. Instead of investigating the effect of wealth shocks on current consumption or on the (planned) retirement age, we examine their effect on self-reported minimal retirement expenditure goals. Such goals are important determinants of retirement savings adequacy, which we measure as the difference between annuitized wealth at retirement and retirement expenditure goals on the individual level. Because of the aging society, understanding the relationship between wealth and such goals becomes even more crucial, as the generosity of public pensions declines and households become more dependent on financial markets and housing wealth.

This study estimates the 'pure' wealth effect, that is the response of retirement expenditure goals to unanticipated wealth shocks. This 'pure' effect is the causal effect that is of interest in most of the literature (Paiella and Pistaferri, 2017) and that can, in the context of retirement expenditure goals, mitigate the negative effect of a crisis on retirement savings adequacy. We separate this 'pure' effect from the effects of macro factors that may be correlated with negative wealth shocks, such as general pessimism and negative expectations about future labor market conditions. The last part of the paper shows the degree to which co-movements between wealth and retirement expenditure goals were able to compensate a decline in retirement savings adequacy brought about by the Great Recession.

We estimate the effects of shocks to both pension wealth and housing wealth by regressing first differences in retirement expenditure goals on differences in annuitized wealth from before and after the Great Recession. In the Netherlands shocks to pensions are exogenous, since workers cannot choose which pension fund to contribute to, how much to contribute, or which investment strategy to follow. All aspects of participation in industry-wide funds are outside the control of participants

– a private pension is a fixed aspect of work in a given industry. The variation in shocks to pension annuities is driven by past investment decisions of pension funds. Moreover, the pension cuts came unexpected, as almost all funds appeared financially fit before the crisis. While the institutional framework renders changes to pension annuities exogenous, home owners could react to the decline in house prices by increasing their mortgage down payments. Therefore, we instrument shocks to net housing wealth, which may be influenced by endogenous mortgage down payments, with shocks in gross housing wealth. Finally, simulations based on a seemingly unrelated regression (SUR) model are used to evaluate retirement savings adequacy with and without co-variation between expenditure goals and resources.

Our analysis utilizes matched administrative and survey data. The survey data contain self-reported retirement expenditure goals for a representative sample of the Dutch population, collected in January 2008 at the eve of the downturn in the financial markets and in December 2014, after some years of recession. A unique feature of these data is that individual panel members can be linked to tax records and administrative data from pension funds and banks. This allows us to construct a complete and precise measure of the financial resources available to households.

The contribution of this paper to the literature is twofold. First, as far as we know we are the first to investigate the effect of unanticipated wealth shocks on retirement expenditure goals. Although effects of wealth shocks on (short term) consumption are often studied, analyses about the expected long term are scarce. However, the expected long term relation is highly important for the development of retirement savings adequacy. The analysis relies on administrative individual-level data on unanticipated wealth shocks, instead of aggregate measures of house and stock price changes that are often used in the literature. Second, this paper studies to what extent co-movements in wealth and retirement expenditure goals during the Great Recession affected the development of retirement savings adequacy. Retirement savings adequacy is defined by the difference between individual retirement expenditure goals and annuitized wealth. It is common to measure readiness against a single universal threshold, e.g. a poverty line or a replacement rate of 70% of prior income or expenditures, or using a life cycle model.[2] However, universal thresholds fail to capture relevant

[2]For examples of universal standards of sufficiency see Haveman et al. (2007), Mitchell and Moore (1998) and Skinner (2007). Engen et al. (2005) and Scholz et al. (2006) use life cycle models to assess preparedness.

differences in coping strategies, which may have changed after some years of recession. Benchmarks based on life cycle models are able to take into account differences between households, but have difficulty to accurately reflect heterogeneous preferences without excessive computational burden. This makes an alternative and complementary analysis useful.[3] Compared to De Bresser and Knoef (2015), a major contribution is that we now have data not only from January 2008 (before the crisis), but also from December 2014. This unique combination of data makes it possible to understand how people adjust their retirement expenditure goals after a wealth shock, which is critical because of its macro-economic implications.

The estimation results show that a decrease of 100 euros per month in pension annuities reduced retirement expenditure goals by 23-33 euros. Splitting the sample by age, the results suggest that expenditure goals of older individuals were primarily affected by pensions, while for younger individuals real estate played a more important role. Older individuals show a strong preference to stay put (De Jong and Rouwendal, 2012). For them, a house price shock may simply imply a change in the implicit rental cost of living in the house, but no real wealth effect[4] (Sinai and Souleles, 2005, and Campbell and Cocco, 2007). Pensions, on the other hand, constitute a relatively large part of the future income of older individuals. Another split, based on the median household income in 2008, reveals that individuals in high-income households adjust their retirement expenditure goals more after a shock to pension wealth than do those with lower incomes. This is interesting, as previous work on the marginal propensity to consume shows that low income individuals adjust *current* consumption more strongly after a shock than do individuals with higher incomes.[5] Low-income individuals may also choose to work longer rather than cut their desired spending, in line with the results of Lindeboom and Montizaan (2018) on planned retirement dates.

Simulation results indicate that co-movements between wealth and retirement expenditure goals tempered the adverse effect of the Great Recession on retirement savings adequacy considerably.

[3]Our focus on attaining retirement expenditure goals after retirement means that we do not take into account other reasons to save, such as precautionary or bequest motives. If such additional rationales exist, our analysis should be interpreted as an upper bound on preparedness.

[4]In case of reverse mortgages there may be real wealth effects, but reverse mortgages are rare in the Netherlands (Suari Andreu et al., 2018).

[5]An exception is Kueng (2018), who finds that the marginal propensity to consume increases with income. Since the lump sum payments under study do not depend on income, the welfare losses from not smoothing the payment is small. That is probably the reason why high income households deviate substantially from the standard model.

The fraction of individuals who are expected not to be able to afford their minimum retirement expenditure goal increased from 27% to 32%, if we only take pension wealth into account. In case individuals would not have revised their goals, around 50% would not have been able to finance their retirement expenditure goals, based on pensions alone.[6]

The remainder of the paper is set up as follows. Section 2 explains the Dutch pension system and the ways it changed between January 2008 and December 2014. Section 3 provides the theoretical underpinning for our empirical analysis. In section 4 we present the data, followed by an analysis on the size and nature of co-movements between wealth and retirement expenditure goals in section 5. Section 6 presents the development of retirement savings adequacy and section 7 concludes.

2 Pension reforms and the crisis

The Dutch pension system consists of four pillars: (1) public pension, (2) mandatory occupational pensions, (3) voluntary private pension products such as life annuities, and (4) all other (voluntary) assets such as private savings and housing wealth. In this section we describe these pillars and their development between January 2008 and December 2014 (the months in which the survey data were collected). In the calculations of projected pension annuities we take these developments into account.

2.1 Public pension

The first pillar consists of a flat rate public old age pension, financed through a pay-as-you-go system. For every year that individuals live in the Netherlands, they build up rights to 2% of the full public pension. Individuals who lived in the Netherlands during all 50 years before the statutory retirement age receive a full public pension (50% of the minimum wage for individuals living in a couple and 70% of the minimum wage for singles). For retirees with less than full public pension

[6]Note that, even though an appropriate decrease in retirement expenditure goals does result in better pension savings adequacy relative to those goals, it still implies that the individual endures a welfare loss. This means that there is less need to worry about individuals adapting their plans appropriately to their new situation. It however does not imply that retirement incomes can decrease without any costs to the individual.

rights as a consequence of living abroad, and insufficient other resources, the first pillar is topped up with social assistance to guarantee a social minimum.

In 2008 the public pension eligibility age was 65. In 2012 an amendment passed that stipulated a stepwise increase of the public pension eligibility age to 67 in 2023, after which it would be linked to life expectancy. In 2014 legislation was proposed to speed up the increase such that the public pension eligibility age will reach 67 in 2021. If individuals work longer, they will build up more wealth in occupational pensions as a consequence of this act.[7] Since there was a lot of media attention for the increase in the statutory retirement age, in our calculations we take the accelerated increase of the retirement age into account.

2.2 Occupational pensions

The Dutch save massively for their retirement via occupational pensions. 90% of all employees in the Netherlands have a mandatory pension scheme with their employer (Bovenberg and Meijdam, 2001) and for many households pension savings are by far their largest financial assets. About 1344 billion euro is accumulated in Dutch pension funds (end 2017), i.e. on average nearly 175,000 euros per household. Employees cannot choose to which pension fund they want to contribute, but are mostly assigned to a sector-specific fund. Changing pension funds would thus often require to change to a job in a different industry.

Most occupational pension schemes are defined-benefit plans and for many years people did not worry about their pension. Pension funds had large reserves and participants were not aware of the fact that indexation was conditional on the financial situation of their fund. This changed dramatically in 2008. Whereas in 2007 the average funding ratio was 144% and only 7 pension funds had a reserve deficit, by the end of 2008 300 pension funds had a reserve deficit and the average funding ratio[8] was 96% (source: Dutch Central Bank). Most pension entitlements were no longer

[7] Mastrobuoni (2009) and Staubli and Zweimüller (2013) indicate that an in increase in the statutory retirement age is likely to result in an increase in the actual retirement age.

[8] The funding ratio is the main measure of financial health of pension funds. The legally required funding ratio in accordance with the European pension fund guidelines is 104.2% (IORP Directive, PbEG 2003/41/EG). Pension funds need to hand over a recovery plan to the Dutch Central Bank if their funding ratio is below 104.2% and need to cut pensions when their funding ratio is below 104.2% in five consecutive years. A fund is allowed to index pensions for price inflation when their funding ratio exceeds 130%. Between 110% and 130% partial indexation is possible (DNB, 2016).

indexed for inflation and some entitlements were even cut in nominal terms. For example, large funds for metal electro, metal technologies, and tooth technologies had to cut nominal pensions in 2013 with 5.2%, 6.3% and 7.0%, respectively. The biggest pension fund in the Netherlands (ABP), covering about 2.8 million individuals, 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).

There are vast differences in funding ratio trends between funds: figure A1 in Appendix A shows that the relative decline in funding ratio during 2008 is spread between 0 and -60%. Such variation is explained by (a) the pursued interest rate hedging policy, (b) the asset mix of the investment portfolio, (c) contributions to the fund, and (d) sensitivity to increased life expectancy (which is higher for funds with a relatively large proportion of young participants) (DNB, 2014). Because of these different trends, households are confronted with different shocks to pension wealth. These shocks were unanticipated and exogenous. Exogeneity is embedded in the system, because individual participants in Dutch pension funds have no influence on their contribution and investment strategy. Moreover, it is difficult to change funds, since funds often cover entire industries (for instance, there is one single fund for all government employees and another one for all of apothecary). However, individual participants were aware of the developments, since the 2008 Pension Act obliged all pension providers to provide a standardized yearly overview of current and projected entitlements (the Uniform Pension Overview, UPO). Research by the Dutch Authority of Financial Markets shows that 89% of the people read their UPO (AFM and GfK, 2010). The fact that shocks to pension wealth are exogenous and salient makes them interesting to investigate.

Pension reforms took place in the aftermath of the financial crisis. Annual tax-favored pension accruals have been reduced from 2.25% to 2.15% in 2014 and to 1.875% in 2015, lowering the rate which pensions are built up while working. Moreover, as of 2014 the age that forms the basis for actuarial adjustments to accrued pension rights increased from 65 to 67. This means that occupational pensions will be less generous for future retirees.

2.3 Voluntary private savings

Voluntary individual pension products, such as life annuities, play a relatively minor role in the Netherlands. The self-employed and individuals with a gap in their public pension entitlements are allowed to buy life annuities on fiscally attractive terms. Voluntary retirement savings in savings accounts, stocks and/or bonds (the fourth pillar) are not very common in the Netherlands because of the fiscally attractive and high accumulation of wealth in mandatory occupational pension plans. Appendix E shows that on the household level the median value of saving accounts was 14.2 thousand euros. Such small amounts are probably precautionary savings rather than intended for retirement. Finally, households may accumulate housing wealth. After a long period of steady increases, house prices have taken a hit between 2008 and 2014, and decreased by 20% on average.

3 Theory

How do we expect individuals' planned retirement consumption to respond to shocks in pension entitlements and housing wealth? We start by explaining the effect of a shock in pension entitlements on planned consumption during retirement (conditional on housing wealth). Consider the standard problem of an individual who lives for many periods and chooses optimal consumption to maximize the expected value of a lifetime time-separable utility function. We assume that capital markets are perfect and that the individual has no bequest motive. The individual's problem can be written as

$$\max \mathrm{E}_t \left[\sum_{\tau=t}^{L} \frac{u(c_\tau)}{(1+\rho)^{\tau-t}} \right] \tag{1}$$

$$\text{s.t. } \sum_{\tau=t}^{L} \frac{c_\tau}{(1+r)^{\tau-t}} = (1+r)A_{t-1} + \sum_{\tau=t}^{L} \frac{y_\tau}{(1+r)^{\tau-t}}, \tag{2}$$

with c_t real consumption in period t, L the final period in the life cycle, $u(\cdot)$ a utility function, ρ the rate of time preferences, r the real interest rate, A_t real net worth at the end of period t, and y_t real income in period t. The optimal solution to this maximization problem is $(c_t^*, c_{t+1}^*, ..., c_L^*)$.

When we assume quadratic preferences or CARA (to obtain a closed form solution) and assume $\rho = r$, the Euler equation becomes $c_t = \mathrm{E}_t[c_\tau], \tau = t+1, \ldots, L$. Substitution of this Euler equa-

tion into the expected lifetime budget constraint and re-arranging yields the following closed form solution for c_t:

$$c_t = \left(\sum_{\tau=t}^{L} (1+r)^{\tau-t} \right)^{-1} \left((1+r)A_{t-1} + \sum_{\tau=t}^{L} \frac{\mathrm{E}_t[y_\tau]}{(1+r)^{\tau-t}} \right), \tag{3}$$

which can be rewritten as

$$c_t = \left(\sum_{\tau=t+1}^{L} (1+r)^{\tau-(t+1)} \right)^{-1} \left((1+r)A_t + \sum_{\tau=t+1}^{L} \frac{\mathrm{E}_t[y_\tau]}{(1+r)^{\tau-(t+1)}} \right). \tag{4}$$

Using (4) the difference between planned retirement consumption (c_R) in year t and in year $t+s$ is given by

$$\begin{aligned} \mathrm{E}_{t+s}[c_R] - \mathrm{E}_t[c_R] = & \left(\sum_{\tau=t+1}^{L} (1+r)^{\tau-(t+1)} \right)^{-1} \times \\ & \left[\sum_{\tau=t+1}^{t+s} \frac{y_\tau - \mathrm{E}_t[y_\tau]}{(1+r)^{\tau-(t+1)}} + \sum_{\tau=t+s+1}^{R-1} \frac{\mathrm{E}_{t+s}[y_\tau] - \mathrm{E}_t[y_\tau]}{(1+r)^{\tau-(t+1)}} + \sum_{\tau=R}^{L} \frac{\mathrm{E}_{t+s}[y_\tau] - \mathrm{E}_t[y_\tau]}{(1+r)^{\tau-(t+1)}} \right], \end{aligned} \tag{5}$$

with R the period of retirement. The first part between the square brackets of this equation shows the difference in expected and realized income between $t+1$ and $t+s$, the second part reflects adjustments in expected income until retirement, and the third part reflects the change in expected pension entitlements. In this study t is January 2008, just before the crisis and $t+s$ is December 2014. Equation (5) shows us that a decline in pension entitlements due to the crisis will have a negative effect on planned consumption during retirement. Furthermore, this equation gives reason to expect that the planned retirement consumption of older household is more sensitive to shocks in pension entitlements than that of young households, because pension entitlements constitute a larger part of their future income. Also, those far from retirement can spread a shock over more years than those close to retirement. In the Dutch pension system all pensions, the last term of equation (5), are lifelong annuities. This means that changes in life expectancy L between period t and $t+s$ can only have a modest effect on changes in planned retirement consumption between t

and $t+s$ (compared to the situation where retirees receive a lump sum pension).[9] Adding a bequest motive to the life cycle model in equations (1) and (2) would mitigate the effect of a shock in pension entitlements, as part of the shock will then be absorbed by an adaption of the bequest.

It is more difficult to predict theoretically the effect of shocks in housing wealth on planned consumption during retirement (as is also explained by Campbell and Cocco, 2007, and Attanasio et al., 2011). On the one hand housing is an asset. Thus, increases in house prices lead to an increase in one's wealth and this may increase current as well as future consumption (the wealth effect). On the other hand, houses provide housing services. For homeowners who expect to live in their current house for a very long time, a higher house price has no *real* wealth effect. For young households, who plan to increase house size later in life, an increase in housing prices leads to an increase in the price of future additional housing services and this may affect current and future consumption negatively. Furthermore, houses can be used as collateral for a loan. An increase in house prices may lead to an increase in consumption because it allows borrowing constrained homeowners to smooth consumption over the life cycle. In the presence of reverse mortgages, homeowners who expect to live in their current house for a very long time would be able to increase their consumption. In practice, however, reverse mortgages are rare and housing prices are more likely to affect the next generation via bequests.

4 Data

In this study we match survey and administrative data at the individual level. Section 4.1 describes the survey data on retirement expenditure goals, and section 4.2 the administrative data on assets.

4.1 Survey data

Survey data are taken from the Longitudinal Internet Study in the Social Sciences (LISS panel), gathered by CentERdata.[10] This panel is recruited through address-based sampling (no self-selection), and households without a computer and/or internet connection receive an internet con-

[9] Moreover, De Bresser (2016) shows that there is little within-individual variation in self-reported life expectancy after accounting for measurement error.

[10] For more information we refer to `http://www.lissdata.nl/lissdata/`.

nection and computer for free. This roughly nationally representative household panel (Van der Laan, 2009) receives online questionnaires on different topics each month. When respondents complete a questionnaire they receive a monthly incentive. A variety of data is available from studies conducted in the LISS panel.

As a proxy for planned consumption during retirement ($E_t[c_R^*]$ from the theoretical framework), we use a question regarding retirement expenditure goals[11] elicited from LISS-respondents both in a single-wave study in January 2008, constructed by Johannes Binswanger and Daniel Schunk (Binswanger et al., 2013), and in a single-wave study in December 2014, constructed by the authors.[12] In both studies the question is placed 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).*

We find that people provide reasonable answers to this question. As shown below, people provide plausible answers compared to their current income level. Furthermore, non-retirees provide a similar distribution of answers as retirees (who know what it is to be retired).[13] Finally, we asked people whether they found it difficult to answer this question.[14] In our models we control for the fact that answers given by respondents who indicate they find it difficult to answer could be systematically higher or lower than others. De Bresser and Knoef (2015) found no evidence of systematically different answers from individuals who found it difficult or easy to answer the question.

[11] As noted by Becker (1965) and Aguiar and Hurst (2005), consumption is the output of a 'home production' function that uses both expenditure and time as inputs. When expenditures decline, this will probably to some extent be substituted with more time spent on home production.

[12] The recession in the Netherlands, defined as a period of two quarters of negative GDP growth, started in the second quarter of 2008. The last period of recession was between the third quarter of 2012 and the second quarter of 2013. Appendix B shows the development of consumer confidence between the two surveys.

[13] These descriptives can be found in Appendix C.

[14] Appendix C provides more details about how respondents rated the difficulty of the question.

It is important to understand how respondents interpreted the question. Therefore, in December 2014 at the end of the questionnaire (after other questions about health expectations, health care, and pension expectations) we asked respondents how satisfied they would be with a retirement income of X euro, where X is their self-reported minimal retirement expenditure goal from the beginning of the questionnaire. Most people report a satisfaction level 3 or a 4 on a scale from 1 to 7. In that same survey we also asked respondents about their preferred retirement expenditure goal (taking into account that there is a tradeoff between current and future expenditures). When asked to rate their preferred retirement income level on a scale from 1 to 7, most people report a 4 or a 5. Both minimal and preferred retirement expenditure goals increase with income, and the difference between them has the same order of magnitude across income groups (the relative difference even declines a bit from 14% of current income for the lowest income quintile to 9% of current income for the highest income quintile). All of this suggests that respondents did not interpret the question as subsistence consumption, but rather as the amount of expenditure they would need to reach a neutral satisfaction level.

In 2008 it was safe to assume that individuals did not take into account health care expenditures when reporting expenditure goals, since long term care costs were almost fully covered by the government and mandatory insurance at that time. By 2014 this was no longer the case, so we asked respondents whether they took health care costs into account in their answer. If so, they were subsequently asked what their minimal expenditures would be without these costs. We analyze minimal expenditures net of health care costs to safeguard comparability.

The survey was administered to household heads and their spouses as from the age of 25, with a reported net monthly household income higher than 800 euros (in this way students are excluded). In 2008 the survey was administered to a random half of the eligible panel members, in 2014 the full eligible sample was included. Descriptive statistics of socio-economic variables can be found in Appendix D.

Table 1 presents descriptive statistics of self-reported retirement expenditure goals in 2008 and 2014 (both expressed in 2014 euros using the consumer price index). The median retirement expenditure goal dropped by 165 euros (10%), from 1625 euros/month in 2008 to 1460 euros/month

Table 1: Descriptive statistics retirement expenditure goals

a. Retirement expenditure goals

	2008						2014					
	N	Mean	SD	p25	Mdn	p75	N	Mean	SD	p25	Mdn	p75
Monthly expenditures[a]	1396	1744	733	1218	1625	2031	2755	1495	570	1095	1460	1825
Replacement rate[b](%)	1396	76	28	57	75	91	2717	67	29	47	63	80

b. Changes in Retirement expenditure goals

	N	Mean	SD	p25	Mdn	p75
Monthly expenditures	456	-267	640	-571	-227	79
Replacement rate (%-points)	452	-11	30	-28	-11	5

[a] Retirement expenditure goals are standardized to a one-person household and expressed in 2014 euros.
[b] Replacement rate is defined as the retirement expenditure goal divided by current income.

in 2014. Both ends of the inter-quartile range (1218 and 2031 euros/month in 2008) also decreased by approximately 10%, indicating that retirement expenditure goals decreased across the distribution. Expenditure goals declined not only in absolute terms, but also relative to current income: replacement rates dropped from a median of 75% in 2008 to 63% in 2014. This can also be seen in figure 1, which shows how retirement expenditure goals are related to current income. Reported goals increase with income in both years, but this relationship was flatter in 2014 compared to 2008.

The bottom panel of table 1 describes the differences between 2008 and 2014 for those individuals whom we observe twice. Due to the limited overlap between the samples for 2008 and 2014 we lose observations: we retain around 450 individuals or one third of the 2008 sample and therefore some caution is required when drawing conclusions. What is comforting, however, is that the average changes between 2008 and 2014 (panel a) are similar to the changes found for those individuals whom we observe twice (panel b).[15] Moreover, Appendix D shows that respondents who participate in both waves are similar to the full sample in terms of socio-economic characteristics. Among those who remain in the sample, most revised their retirement expenditure goal downwards with a median revision of -227 euros/month. The median revision in the replacement rates is -11%-points. However, there is a lot of variation: a quarter of the individuals reduced their minimum consumption level by at least 571 euros/month, while another quarter of individuals increased their retirement expenditure goal by 79 euros or more. Retirement expenditure goals are fairly strongly correlated

[15]The change in average monthly expenditures is -249 euro (1495-1744), compared to -267 euro for those whom we observe twice. The change in the average replacement rate is -9%-points (67-76), compared to -11%-points for those whom we observe twice.

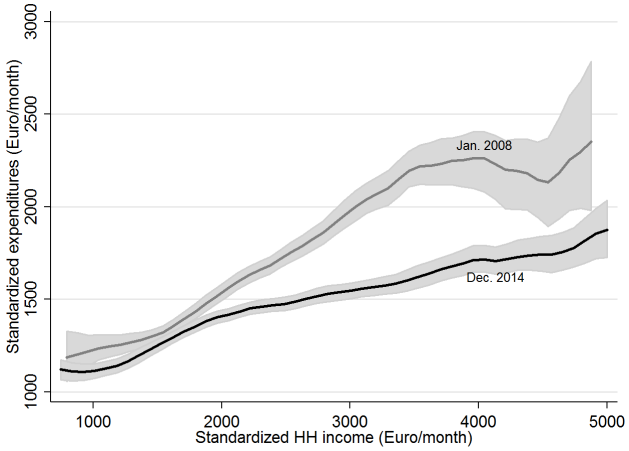

Figure 1: Kernel regressions of retirement expenditure goals on household income (shaded areas are 95% confidence bands).

across the years: the correlation coefficient is 0.55 for levels and 0.29 for replacement rates.

4.2 Administrative data

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

The CAD consists of all households in the Netherlands and contains data on 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 have to report accounts with a balance of 500 euro or more (or 15 euro in interest payments), which means that we only miss small amounts of money held in bank accounts.

PPE and OPE contain data on public and occupational pension entitlements for the entire Dutch population between the ages of 21 and 64. PUBLB and PRIVB contain data on public and private pension benefits received by all retirees (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, the LISS Assets Survey is used 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 administrative data available and adjust for aggregate changes between the time of measurement and 2014.

Panel a of table 2 summarizes the monthly annuities from pensions and wealth (more details about the wealth data can be found in Appendix E). We use three definitions of after-tax annuities during retirement: (1) annuities based on pensions (public and private), (2) annuities based on pensions plus private wealth other than real estate, and (3) annuities based on all wealth (including real estate). The assumptions used to annuitize wealth can be found in Appendix F.[16] The median projected annuity based on pensions declined by around 400 euros, or 20%, from 2146 to 1723 euros/month between 2008 and 2014.[17] We observe similar declines of 15-20% (300-400 euros) for the 25th and 75th percentiles of the distribution, respectively. These are due to disappointing developments in private pensions. The flat rate public pension tracks the minimum wage and has been adjusted for inflation during the period spanned by our sample (and, according to our assumptions, will be indexed for inflation in the future). To estimate the effect of pension wealth shocks on retirement expenditure goals, we thus exploit shocks in private pension wealth.[18]

Taking non-housing wealth into account does not change the pattern, which suggests that accumulation of discretionary wealth did not compensate much of the decline in pensions across the annuity distribution. The last definition, based on all wealth components, shows the remarkable decline in the value of real estate. The median monthly annuity according to this definition declined by 635 euros (20%), from 3104 to 2469 euros/month. In relative terms the decline is more pronounced for the 25th percentile (572 euros or 25%) than for the 75th percentile (623 euros or 16%).

The bottom panel of table 2 describes the distribution of changes in annuities between 2008

[16]The 2008 figures differ slightly from the numbers in De Bresser and Knoef (2015). In that paper the 2008 figures were adjusted to reflect the situation at that time (2014) as closely as possible. In this paper however, we aim to produce figures as close to the 2008 situation as possible.

[17]The descriptives in table 2 refer to the baseline scenario regarding future indexation of pensions, descriptives for other scenarios that are used for robustness checks are available on request.

[18]Disaggregating public and private pensions would not affect our analysis of changes in pension wealth.

Table 2: Descriptive statistics of assets, debt and annuities

a. Annuities

	2008						2014					
	N	Mean	SD	p25	Mdn	p75	N	Mean	SD	p25	Mdn	p75
Pensions	900	2170	729	1673	2146	2537	3646	1789	768	1352	1723	2135
Percentage of total	890	72	18	61	71	83	3426	73	33	61	74	93
Pensions + wealth	890	2401	959	1811	2271	2767	3429	2103	1447	1479	1890	2409
Percentage of total	890	78	16	68	76	92	3429	81	20	70	80	100
Pensions + wealth + housing	890	3275	1650	2306	3104	3900	3429	2781	1947	1734	2469	3277

b. Changes in annuities between 2008 and 2014

	Absolute changes (2014 euros)						Percentage changes (%)					
	N	Mean	SD	p25	Mdn	p75	N	Mean	SD	p25	Mdn	p75
Pensions	630	-355	502	-515	-284	-84	630	-13	19	-22	-12	-5
Pensions + wealth	597	-298	809	-514	-256	-37	597	-10	26	-20	-11	-2
Pensions + wealth + housing	597	-507	1441	-806	-449	-114	597	-13	26	-24	-15	-4

Monthly standardized annuities in 2014 euros.

and 2014 for those households that we observe twice and can be matched to administrative data in both waves. A similar picture emerges: the crisis and subsequent pension reforms substantially reduced the financial resources available during retirement. The median attainable pension (public plus private), dropped by around 20% due to reductions in real occupational pension entitlements. Furthermore, annuities based on all wealth declined by a similar percentage as a result of the decline in house prices.

5 Size and nature of co-movements between wealth and retirement expenditure goals

5.1 Empirical strategy

In this section we investigate the relationship between wealth shocks and retirement expenditure goals. Based on the equation (5), we regress changes in retirement expenditure goals on changes in

wealth, controlling for common factors and demographic variables. More precisely, we estimate[19]

$$\Delta R_i = \beta_0 + \beta_1 \Delta PA_i + \beta_2 \Delta HA_i + \mathbf{\Delta x}_i \boldsymbol{\beta}_3 + \varepsilon_i \tag{6}$$

$$\Delta HA_i = \gamma_0 + \gamma_1 \Delta HP_i + \gamma_2 \Delta PA_i + \mathbf{\Delta x}_i \boldsymbol{\gamma}_3 + \nu_i \tag{7}$$

In (6) ΔR_i is the change in retirement expenditure goals between 2008 and 2014 for individual i, PA_i is the pension annuity, HA_i is the annuity from net housing wealth,[20] and ε_i an error term. $\mathbf{x}_i$ contains individual-level covariates such as income, education, marital status and labor market status.

In addition to estimation of equation (6) by OLS, we use 2SLS to disentangle exogenous variation in housing wealth from individual decisions (e.g. extra mortgage down payments). Similar to Angrisani et al. (2015) we instrument shocks in net housing wealth with shocks in house prices (HP_i in equation (7)). However, Angrisani et al. (2015) and most of the literature use regional variation in the development of house prices to identify the causal link between shocks in housing wealth and current spending, because reliable data on housing wealth at the household level are rare. Our administrative data do allow us to exploit shocks in house prices at the household level. In this way we can exploit the idiosyncratic component of house price risk specific to each dwelling to identify the causal effect of housing wealth shocks on changes in retirement expenditure goals (β_2). In addition to mortgage down payments, households may experience simultaneous changes to housing wealth and expenditure goals when they shift from renting a home to home ownership or visa versa, or when they purchase a new home. Semi-annual data on home ownership and annual data on time spent living in the current dwelling allow us to check whether results change if we restrict the sample to individuals who were homeowners throughout the period covered by our sample or who stayed at the same address.

Identifying causal effects (often called 'pure' or direct wealth effects) is important, as they diminish the negative effect of a recession on retirement savings adequacy (measured by the difference between expenditure goals and resources). Macro-economic factors, which can induce correlation

[19] This framework is comparable to the framework used by others, such as Parker (1999), Johnson et al. (2006), Agarwal et al. (2007), Disney et al. (2010), and Christelis et al. (2015).

[20] Defined as the difference between the total annuity and the annuity from pensions and non-housing wealth.

between asset prices and retirement expenditure goals over time, can also contribute to mitigate the negative effect of a recession on retirement savings adequacy. However, by definition such factors affect all individuals regardless of the size of their change in wealth. Unlike 'pure' wealth effects, such aggregate adjustments of goals are not concentrated among those individuals who experience large shocks.

To identify the 'pure' effect of pension wealth, we exploit variation across households in pension wealth shocks (ΔPA) brought about by the Great Recession. As explained in section 2.2, pension contributions are mandatory in the Netherlands. Participants cannot choose their own pension fund, set their level of contributions, or influence the investment strategy. This implies that changes to pension wealth are plausibly exogenous and we can interpret β_1 as the 'pure' effect of pension wealth.

As mentioned above, macroeconomic factors, such as changing future income prospects, pessimism, and risk aversion, may induce correlation between asset prices and retirement expenditure goals. They may affect both asset prices (Campbell, 1991) and retirement expenditure goals. However, this would not impede us from identifying a 'pure' effect of pension wealth shocks, because our identification relies on *variation between* pension funds. This variation is caused by differences in the pursued interest rate hedging policy of the fund, the asset mix of the investment portfolio, contributions, and the average age of the participants in a fund. None of these pension fund characteristics can be influenced by individual households. Macroeconomic factors, such as general pessimism, that affect the average level of goals are captured by β_0. β_0 also contains age effects, as age and period effects can not be identified simultaneously in our model.

Individual heterogeneity in future income prospects influences retirement expenditure goals (as can be seen from equation (5)). However, this is no threat to the identification of causal effects as individual income prospects are not correlated with the exogenous changes in pension wealth. In particular, asset portfolios of pension funds are not biased towards their own sector (therefore pension cuts hit various people, white collar, blue collar, etc.)[21]. Unemployment may have an effect on both pension wealth and retirement expenditure goals, therefore we include labor market status

[21]Funding ratios are published by the Dutch central bank as from 2015. In 2015 funding ratios were relatively low for example in the iron/steel/electronics industry, the hairdressing sector, and the healthcare sector, but also in the accountancy sector and the public sector.

as a control variable in the model. Moreover, while pension goals are only observed in 2008 and 2014, we do observe labor market status on a semi-annual basis throughout the sample period. We verify that results are robust to excluding all respondents who were unemployed at any time between 2008 and 2014 or lived with someone who was unemployed.

Finally, one could argue that during the crisis households may have observed reduced rates of return on retirement saving. This could lead to lower voluntary retirement saving, through a substitution effect, and hence cause lower retirement expenditure goals. However, as explained in section 2.3, retirement savings in voluntary private saving accounts are rather low in the Netherlands because of the relatively high fiscally attractive and mandatory pension schemes. Even if households would have halved their private retirement savings, this would be irrelevant compared to the accumulated wealth in pension funds.

5.2 Results

Table 3 presents estimation results for the model described in equations (6) and (7). Panel a. contains the full sample estimates. The baseline estimates reported in column (1) show that a 1 euro drop in the pension annuity reduced retirement expenditure goals with 33 cents on average. So, one third of the drop in pension wealth is compensated by lower retirement expenditure goals (the remainder could be compensated by working longer, saving more or reducing bequests[22]). The coefficient on real estate is 0.06 and not statistically significant. The constant, which captures age effects and aggregate factors like pessimistic future income prospects, is large though insignificant.

To establish that results are not driven by outliers, we rerun the model after winsorizing changes in both goals and annuities. The results in column (2) show that the effect of the change in pension annuities on expenditure goals becomes smaller, but remains economically and statistically significant at 0.23. Moreover, the size and especially the precision of the constant increases, providing stronger evidence for a revision in the average expenditure goal (which may reflect changes in sentiment due to the recession). On average, goals declined by 132 euro in 2014 relative to 2008 (conditional on pension and real estate annuities). The 2SLS estimates in column (3) are virtually

[22]This paper focuses on retirement expenditure goals, which is unique in the literature. Unfortunately, we do not have enough data about the planned retirement age, current consumption, or bequest motives to analyze these outcome variables simultaneously.

Table 3: Shocks to annuities and changes in expenditure goals

	Dependent variable: Δ retirement expenditure goal		
	(1) OLS	(2) OLS	(3) 2SLS
a. All ages			
Δ Pension (β_1)	0.332**	0.229**	0.332**
	(0.141)	(0.0983)	(0.134)
Δ Real estate (β_2)	0.0591	0.152	0.0599
	(0.108)	(0.120)	(0.117)
Constant (β_0)	-103.3	-132.3***	-103.1
	(71.4)	(44.9)	(68.0)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	116.1***
Endogeneity Δ real estate F(1, n-1)	–	–	2.07e-04
n (number HHs)	282	282	282
N (total obs.)	307	307	307
b. Age 25-49[b]			
Δ Pension (β_1)	0.0625	0.0161	0.0618
	(0.114)	(0.151)	(0.115)
Δ Real estate (β_2)	0.229***	0.371**	0.219**
	(0.0640)	(0.181)	(0.0875)
Constant (β_0)	-86.2	-81.7	-87.9
	(63.9)	(75.7)	(66.2)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, 117)	–	–	34.2***
Endogeneity Δ real estate F(1, 117)	–	–	0.020
n (number HHs)	118	118	118
N (total obs.)	129	129	129
c. Age 50+[b]			
Δ Pension (β_1)	0.419**	0.341***	0.419**
	(0.182)	(0.115)	(0.182)
Δ Real estate (β_2)	-0.0455	0.0257	-0.0286
	(0.144)	(0.141)	(0.156)
Constant (β_0)	-142.5	-171.5***	-137.9
	(105.4)	(57.5)	(104.6)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	134.1***
Endogeneity Δ real estate F(1, n-1)	–	–	0.047
n (number HHs)	168	168	168
N (total obs.)	178	178	178
d. Difference between ages 25-49 and 50+			
(H_0: equal coefficients; statistics follow χ^2 (1) distribution)			
Δ Pension (β_1)	2.75*	2.95*	–
Δ Real estate (β_2)	3.03*	2.28	–
Constant (β_0)	0.21	0.91	–

[a] Δ Annuities and Δ expenditures are winsorized at p5 and p95. Winsorizing at p1-p99, or p2.5-p97.5 leads to similar results.

[b] OLS models on age subsamples are estimated jointly.

The models also control for the individual-level covariates listed in Appendix D (with the exception of gender, age, education and degree of urbanisation, since those variables display little or no variation within individuals). Annuities and expenditures are standardized to a one-person household. Standard errors clustered at the household level, in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

identical to the OLS results in column (1), which is confirmed by failure to reject the null of the endogeneity test for the annuity from real estate.[23]

Panels b. and c. of table 3 report estimates for subsamples based on age. Again the models (1)-(3) tell a similar story. The estimation results show that expenditure goals of people younger than 50 are affected by changes in the annuity from real estate, while the goals of older individuals are influenced more strongly by pension annuities. For the younger group the estimates based on winsorized data show that a decrease of 1 euro in the expected monthly annuity from real estate reduced expenditure goals significantly with 37 cents. A similar decline in the expected annuity from pensions reduced goals insignificantly with 2 cents. For older individuals the pattern is reversed: the coefficient on the real estate annuity is 0.03 (insignificant), while the coefficient on pensions is 0.34 (significant). The 2SLS model in column (3) does not indicate endogeneity for the annuity from real estate in either sample. Panel d shows that the differences between coefficients for the two samples are marginally significant for non-winsorized data, but only the difference in the effect of pensions remains significant once we winsorize.

The heterogeneous effects of shocks in pension entitlements by age are in line with the theory (equation (5)), which states that the effects are larger for older people because for them pension entitlements constitute a larger part of future income. Furthermore, those far from retirement can spread a shock over more years. Another interpretation could be that different age groups interpret shocks differently, with younger individuals more likely to see shocks to pension entitlements as transitory.

Heterogeneous effects of shocks in housing wealth could be explained by differences in how people consider their housing wealth. 51% of the older respondents in our dataset indicate they are not willing to move house in order to free resources in retirement. In addition, De Jong and Rouwendal (2012) show that among old age groups there is a strong preference to stay put. Since

[23]When we express both annuities and goals in logs rather than levels, we find no evidence for an effect of either annuity on the retirement expenditure goals (estimates available on request). This difference between models in logs and levels may indicate that our results are mainly driven by individuals that experienced substantial wealth shocks. Different explanations for a non-linear relationship between wealth shocks and expenditure goals include bounded rationality, mental accounting or inattention underlying the 'magnitude hypothesis' (Coulibaly and Li, 2006; Scholnick, 2013). This hypothesis states that individuals do smooth large income shocks, but that they will not bother to adjust optimally to small income changes. While disproportionately larger responses to larger shocks may be plausible, quadratic terms for wealth shocks are not statistically significant (estimates available on request). Hence, our evidence on the magnitude hypothesis is inconclusive.

Table 4: Shocks to annuities and changes in expenditure goals – heterogeneity by income

	Dependent variable: Δ retirement expenditure goal		
	(1) OLS	(2) OLS	(3) 2SLS
a. Low net household income in 2008[b]			
Δ pension	-0.0192	-0.00951	-0.0200
	(0.0902)	(0.134)	(0.0894)
Δ real estate	0.0330	0.152	0.112
	(0.115)	(0.190)	(0.230)
Constant	-99.6*	-100.1*	-86.0
	(51.8)	(52.6)	(60.4)
wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	41.7***
Endogeneity Δ real estate F(1, n-1)	–	–	0.18
n (number HHs)	137	137	137
N (total obs.)	149	149	149
b. High net household income in 2008[b]			
Δ pension	0.484**	0.314**	0.487**
	(0.200)	(0.133)	(0.199)
Δ real estate	0.0273	0.0518	0.0498
	(0.127)	(0.140)	(0.134)
Constant	-109.7	-204.5**	-102.0
	(13.9)	(83.0)	(137.7)
wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	86.2***
Endogeneity Δ real estate F(1, n-1)	–	–	0.14
n (number HHs)	145	145	145
N (total obs.)	158	158	158
c. Difference between low and high income groups			
(H_0: equal coefficients; statistics follow χ^2 (1) distribution)			
Δ pension	5.27**	2.95*	–
Δ real estate	0.00	0.18	–
Constant	0.00	1.13	–

[a] Δ annuities and Δ expenditures are winsorized at p5 and p95. Winsorizing at p1-p99, or p2.5-p97.5 leads to similar results.

[b] OLS models on income subsamples are estimated jointly. Cutoff between low and high income group is chosen to include about half of the respondents in each group.
The models also control for the individual-level covariates listed in Appendix D (with the exception of gender, age, education and degree of urbanisation, since those variables display little or no variation within individuals). Annuities and expenditures are standardized to a one-person household. Standard errors clustered at the household level, in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

reverse mortgages are rare, it is likely that they see their house as a bequest and/or as precautionary saving. Moreover, the results are in line with Mian and Sufi (2010), who mention that old households respond less aggressively to unexpected house price growth than young households. In the young age group, 66% indicate that they *are* willing to move house in order to free resources in retirement. So, the young may be more likely to see real estate as a means to finance retirement, which would explain their stronger reaction to changes in housing wealth documented in table 3.

Table 4 shows that the results are mainly driven by households with a relatively high income level. Thus, although most of the previous literature found that the marginal propensity to consume out of shocks is larger for households with modest resources (among others, McCarthy, 1995, Dynan et al., 2004, and Johnson et al., 2006), we find that in the long run high-income households adjust their (planned) consumption more after a wealth shock than low-income households. It could be that low-income households have fewer possibilities to adjust their retirement expenditure goals downward, as they have relatively more essential spending. In the long run low-income households may therefore prefer to retire later (in line with Lindeboom and Montizaan, 2018).

Robustness checks reported in Appendices G–I corroborate our results in quantile models, in specifications that only control for household composition and for annuities calculated under different assumptions regarding future indexation of pensions for inflation.[24] Furthermore, the relationship between pension annuities and expenditure goals cannot be explained by unemployment spells during the sample period (which are likely to influence both retirement expenditure goals and pension wealth). We do find that unemployment was an important concern: 11% of respondents were themselves unemployed and 21% lived in a household in which someone was unemployed at some point between 2008 and 2014. However, Appendix J shows that our results are virtually identical if we drop all respondents who experienced unemployment directly and remain very similar if we eliminate those who live in households in which at least one person was unemployed. Finally, the estimates for housing wealth are not driven by shifts between renting and home ownership. 78% of

[24]Estimates from quantile models can be found in Appendix G. Furthermore, following Christelis et al. (2015), Appendix H shows that these results are largely confirmed in models that only control for household composition. Hence, they are not driven by the potential endogeneity of some of our control variables. Appendix I assesses robustness of these findings to alternative scenarios for the indexation of penion entitlements after 2014. The estimates prove robust, because they are driven by variation between pension funds in the period 2008-2014. Changing the assumptions for indexation after the sample period affects the level of entitlements, but not their variation across funds.

the sample were homeowners during the entire sample period and Appendix K illustrates that all results hold for that subsample. Selecting only those individuals who never moved house during the relevant period entails substantial loss of data due to non-response to the survey from which that information is retrieved (14% of the sample is lost this way). Nonetheless, the estimates obtained from the subsample of homeowners who never moved are close to those reported in the main text and almost all remain statistically significant. The only exception is the annuity from housing for the younger subsample, which larger standard errors render insignificant.

6 The development of retirement savings adequacy

6.1 Empirical strategy

The last part of the paper analyzes to what extent co-movements between wealth and retirement expenditure goals mitigated the negative effect of the Great Recession on retirement savings adequacy. To this end, we compare the simulated preparedness based on a SUR model describing changes in wealth and retirement expenditure goals with a counterfactual scenario in which goals are kept constant at their 2008 level. In this way we isolate the impact of revisions in expenditure goals on the development of the adequacy of retirement resources.

We estimate SUR models to analyze how wealth and retirement expenditure goals of different socio-economic groups changed during the crisis. In these models we utilize data on all individuals (also those whom we observe only in 2008 or 2014). Separate equations for annuities and expenditures in 2008 and 2014 allow the relationships between goals and resources on the one hand and individual and household characteristics on the other to be different in 2014 compared to 2008. Hence, socio-economic groups are allowed to be affected differently by the recession (or, alternatively, the composition of subgroups may have changed). 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, three for 2008 and three for 2014:

$$M_i^t = \mathbf{x}_{m,i}^{t\prime}\boldsymbol{\beta}_m^t + u_{m,i}^t \tag{8}$$

$$N_i^t = \mathbf{x}_{n,i}^{t\prime}\boldsymbol{\beta}_n^t + u_{n,i}^t \tag{9}$$

$$W_i^t = \mathbf{x}_{w,i}^{t\prime}\boldsymbol{\beta}_w^t + u_{w,i}^t \tag{10}$$

where M_i^t is the log of the retirement expenditure goal reported by the man in household i in wave $t \in \{2008, 2014\}$ and N_i^t is the log of the retirement expenditure goal reported by the woman in household i and wave t. For singles, only one of the equations for minimal expenditures is relevant for each year (depending on gender). W_i^t is log annuitized household wealth, and $\mathbf{x}$ is a vector containing individual and household characteristics. We assume that the error terms follow a 6-variate normal distribution with mean zero and covariance matrix Σ and estimate the SUR model by maximum likelihood (see Roodman, 2011, for details on the CMP command that we used to estimate the model in Stata). Differences between the estimated coefficients for 2008 and 2014 reveal how the crisis (and the subsequent reforms) affected retirement goals and wealth for different socio-economic groups.

To assess the effect of co-movements between wealth and retirement expenditure goals on retirement savings adequacy, we use the SUR estimates to simulate preparedness in 2008, in 2014 and for the counterfactual scenario with annuities at their 2014 level and retirement expenditure goals at their 2008 level. We simulate goals and annuities for all individuals in the sample, regardless of whether they are actually observed in the data (to safeguard representativeness for the Dutch population). Since the dependent variables are missing at random conditional on covariates, the model estimates allow us to simulate preparedness in a way that is representative for the Dutch population.[25] Simulations are based on an expanded sample in which we replicate each observation 50 times (replicated observations have the same values of covariates but different error terms).

[25]The subsample for which we observe both wealth and retirement expenditure goals is not representative for the population. That is caused by substantial non-response to the expenditure question and incomplete linkage with administrative data for both years in our sample. De Bresser and Knoef (2015) show that non-response and failure to match administrative records are correlated with observed characteristics that are related to goals and resources, such as income. However, they also show that selection into the sample is exogenous once we condition on those observed characteristics.

From this expanded sample we calculate descriptive statistics of the distribution of the difference between annuities and retirement expenditure goals. Confidence intervals are obtained by means of parametric bootstrap consisting of 500 draws of parameter vectors from their estimated asymptotic distribution. We control for perceived question difficulty by setting the difficulty of imagining how much one would need to spend in retirement to the lowest value.

6.2 Simulation results

To investigate the extent to which co-movements between wealth and retirement expenditure goals tempered the negative effect of the crisis on retirement savings adequacy, we simulate preparedness using the SUR estimates presented in Appendix L. Figure 2 and table 5 summarize the simulation results (a more detailed description can be found in Appendix M). We find that between 2008 and 2014 the fraction of individuals who do not accumulate a sufficiently generous pension entitlement to afford their self-reported retirement expenditure goal increased from 27% to 32%. Furthermore, the median difference between pension annuities and retirement expenditure goals decreased from 24% in 2008 to 20% in 2014. Hence, based on pensions alone the aggregate preparedness for retirement of the Dutch population declined only slightly during the period of the financial crisis and the subsequent recession. A similar picture of modest decline in preparedness emerges if we include discretionary wealth and/or housing wealth: the fraction for whom the annuity will fall short of their consumption goal increased by a similar amount and the median excess annuity declined by less than 5%-points. In particular, while 11% of the population was predicted to fall short of their retirement expenditure goal in 2008 even if they would draw down housing wealth, this fraction had risen to 17% by 2014.

In order to separate changes in goals and resources we simulate the fraction that would have failed to meet their expenditure goals had the relationship between goals and covariates remained the same in 2014 as it was in 2008 (so that goals are fixed for a given level of covariates). In this counterfactual scenario the fraction with insufficient resources to afford their retirement expenditure goals would have almost doubled from 27% to 50% (if we only take pensions into account). Adjusting goals reduced the fraction of insufficiently prepared by 18%-points. Based on all wealth components,

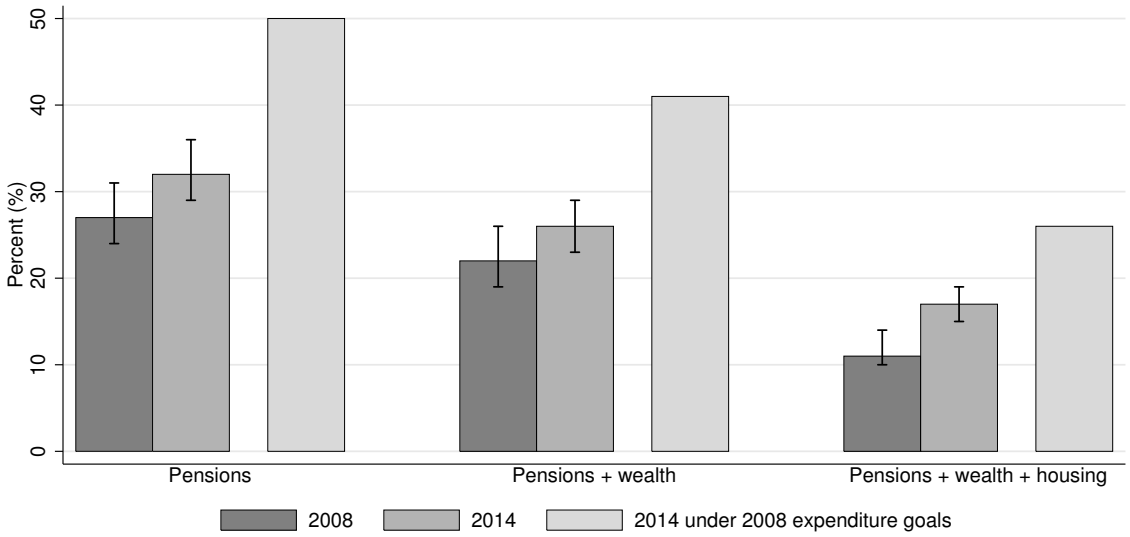

Figure 2: Simulated preparedness for retirement: fraction that cannot afford retirement expenditure goals (spikes are 90% CIs)

Table 5: Aggregate simulation results: differences between annuities and expenditure goals

	Pensions		Pensions + wealth		Pensions + wealth + housing	
	2008	2014	2008	2014	2008	2014
Median goal (2014 euro)	1565	1371	1560	1375	1561	1376
	(1494; 1648)	(1310; 1437)	(1492; 1645)	(1313; 1442)	(1491; 1645)	(1315; 1444)
Median annuity (2014 euro)	1989	1656	2146	1846	2795	2314
	(1964; 2013)	(1644; 1670)	(2119; 2179)	(1829; 1866)	(2758; 2838)	(2290; 2338)
Median difference (%)	24	20	32	31	57	53
	(19; 29)	(15; 25)	(27; 37)	(26; 35)	(52; 61)	(48; 58)

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. Understanding of items measuring consumption goals is controlled for by setting it to the highest level.

co-movements between wealth and retirement expenditure goals reduced the fraction falling short from about a quarter to 17%. These results show that co-movements between wealth and retirement expenditure goals mitigated the decline in retirement savings adequacy considerably.

Results are similar if we do not control for question difficulty. In that case expenditure goals are slightly lower in both years so that the median difference and the fraction that falls short respectively increase and decrease with 3%-points across the board. Hence, our simulations are not driven by the adjustment of expenditure goals for question difficulty. Moreover, robustness checks with different indexation scenarios for occupational pensions in 2014 indicate that annuities are robust with regard to reasonable variation in the assumptions under which they are computed. Robustness checks of the simulations are available on request.

7 Conclusion

This paper investigates co-movements between wealth and retirement expenditure goals using variation brought about by the Great Recession. These co-movements have important implications for retirement savings adequacy, and become increasingly important as the generosity of public pensions declines and people depend more on financial markets and housing wealth. We quantify co-movements and separate 'pure' wealth effects from third factors that influence both wealth and retirement expenditure goals. Furthermore, we examine how adjustments to expenditure goals mitigated the negative effect of the Great Recession on retirement savings adequacy, defined by the difference between individual retirement expenditure goals and annuitized wealth.

The setting of the Netherlands during the aftermath of the crisis is particularly interesting for this study, because it constituted an exogenous shock to a system that enrolls individuals into mandatory public and occupational pension schemes. Participants cannot choose their own pension fund, their contribution level, or their investment strategy. Hence, variation across funds in shocks to pension wealth, the most important source of income in retirement, is exogenous to workers. Moreover, we observe house price shocks from administrative data on the individual level. House prices decreased by 20% on average between 2008 and 2013, eating into the most important category

of discretionary wealth. This context of large and exogenous changes to wealth provides a unique opportunity to study the updating of expenditure goals.

For this study we match individual level administrative data on pensions, real estate and other forms of wealth with survey data on expenditure goals in retirement. Goals and resources are observed in 2008 and 2014. The combination of administrative data and surveys before and during the Great Recession is unique. The results show that between January 2008 and December 2014 both 'pure' wealth effects and macro factors played a role in co-movements between wealth and retirement expenditure goals. At the level of the individual, we find suggestive evidence for heterogeneous effects of shocks to pensions and real estate wealth. Shocks to pensions exert the stronger effect overall, with a reduction in goals of 23-33 cents on average for a 1 euro decrease in the pension annuity. Moreover, the relative importance of shocks in wealth components varies with age: individuals younger than 50 adjusted goals more strongly after a shock to housing wealth, while the goals of older people were most affected by shocks to pensions. Interestingly, while in the short run consumption of low income households is found to be more sensitive to wealth shocks (they have a relatively high marginal propensity to consume), we find that for the long run high income households are adjusting their retirement expenditure goals more after a wealth shock. Low income households have relatively high essential spending, therefore in the long run they may prefer to work more or retire later instead of adjusting their retirement expenditure goals downward (in addition to adjusting current consumption).

Comparison of the two cross-sectional waves shows that in case people would not have adjusted their goals, the percentage falling short with respect to their own retirement expenditure goals would have risen from 11% in 2008 to 26% in 2014 if we take all wealth components into account. Instead, people adjusted their goals downwards and the fraction who was ill-prepared increased only to 17% (based on all wealth components). The results underline the importance of co-movements between wealth and retirement expenditure goals, and that a static benchmark for the assessment of savings sufficiency not only misses cross-sectional differences in preferences, but also cannot capture adjustments to a changing environment.

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A Funding ratios

The y-axis of figure A1 shows the relative decline in funding ratios of Dutch pension funds during 2008. The figure shows that there are vast differences across funds in the relative decline in funding ratios. In the first quarter of 2008 only 7 funds had a funding ratio below 105%, 256 funds had a funding ratio between 105% and 130% and 166 funds had a funding ratio above 130%. In the first quarter of 2009 the number of funds with a funding ratio below 105% increased to 314, 65 funds had a funding ratio between $105 - 130\%$, and only 20 funds had a funding ratio above 130%.

Pension funds with a low funding ratio were forced to draw up recovery plans in early 2009 in order to bring their funding ratios back to the required levels within five years. These plans ended in late 2013. DNB (2014) reports that funding ratios recovered primarily as a results of rising equity prices, but as interest rates fell further and life expectancy rose, the recovery remained relatively limited. All in all, about 25% of the original decline in funding ratios since the credit crisis was recovered at the end of 2013 (with vast differences between individual funds).

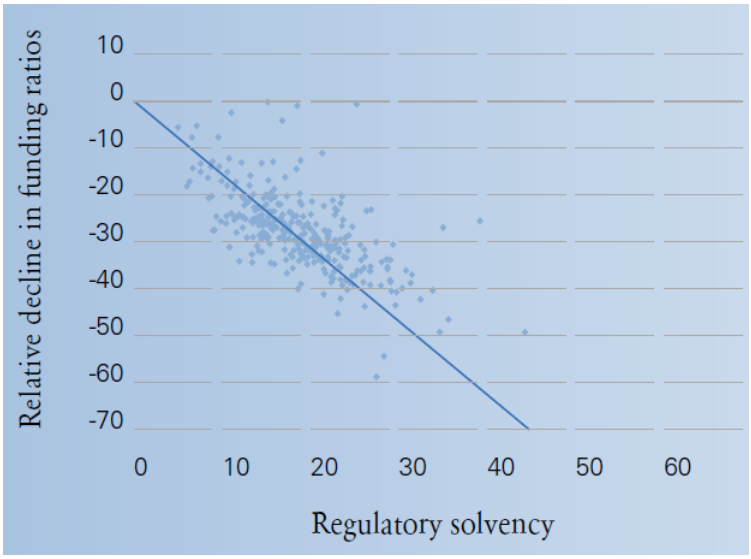

Figure A1: Relationship between regulatory solvency and relative decline in funding ratios during 2008, source: DNB (2009)

B Development consumer confidence

Figure B1 shows the development of a subquestion of consumer confidence, namely people's confidence in their financial situation in the next 12 months. The vertical axes shows the balance between positive and negative answers, normalized to 0 in the first quarter of 2008 for low, middle and high education levels. While the levels of confidence are higher for high education groups than for low education groups, the development is almost the same in both groups.

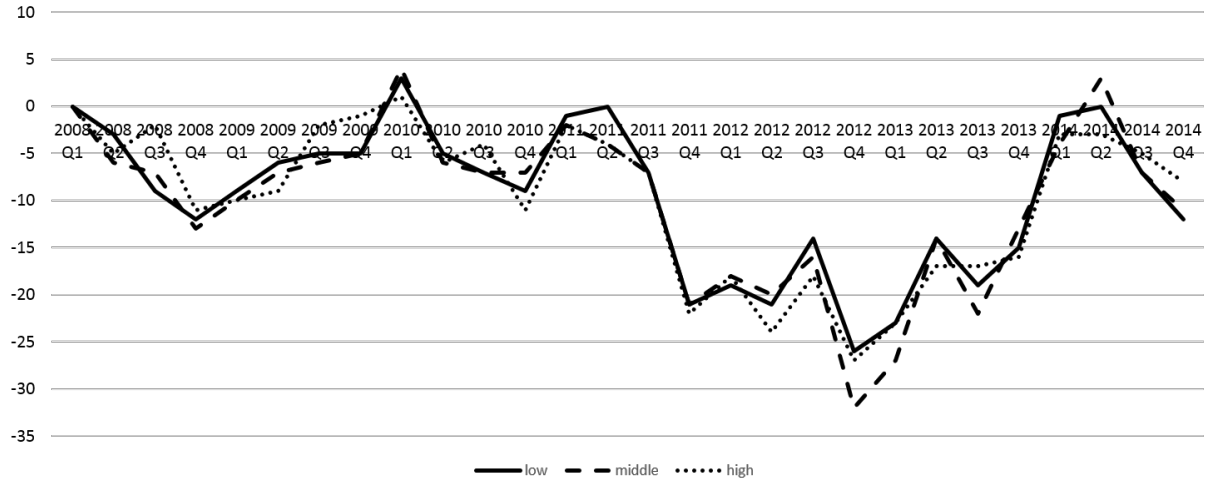

Figure B1: Development of people's confidence in their financial situation in the next 12 months, by education level

C Thinking about retirement and difficulty of the questions

Respondents find questions on expenditure goals during retirement challenging. This appendix first compares the distribution of retirement expenditure goals between retirees and non-retirees. Secondly, we provide descriptive statistics on the extent to which respondents have thought about retirement and how they evaluated the difficulty of the questions.

Comparison retirees and non-retirees

Table C1: Descriptive statistics of minimum expenditures during retirement

	Non-retired						Retired					
	N	Mean	SD	p25	Mdn	p75	N	Mean	SD	p25	Mdn	p75
a. 2008												
Min. monthly expenditures[a]	1142	1716	721	1218	1625	2031	254	1871	772	1335	1625	2226
Min. replacement rate (%)[b]	1142	74	28	56	73	88	254	83	26	67	81	98
b. 2014												
Min. monthly expenditures[a]	1918	1471	567	1095	1460	1825	837	1549	576	1168	1460	1825
Min. replacement rate (%)[b]	1891	67	31	46	63	81	826	65	24	49	63	77

[a] Monthly retirement expenditure goals are standardized to a one-person household and denoted in 2014 euros.
[b] Replacement rate := monthly expenditure goal/current income

Table C1 shows that retirees reported higher expenditure goals than non-retirees across the distribution, especially in 2008. The mean and the first and third quartiles were 100-200 euros higher among retirees. Such differences cannot be explained by current incomes, as illustrated by replacement rates that were also around 10pp higher among retirees. However, the differences in levels are modest compared to the standard deviations in excess of 700 euros for both subsamples. Differences were smaller in 2014: less than 100 euros or 5pp in replacement rates. Hence, though we do find that retirees had more ambitious goals than those not yet retired, the order of magnitude was the same for both groups. Furthermore, the variation within groups far exceeds that between groups.

Difficulty of the questions

Table C2 summarizes items that are related to perceived difficulty of the questions. These questions allow us to investigate whether those who do not understand the questionnaire give systematically

Table C2: Descriptives of self-reported question difficulty

	2008				2014			
	Mean	Age 25-39	Age 40-54	Age 55+	Mean	Age 25-39	Age 40-54	Age 55+
I find it very difficult to imagine how much money I would want to have during retirement.								
Fully disagree	0.07	0.04	0.06	0.15	0.05	0.02	0.03	0.11
Somewhat disagree	0.09	0.07	0.10	0.11	0.09	0.06	0.08	0.12
Somewhat agree	0.42	0.43	0.42	0.41	0.38	0.31	0.39	0.41
Fully agree	0.41	0.47	0.41	0.33	0.48	0.60	0.51	0.36
N	1610	502	728	380	3272	851	1257	1164

Table C3: Descriptives of retirement expenditure goals by level of question difficulty

	2008				2014			
I find it very difficult to imagine goals...	N	Mean	Median	SD	N	Mean	Median	SD
a. Consumption goals: levels								
...fully disagree	109	1913	1669	913	139	1633	1460	735
...somewhat disagree	133	1918	1787	797	212	1449	1430	518
...somewhat agree	530	1695	1625	677	806	1482	1460	572
...fully agree	399	1639	1625	674	804	1434	1400	532
...difficult to imagine: missing	266	1904	1669	856	865	1546	1460	577
b. Consumption goals: replacement rates (in %, relative to current household income)								
...fully disagree	109	74	75	22	137	67	63	26
...somewhat disagree	133	80	77	37	208	64	58	30
...somewhat agree	530	74	71	28	790	67	63	31
...fully agree	399	71	71	27	789	69	66	31
...difficult to imagine: missing	266	83	82	26	852	65	63	24

different answers. When asked whether individuals find the question difficult to answer, in 2014 more individuals said they fully agree to the statement than in 2008. This holds especially for individuals under 54.

Table C3 summarizes the retirement expenditure goals by level of question difficulty. Individuals who find the question more difficult on average report lower retirement expenditure goals. However, when retirement expenditure goals are measured relative to current household income this is no longer the case, suggesting that question difficulty correlates with current household income.

D Descriptives socio-economic variables

Table D1: Descriptives of socio-economic variables

a. Household level variables					**b. Individual level variables**				
	2008		2014			2008		2014	
	Mean	SD	Mean	SD		Mean	SD	Mean	SD
Single	0.20	0.40	0.38	0.48	Single	0.16	0.37	0.29	0.45
Female × single	0.12	0.32	0.21	0.41	Female	0.52	0.50	0.53	0.50
Age HH head	50	13	53	16	Age	49	13	53	15
Any kids	0.47	0.50	0.34	0.48	HH head	0.59	0.49	0.64	0.48
Number of kids	0.88	1.10	0.66	1.03	Any kids	0.48	0.50	0.37	0.48
Homeowner	0.76	0.43	0.69	0.46	Number of kids	0.92	1.11	0.72	1.06
					Homeowner	0.77	0.42	0.73	0.45
Education									
Primary	0.04	0.20	0.05	0.21	Education				
Intermediate secondary	0.18	0.39	0.16	0.36	Primary	0.09	0.29	0.07	0.25
Higher secondary	0.08	0.27	0.07	0.25	Intermediate secondary	0.26	0.44	0.22	0.42
Intermediate vocational	0.27	0.44	0.26	0.44	Higher secondary	0.08	0.27	0.08	0.28
Higher vocational	0.31	0.46	0.31	0.46	Intermediate vocational	0.25	0.43	0.26	0.44
University	0.12	0.33	0.16	0.37	Higher vocational	0.23	0.42	0.26	0.44
					University	0.08	0.28	0.12	0.32
Primary activity									
1 salary worker	0.70	0.46	0.60	0.49	Primary activity				
all salary workers	0.45	0.50	0.41	0.49	Salary worker	0.58	0.49	0.50	0.50
1 self-employed	0.13	0.34	0.11	0.31	Self-employed	0.08	0.28	0.07	0.25
all self-employed	0.04	0.19	0.03	0.18	Family business	0.02	0.13	0.01	0.11
1 family business	0.02	0.16	0.02	0.13	ZZP	0.07	0.25	0.06	0.23
all family business	0.01	0.09	0.01	0.07	HH work	0.12	0.32	0.08	0.27
1 zzp	0.11	0.31	0.10	0.30	Retired	0.15	0.36	0.24	0.43
all zzp	0.02	0.15	0.02	0.15	Disabled	0.03	0.17	0.04	0.20
1 retired	0.20	0.40	0.28	0.45	Other	0.04	0.20	0.08	0.27
all retired	0.10	0.30	0.19	0.40					
1 disabled	0.06	0.23	0.06	0.24	Marital status				
all disabled	0.01	0.10	0.02	0.15	Married	0.71	0.45	0.59	0.49
					Separated/divorced	0.08	0.28	0.11	0.32
Marital status					Widowed	0.03	0.17	0.06	0.24
Married	0.68	0.47	0.52	0.50	Never married	0.18	0.38	0.23	0.42
Separated/divorced	0.09	0.29	0.14	0.35					
Widowed	0.04	0.19	0.07	0.25	Urbanisation				
Never married	0.19	0.39	0.27	0.44	Extremely urban	0.12	0.33	0.15	0.36
					Very urban	0.27	0.44	0.26	0.44
Urbanisation					Moderately urban	0.22	0.42	0.23	0.42
Extremely urban	0.13	0.33	0.17	0.38	Slightly urban	0.23	0.42	0.21	0.41
Very urban	0.27	0.44	0.26	0.44	Not urban	0.15	0.36	0.14	0.35
Moderately urban	0.22	0.42	0.22	0.42					
Slightly urban	0.23	0.42	0.20	0.40	Net personal income	2025	7812	1796	4580
Not urban	0.15	0.36	0.14	0.35	Net household income	3528	6920	3052	4682
Net HH income	3529	7604	2987	5423					
N	1894		4098			2308		5623	

Table D2: Descriptives of socio-economic variables for complete sample and for the subsample that is observed twice

	a. 2008			**b. 2014**		
	Complete sample		Observed twice	Complete sample		Observed twice
	Mean	(SD)	Mean	Mean	(SD)	Mean
Single	0.16	(0.37)	0.21	0.29	(0.45)	0.21
Female	0.52	(0.50)	0.41	0.53	(0.50)	0.41
Age	49	(13)	51	53	(15)	58
HH head	0.59	(0.49)	0.70	0.64	(0.48)	0.71
Any kids	0.48	(0.50)	0.42	0.37	(0.48)	0.37
Number of kids	0.92	(1.11)	0.75	0.72	(1.06)	0.71
Homeowner	0.77	(0.42)	0.80	0.73	(0.45)	0.81
Education						
Primary	0.09	(0.29)	0.07	0.07	(0.25)	0.06
Intermediate secondary	0.26	(0.44)	0.21	0.22	(0.42)	0.22
Higher secondary	0.08	(0.27)	0.08	0.08	(0.28)	0.07
Intermediate vocational	0.25	(0.43)	0.24	0.26	(0.44)	0.23
Higher vocational	0.23	(0.42)	0.33	0.26	(0.44)	0.33
University	0.08	(0.28)	0.07	0.12	(0.32)	0.08
Primary activity						
Salary worker	0.58	(0.49)	0.58	0.50	(0.50)	0.47
Self-employed	0.08	(0.28)	0.06	0.07	(0.25)	0.05
Family business	0.02	(0.13)	0.00	0.01	(0.11)	0.00
ZZP	0.07	(0.25)	0.05	0.06	(0.23)	0.05
HH work	0.12	(0.32)	0.08	0.08	(0.27)	0.09
Retired	0.15	(0.36)	0.22	0.24	(0.43)	0.30
Disabled	0.03	(0.17)	0.03	0.04	(0.20)	0.03
Other	0.04	(0.20)	0.03	0.08	(0.27)	0.07
Marital status						
Married	0.71	(0.45)	0.71	0.59	(0.49)	0.73
Separated/divorced	0.08	(0.28)	0.09	0.11	(0.32)	0.08
Widowed	0.03	(0.17)	0.03	0.06	(0.24)	0.03
Never married	0.18	(0.38)	0.18	0.23	(0.42)	0.16
Urbanisation						
Extremely urban	0.12	(0.33)	0.12	0.15	(0.36)	0.11
Very urban	0.27	(0.44)	0.25	0.26	(0.44)	0.26
Moderately urban	0.22	(0.42)	0.26	0.23	(0.42)	0.26
Slightly urban	0.23	(0.42)	0.22	0.21	(0.41)	0.23
Not urban	0.15	(0.36)	0.14	0.14	(0.35)	0.14
Net personal income	2025	(7812)	1945	1796	(4580)	1846
Net household income	3528	(6920)	2420	3052	(4682)	2343
N	2308		307	5623		307

E Descriptive statistics assets and debts

Table E1 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 euros. Residential real estate made up close to two thirds of the 2008 assets portfolio on average and the median value was 246 thousand euros. By 2014 the median value of residential real estate declined to 170 thousand euros and the average share in the assets portfolio 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.

Table E1: Descriptive statistics of assets and debts

	2008						2014					
	% portfolio[a]	Mean	SD	p25	Mdn	p75	% portfolio[a]	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
Residential real estate	65	247.2	222.8	104.7	246.0	335.6	58	168.5	149.0	0.0	170.2	242.7
Non-residential 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			

[a] Mean share of category in HH portfolio conditional on having non-negative total asset/debt.
Assets and debt in thousands of 2014 euros.

F Assumptions underlying the annuities

An annuity value is an estimated monthly income from pensions, savings, and housing at the date of retirement. In order to construct such annuities we need to make assumptions about the future. The future looked different in 2008 and 2014, so that in some cases the assumptions differ between those years. The scenario for the future from the perspective of 2014 was set up in correspondence with specialists at the Dutch Ministry of Social Affairs and Employment, the Ministry of the Interior and Kingdom Relations, the Ministry of Finance and the Netherlands Bureau for Economic Policy Analysis (CPB). In this section we explain the assumptions underlying the annuity values. Moreover, we describe how we updated the private pension data to include policy changes introduced in 2013.

Life course

The level of a public pension depends on the number of years someone lived in the Netherlands between the ages of 25 and 67, and on one's marital status during retirement. We observe the number of years individuals lived outside the Netherlands up to 2012 and assume that they will not leave the Netherlands from this moment onwards. Moreover, we assume that marital status stays the same. That is, we take into account marital status in our models, but we do not model future divorces, marriages, or widowhood. Lastly, we assume that individuals stay in their job until they reach the statutory retirement age. (We verify that results are robust to excluding all respondents who were unemployed at any time between 2008 and 2014, or lived with someone who was unemployed.)

Statutory retirement age and private pension target age

In 2008 the age at which one could claim public pensions was 65, which was also the target age for defined benefit calculations in private pension plans. At that point there was no indication that this would change in the future (Goudswaard, 2011). We thus assume a retirement age of 65 when calculating the 2008 annuities.

In 2012 a law had been passed ensuring a stepwise increase in the statutory retirement age to 67 in 2023, after which it will raise in accordance with life expectancy. In 2014 an amendment was

proposed to accelerate the process: the statutory retirement age now increases stepwise to 67 in 2021. The level of the flat rate public pension, however, remains the same. It tracks the minimum wage and we assume that it will be indexed for inflation in the future (as it was during the last decade). The target age for the defined benefit calculations in private pension plans was set at 67 for the part of the claim built up after 2012. The increase of the target age went hand in hand with a lowering of the maximum of tax advanced yearly accrual rates. We assume that in the future any further increases in the target age will be accompanied with lower accrual rates, such that the pension levels remain roughly unchanged. In the calculation of private pension entitlements, we use the statutory retirement age, inducing some exogenous variation between generations.

Inflation and indexation

We assume an inflation of 2% each year. Both for the 2008 and the 2014 annuities, we assume the level of public pension benefits to be fully adjusted for inflation.

In 2008, 90% of occupational pension wealth was adjusted for inflation. During that time the financial position of private pension funds seemed perfectly in order, and in January 2008 people were optimistic about their future pensions. For the calculation of 2008 annuities we assume the situation remains unchanged and all pension entitlements are adjusted for inflation by 90%.

In the past years, however, occupational pension wealth has rarely been adjusted for inflation, so the value of pension wealth has declined in real terms. For the 2014 annuities we assume that pension funds will not adjust pension entitlements for inflation until 2020, after which indexation will rise gradually to 90% in 2030 and the years after. The 2008 and 2014 expected indexation patterns and the realizations for the years 2008-2014 are shown in Figure F1.

Development of private savings and housing wealth

We take into account the current level of private savings and assume a real yearly interest rate of 1% per year. Private savings are annuitized at the moment of retirement given the most recent mortality tables of the CBS and a real interest rate of 1%. The annuitization procedure is explained in detail in Knoef et al. (2016a).

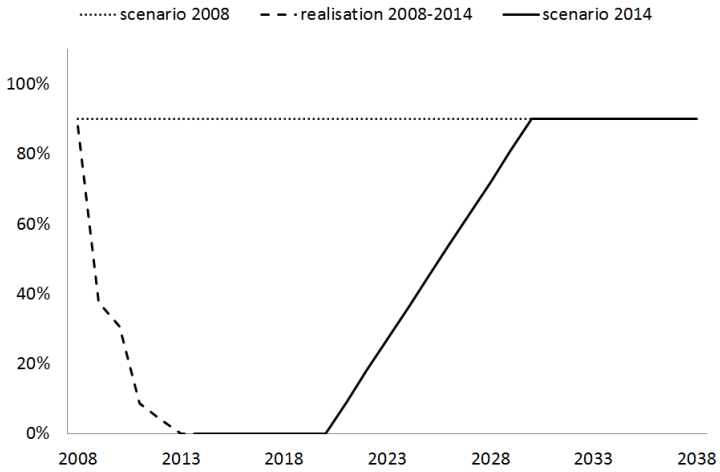

Figure F1: Indexation scenario's and realisations, after Knoef et al. (2016b)

We assume that real housing prices increase with 1% a year. For individuals with positive net housing wealth we assume that the net imputed rent (1%) is put in a savings account where it receives an annual interest of 1%. For individuals who have a mortgage we assume mortgage payments are made. As of 2013 only individuals holding a mortgage contract with a pay off scheme of at most thirty years can benefit from fiscal benefits. We therefore assume individuals born before 1968 will pay off 25% of the remaining mortgage debt, individuals born between 1968 and 1978 will pay 50%, and individuals born after 1878 will pay 75%. Housing wealth is annuitized at the moment of retirement, given the most recent mortality tables of the CBS and a real interest rate of 1%, similar to private savings.

The third-pillar pensions (voluntary individual pension products) are not shown in the administrative data, since they are not subject to taxation until they are paid out. However, the LISS survey does provide information on wealth accumulated in these products. For individuals who are self-employed and have a third-pillar pension product according to the survey, we assume that they will contribute 1.875% of their gross wage until retirement, in line with the contributions of salary workers to their occupational pension plans.

Updating 2012 occupational pension data

The latest administrative data available on occupational pension entitlements dates from 2012. Between 2012 and the end of 2014 several policy changes have taken place that will affect pension entitlements. Furthermore, most pension funds have not been able to correct the DB entitlements for inflation, and some even cut entitlements.

The entitlement data consist of two elements: (1) the accrued rights; (2) the rights to be accrued assuming income remains unchanged. First, we correct the accrued rights for the absence of inflation adjustment between 2012 and 2014. Second, we decrease the accrued rights by an amount equal to the cuts made in the respondent's pension fund.[26] The administrative data contain information on the amount of pension rights, but not on the name of the pension fund. Therefore, we provided the survey respondents in 2014 a list with the biggest pension funds in the Netherlands and asked them indicate at which of those they had entitlements. Third, maximum pension contributions declined from 2.25% to 2.15% in 2014, and further to 1.875% in 2015. The total relative decline is 17%. We assume that the actual build up percentages decrease to the same extent for all pension funds, hence we decrease the rights to be accrued until retirement by 17% for all individuals. Finally, the target age used to calculate the DB income changed from 65 to 67 in 2013. Accrued pension rights are therefore adjusted to the new statutory retirement age, at a rate of 7.5% per year. Pension rights that are to be accumulated in the years until retirement are extrapolated to the new statutory retirement age.

[26]Five major pension funds needed to cut accrued pension rights, that is 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, 2.0% in 2014).

G Quantile models of changes in expenditure goals

Table G1a: Quantiles of shocks to annuities and changes in expenditure goals – heterogeneity by age

	Dependent variable: Δ retirement expenditure goal (2014 Euros)				
	p30	p40	p50	p60	p70
a. Complete sample					
Δ pension	0.162	0.206**	0.287**	0.263**	0.254**
	(-0.0421; 0.467)	(0.0258; 0.475)	(0.0533; 0.465)	(0.0683; 0.491)	(0.0951; 0.536)
Δ real estate	0.126	0.0520	0.00837	0.0594	0.104
	(-0.154; 0.357)	(-0.114; 0.306)	(-0.115; 0.294)	(-0.0946; 0.267)	(-0.210; 0.231)
Sample quantiles	-469	-324	-206	-125	18
N (total obs.)			307		
b. Age 25-49					
Δ pension	-0.0160	0.123	0.194	0.322	0.168
	(-0.303; 0.597)	(-0.180; 0.599)	(-0.117; 0.588)	(-0.0585; 0.581)	(-0.0576; 0.574)
Δ real estate	0.235	0.199	0.150	0.146**	0.170**
	(-0.250; 0.487)	(-0.102; 0.501)	(-0.0897; 0.471)	(0.00766; 0.491)	(0.0163; 0.594)
Sample quantiles	-430	-311	-206	-82	120
N (total obs.)			129		
c. Age 50+					
Δ pension	0.284	0.272**	0.262**	0.272**	0.298**
	(-0.0110; 0.601)	(0.0426; 0.544)	(0.0310; 0.528)	(0.0493; 0.547)	(0.0556; 0.685)
Δ real estate	0.154	0.0313	-0.0103	0.000703	-0.185
	(-0.212; 0.400)	(-0.253; 0.360)	(-0.267; 0.324)	(-0.343; 0.282)	(-0.431; 0.199)
Sample quantiles	-494	-326	-204	-139	-18
N (total obs.)			178		

The models also control for the individual-level covariates listed in Appendix D (with the exception of gender, age, education and degree of urbanisation, since those variables display little or no variation within individuals). Annuities and expenditures are standardized to a one-person household. Bootstrapped 95% confidence intervals in parentheses; ** significant at 5%.

Table G1b: Quantiles of shocks to annuities and changes in expenditure goals – heterogeneity by income

	Dependent variable: Δ retirement expenditure goal (2014 Euros)				
	p30	p40	p50	p60	p70
a. Low net household income in 2008					
Δ pension	0.0742	0.121	0.0794	0.0737	0.123
	(-0.258; 0.335)	(-0.212; 0.333)	(-0.169; 0.370)	(-0.152; 0.392)	(-0.205; 0.395)
Δ real estate	0.0288	-0.0239	0.0408	-0.0142	0.0738
	(-0.473; 0.537)	(-0.442; 0.472)	(-0.368; 0.416)	(-0.456; 0.335)	(-0.407; 0.400)
Sample quantiles	-351	-261	-165	-81	83
N (total obs.)			149		
b. High net household income in 2008					
Δ pension	0.341	0.234	0.334	0.381**	0.471**
	(-0.0708; 0.627)	(-0.0799; 0.686)	(-0.00577; 0.680)	(0.0312; 0.662)	(0.0373; 0.763)
Δ real estate	0.119	0.0877	0.0782	0.158	0.188
	(-0.320; 0.358)	(-0.275; 0.325)	(-0.272; 0.294)	(-0.280; 0.296)	(-0.251; 0.271)
Sample quantiles	-603	-393	-209	-165	-18
N (total obs.)			158		

The models also control for the individual-level covariates listed in Appendix D (with the exception of gender, age, education and degree of urbanisation, since those variables display little or no variation within individuals). Annuities and expenditures are standardized to a one-person household. Bootstrapped 95% confidence intervals in parentheses; ** significant at 5%.

H Models of changes in expenditure goals that only control for family composition

Table H1a: Shocks to annuities and changes in expenditure goals

	Dependent variable: Δ retirement expenditure goal		
	(1) OLS	(2) OLS	(3) 2SLS
a. All ages			
Δ Pension (β_1)	0.329**	0.235**	0.329***
	(0.129)	(0.0930)	(0.128)
Δ Real estate (β_2)	0.0618	0.139	0.0836
	(0.105)	(0.114)	(0.111)
Constant (β_0)	-87.4	-111.2***	-83.1
	(63.9)	(41.4)	(62.1)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	104.9***
Endogeneity Δ real estate F(1, n-1)	–	–	0.17
n (number HHs)	282	282	282
N (total obs.)	307	307	307
b. Age 25-49[b]			
Δ Pension (β_1)	0.144	0.140	0.141
	(0.123)	(0.142)	(0.124)
Δ Real estate (β_2)	0.154*	0.182	0.113
	(0.0832)	(0.191)	(0.104)
Constant (β_0)	-110.6*	-104.7	-115.8*
	(66.0)	(68.0)	(66.0)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, 117)	–	–	34.2***
Endogeneity Δ real estate F(1, 117)	–	–	0.35
n (number HHs)	118	118	118
N (total obs.)	129	129	129
c. Age 50+[b]			
Δ Pension (β_1)	0.400**	0.304**	0.398**
	(0.170)	(0.119)	(0.170)
Δ Real estate (β_2)	-0.00845	0.0857	0.0581
	(0.155)	(0.139)	(0.157)
Constant (β_0)	-115.8	-134.3***	-99.0
	(91.1)	(51.9)	(89.9)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	94.2***
Endogeneity Δ real estate F(1, n-1)	–	–	0.81
n (number HHs)	168	168	168
N (total obs.)	178	178	178
d. Difference between ages 25-49 and 50+			
(H_0: equal coefficients; statistics follow χ^2 (1) distribution)			
Δ Pension (β_1)	1.49	0.78	–
Δ Real estate (β_2)	0.85	0.17	–
Constant (β_0)	0.00	0.12	–

[a] Δ Annuities and Δ expenditures are winsorized at p5 and p95. Winsorizing at p1-p99, or p2.5-p97.5 leads to similar results.

[b] OLS models on age subsamples are estimated jointly.

The models also control for living with a partner and the number of children in the household. Annuities and expenditures are standardized to a one-person household. Standard errors clustered at the household level, in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table H1b: Shocks to annuities and changes in expenditure goals – heterogeneity by income

	Dependent variable: Δ retirement expenditure goal		
	(1) OLS	(2) OLS	(3) 2SLS
a. Low net household income in 2008[b]			
Δ pension	0.0496	0.0674	0.0509
	(0.0840)	(0.125)	(0.0837)
Δ real estate	0.0153	0.0779	-0.0109
	(0.0980)	(0.186)	(0.169)
Constant	-125.2***	-121.2***	-128.3***
	(43.8)	(45.7)	(44.9)
wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	39.9***
Endogeneity Δ real estate F(1, n-1)	–	–	0.059
n (number HHs)	137	137	137
N (total obs.)	149	149	149
b. High net household income in 2008[b]			
Δ pension	0.434**	0.297**	0.435**
	(0.184)	(0.137)	(0.184)
Δ real estate	0.0729	0.118	0.0904
	(0.133)	(0.145)	(0.139)
Constant	-61.9	-120.1	-56.9
	(119.6)	(79.6)	(120.5)
wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	90.9***
Endogeneity Δ real estate F(1, n-1)	–	–	0.080
n (number HHs)	145	145	145
N (total obs.)	158	158	158
c. Difference between low and high income groups			
(H_0: equal coefficients; statistics follow χ^2 (1) distribution)			
Δ pension	3.61*	1.53	–
Δ real estate	0.12	0.03	–
Constant	0.25	0.00	–

[a] Δ annuities and Δ expenditures are winsorized at p5 and p95. Winsorizing at p1-p99, or p2.5-p97.5 leads to similar results.

[b] OLS models on income subsamples are estimated jointly. Cutoff between low and high income group is chosen to include about half of the respondents in each group.
The models also control for living with a partner and the number of children in the household. Annuities and expenditures are standardized to a one-person household. Standard errors clustered at the household level, in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

I Models of changes in expenditures goals – robustness to assumptions under which annuities are calculated

Table I1a: Shocks to annuities and changes in expenditure goals; annuities calculated under *low* indexation scenario for future pension entitlements

	Dependent variable: Δ retirement expenditure goal		
	(1) OLS	(2) OLS	(3) 2SLS
a. All ages			
Δ Pension (β_1)	0.325**	0.211**	0.325**
	(0.141)	(0.0996)	(0.135)
Δ Real estate (β_2)	0.0579	0.155	0.0609
	(0.108)	(0.119)	(0.117)
Constant (β_0)	-97.2	-131.1***	-96.5
	(74.6)	(47.0)	(71.1)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	115.60***
Endogeneity Δ real estate F(1, n-1)	–	–	2.9e-03
n (number HHs)	282	282	282
N (total obs.)	307	307	307
b. Age 25-49[b]			
Δ Pension (β_1)	0.0484	-0.0145	0.0480
	(0.116)	(0.159)	(0.116)
Δ Real estate (β_2)	0.227***	0.372**	0.219**
	(0.0647)	(0.180)	(0.0875)
Constant (β_0)	-89.3	-93.0	-90.6
	(67.6)	(83.5)	(69.8)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, 117)	–	–	32.93***
Endogeneity Δ real estate F(1, 117)	–	–	0.01
n (number HHs)	118	118	118
N (total obs.)	129	129	129
c. Age 50+[b]			
Δ Pension (β_1)	0.418**	0.346***	0.418**
	(0.183)	(0.117)	(0.183)
Δ Real estate (β_2)	-0.0461	0.0236	-0.0290
	(0.144)	(0.141)	(0.156)
Constant (β_0)	-143.1	-169.5***	-138.6
	(105.5)	(57.9)	(0.105)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	134.0***
Endogeneity Δ real estate F(1, n-1)	–	–	0.05
n (number HHs)	168	168	168
N (total obs.)	178	178	178
d. Difference between ages 25-49 and 50+			
(H_0: equal coefficients; statistics follow $\chi^2(1)$ distribution)			
Δ Pension (β_1)	2.91*	3.34*	–
Δ Real estate (β_2)	2.99*	2.32	–
Constant (β_0)	0.19	0.58	–

[a] Δ Annuities and Δ expenditures are winsorized at p5 and p95. Winsorizing at p1-p99, or p2.5-p97.5 leads to similar results.

[b] OLS models on age subsamples are estimated jointly.

The models also control for the individual-level covariates listed in Appendix D (with the exception of gender, age, education and degree of urbanisation, since those variables display little or no variation within individuals). Annuities and expenditures are standardized to a one-person household. Standard errors clustered at the household level, in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table I1b: Shocks to annuities and changes in expenditure goals – heterogeneity by income; annuities calculated under *low* indexation scenario for future pension entitlements

	Dependent variable: Δ retirement expenditure goal		
	(1) OLS	(2) OLS	(3) 2SLS
a. Low net household income in 2008[b]			
Δ pension	-0.0136	-0.00460	-0.0159
	(0.0911)	(0.138)	(0.0900)
Δ real estate	0.0332	0.152	0.112
	(0.115)	(0.191)	(0.230)
Constant	-98.7*	-99.2*	-85.5
	(52.4)	(54.4)	(60.6)
wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	41.6***
Endogeneity Δ real estate F(1, n-1)	–	–	0.18
n (number HHs)	137	137	137
N (total obs.)	149	149	149
b. High net household income in 2008[b]			
Δ pension	0.470**	0.280**	0.474**
	(0.202)	(0.135)	(0.201)
Δ real estate	0.0274	0.0578	0.0519
	(0.127)	(0.139)	(0.133)
Constant	-105.0	-210.5**	-96.4
	(145.3)	(87.5)	(143.8)
wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	85.7***
Endogeneity Δ real estate F(1, n-1)	–	–	0.17
n (number HHs)	145	145	145
N (total obs.)	158	158	158
c. Difference between low and high income groups			
(H_0: equal coefficients; statistics follow χ^2 (1) distribution)			
Δ pension	4.77**	2.18	–
Δ real estate	0.00	0.16	–
Constant	0.00	1.17	–

[a] Δ annuities and Δ expenditures are winsorized at p5 and p95. Winsorizing at p1-p99, or p2.5-p97.5 leads to similar results.

[b] OLS models on income subsamples are estimated jointly. Cutoff between low and high income group is chosen to include about half of the respondents in each group.
The models also control for the individual-level covariates listed in Appendix D (with the exception of gender, age, education and degree of urbanisation, since those variables display little or no variation within individuals). Annuities and expenditures are standardized to a one-person household. Standard errors clustered at the household level, in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table I2a: Shocks to annuities and changes in expenditure goals; annuities calculated under *high* indexation scenario for future pension entitlements

	Dependent variable: Δ retirement expenditure goal		
	(1) OLS	(2) OLS	(3) 2SLS
a. All ages			
Δ Pension (β_1)	0.332**	0.227**	0.332**
	(0.140)	(0.100)	(0.134)
Δ Real estate (β_2)	0.0577	0.153	0.0591
	(0.108)	(0.120)	(0.117)
Constant (β_0)	-109.7	-136.5***	-109.3*
	(69.1)	(43.9)	(65.8)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	115.80***
Endogeneity Δ real estate F(1, n-1)	–	–	5.8e-04
n (number HHs)	282	282	282
N (total obs.)	307	307	307
b. Age 25-49[b]			
Δ Pension (β_1)	0.0472	-0.00879	0.0468
	(0.111)	(0.149)	(0.111)
Δ Real estate (β_2)	0.228***	0.372**	0.220**
	(0.0646)	(0.180)	(0.0877)
Constant (β_0)	-93.8	-90.0	-95.1
	(59.5)	(70.8)	(61.7)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, 117)	–	–	33.3***
Endogeneity Δ real estate F(1, 117)	–	–	0.01
n (number HHs)	118	118	118
N (total obs.)	129	129	129
c. Age 50+[b]			
Δ Pension (β_1)	0.417**	0.339***	0.418**
	(0.183)	(0.116)	(0.182)
Δ Real estate (β_2)	-0.0458	0.0273	-0.0284
	(0.144)	(0.141)	(0.156)
Constant (β_0)	-144.1	-173.3***	-139.5
	(105.2)	(57.6)	(104.4)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	134.1***
Endogeneity Δ real estate F(1, n-1)	–	–	0.05
n (number HHs)	168	168	168
N (total obs.)	178	178	178
d. Difference between ages 25-49 and 50+			
(H_0: equal coefficients; statistics follow $\chi^2(1)$ distribution)			
Δ Pension (β_1)	3.01*	3.38*	–
Δ Real estate (β_2)	2.99*	2.27	–
Constant (β_0)	0.18	0.85	–

[a] Δ Annuities and Δ expenditures are winsorized at p5 and p95. Winsorizing at p1-p99, or p2.5-p97.5 leads to similar results.

[b] OLS models on age subsamples are estimated jointly.

The models also control for the individual-level covariates listed in Appendix D (with the exception of gender, age, education and degree of urbanisation, since those variables display little or no variation within individuals). Annuities and expenditures are standardized to a one-person household. Standard errors clustered at the household level, in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table I2b: Shocks to annuities and changes in expenditure goals– heterogeneity by income; annuities calculated under *high* indexation scenario for future pension entitlements

	Dependent variable: Δ retirement expenditure goal		
	(1) OLS	(2) OLS	(3) 2SLS
a. Low net household income in 2008[b]			
Δ pension	-0.0279	-0.0243	-0.0296
	(0.0921)	(0.138)	(0.0909)
Δ real estate	0.0334	0.154	0.112
	(0.115)	(0.190)	(0.230)
Constant	-101.1**	-102.9**	-87.8
	(51.1)	(51.5)	(59.5)
wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	41.5***
Endogeneity Δ real estate F(1, n-1)	–	–	0.18
n (number HHs)	137	137	137
N (total obs.)	149	149	149
b. High net household income in 2008[b]			
Δ pension	0.487**	0.322**	0.489**
	(0.199)	(0.136)	(0.198)
Δ real estate	0.0251	0.0514	0.0466
	(0.127)	(0.140)	(0.134)
Constant	-119.7	-208.4**	-112.4
	(134.5)	(81.6)	(132.9)
wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	86.1***
Endogeneity Δ real estate F(1, n-1)	–	–	0.13
n (number HHs)	145	145	145
N (total obs.)	158	158	158
c. Difference between low and high income groups			
(H_0: equal coefficients; statistics follow χ^2 (1) distribution)			
Δ pension	5.52**	3.19*	–
Δ real estate	0.00	0.19	–
Constant	0.02	1.20	–

[a] Δ annuities and Δ expenditures are winsorized at p5 and p95. Winsorizing at p1-p99, or p2.5-p97.5 leads to similar results.

[b] OLS models on income subsamples are estimated jointly. Cutoff between low and high income group is chosen to include about half of the respondents in each group.
The models also control for the individual-level covariates listed in Appendix D (with the exception of gender, age, education and degree of urbanisation, since those variables display little or no variation within individuals). Annuities and expenditures are standardized to a one-person household. Standard errors clustered at the household level, in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

J Models of changes in expenditure goals – estimates for subsample that did not experience unemployment during 2008-2014

Table J1a: Shocks to annuities and changes in expenditure goals; sample limited to respondents who did not experience unemployment during sample period

	Dependent variable: Δ retirement expenditure goal		
	(1) OLS	(2) OLS	(3) 2SLS
a. All ages			
Δ Pension (β_1)	0.375**	0.276***	0.375***
	(0.152)	(0.106)	(0.145)
Δ Real estate (β_2)	0.0139	0.128	0.0574
	(0.119)	(0.125)	(0.131)
Constant (β_0)	-99.9	-117.8**	-90.3
	(73.9)	(46.9)	(70.3)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	139.7***
Endogeneity Δ real estate F(1, n-1)	–	–	0.48
n (number HHs)	253	253	253
N (total obs.)	274	274	274
b. Age 25-49[b]			
Δ Pension (β_1)	0.104	0.0624	0.105
	(0.121)	(0.155)	(0.121)
Δ Real estate (β_2)	0.187**	0.354*	0.197*
	(0.0766)	(0.183)	(0.112)
Constant (β_0)	-83.0	-60.1	-81.3
	(63.2)	(76.6)	(65.0)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	35.9***
Endogeneity Δ real estate F(1, n-1)	–	–	0.02
n (number HHs)	107	107	107
N (total obs.)	116	116	116
c. Age 50+[b]			
Δ Pension (β_1)	0.451**	0.402***	0.452**
	(0.186)	(0.124)	(0.186)
Δ Real estate (β_2)	-0.0904	-0.0334	-0.00814
	(0.157)	(0.147)	(0.166)
Constant (β_0)	-136.6	-159.2***	-114.6
	(107.9)	(59.3)	(107.3)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	122.9***
Endogeneity Δ real estate F(1, n-1)	–	–	1.02
n (number HHs)	149	149	149
N (total obs.)	158	158	158
d. Difference between ages 25-49 and 50+			
(H_0: equal coefficients; statistics follow $\chi^2(1)$ distribution)			
Δ Pension (β_1)	2.44	2.95*	–
Δ Real estate (β_2)	2.52	2.74*	–
Constant (β_0)	0.19	1.07	–

[a] Δ Annuities and Δ expenditures are winsorized at p5 and p95. Winsorizing at p1-p99, or p2.5-p97.5 leads to similar results.

[b] OLS models on age subsamples are estimated jointly.

The models also control for the individual-level covariates listed in Appendix D (with the exception of gender, age, education and degree of urbanisation, since those variables display little or no variation within individuals). Annuities and expenditures are standardized to a one-person household. Standard errors clustered at the household level, in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table J1b: Shocks to annuities and changes in expenditure goals– heterogeneity by income; sample limited to respondents who did not experience unemployment during sample period

	Dependent variable: Δ retirement expenditure goal		
	(1) OLS	(2) OLS	(3) 2SLS
a. Low net household income in 2008[b]			
Δ pension	-0.0204	-0.0352	-0.0226
	(0.0927)	(0.148)	(0.0916)
Δ real estate	0.0115	0.124	0.106
	(0.103)	(0.191)	(0.250)
Constant	-94.3*	-99.5	-77.1
	(52.9)	(54.8)	(65.5)
wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	37.1***
Endogeneity Δ real estate F(1, n-1)	–	–	0.18
n (number HHs)	123	123	123
N (total obs.)	133	133	133
b. High net household income in 2008[b]			
Δ pension	0.513**	0.358***	0.517**
	(0.206)	(0.139)	(0.206)
Δ real estate	-0.0256	0.0360	0.0315
	(0.143)	(0.148)	(0.150)
Constant	-121.4	-190.0**	-103.7
	(138.5)	(85.0)	(137.2)
wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	93.9***
Endogeneity Δ real estate F(1, n-1)	–	–	0.68
n (number HHs)	130	130	130
N (total obs.)	141	141	141
c. Difference between low and high income groups			
(H_0: equal coefficients; statistics follow χ^2 (1) distribution)			
Δ pension	5.57**	3.76*	–
Δ real estate	0.04	0.13	–
Constant	0.03	0.80	–

[a] Δ annuities and Δ expenditures are winsorized at p5 and p95. Winsorizing at p1-p99, or p2.5-p97.5 leads to similar results.

[b] OLS models on income subsamples are estimated jointly. Cutoff between low and high income group is chosen to include about half of the respondents in each group.
The models also control for the individual-level covariates listed in Appendix D (with the exception of gender, age, education and degree of urbanisation, since those variables display little or no variation within individuals). Annuities and expenditures are standardized to a one-person household. Standard errors clustered at the household level, in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table J2a: Shocks to annuities and changes in expenditure goals; sample limited to respondents living in HHs in which *nobody* experienced unemployment during sample period

	Dependent variable: Δ retirement expenditure goal		
	(1) OLS	(2) OLS	(3) 2SLS
a. All ages			
Δ Pension (β_1)	0.431**	0.332***	0.431**
	(0.178)	(0.112)	(0.169)
Δ Real estate (β_2)	-0.00891	0.135	0.0276
	(0.128)	(0.129)	(0.142)
Constant (β_0)	-104.1	-111.2**	-95.6
	(79.2)	(48.8)	(75.5)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	141.7***
Endogeneity Δ real estate F(1, n-1)	–	–	0.28
n (number HHs)	223	223	223
N (total obs.)	243	243	243
b. Age 25-49[b]			
Δ Pension (β_1)	0.0985	0.0787	0.100
	(0.118)	(0.172)	(0.118)
Δ Real estate (β_2)	0.178	0.342*	0.155
	(0.125)	(0.194)	(0.176)
Constant (β_0)	-147.0**	-116.6	-150.7**
	(66.4)	(77.9)	(68.8)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, 117)	–	–	47.8***
Endogeneity Δ real estate F(1, 117)	–	–	0.03
n (number HHs)	94	94	94
N (total obs.)	102	102	102
c. Age 50+[b]			
Δ Pension (β_1)	0.547**	0.432***	0.547**
	(0.222)	(0.132)	(0.222)
Δ Real estate (β_2)	-0.0882	-0.0220	-0.00684
	(0.154)	(0.151)	(0.162)
Constant (β_0)	-120.5	-166.1**	-98.4
	(118.5)	(65.1)	(118.4)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	112.9***
Endogeneity Δ real estate F(1, n-1)	–	–	1.01
n (number HHs)	132	132	132
N (total obs.)	141	141	141
d. Difference between ages 25-49 and 50+			
(H_0: equal coefficients; statistics follow χ^2 (1) distribution)			
Δ Pension (β_1)	3.20*	2.66	–
Δ Real estate (β_2)	1.81	2.18	–
Constant (β_0)	0.04	0.24	–

[a] Δ Annuities and Δ expenditures are winsorized at p5 and p95. Winsorizing at p1-p99, or p2.5-p97.5 leads to similar results.

[b] OLS models on age subsamples are estimated jointly.

The models also control for the individual-level covariates listed in Appendix D (with the exception of gender, age, education and degree of urbanisation, since those variables display little or no variation within individuals). Annuities and expenditures are standardized to a one-person household. Standard errors clustered at the household level, in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table J2b: Shocks to annuities and changes in expenditure goals– heterogeneity by income; sample limited to respondents living in HHs in which *nobody* experienced unemployment during sample period

	Dependent variable: Δ retirement expenditure goal		
	(1) OLS	(2) OLS	(3) 2SLS
a. Low net household income in 2008[b]			
Δ pension	0.00327	0.00619	0.00305
	(0.0990)	(0.165)	(0.0976)
Δ real estate	0.0622	0.227	0.145
	(0.107)	(0.197)	(0.265)
Constant	-77.6	-75.0	-62.8
	(55.9)	(57.5)	(68.6)
wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	30.1***
Endogeneity Δ real estate F(1, n-1)	–	–	0.12
n (number HHs)	112	112	112
N (total obs.)	121	121	121
b. High net household income in 2008[b]			
Δ pension	0.627***	0.433***	0.629***
	(0.238)	(0.140)	(0.237)
Δ real estate	-0.108	-0.0630	-0.0770
	(0.138)	(0.145)	(0.144)
Constant	-142.8	-214.8**	-131.9
	(147.9)	(89.3)	(146.5)
wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	99.7***
Endogeneity Δ real estate F(1, n-1)	–	–	0.18
n (number HHs)	111	111	111
N (total obs.)	122	122	122
c. Difference between low and high income groups			
(H_0: equal coefficients; statistics follow χ^2 (1) distribution)			
Δ pension	5.86**	3.90**	–
Δ real estate	0.95	1.40	–
Constant	0.17	1.73	–

[a] Δ annuities and Δ expenditures are winsorized at p5 and p95. Winsorizing at p1-p99, or p2.5-p97.5 leads to similar results.

[b] OLS models on income subsamples are estimated jointly. Cutoff between low and high income group is chosen to include about half of the respondents in each group.
The models also control for the individual-level covariates listed in Appendix D (with the exception of gender, age, education and degree of urbanisation, since those variables display little or no variation within individuals). Annuities and expenditures are standardized to a one-person household. Standard errors clustered at the household level, in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

K Models of changes in expenditure goals – estimates for subsample of homeowners throughout 2008-2014

Table K1a: Shocks to annuities and changes in expenditure goals; sample limited to respondents who were homeowners throughout the sample period

	Dependent variable: Δ retirement expenditure goal		
	(1) OLS	(2) OLS	(3) 2SLS
a. All ages			
Δ Pension (β_1)	0.412**	0.250**	0.411***
	(0.166)	(0.114)	(0.157)
Δ Real estate (β_2)	0.0437	0.141	0.0151
	(0.114)	(0.128)	(0.128)
Constant (β_0)	-97.3	-134.8**	-105.2
	(87.2)	(56.4)	(84.3)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	102.9***
Endogeneity Δ real estate F(1, n-1)	–	–	0.25
n (number HHs)	218	218	218
N (total obs.)	239	239	239
b. Age 25-49[b]			
Δ Pension (β_1)	0.0226	-0.0693	0.0196
	(0.124)	(0.177)	(0.126)
Δ Real estate (β_2)	0.204***	0.369**	0.177**
	(0.0630)	(0.187)	(0.0880)
Constant (β_0)	-151.8**	-146.9*	-157.4**
	(69.7)	(84.5)	(71.3)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, 117)	–	–	37.2***
Endogeneity Δ real estate F(1, 117)	–	–	0.14
n (number HHs)	98	98	98
N (total obs.)	108	108	108
c. Age 50+[b]			
Δ Pension (β_1)	0.541**	0.380***	0.540**
	(0.212)	(0.126)	(0.212)
Δ Real estate (β_2)	-0.0896	-0.0500	-0.110
	(0.149)	(0.157)	(0.176)
Constant (β_0)	-178.7	-221.1***	-185.6
	(137.2)	(81.0)	(139.9)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	108.7***
Endogeneity Δ real estate F(1, n-1)	–	–	0.06
n (number HHs)	124	124	124
N (total obs.)	131	131	131
d. Difference between ages 25-49 and 50+			
(H_0: equal coefficients; statistics follow $\chi^2(1)$ distribution)			
Δ Pension (β_1)	4.47**	4.30**	–
Δ Real estate (β_2)	3.30*	2.93*	–
Constant (β_0)	0.03	0.41	–

[a] Δ Annuities and Δ expenditures are winsorized at p5 and p95. Winsorizing at p1-p99, or p2.5-p97.5 leads to similar results.

[b] OLS models on age subsamples are estimated jointly.

The models also control for the individual-level covariates listed in Appendix D (with the exception of gender, age, education and degree of urbanisation, since those variables display little or no variation within individuals). Annuities and expenditures are standardized to a one-person household. Standard errors clustered at the household level, in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table K1b: Shocks to annuities and changes in expenditure goals– heterogeneity by income; sample limited to respondents who were homeowners throughout the sample period

	Dependent variable: Δ retirement expenditure goal		
	(1) OLS	(2) OLS	(3) 2SLS
a. Low net household income in 2008[b]			
Δ pension	-0.159	-0.122	-0.160
	(0.201)	(0.204)	(0.205)
Δ real estate	0.0193	0.176	-0.00312
	(0.121)	(0.241)	(0.330)
Constant	-172.3**	-148.1*	-177.9*
	(73.1)	(80.0)	(103.0)
wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	22.0***
Endogeneity Δ real estate F(1, n-1)	–	–	0.01
n (number HHs)	90	90	90
N (total obs.)	98	98	98
b. High net household income in 2008[b]			
Δ pension	0.514**	0.363***	0.514**
	(0.202)	(0.138)	(0.201)
Δ real estate	-0.0214	-0.0181	-0.0197
	(0.135)	(0.143)	(0.141)
Constant	-116.3	-206.4**	-115.7
	(147.0)	(91.2)	(145.7)
wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	75.2***
Endogeneity Δ real estate F(1, n-1)	–	–	0.00
n (number HHs)	128	128	128
N (total obs.)	141	141	141
c. Difference between low and high income groups			
(H_0: equal coefficients; statistics follow χ^2 (1) distribution)			
Δ pension	5.59**	3.88**	–
Δ real estate	0.05	0.48	–
Constant	0.12	0.23	–

[a] Δ annuities and Δ expenditures are winsorized at p5 and p95. Winsorizing at p1-p99, or p2.5-p97.5 leads to similar results.

[b] OLS models on income subsamples are estimated jointly. Cutoff between low and high income group is chosen to include about half of the respondents in each group.
The models also control for the individual-level covariates listed in Appendix D (with the exception of gender, age, education and degree of urbanisation, since those variables display little or no variation within individuals). Annuities and expenditures are standardized to a one-person household. Standard errors clustered at the household level, in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

Table K2a: Shocks to annuities and changes in expenditure goals; sample limited to respondents who were homeowners *and* did not move house throughout the sample period

	Dependent variable: Δ retirement expenditure goal		
	(1) OLS	(2) OLS	(3) 2SLS
a. All ages			
Δ Pension (β_1)	0.375*	0.187	0.376**
	(0.203)	(0.132)	(0.188)
Δ Real estate (β_2)	0.120	0.159	0.0402
	(0.115)	(0.172)	(0.155)
Constant (β_0)	-70.0	-142.1*	-95.0
	(109.8)	(72.9)	(106.4)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	116.5***
Endogeneity Δ real estate F(1, n-1)	–	–	0.71
n (number HHs)	173	173	173
N (total obs.)	182	182	182
b. Age 25-49[b]			
Δ Pension (β_1)	-0.105	-0.210	-0.107
	(0.161)	(0.243)	(0.162)
Δ Real estate (β_2)	0.238	0.304	0.176
	(0.207)	(0.331)	(0.424)
Constant (β_0)	-168.2	-193.9	-185.1
	(109.8)	(137.1)	(159.7)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, 117)	–	–	15.2***
Endogeneity Δ real estate F(1, 117)	–	–	0.02
n (number HHs)	70	70	70
N (total obs.)	76	76	76
c. Age 50+[b]			
Δ Pension (β_1)	0.517**	0.327**	0.514**
	(0.240)	(0.135)	(0.240)
Δ Real estate (β_2)	0.0755	0.00596	-0.0274
	(0.137)	(0.186)	(0.181)
Constant (β_0)	-94.0	-203.8**	-131.9
	(154.5)	(90.0)	(156.3)
Wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	111.5***
Endogeneity Δ real estate F(1, n-1)	–	–	1.11
n (number HHs)	104	104	104
N (total obs.)	106	106	106
d. Difference between ages 25-49 and 50+			
(H_0: equal coefficients; statistics follow $\chi^2(1)$ distribution)			
Δ Pension (β_1)	4.61**	3.75*	–
Δ Real estate (β_2)	0.43	0.61	–
Constant (β_0)	0.15	0.00	–

[a] Δ Annuities and Δ expenditures are winsorized at p5 and p95. Winsorizing at p1-p99, or p2.5-p97.5 leads to similar results.

[b] OLS models on age subsamples are estimated jointly.

The models also control for the individual-level covariates listed in Appendix D (with the exception of gender, age, education and degree of urbanisation, since those variables display little or no variation within individuals). Annuities and expenditures are standardized to a one-person household. Standard errors clustered at the household level, in parentheses. * significant at 10%; ** significant at 5%; *** significant at 1%.

Table K2b: Shocks to annuities and changes in expenditure goals– heterogeneity by income; sample limited to respondents who were homeowners *and* did not move house throughout the sample period

	Dependent variable: Δ retirement expenditure goal		
	(1) OLS	(2) OLS	(3) 2SLS
a. Low net household income in 2008[b]			
Δ pension	-0.165	-0.135	-0.164
	(0.227)	(0.244)	(0.226)
Δ real estate	0.00207	0.116	0.0552
	(0.133)	(0.284)	(0.330)
Constant	-151.5*	-142.8	-137.2
	(89.4)	(101.4)	(112.0)
wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	21.8***
Endogeneity Δ real estate F(1, n-1)	–	–	0.04
n (number HHs)	73	73	73
N (total obs.)	78	78	78
b. High net household income in 2008[b]			
Δ pension	0.484*	0.283*	0.484*
	(0.261)	(0.152)	(0.260)
Δ real estate	0.0368	-0.0900	-0.0122
	(0.150)	(0.182)	(0.184)
Constant	-116.7	-285.4**	-137.3
	(200.3)	(113.3)	(208.0)
wealth expressed as	annuity	winsorized annuity[a]	annuity
First stage F(1, n-1)	–	–	85.1***
Endogeneity Δ real estate F(1, n-1)	–	–	0.19
n (number HHs)	100	100	100
N (total obs.)	104	104	104
c. Difference between low and high income groups			
(H_0: equal coefficients; statistics follow χ^2 (1) distribution)			
Δ pension	3.53*	2.11	–
Δ real estate	0.03	0.37	–
Constant	0.03	0.88	–

[a] Δ annuities and Δ expenditures are winsorized at p5 and p95. Winsorizing at p1-p99, or p2.5-p97.5 leads to similar results.

[b] OLS models on income subsamples are estimated jointly. Cutoff between low and high income group is chosen to include about half of the respondents in each group.
The models also control for the individual-level covariates listed in Appendix D (with the exception of gender, age, education and degree of urbanisation, since those variables display little or no variation within individuals). Annuities and expenditures are standardized to a one-person household. Standard errors clustered at the household level, in parentheses.
* significant at 10%; ** significant at 5%; *** significant at 1%.

L Estimation results SUR model

Retirement expenditures equations

Table L1 presents estimation results of the expenditure equations (8) and (9). The coefficients for 2008 show that homeowners, highly educated men and women, self-employed men, and seperated/divorced men had relatively high retirement expenditure goals. Widowers reported 19% lower retirement expenditure goals while widows required 17% higher expenditures relative to married couples. Furthermore, household income plays a significant role in explaining retirement expenditure goals, with an elasticity of 0.48 for both men and women.[27]

We observe interesting changes between the coefficients of 2008 and 2014. Homeowners reported 6-9% higher retirement expenditure goals than renters in 2008, but that difference disappeared by 2014 (in line with the decline in house prices). The income elasticity of the retirement expenditure goals dropped from 0.48 to 0.35, and highly educated women reduced their retirement expenditure goals. Finally, self-employed men, who had relatively high retirement expenditure goals in 2008, did not have these relatively high goals anymore in 2014.

Annuity equations

Table L2 presents estimation results of the annuity equation (10), both for annuities from public and occupational pensions and for annuities from total wealth (including real estate). The estimates for 2008 show that annuities from pensions were relatively high for homeowners, for households with highly educated heads, and for households that contain at least one salary worker. On the other hand, those annuities were relatively low on average for single females, for households with a family business, and for households with self-employed or a disabled household member. Furthermore, we estimate the elasticity of annuities with respect to net household income at 0.3. Taking into account

[27] The estimates for the retirement expenditure goals for 2008 are mostly similar to those documented by De Bresser and Knoef (2015). The largest difference is a stronger relationship between retirement goals 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 retirement expenditure goals between education groups are smaller than in the earlier paper, they remain large and highly statistically significant with university graduates reporting 27-28% higher goals than those with no education beyond primary school.

Table L1: Joint models of annuities and retirement expenditures – expenditure equations.

	Retirement expenditure goals men				Retirement expenditure goals women			
	2008		2014 − 2008		2008		2014 − 2008	
Partner	-0.023	(0.0425)	-0.117**	(0.0509)	-0.041	(0.0528)	-0.131**	(0.0653)
Age/10	-0.011	(0.0143)	0.016	(0.0177)	0.050***	(0.0152)	-0.032*	(0.0180)
HH head	0.008	(0.0470)	0.037	(0.0599)	-0.009	(0.0447)	-0.020	(0.0550)
Any Children	-0.063	(0.0518)	-0.019	(0.0665)	-0.052	(0.0479)	0.072	(0.0620)
Number Children	0.009	(0.0233)	0.018	(0.0301)	-0.001	(0.0219)	-0.003	(0.0291)
Homeowner	0.059*	(0.0309)	-0.055	(0.0376)	0.091***	(0.0303)	-0.096***	(0.0369)
log pers. Income	0.010	(0.0167)	-0.039*	(0.0216)	-0.003	(0.0067)	0.000	(0.0082)
Log HH income	0.482***	(0.0372)	-0.130***	(0.0454)	0.478***	(0.0374)	-0.131***	(0.0444)
Has simPC	-0.013	(0.0637)	-0.065	(0.0757)	-0.056	(0.0615)	0.017	(0.0703)
Education[a]								
Inter. secondary	0.026	(0.0469)	0.012	(0.0618)	0.045	(0.0464)	-0.071	(0.0582)
Higher secondary	0.140**	(0.0600)	-0.039	(0.0752)	0.173***	(0.0585)	-0.150**	(0.0704)
Inter. vocational	0.113**	(0.0463)	-0.053	(0.0612)	0.160***	(0.0505)	-0.153**	(0.0626)
Higher vocational	0.132***	(0.0464)	-0.005	(0.0612)	0.181***	(0.0503)	-0.132**	(0.0622)
University	0.277***	(0.0539)	-0.094	(0.0696)	0.275***	(0.0654)	-0.162**	(0.0790)
Labor market status[a]								
Family business	-0.079	(0.1006)	-0.024	(0.1361)	0.106	(0.0964)	-0.051	(0.1305)
Self-employed	0.147***	(0.0448)	-0.131**	(0.0570)	-0.036	(0.0542)	0.007	(0.0687)
Home maker	0.153	(0.1535)	0.135	(0.2097)	-0.026	(0.0418)	0.004	(0.0530)
Retired	0.145	(0.1493)	-0.112	(0.2256)	-0.009	(0.1861)	0.101	(0.2477)
Disabled	0.046	(0.0728)	-0.027	(0.0901)	0.028	(0.0727)	-0.023	(0.0828)
Other primary act.	0.063	(0.0742)	-0.069	(0.0856)	-0.029	(0.0607)	0.041	(0.0693)
Marital status[a]								
Seperated/divorced	0.105**	(0.0519)	-0.087	(0.0617)	0.057	(0.0498)	-0.072	(0.0613)
Widow	-0.186**	(0.0939)	0.153	(0.1034)	0.167**	(0.0786)	-0.240***	(0.0889)
Never married	-0.001	(0.0391)	0.010	(0.0489)	0.079*	(0.0418)	-0.097*	(0.0510)
How much have you thought about retirement?[a]								
Thought some	-0.052	(0.0513)	0.057	(0.0736)	0.051	(0.0623)	-0.065	(0.0788)
Thought a little	-0.031	(0.0516)	0.008	(0.0734)	0.034	(0.0598)	-0.074	(0.0753)
Hardly thought	-0.031	(0.0622)	0.019	(0.0839)	0.037	(0.0657)	-0.029	(0.0818)
No answer	-0.233	(0.2089)	0.011	(0.2946)	0.128	(0.2887)	-0.201	(0.3481)
Urbanization[a]								
Extremely urban	0.082*	(0.0423)	-0.028	(0.0510)	-0.066	(0.0443)	0.111**	(0.0518)
Very urban	0.068**	(0.0323)	-0.047	(0.0392)	0.018	(0.0339)	0.036	(0.0404)
Slightly urban	0.054*	(0.0324)	-0.038	(0.0393)	0.014	(0.0351)	0.018	(0.0421)
Not urban	0.018	(0.0382)	-0.042	(0.0464)	-0.041	(0.0400)	0.009	(0.0475)
I find it difficult to imagine how much I need to spend in retirement[a]								
Somewhat disagree	0.069	(0.5469)	-0.165**	(0.0753)	-0.044	(0.0614)	0.016	(0.0779)
Somewhat agree	0.003	(0.0473)	-0.110*	(0.0666)	-0.071	(0.0493)	0.082	(0.0633)
Totally agree	-0.065	(0.0501)	-0.025	(0.0697)	-0.083*	(0.0505)	0.050	(0.0643)
No answer	0.235	(0.1449)	-0.263	(0.1909)	-0.152	(0.2163)	0.171	(0.2392)
Constant	3.426***	(0.2980)	1.260***	(0.3630)	3.321***	(0.3140)	1.245***	(0.3713)
Sigma epslion	0.309***	(0.0081)			0.312***	(0.0086)		
Log likelihood	-1310.220							
N	4,521							

[a] The reference categories are *primary education*; *salary worker*; *married*; *thought a lot about retirement*; *moderately urban*; and *totally disagree*.

Dependent variables are logs of monthly retirement expenditure goals. Expenditures standardized to a one-person household; equations reported from models of annuity excluding housing wealth but including other savings. Standard errors in parentheses. *significant at 10%; **significant at 5%; ***significant at 1%.

wealth outside pensions changes some patterns: single men, but not women, now do better than couples and home-ownership plays a much more prominent role.[28]

Comparing the estimated coefficients for 2008 and 2014 in table L2 we find interesting differences. Strikingly, the age gradient of pension annuities switched from negative to positive. While the average annuity from pensions in 2008 *de*creased with 1.5 percent for a 10 year increase in age, in 2014 this was associated with a 2.0 percent *in*crease in the average annuity. Moreover, the income elasticity of pension annuities decreased from 0.3 to 0.2 (in table I1 we saw that this was mirrored by a lower income elasticity of retirement expenditure goals) and the gaps between households with and without wage workers and with and without self-employed adults narrowed somewhat (as self-employed men also reduced their retirement expenditure goals, their relative position compared to wage workers improved).

All these changes can be explained by the worsened situation of occupational pensions, which are relatively more important for high income earners. As a result, pension cuts affect high earners disproportionately and this flattens the association between income and annuities. The relative positions of old and young individuals, and of wage workers and the self-employed are aligned by the same mechanism (since occupational pensions typically play a minor role for the self-employed). Though the changes we observe can plausibly be attributed to changing circumstances, a change in the composition of socio-economic groups may also play a role.

We find broadly similar patterns when we take into account all private wealth. While in 2008 the annuity based on all wealth increased by 1.8% on average for a 10 year increase in age, in 2014 the corresponding figure was 4.1%. Similarly, the relationship between income and annuities flattened and the gap between households with and without salary workers closed. Unsurprisingly, the role of home ownership changed between 2008 and 2014 once we take into account housing wealth. The

[28]The estimates for 2008 are mostly 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 0.3, while De Bresser and Knoef (2015) report smaller estimates around 0.1. 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 income measure. 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 24-27%, 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.

Table L2: Joint models of annuities and retirement expenditure goals – annuity equations.

	Pensions				Pensions + wealth + housing			
	2008		2014 − 2008		2008		2014 − 2008	
Single	-0.005	(0.0328)	0.044	(0.0353)	0.169***	(0.0378)	-0.003	(0.0414)
Female × single	-0.079**	(0.0354)	0.038	(0.0372)	-0.143***	(0.0404)	0.068	(0.0428)
Age HH head/10	-0.015*	(0.0085)	0.035***	(0.0094)	0.018*	(0.0098)	0.023**	(0.0111)
Any kids	-0.104***	(0.0270)	0.077**	(0.0316)	-0.069**	(0.0309)	0.026	(0.0380)
Number children	0.026**	(0.0115)	-0.030**	(0.0135)	0.024*	(0.0132)	0.002	(0.0163)
Homeowner	0.089***	(0.0180)	0.025	(0.0195)	0.493***	(0.0208)	-0.040*	(0.0231)
log HH income	0.304***	(0.0215)	-0.096***	(0.0238)	0.333***	(0.0250)	-0.068**	(0.0283)
Education[a]								
Inter. secondary	0.010	(0.0348)	0.038	(0.0394)	0.030	(0.0397)	0.015	(0.0465)
Higher secondary	0.031	(0.0399)	0.023	(0.0451)	0.087*	(0.0458)	-0.040	(0.0537)
Inter. vocational	0.075**	(0.0347)	0.015	(0.0391)	0.074*	(0.0396)	0.027	(0.0461)
Higher vocational	0.167***	(0.0349)	0.023	(0.0394)	0.204***	(0.0399)	-0.015	(0.0464)
University	0.241***	(0.0399)	-0.036	(0.0446)	0.271***	(0.0460)	0.021	(0.0527)
Labor market status								
1 salary worker	0.119***	(0.0273)	-0.051*	(0.0308)	0.058*	(0.0314)	-0.046	(0.0367)
All salary workers	0.056***	(0.0197)	0.023	(0.0235)	0.014	(0.0226)	0.051*	(0.0285)
1 family business	-0.053	(0.0612)	-0.047	(0.0707)	0.098	(0.0742)	0.098	(0.0890)
All family business	-0.218**	(0.0980)	0.106	(0.1109)	-0.208*	(0.1146)	-0.019	(0.1374)
1 self employed	-0.147***	(0.0295)	0.071**	(0.0340)	-0.154***	(0.0337)	0.186***	(0.0411)
All self employed	-0.208***	(0.0555)	0.084	(0.0638)	-0.090	(0.0646)	0.000	(0.0782)
1 retired	0.037	(0.0329)	-0.036	(0.0373)	0.028	(0.0374)	-0.031	(0.0442)
All retired	0.051	(0.0329)	0.009	(0.0360)	0.016	(0.0374)	0.049	(0.0419)
1 disabled	-0.076**	(0.0315)	0.030	(0.0369)	-0.095**	(0.0369)	0.043	(0.0455)
All disabled	0.137*	(0.0793)	-0.110	(0.0861)	0.091	(0.0901)	-0.117	(0.1011)
Marital status[a]								
Separated/divorced	-0.022	(0.0445)	0.009	(0.0481)	-0.026	(0.0514)	-0.055	(0.0570)
Female × sep/div	-0.063	(0.0512)	0.016	(0.0559)	-0.087	(0.0589)	0.102	(0.0664)
Widow	-0.021	(0.0455)	0.033	(0.0476)	-0.024	(0.0514)	0.129**	(0.0545)
Never married	-0.051**	(0.0241)	0.048*	(0.0264)	-0.003	(0.0282)	0.016	(0.0317)
Urbanization[a]								
Extremely urban	-0.005	(0.0244)	0.053**	(0.0260)	0.057**	(0.0281)	-0.016	(0.0306)
Very urban	0.023	(0.0253)	0.035	(0.0269)	0.083***	(0.0290)	0.012	(0.0315)
Slightly urban	0.013	(0.0253)	0.050*	(0.0270)	0.101***	(0.0291)	-0.002	(0.0318)
Not urban	-0.010	(0.0281)	0.062**	(0.0301)	0.091***	(0.0323)	0.022	(0.0353)
Constant	5.123***	(0.1595)	0.273	(0.1776)	4.724***	(0.1852)	0.161	(0.2115)
Sigma epsilon	0.229***	(0.0056)			0.273***	(0.0066)		
Log likelihood	-1310.330				-2404.338			
N	4,521				4,420			

[a] The reference categories are *primary education*; *married*; and *moderately urban*.
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%.

importance of housing in the household portfolio decreased as a result of lower house prices: the difference between the average annuity of homeowners compared to renters was 49% in 2008 and 45% in 2014.

Error correlations

Table L3 reports the estimated correlations between the error terms for all equations of the SUR model. We find that the cross-sectional correlations between annuities and retirement expenditure goals are positive and significant in both years (0.17-0.22). Hence, individuals in households that can look forward to generous annuities conditional on their demographic characteristics, are also more ambitious regarding their retirement expenditure goals. The cross-sectional correlations between expenditure goals of partners within couples are even stronger, around 0.44-0.50, suggesting some agreement between partners on the retirement expenditure goal they should meet.[29]

As for correlations between the years we find that conditional on background characteristics annuities are relatively persistent, even in times of economic turbulence. The estimated correlations between the errors of the annuity equations in 2008 and 2014 are 0.56 and 0.65 for annuities based on pensions and on all wealth, respectively. Retirement expenditure goals are autocorrelated as well, but less strongly with estimated correlations around 0.36.

[29]For the revision of retirement expenditure goals between 2008 and 2014 we also find some agreement between partners, with a correlation of 0.5 conditional on observed charachteristics.

Table L3: Error correlations

	Annuity 2008	Min exp. men 2008	Min exp. women 2008	Annuity 2014	Min exp. men 2014	Min exp. women 2014
a. Annuities from pensions						
Annuity 2008	1					
Min exp. men 2008	0.22***	1				
Min exp. women 2008	0.21***	0.44***	1			
Annuity 2014	0.56***	0.06	0.07	1		
Min exp. men 2014	0.14***	0.36***	0.03	0.15***	1	
Min exp. women 2014	0.07	0.22***	0.38***	0.15***	0.49***	1
b. Annuities from pensions and all wealth						
Annuity 2008	1					
Min exp. men 2008	0.17***	1				
Min exp. women 2008	0.19***	0.44***	1			
Annuity 2014	0.65***	0.09	0.09	1		
Min exp. men 2014	0.05	0.36***	0.06	0.12***	1	
Min exp. women 2014	0.08	0.24***	0.39***	0.12***	0.50***	1

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

M Distribution of differences between goals and annuities

Figure M1 shows the simulated differences between retirement expenditure goals and annuities (both in logs and at the level of the individual). The differences subtract expenditure goals from annuities, so a positive difference means that the predicted annuity is sufficient to afford one's retirement expenditure goal and a negative difference implies insufficient funds. The graphs in the left column correspond to 2008 and those on the right to 2014, 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 Great Recession increased inequality in retirement preparedness.

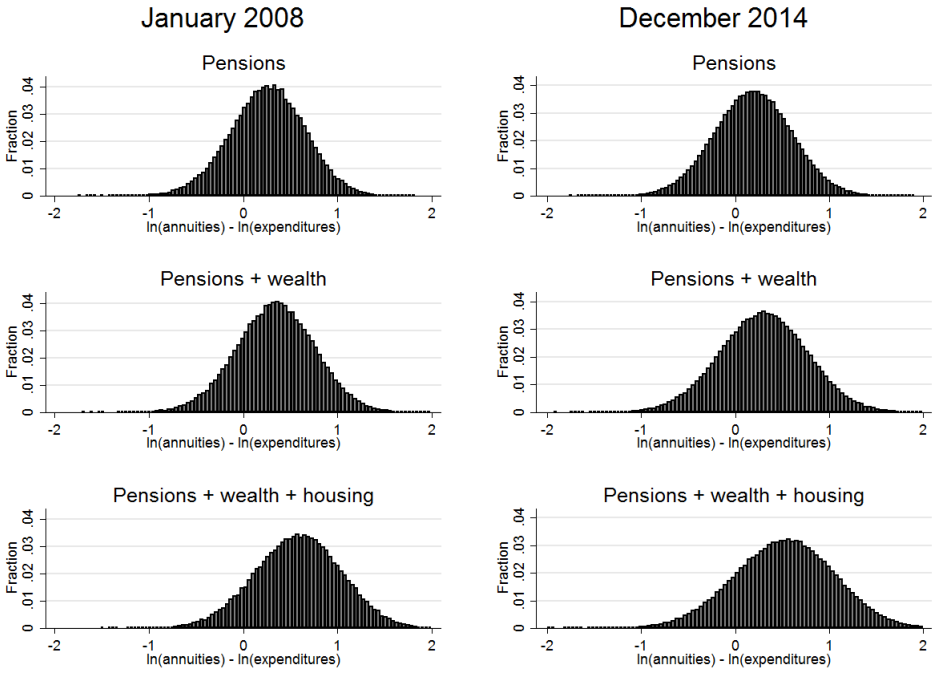

Figure M1: Simulated differences between annuities and expenditure goals