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Intertemporal and intratemporal consumption smoothing at retirement

Micro evidence from detailed spending and time use data

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Intertemporal and intratemporal consumption smoothing at retirement: Micro evidence from detailed spending and time use data.[1]

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Abstract

Using detailed spending and time use data from the Netherlands, a country with high mandatory pension savings, this paper analyzes the role of intertemporal and intratemporal substitution to smooth consumption at retirement. We do not find empirical evidence for drops in total non-durable spending. Our estimates suggest increases in leisure-complementary spending at retirement, but no substitution of spending by home production despite increases in time spend in home production. We link our estimation results to implied intertemporal and intratemporal elasticities and conclude that our empirical results imply elasticities below unity and close to one in a simple Life-Cycle Model, respectively.

JEL-codes: C33, D1, H55, J22, J26

Keywords: Regression Discontinuity, Retirement, Consumption, Time use, Panel data, Life-cycle model

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1 Introduction

Consumption smoothing at retirement has been empirically assessed in a wide variety of countries.[4] Much of this empirical literature generally finds consumption drops at retirement which is at odds with the predictions of the seminal Life-Cycle Model (LCM) of Ando & Modigliani (1963) and therefore known as the *Retirement Savings Puzzle* (RSP).[5] Nonetheless, consumption drops at retirement do not need to be inconsistent with the basic LCH per se for few reasons such as existing bequest motives (De Nardi et al., 2016), imperfect foresight in available retirement resources (Hurd & Rohwedder, 2003), large heterogeneity among the types of spending (Hurd & Rohwedder, 2013), strong consumption-leisure complementarities (Laitner & Silverman, 2005), and inadequacy of expenditure measures to capture consumption because of home production (Aguiar & Hurst, 2005).

In this paper we provide new empirical evidence on reconciling consumption smoothing at retirement with home production in a simple Life-Cycle Model. Our analysis simultaneously takes into account suggested extensions of the LCM by Hurd & Rohwedder (2003), Laitner & Silverman (2005), and Aguiar & Hurst (2005). We are the first to estimate causal effects of retirement on a wide array of consumption spending[6] and time categories[7] available for the same longitudinal

[4] US: Bernheim et al., 2001; Laitner & Silverman, 2005; Aguiar & Hurst, 2005; Haider & Stephens, 2007; Blau, 2008; Fisher et al., 2008; Hurst, 2008; Aguila et al., 2011; Laitner & Silverman, 2012; Hurd & Rohwedder, 2003; 2006; 2013. UK: Banks et al., 1998; Smith, 2006. France: Moreau & Stancanelli, 2015. Germany: Schwerdt, 2005; Luhrmann, 2010; Velarde & Hermann, 2014. Italy: Battistin et al., 2009; Miniaci et al., 2010; Borella et al., 2014. Spain: Luengo-Prado & Sevilla, 2012. Japan: Wakabayashi, 2008; Stephens & Unayama, 2012. Korea: Cho, 2012 China: Li et al., 2015; 2016. South Africa: Butler, 2012. Australia: Barrett et al., 2010.

[5] Studies almost unanimously find a drop in consumption at retirement, except in the case of Spain in which no change in total consumption is observed. Luengo-Prado & Sevilla (2012) only find a drop in food-related spending at retirement.

[6] Papers using single spending categories, predominantly spending on food: Aguiar & Hurst, 2005; Haider & Stephens, 2007; Blau, 2008; Hurst, 2008; Aguila et al., 2011; Laitner & Silverman, 2012. Papers using subjective categorical data: Kapteyn et al., 2009; Limosani & Millemaci, 2011; Giamboni et al., 2013; Mastrogiacomo & Van Ooijen, 2014; Suari-Andreu, 2019.

[7] Papers estimating the effects of retirement on home production rely solely on time use information and no spending information: Stancanelli & Van Soest, 2012; Bonsang & Van Soest, 2020. Luengo-Prado & Sevilla (2012) use both spending and time use data but the cross-sectional nature of their estimated effects on home production cannot be interpreted causally.

sample,[8] particularly focusing on leisure-complementary spending and home production substitutable spending of households' main income earners. Our unique micro level panel data on consumption and time use come from the Dutch LISS which is administered by CentERdata at Tilburg University. Causal inference relies on Fuzzy Regression Discontinuity (RD), like Stancanelli & Van Soest (2012), and Fixed Effects (FE) estimation, like Aguila et al. (2011). Unlike many earlier empirical evidence, we do not find significant drops in total consumption spending at retirement. However, we find substantial complementarities in spending and leisure, but no substitution between spending and home production. This contradicts empirical studies that argue that increases in home production at retirement are sufficient to imply substitution (Schwerdt, 2005; Atalay et al., 2020; Bonsang & Van Soest, 2020). These main results are robust to a wide variety of different estimators, samples, and definitions, including different types of households.

Our empirical results provide important new causal evidence of the effect of retirement on consumption and time use that sheds new light on the importance of intertemporal consumption smoothing (e.g. choices of consumption and saving over the life-cycle) versus intratemporal consumption smoothing (e.g. contemporaneous choices of spending and home production) to explain the degree of consumption smoothing at retirement. We link our empirical estimates to the theoretical LCM to analyze the quantitative implications of our results for the LCM. The quantitative implications suggest that for any reasonable estimate of the intratemporal elasticity of substitution found in the literature, our estimates imply an intertemporal elasticity of substitution (IES) that is bigger than zero which is comparable to estimates from American households. As our

[8] Luengo-Prado & Sevilla (2012) use both spending and time use data but the cross-sectional nature of their estimated effects on home production cannot be interpreted causally.

results suggest a lack of substitution between spending and home production, the LCM implies that the IES is most likely below unity. We point out important extensions in future empirical analyses of the LCM with consumption-leisure-complementarities, bequest motives and uncertainty. Empirically, our results suggest that bequest motives and uncertainty are potentially important in explaining the lack of consumption drops at retirement which has consequences for the implied IES.

Studying Dutch LISS data does not only allow us to have more details in consumption spending and time use, but using Dutch data also broadens our view on the implications of retirement for consumption. Much of the empirical evidence of the RSP, possible explanations of the RSP, and estimated elasticities are based on Anglo-Saxon households.[9] Although Scandinavian-type of social models in countries such as Denmark, Finland, the Netherlands, Norway, and Sweden perform among the top countries in terms of providing retirement income according to the *Global Pension Index* (Mercer, 2018),[10] there is no empirical evidence on the effect of retirement on consumption in these countries. The success of these models might imply intertemporal and intratemporal elasticities that differ from Anglo-Saxon analyses. This might especially apply to the Netherlands due to highly institutionalized saving through generous public pensions, high mandatory occupational pensions, and little options to deviate from defaults for most of the population.

The paper continues with a description of the Dutch pension system and the Dutch LISS data in Section 2. In Section 3, we present our econometric model to estimate the causal effect of retirement on consumption and time use. The estimation results are presented in Section 4 after

[9] Many of the analyses are based on American CEX, ATUS, or HRS/CAMS data.
[10] The US and UK perform relatively poorly relative to aforementioned European countries.

which we interpret our estimation results in terms of the LCM and its parameters in Section 5. We draw the conclusions of our study in Section 6.

2 Data

2.1. Institutional framework of the Netherlands

This paper exploits detailed consumption spending and time use data from the Netherlands. In the Netherlands, households receive relatively generous public pensions at retirement and face high mandatory savings through occupational pensions. As in many European countries, the Dutch pension system consists of three pillars. The first is a pay-as-you-go system and involves a flat-rate public pension benefit for all residents as from the statutory retirement age. Because of the rapid ageing of the population, the statutory retirement age, which has been 65 since the introduction of the public pension scheme in 1957, has been gradually raised in steps as of January 2013. In 2020 the retirement age is 66 and 4 months and it will be 67 in 2024. Flexible take-up, such as in the United States (Duggan et al., 2007) and Norway (Brinch et al., 2017), is not possible. The second pillar consists of capital-funded occupational pensions, of which the primary responsibility lies with employers and employees. Around 90 percent of all employees have a mandatory pension scheme with their employer. Occupational pensions mainly consist of defined-benefit pension plans, although the number of defined contribution schemes is growing. Most pension plans aim to pay 70% of the average career salary. The third pillar is formed by private individual pension products (such as life annuities) and other private savings. Life annuities can only be bought at tax beneficial terms by self-employed and by other individuals with a gap in their pension entitlements.

Other pillars are housing wealth or an extension of working life on a part-time or fulltime basis. People who have paid off part of their mortgage benefit from lower housing costs during retirement. Although it is not commonly done by the current generation of elderly, people may move or use reverse mortgages to deplete housing wealth.

Replacement rates in the Netherlands are relatively high according to comparisons by the OECD (2017). These replacement rates are calculated for a fictitious person who earns a median income during his whole career and accumulates a pension for 45 years. In reality, however, there are few Dutch people who actually accumulate a pension for the full 45 years. Knoef et al. (2016) analyze pension savings that people actually accumulate using a large administrative dataset. When only public and occupational pension income is considered (on average roughly two third of the total), they find a median net replacement rate of 84 percent. When private pensions, private savings and housing wealth are also included, they find a median net replacement rate of roughly 100 percent. The authors stress that there is a lot of heterogeneity in pension income at retirement, but mostly in absolute levels (euros) and less so in (net) replacement rates. Even vulnerable groups, including self-employed, immigrants, single women, unemployed and disabled persons, have median replacement rates that are relatively close to the population's average.

2.2 LISS Data

We use data from the LISS panel (Longitudinal Internet Studies for the Social sciences) administered by CentERdata at Tilburg University. The annual core waves consist of 5,000 representative households (about 8,000 individuals) in the Netherlands. These households are followed over the time period 2008-2019. The LISS Background Variables was supplemented with an additional module on Time Use and Consumption in the 2009, 2010, 2012, 2015, 2017 and

2019 waves, and an additional module on Economics Assets related to Income in the 2008-2019 waves. The Time Use and Consumption module is used by, among others, Cherchye et al. (2012; 2017) and Boerma & Karabarbounis (2019).

For the empirical analysis, we select only household heads,[11] following Aguiar & Hurst (2005), and keep those aged 55-75[12] and those who report not to depend on unemployment or sickness/disability benefits.[13,14] Household heads are the main income earner in multiple-member household. Following prior analyses by a.o. Aguiar & Hurst (2005), Aguila et al. (2011), and Luengo-Prado & Sevilla (2012), we leave any interaction in time use decisions between spouses, as analyzed by Rogerson & Wallenius (2019), for future research but explicitly take into account the different structures of the household in the sensitivity analysis. Using only household heads reduces issues regarding within-household interactions as most collective household models assume that the bargaining power depends on relative income within the household (e.g. Cherchye et al., 2012).[15] This also solves the issue of using households multiple times in the analysis.

Table A1 provides summary statistics of the variables used in the empirical analysis. Moreover, it indicates which variables are available in what years of the LISS panel. The Time Use and Consumption survey considers spending categories at the household level (e.g. mortgage, utilities, etc.) and spending categories for personal use and children (e.g. clothing, personal care, etc.). Note that the LISS data only consider non-durable consumption spending. We construct households' personal spending categories by summing these categories to the household level. We construct

[11] This reduces the number of observations from 65,888 in the raw data to 45,136. Additionally, we delete those households whose household head changed over time to make sure we keep tracking the same person in the household. This reduces the number of observations to 42,457.
[12] This reduces our number of observations further from 42,457 to 14,322. In Table 5 we present results that use a tighter age-window from 60-70 and show that the main conclusions hold.
[13] This reduces our number of observations from 14,322 to 12,597. This selection is important as our analysis indicates that this subsample increases consumption spending at retirement (not reported here) which is likely due to budget constraints in unemployment and disability prior to retirement.
[14] These 12,597 observations imply 6,257 observations for the years in which the Time Use and Consumption component is available.
[15] We include robustness checks on the potential importance of within-household bargaining, such as men, singles, and dual- and single-earners only. Table 6 shows that our main conclusions are robust to using different definitions of households.

total (non-durable) household spending by summing all categories, household- and personal spending, to the household level. We set missing observations in spending categories to zero for those households who reported at least total household spending (which is asked after all the separate categories – see Appendix A). This assumes that respondents who reported total consumption but did not respond to questions on a particular category have zero expenditures in this category despite explicitly being asked to enter a zero in such cases. This approach ensures the same number of observations in all household spending categories. We do the same for personal spending categories. However, the number of observations per personal spending category can be different as the separate categories are only present in the 2009, 2010, and 2012 waves. Nonetheless, total personal spending is asked in every wave.

Regarding time use categories, categories are either available in all waves (like paid work and commuting) or are missing in in 2015 and 2017 waves (like home production and leisure time). Since we have no 'total time spend' category, we cannot benchmark missings against responding to total time spent and therefore assume that we cannot replace missings by zeros as we do not know if a missing means zero time spend on that category. This is further complicated by potential multi-tasking. Changing this assumption, however, does not alter our main conclusions (not reported here). We refer to Appendix A for details on the survey questions asked to the respondents.

2.3 Discontinuities at the retirement age

Our empirical methodology, as explained in Section 3.2, assumes that retirement is induced by the institutionally set statutory retirement age of 65. This implies that there should be a discontinuous

jump in the probability of retirement. We provide graphical evidence in this section and a formal regression model in Section 3.

The discontinuous jump in the probability to retire is graphically confirmed in Figure 1. In this figure, we observe that the percentage of respondents who are retired is about 40 percentage points higher at age 65 than at age 64. 95-percent confidence intervals are shown. Although the percentage of retirees increases over age, this year-to-year increase is never bigger than at the jump from 64 to 65 years old. This visual evidence indicates that Dutch households are responsive to the statutory retirement age.

[Insert Figure 1 here]

In Figure 2, we show people's responses by age to the level of total household consumption spending and the 95-percent confidence intervals of the responses. Here, the results suggest that there is a positive jump in the level of total consumption at the cutoff of 65. This visual evidence contradicts the LCM which suggests that agents smooth consumption over the life-cycle in such a way that no differences prior to and after retirement should exist.[16] However, these results should be interpreted with caution as, on the basis of this figure, no causal claims can be made. In Section 3, we provide a comprehensive econometric model that allows us to make such causal claims.

[Insert Figure 2 here.]

3 Econometric model

To infer a causal relationship between retirement decisions and consumption spending and time use categories, we use a fuzzy Regression Discontinuity (RD) design, with a jump in the

[16] In Figure B.1 in the Online Appendix we provide similar figures for subjective measures of spending versus income, that is savings. Here, the visual evidence shows that Dutch households do not deplete their savings during retirement.

probability of retirement at the statutory retirement age that is greater than zero but less than one. We estimate:

$$y_{it} = \alpha_1 + \beta_1 \cdot Retired_{it} + X'_{it}\gamma_1 + v_i + \epsilon_{it} \quad (1)$$

$$Retired_{it} = \alpha_2 + \beta_2 D_{it} + \delta_2 A_{it} + \theta_2 D \cdot A_{it} + X'_{it}\gamma_2 + \eta_i + \mu_{it} \quad (2)$$

Where, *y* measures either consumption spending or time use in levels.[17] *Retired* indicates whether a respondent's most important occupation is being retired (one if retired and zero otherwise),[18] and X'_i is a vector of control variables[19] gender, having a partner, number of kids in the household, being an immigrant, low education dummy, high education dummy, and period effects.[20] In Equation 2, X'_i also includes age effects through $A_{it} = (age_{it} - 65)$.[21] *D* is the discontinuity defined as $D_{it} = 1(age_{it} \geq 65)$. The interaction between *D* and *A* allows for a kink in the slope at the discontinuity.[22] *D* and *A* measure the responsiveness of retirement decisions to the institutional retirement age. The institutional retirement age is likely to induce retirement, but has no direct effect on consumption behavior other than through the retirement decision.

Prior evidence has shown that households are very responsive to the (change in) institutional retirement ages which causes discontinuous retirement probabilities right before and after reaching the retirement age (Duggan et al., 2007; Mastrobuoni: 2009; Behaghel & Blau, 2012). Such evidence of responsiveness to the statutory retirement age is also found for the Netherlands (De

[17] The main conclusions are robust to using logs of consumption spending and time use (see Table D1). This table also indicates the percentage of households engaging in the different spending and time use categories suggesting that most households engage in these categories.
[18] This may include partial retirement. We provide several sensitivity checks with respect to the definition of retirement in Table 5. We find that our conclusions are robust to definitions of full retirement and retirement from paid employment as well as using working hours as an intensive labor supply measure.
[19] In the full estimation results in Table C2 we show that these characteristics significantly explain consumption spending with the a priori expected sign. This suggests that our data have reasonable variation to detect meaningful differences between households.
[20] Estimation results are robust to different functional form assumptions regarding period effects such as polynomials and semi-parametric age-dummies (not reported here).
[21] We use an age-polynomial of order 2 in the baseline regressions. Estimation results are robust to different functional form assumptions regarding age (not reported here).
[22] Excluding the kink and exploiting the jump only does not alter our main conclusions (not reported here).

Grip et al., 2013; Van Erp et al., 2014; Vermeer, 2016; Atav et al., 2019; Piccheo & Van Ours, 2019), even for the self-employed who are more flexible and less dependent on the statutory retirement age set in occupational pensions (Nagore Garcia et al., 2019). In the Netherlands, people have a strong incentive to retire at the (non-flexible) statutory pension age as it provides a substantial amount of available pension income in most cases. Retiring earlier basically gives a discount of 100 percent in public pensions and retiring later does not actuarially increase the state pension.[23] Graphical evidence of the discontinuous probability to retire at the statutory retirement age is provided in Section 2.2. In Online Appendix B, we show that even the expected future retirement age of non-retirees depends heavily on the state pension retirement age (Figure B2a) with most people expecting to retire at age 65 in 2008.

Since we have panel data, we can specify v_i and η_i and check the extent to which the RD studies people that are comparable with respect to both observed and unobserved characteristics. The error terms ϵ and μ are assumed to be correlated. Error distributions and the joint error distribution are assumed to be independent, identically distributed, and normal. We estimate Equations 1 and 2 simultaneously through Maximum Likelihood using a 2SLS routine. The "instrument," based on a discontinuity at the statutory retirement age, is likely to affect the choice of retirement (e.g. relevancy),[24] but is not likely to affect consumption decisions other than through the retirement decision (e.g. validity). Our approach is, therefore, similar to an IV approach where the discontinuity at the statutory retirement age is used as an instrumental variable.

[23] However, many occupational pension schemes are flexible up to some extent. Yearly pension incomes are actuarially adjusted when people retire earlier or later than the statutory retirement age. Retiring earlier than the state pension age often needs sufficient private wealth holdings to bridge the gap to receiving state pension.

[24] The empirical analysis in Section 4 shows that the instruments based on the discontinuity at the statutory retirement age are highly relevant with F-statistics far beyond the rule of thumb of 10 in every regression. For the full first-stage estimation results we refer to Table C1.

To test the robustness of the results to the cutoff at age 65, we also use a more sophisticated cutoff measure by exploiting the changes in the statutory retirement age as an instrumental variable instead of relying on the discontinuity at age 65. In this case, we specify

$$D_{it} = 1(age_{it} \geq SRA_{it}) \tag{3}$$

$$A_{it} = age_{it} - SRA_{it} \tag{4}$$

with

$$65 \leq SRA_{it} \leq 67 \tag{5}$$

Here, *SRA* is based on the cohort-dependent statutory retirement age. Prior to 2013, *SRA = 65* for everyone. From 2013, *SRA = 65 + d* with *d = {1/12, …, 2}* where *d* depends on the birth year. The exact birth-date dependent *SRA* can be observed in Table 1. In Online Appendix B, we show that also the expected future retirement age of non-retirees shifts due to the retirement age increases (Figure B2b) and replicate Figure 1 for differences in the SRA (Figure B3-B5).

[Insert Table 1 here.]

Although an RD design is very attractive because of its simple nature, the approach has clear limitations which should be noted. At best, an RD estimates Local Average Treatment Effects (LATE) at the threshold. Only with very specific assumptions, that is constant treatment effects, the RD estimates an average treatment effect. Next, since the RD is fuzzy, there are both compliers ($Retired_{it} = 1 \mid D_{it} = 1$) and non-compliers to the "treatment" ($Retired_{it} = 1 \mid D_{it} = 0$ and $Retired_{it} = 0 \mid D_{it} = 1$). Hence, β_2 estimates a LATE for compliers at the threshold. This limits the external validity of the RD results for the population.

Luengo-Prado & Sevilla (2012) and Bonsang & Van Soest (2020) propose that it is sufficient to condition on unobserved time-invariant heterogeneity v_i and η_i to infer causal effects of retirement on consumption. Correcting for household specific unobserved effects should make the error-term independent of retirement in the time-use equation. We apply a Fixed Effects (FE) model to check the sensitivity of our RD results.

4 Estimation results

4.1 Total spending and household-level spending categories

The estimated effects of retirement on household-level consumption categories are presented in Table 2. We present the results for naïve OLS estimation, Fixed Effects (FE, like Luengo-Prado & Sevilla (2012)), Regression Discontinuity (RD, like Stancanelli & Van Soest (2012)), and Regression Discontinuity including Fixed Effects (RD-FE).[25] We apply statutory retirement ages based on both the age of 65 and the increased statutory retirement age *SRA* effective from 2013.[26]

Regardless of the estimation method, we do not find a drop in households' total consumption spending (the sum of household-level categories and personal-level categories summed to the household level). In our preferred specification, we find that only spending on food at home and spending on holidays/trips increases by about 93 and 62 euros per month, respectively. The increase in spending on food at home might suggest increases in home production at retirement. We investigate this further by analyzing food out in Section 4.2. and time spend on home production in Section 4.3. We find little to no evidence for spending categories that decrease at retirement. Although spending on transport is likely to decrease at retirement, our definition of

[25] Table D1 in Appendix D show that our main results are also robust to estimators using logs and tobit estimation.
[26] Our conclusions are robust to using the SRA over the age of 65 as cutoff in the RD, although the SRA gives less precise estimates. Since the SRA only became effective as of 2013 it only affects those estimates with dependent variables available for the 2015, 2017, and 2019 waves. Moreover, this might explain why the results do not differ much from the results using the age of 65 as a cutoff in the RD.

transport costs does not explicitly exclude leisure-related use of transport. Therefore, the lack of decreases found in transport costs can be explained by leisure-complementary spending. Similarly, spending on holiday/trips is leisure-complementary spending.

[Include Table 2 here.]

For the full estimation results of the most important categories, we refer to Tables C1 and C2.

4.2 Personal spending categories at the household level

The estimated effects of retirement on personal-level consumption categories are presented in Table 3. The different estimators give a consistent view across personal-level spending categories. Similar to the total of consumption spending and the total of household-level spending (Table 2) we find no drop in total personal-level spending at retirement. We find little to no changes in personal-level spending patterns at retirement.

Interestingly, we find no significant decreases in spending on food outside of the home at retirement in our preferred RD-estimation although this category is very likely to be easily substituted by home production in the form of home cooking. We find increases in home cooking in Table 2, but this apparently does not replace food outside of the home contrasting the findings by Aguiar & Hurst (2005) for American households. Explicitly estimating the effect of retirement on food out relative to food in shows a decrease, but this decrease is not significant which truly suggests the absence of substitution between food outside the home spending and food at home spending.[27] We analyze this matter further using time use data in Section 4.3.

[27] The effect of retirement on *(food out / food in) * 100* is -3.343 (SE = 10.932, N = 2,454).

Unlike household-level leisure spending (e.g. holidays/trips), we find no significant increases in personal-level leisure spending. This may suggest leisure-time complementarities between spouses at retirement consistent with Stancanelli & Van Soest (2012). We find no drops in spending on clothing which may be considered a work-related expenditure.

[Include Table 3 here.]

For the full estimation results of the most important categories, we refer to Tables C1 and C2.

4.3 Time use categories

In Table 4 we present the estimated effects of retirement on time use categories. The different estimators give a consistent view across time use categories. At retirement, we find paid working hours to decrease by about 26 hours per week which is about 100 percent and consistent with full retirement.[28] Similarly, time commuting decreases by about 3 hours per week at retirement. Much of the hours related to work and commuting are reallocated towards leisure, personal and informal care, and home production. In our preferred RD-estimation, we find an increase in pure leisure time (excluding sleeping/resting) of about 16 hours per week. The increase in time spend in home production at retirement is about 62 percent of the foregone work hours. Similarly, home production increases by about 7 hours per week and absorbs about 27 percent of foregone working hours. This is consistent with using the intensive margin of labor supply instead of a retirement dummy (Table 5, Work hours).

Despite the increases in time spend in home production, we do not find a decrease in potentially replaceable spending categories (cleaning, food out) in Tables 2 and 3. This suggests that retirees

[28] In Table 5 we present estimates for only those retirees who report zero working hours at retirement, that is full retirement. Estimation results are robust.

do not replace spending categories, but increase home production without replacement instead. This is consistent with our estimation results regarding home cooking spending and food outside of the home spending in Tables 2 and 3, respectively.[29] The results suggest increases in food in without any decreases in food out. Additionally, it should be noted that food out has a leisure component in the Netherlands such that the lack of decreases in food out spending are leisure-complementary. Contrasting the findings of Aguiar & Hurst (2005) for American retirees, we find no clear substitution between spending and home production for Dutch retirees.

[Include Table 4 here.]

For the full estimation results of the most important categories, we refer to Tables C1 and C2.

4.4 Sensitivity

Earlier in the paper we referred to the robustness of the results regarding the estimation method used to find the effects of retirement on spending and time use. These results can be found in Table D1. Additionally, we test the sensitivity of the results to samples used in the regression analysis. Table 5 shows that the main effects found in the preferred baseline RD-estimation are also found for the sample that reports home production hours, the sample aged 60-70, full retirees, and (full time) paid workers prior to retirement, although estimated effects are generally smaller for the smaller age-window. Using an intensive labor supply measure instead of an extensive labor supply measure in the form of paid working hours does not change our main conclusions either. The main conclusions do not change if we consider spending and time use categories at time $t+1$ to account for a potential lack of immediate effects of retirement. However, we do observe more evidence for

[29] The same conclusion applies to restricting the data to exactly those households who respond to the home production question (Table 5).

decreases in spending at retirement taking into account a longer adjustment-period although this result is not significant.

[Include Table 5 here.]

For the full estimation results of the most important categories, we refer to Tables C1 and C2.

4.5 Heterogeneity

In Table 6 we present a range of subsamples for who we rerun our baseline RD-estimation to identify the extent to which our main results are representative for different groups of households. Firstly, we consider different household types such as household with a male household head, a female household head, singles, couples, single-earner couples, and dual-earner couples. Our main conclusions regarding the lack of total spending drops, the lack of substitution between spending and home production, and complementariness in leisure-related spending are largely confirmed for these subsamples of households. Spending and time use patterns are slightly different between households with a male and female household head and single and couple households.

Secondly, we use subsamples of potentially vulnerable groups. Our main conclusions are largely confirmed for potentially vulnerable groups such as low-educated households, and low-income households.[30] We find no significant drops in consumption spending at retirement among aforementioned groups which is likely a consequence of the relatively generous state pension which ensures a replacement rate close to 100 percent for low-income households. Although we present estimates on subsamples in Table 6, estimation results are robust to specifications with interactions showing that none of the aforementioned samples observe significantly different

[30] Analyzing a subsample of high-educated and high-income households does not alter our main conclusions (not reported here).

effects of retirement (not reported here). Since, focusing on immigrant households reduces the number of observations substantially, our conclusions regarding this group rely on interaction effects instead of subsample. We find no significantly different consumption patterns of immigrants at retirement.

Knoef et al. (2016) and Been & Knoef (2017) also indicate that the self-employed are potentially vulnerable due to a potential lack of occupational pension accumulation and bad labor market position at older ages. Unfortunately, our number of self-employed is too small to do estimates on this subsample. However, by performing estimates with an interaction between retirement and self-employment at time *t-1*, we observe some different spending patterns (not reported here): although total spending is not significantly different for the self-employed at retirement, which also applies to spending categories such as food in and holidays/trips, we observe significantly bigger spending on food out and significantly smaller increases in home production than non-self-employed.[31] This suggests that, on average, self-employed are also able to smooth consumption without substituting towards home production. Interestingly, the self-employed do not report more working hours and home production at retirement.

All in all, we find remarkably little heterogeneity in total consumption responses implying that even potentially vulnerable groups are likely to be able to smooth consumption spending at retirement. Nonetheless, there is of course substantial heterogeneity in the level of spending between aforementioned groups.

Finally, we use subsamples of households that are not likely to be constrained by liquidity such as households without expenses on debt other than mortgage and households without spending on

[31] These conclusions hold if we compare the self-employed to paid employed only.

rent (e.g. homeowners). The main conclusions are confirmed for these non-liquidity constrained households which suggests that our results are not driven by liquidity-constrained households.

[Include Table 6 here.]

5 Quantitative implications for the Life-Cycle Model

5.1 Importance of LCM parameters

In the literature, it remains largely unknown to what extent intertemporal (IES) or intratemporal elasticities drive consumption smoothing. The estimated IES varies substantially between studies (e.g. Guvenen, 2006; Rogerson & Wallenius, 2013, 2019), and especially between countries (Havranek et al., 2015). Best et al. (2019) find an IES very close to zero, which is inconsistent with a drop in consumption at retirement, but other estimates are close to two, suggesting substantial drops in consumption at retirement (Gruber, 2013). Similarly, there is little consensus on the size of the intratemporal substitution between spending and home production. Empirical analyses by Aguiar & Hurst (2005) and Nevo & Wong (2018) suggest substantial intratemporal substitution between spending and home production. Recent evidence from Been et al. (2020), however, shows that the actual substitution might be much smaller as only a small component of total spending can potentially be replaced by home production. Hence, the interaction between intertemporal and intratemporal substitution of consumption remains largely unclear.

Due to the lack of consensus on the size of both elasticities, it remains largely unclear whether households smooth consumption at retirement due to intratemporal or intertemporal smoothing. Integrating both elasticities in an LCM model, Rogerson & Wallenius (2016) show that the two elasticities are linked, suggesting that higher values of intratemporal substitution imply higher values of intertemporal substitution. However, conclusions regarding the link and the size of the

elasticities are largely based on summary statistics from cross-sectional time use data. In contrast, we use our estimated causal effects from Section 4 to determine the quantitative implications for the elasticities.

5.2 Retirement in a Life-Cycle Model with home production

To analyze the consequences of our empirical results for the LCM, we follow Rogerson & Wallenius (2016) who build forth on Becker (1965) and consider an individual who solves the following lifetime utility function with standard properties and additive separability between consumption and leisure.

$$\int_0^1 [u(c_t) + \frac{\alpha}{1-\frac{1}{\gamma}} l_t^{1-\frac{1}{\gamma}}]\, dt \tag{6}$$

Here, α measures the preferences for leisure and γ measures the intertemporal elasticity of substitution between consumption and saving, that is how much an agent is willing to substitute leisure over time. Utility is maximized with respect to the following budget constraint in which we assume that wages *w* are constant and agents receive retirement benefits *b* as of retirement at *t* = *R*.

$$\int_0^1 c_t^m dt = \int_0^1 w\, h_t dt + \int_R^1 b_t dt \tag{7}$$

We assume that consumption c_t can either be bought on the market c_t^mor produced at home[32]

$$c_t = (a\,(c_t^m)^{1-\frac{1}{\eta}} + (1-a)(h_t^n)^{1-\frac{1}{\eta}})^{\frac{\eta}{\eta-1}} \tag{8}$$

with

[32] This functional form assumes that home production only uses time spend in home production as an input factor. However, it is able to reproduce Becker's (1965) most important result that a lower price of time entails shifts to consumption with relatively more time and less income as an input.

$$h_t = 1 - h_t^n - l_t \tag{9}$$

where η is the intratemporal elasticity between contemporaneous spending and time use. Spending and time use are perfect substitutes if $\eta \to \infty$. If $\eta \sim 1$, then spending and time use are not substitutable.

Hence, following most of the literature on home production starting from Becker (1965) we assume that there is no pure leisure component to home production for simplicity. However, Pollak & Watcher (1975) and Kerkhofs & Kooreman (2003) allow for both a consumption and leisure component in home production (e.g. joint production) which substantially complicates the solution of the model. In the econometric model we cannot differentiate between the consumption and leisure components of home production and keep our theoretical model consistent with the limits of our data.

Following the framework of Rogerson & Wallenius (2016), we assume that retirement is a discontinuous drop in working hours from $h_t = h^{FT}$ to $h_t = 0$ and that time spend on home production h_t^n can change continuously. Given these assumptions, Rogerson & Wallenius (2016) show that the model can be simplified substantially which gives the following solutions for any interior solution of the model

$$\left[\frac{c_w^m}{c_r^m}\right]^{\frac{1}{\gamma}} = \frac{u\prime(c_w)}{u\prime(c_r)}\left[\frac{c_w}{c_r}\right]^{\frac{1}{\gamma}} \tag{10}$$

$$\left[\frac{1-h_r^n}{1-h^{FT}-h_w^n}\right]^{\frac{1}{\gamma}}\left[\frac{h_w^n}{h_r^n}\right]^{\frac{1}{\eta}} = \frac{u\prime(c_w)}{u\prime(c_r)}\left[\frac{c_w}{c_r}\right]^{\frac{1}{\gamma}} \tag{11}$$

With $t = w$ indicating working life and $t = r$ indicating the period of retirement. Here, Equation 10 measures the drop in consumption spending at retirement. Equation 11 shows the relation between

the change in spending versus home production at retirement. These expressions show that the degree of smoothing of smoothing of consumption depends on both γ, that is the intertemporal elasticity, and η, the intratemporal elasticity. The higher the value of γ, the less an agent desires smoothing of spending over the life cycle. Therefore, the agent should have a relatively high value for η in order to maximize utility. This becomes clear by inserting Equation 10 in 11, taking logs, and rearranging which gives the following constant

$$\frac{\gamma}{\eta} = \frac{\log\left((1-h_r^n)/(1-h^{FT}-h_w^n)\right)}{\log(c_w^m/c_r^m)-\log(h_w^n/h_r^n)} \equiv \frac{\varepsilon_l}{\varepsilon_c-\varepsilon_{hp}} \tag{12}$$

Such that

$$\gamma = \frac{\varepsilon_l}{\varepsilon_c-\varepsilon_{hp}}\eta \tag{13}$$

Our empirical model allows for the estimation of ε_l, ε_c, and ε_{hp}. The empirical analysis helps us identify the size η. Based on Equation 13 and our empirical estimates, we can therefore identify reasonable values for γ.

The model considered by Rogerson & Wallenius (2016) assumes additive separability between consumption and leisure. Allowing for non-separability, as in Laitner & Silverman (2005) gives an additional parameter θ measuring the degree of complementariness (or substitution) between consumption and leisure thereby inducing another channel through which spending categories change at retirement next to substitution by home production in η.

θ is likely to affect the intertemporal elasticity of substitution, but not the intratemporal elasticity of substitution as we assume an absence of leisure in home production. If $\theta > 1$ (e.g. consumption and leisure are complements), then a discontinuous drop in consumption at retirement (e.g. an IES

not close to zero) can be rationalized as increased leisure offsets utility lost from decreased consumption. On the other hand, agents can take advantage of the complements between consumption and leisure by discontinuously increasing consumption at retirement. Therefore, stronger complements between consumption and leisure decrease the preferences for smoothing consumption. The empirical analysis helps us identify the sign of θ for life cycle consumption decisions.

Our framework assumes a unitary household model that does not take into account spouses' interactions within the households as our empirical analysis focusses on the main income earner of the household without focusing on spouses' interactions in time use. However, Rogerson & Wallenius (2019) show that this theoretical framework can easily be extended to a collective household model with two spouses.

5.3 Implied elasticities

To analyze the quantitative implications of our estimation results for intertemporal and intratemporal elasticities, we base our analysis on the RD results using age 65 as a cutoff point. Table 4 implies that retirement increases time spend on leisure and home production by about 39 percent and 44 percent, respectively. Table 2 indicates that total consumption spending does not change at retirement. These results give $\varepsilon_l = \log(1.39) \sim 0.158$, $\varepsilon_c = \log(1.00) = 0$, and $\varepsilon_{hp} = \log(0.56) \sim -0.252$. Inserting these results in Equation 13 gives

$$\gamma = 0.57\,\eta \qquad (14)$$

This equality suggests that, for any reasonable value of η, we find a positive but smaller elasticity of intertemporal substitution (IES) than for intratemporal substitution. This result is partially driven by the lack of spending drops at retirement. Reasonable values of η from the literature range

from 1 to about 2 (Rogerson & Wallenius, 2016), with a typical value equal to 2 (Aguiar et al., 2013), which implies an IES ranging from 0.57 to 1.14. Although there is no clear consensus on the value of the IES in the literature, many studies using American data find elasticities between zero and one depending on consumption data and calibration methods used, respectively (Guvenen, 2006).[33] Hence, for any reasonable estimate of η based on American households, we get an IES that is smaller but comparable to estimates from American households.

However, unlike for the IES, there is little direct empirical evidence on the size of η. Most theoretical evidence exploits the positive correlation between γ and η to determine the size of η (Campbell & Ludvigson, 2001). Although we cannot derive the value of η from our empirical estimates, they do imply a lack of intratemporal substitution. More specifically, our estimates specifically targeted at (potential) retirees suggest no substitution between replaceable spending categories, such as cleaning and food outside the home, despite substantial increases in time spend in home production. In other words, the lack of consumption drops found cannot be explained by increased home production. In fact, the increases in time use in home production may simply represent increases in non-work time available that are devoted to the leisure-component in home production categories (Pollak & Watcher, 1975; Kerkhofs & Kooreman, 2003). Therefore, η may be close to one in our case implying an IES below unity.

As for the degree of complementariness between consumption and leisure θ, our results suggest that both spending and leisure time increase at retirement. This is especially true for typical leisure-related spending such as holidays/trips: in terms of percentages increases in spending on holidays and trips increase more substantially than total spending at retirement.[34] Hence, our micro

[33] However, more recent studies by Gruber (2013) and Rogerson & Wallenius (2016) suggest that the IES should be bigger with estimates up to 2.

[34] Other personal leisure spending on hobbies, for example, increases at retirement but is not significant.

estimates suggest $\theta > 1$, which is inconsistent with a small IES according to Laitner & Silverman (2005). Two options would make θ and the IES consistent according to our empirical findings: 1) A bigger intratemporal elasticity, which is not supported by our empirical findings, would increase the IES consistent with $\theta > 1$. 2) Preferences for non-smoothing and inabilities to smooth are not captured in the simple relationship in Equation 13. One such preference is the motive to leave bequests. Inabilities to smooth can be related to liquidity constraints and wrong expectations. Hence, we need extensions to the LCM-framework of Rogerson & Wallenius (2016) to explain the life cycle parameters in the Netherlands.

5.4 Empirics of extensions to the Life-Cycle Model

Although the theoretical framework proposed by Rogerson & Wallenius (2016) provides nice insights in the link between intertemporal and intratemporal substitution to explain consumption behavior over the life cycle, several potentially features of the LCM are not included. Firstly, liquidity constraints are not considered in the model (Mariger, 1987). However, our results in Table 6 suggest that our estimation results and quantitative implications are not likely to depend on liquidity as spending and time use patterns are similar among households without debt and homeowners.

Secondly, the theoretical framework does not consider savings motives such as bequests (De Nardi et al., 2016). Van Ooijen et al. (2015) show that bequest motives are important in explaining a lack of dissaving during retirement. In Table E1 in Appendix E we show that retirement does not induce dissaving, despite the lack of drops in spending. In our theoretical framework without bequest motives, preferences for bequests (e.g. saving during work life to prevent dissaving at retirement) are captured by the IES which is likely to be downward biased if bequest motives are strong. A

model with a bequest motive that produces a higher IES is more consistent with the substantial consumption-leisure complementariness we find.

In Table E1 we also show that households expect their subjective financial situation to stay the same at retirement. However, our results also indicate that their realized subjective situation at retirement is significantly better than pre-retirement. Although this measure only measures the perceived financial situation, households may have imperfect foresight in available retirement resources as suggested by Hurd & Rohwedder (2003). A substantial source of imperfect foresight is the relatively low financial literacy regarding pension in the Netherlands (Knoef et al., 2020) which might be related to the high mandatory nature of retirement savings with little flexibility to deviate from the default. With the high mandatory savings households can be positively surprised at retirement. Another likely unanticipated source is the tax-benefit system that reduces income taxes by 17.9 percent in retirement. In Table E1 we show that gross income significantly decreases by about 18 percent at retirement whilst net income stays the same at retirement. This is consistent with the simulated net replacement rates of about 100 percent for at least half of the Dutch households (Knoef et al., 2016).

6 Conclusion

Many studies have documented a drop in consumption spending at retirement which was long assumed to be inconsistent with the Life-Cycle Model (LCM). More recent work has tried to reconcile the spending drops at retirement with the LCH. Three recent prominent explanations to solve the *Retirement Savings Puzzle* (RSP) are 1) a relatively high intertemporal elasticity of substitution (IES - Rogerson & Wallenius, 2016), 2) strong consumption-leisure

complementarities (Laitner & Silverman, 2005), and 3) substantial intratemporal substitution between spending and home production (Aguiar & Hurst, 2005).

In this paper we provide new empirical evidence on reconciling consumption smoothing at retirement with home production using detailed micro data concerning spending and time use. We are the first to estimate causal effects of retirement on a wide array of consumption spending and time categories available for the same longitudinal sample, particularly focusing on leisure-complementary spending and home production substitutable spending. Causal inference relies on Fuzzy Regression Discontinuity (RD), like Stancanelli & Van Soest (2012), and Fixed Effects (FE) estimation, like Aguila et al. (2011). Our results shed new light on the importance of intertemporal consumption smoothing (e.g. choices of consumption and saving over the life-cycle) versus intratemporal consumption smoothing (e.g. contemporaneous choices of spending and home production) to explain the degree of consumption smoothing at retirement.

Much of the empirical evidence of consumption smoothing at retirement is based on American households with exceptions analyzing mostly European countries with non-Nordic social policy models such as France (Battistin et al., 2009), Germany (Luhrmann, 2010), Italy (Moreau & Stancanelli, 2015), Spain (Luengo-Prado & Sevilla, 2012), and the UK (Banks et al., 1998). Unlike much of this earlier literature, we do not find significant drops in total consumption spending at retirement. This is likely due to the relatively high replacement rates that the Dutch pension system provides (Knoef et al., 2016). However, we find substantial complementarities in spending and leisure as suggested by Laitner & Silverman (2005). Contrasting Aguiar & Hurst (2005), our estimates on detailed spending and time use categories suggest an absence of substitution between spending and home production. Our results indicate that time spend in home production increases, but not due to substitution of spending categories. This contradicts empirical studies that argue

that increases in home production at retirement are sufficient to imply substitution (Schwerdt, 2005; Stancanelli & Van Soest, 2012; Atalay et al., 2020; Bonsang & Van Soest, 2020). These main results are robust to a wide variety of different estimators, samples, and definitions.

The quantitative implications of our empirical findings for a simple LCM with home production suggest that for any reasonable estimate of η based on American households our estimates imply an IES that is smaller than but comparable to estimates from American households. However, as our results suggest a lack of substitution between spending and home production, the elasticity of intertemporal substitution and the elasticity of intratemporal substitution are most likely below unity and close to 1, respectively. We point out important extensions in future LCM models with home production using bequest motives and uncertainty. Empirically, our results suggest that bequest motives and uncertainty are potentially important in explaining the lack of consumption drops at retirement.

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Tables

Table 1. *Step-wise increase of the statutory retirement age as introduced in 2013*

Birth date	Statutory Retirement Age
< January 1, 1948	65
January 1, 1948 - November 30, 1948	65 + 1 month
December 1, 1948 - October 31, 1949	65 + 2 months
November 1, 1949 - September 30, 1950	65 + 3 months
October 1, 1950 - June 30, 1951	65 + 6 months
July 1, 1951 - March 31, 1952	65 + 9 months
April 1, 1952 - December 31, 1952	66
January 1, 1953 - August 31, 1953	66 + 4 months
September 1, 1953 - April 30, 1954	66 + 8 months
May 1, 1954 - December 31, 1955	67
> December 31, 1955	67 + 3 months

Table 2. *Estimation results of the effect of retirement on household spending*

		Household consumption spending categories (euros/month) - N = 5,815												
		Mortgage	**Rent**	**Utilities**	**Transport**	**Insurance**	**Alimony**	**Debt**	**Cleaning**	**Food**	**Daycare**	**Holiday**	**Other_hh**	**Total_hh**	**Total**
OLS	Coeff.	0.872	-1.231	2.857	-4.094	10.550	-3.144	0.200	-0.852	11.176	0.145	13.851*	6.689	-20.110	-3.539
	SE	(17.019)	(12.009)	(5.330)	(5.387)	(6.787)	(3.306)	(2.846)	(2.580)	(9.528)	(0.131)	(7.837)	(5.501)	(44.042)	(48.795)
FE	Coeff.	0.974	-12.626*	12.465**	5.494	6.809	1.117	-1.813	-0.487	30.920***	0.824	27.512***	-1.481	86.122*	84.223
	SE	(16.349)	(6.545)	(6.331)	(6.309)	(9.428)	(4.783)	(4.424)	(3.288)	(11.287)	(0.704)	(9.070)	(8.130)	(46.223)	(53.739)
RD	Coeff.	-42.739	48.446	11.858	5.837	-13.734	-27.051***	-2.217	4.071	92.646***	0.248	65.292***	-7.113	154.333	216.923
Cut = 65	SE	(49.088)	(33.427)	(16.170)	(15.930)	(22.156)	(10.276)	(10.163)	(8.211)	(30.211)	(0.804)	(24.824)	(20.032)	(126.834)	(148.485)
RD	Coeff.	9.156	33.377	6.639	-1.464	-23.598	-14.281*	-9.526	0.180	32.625	0.790	28.294	-0.504	125.452	75.279
Cut = AOW	SE	(40.235)	(27.301)	(12.734)	(12.810)	(17.363)	(7.666)	(8.216)	(6.610)	(23.708)	(0.915)	(19.365)	(15.940)	(102.478)	(119.745)
RD-FE	Coeff.	-52.438	-8.942	9.484	14.862	-31.029	-3.118	-8.204	6.285	90.477***	0.138	57.681**	-8.748	123.063	93.440
Cut = 65	SE	(40.451)	(18.519)	(18.120)	(17.736)	(27.015)	(13.566)	(11.159)	(9.147)	(31.964)	(0.713)	(28.612)	(23.561)	(124.653)	(152.285)

* denotes significant at the 10% level, ** at the 5% level and *** at the 1% level. Amounts are expressed in 2015 euros. Control variables are included.

Table 3. *Estimation results of the effect of retirement on personal spending at the household level*

		Personal consumption spending categories at HH level (euros/month) - N = 5,493 (total), 2,751 (cats)									
		Food out	**Tobacco**	**Clothes**	**Pers care**	**Med care**	**Leisure**	**School**	**Donation**	**Other**	**Total**
OLS	Coeff.	0.205	-4.534	-0.113	3.687	2.640	14.086***	-1.450	0.323	3.705**	11.819
	SE	(4.454)	(2.829)	(6.390)	(2.656)	(3.072)	(4.316)	(1.662)	(4.122)	(1.831)	(13.214)
FE	Coeff.	-10.546	0.295	2.596	2.111	3.901	11.761	-2.141	4.245	10.083**	-13.704
	SE	(8.031)	(2.836)	(10.093)	(3.832)	(4.744)	(8.458)	(4.385)	(8.283)	(4.959)	(19.659)
RD	Coeff.	12.177	1.016	15.435	10.037	1.547	11.746	-9.984*	-15.979	2.498	24.578
Cut = 65	SE	(14.357)	(8.406)	(19.038)	(8.221)	(9.046)	(13.160)	(5.180)	(11.274)	(6.370)	(50.232)
RD	Coeff.	12.177	1.016	15.435	10.037	1.547	11.746	-9.984*	-15.979	2.498	-50.754
Cut = AOW	SE	(14.357)	(8.406)	(19.038)	(8.221)	(9.046)	(13.160)	(5.180)	(11.274)	(6.370)	(41.683)
RD-FE	Coeff.	-51.104	-15.485	-20.363	-0.966	27.576	-7.784	-6.977	-6.503	5.517	-61.276
Cut = 65	SE	(37.037)	(15.504)	(44.723)	(19.765)	(24.413)	(34.738)	(12.369)	(30.975)	(19.436)	(65.435)

* denotes significant at the 10% level, ** at the 5% level and *** at the 1% level. Amounts are expressed in 2015 euros. Control variables are included.

Table 4. *Estimation results of the effect of retirement on time use*

		Personal time use (hours/week)											
		Work	**Commute**	**Home**	**Pers care**	**Childcare**	**Care parents**	**Care family**	**Care other**	**Leisure**	**School**	**Admin**	**Rest**
OLS	Coeff.	-16.344***	-1.965***	2.768***	1.124***	-0.006	0.213**	0.880***	0.346*	6.760***	-0.170	0.430**	3.265***
	SE	(0.681)	(0.135)	(0.614)	(0.400)	(0.072)	(0.098)	(0.269)	(0.190)	(1.158)	(0.164)	(0.217)	(0.830)
FE	Coeff.	-19.607***	-2.376***	5.498***	2.007**	0.039	0.040	0.670*	0.487*	7.697***	-0.579**	1.264***	2.898*
	SE	(0.895)	(0.205)	(1.060)	(0.982)	(0.102)	(0.136)	(0.354)	(0.255)	(1.790)	(0.275)	(0.444)	(1.536)
RD	Coeff.	-26.190***	-2.928***	7.002***	3.195**	0.347	-0.001	2.101**	1.434**	15.790***	0.780	-0.541	0.934
Cut = 65	SE	(1.769)	(0.405)	(2.216)	(1.241)	(0.341)	(0.326)	(0.841)	(0.611)	(4.106)	(0.623)	(0.653)	(3.081)
RD	Coeff.	-27.323***	-2.974***	5.857***	3.059**	0.155	-0.040	3.154***	2.064***	20.449***	0.245	-0.506	1.107
Cut = AOW	SE	(1.714)	(0.382)	(2.190)	(1.272)	(0.338)	(0.326)	(0.892)	(0.645)	(4.331)	(0.586)	(0.670)	(3.128)
RD-FE	Coeff.	-26.428***	-3.280***	11.882***	-1.637	0.316	-0.117	2.532**	1.510**	10.070	-0.489	-0.758	-3.021
Cut = 65	SE	(1.917)	(0.443)	(3.505)	(3.521)	(0.348)	(0.388)	(1.023)	(0.753)	(6.474)	(0.928)	(1.616)	(5.001)
	N	5,769	5,787	3,676	2,772	5,809	5,773	5,701	5,711	3,651	3,684	2,759	3,663

* denotes significant at the 10% level, ** at the 5% level and *** at the 1% level. Amounts are expressed in 2015 euros. Control variables are included.

Table 5. *Sensitivity to sample and definitions of retirement*

			Spending							Time use			
			Transport	**Cleaning**	**Food in**	**Holiday**	**Food out**	**Leisure**	**Total**	**Work**	**Commute**	**Home**	**Leisure**
HP-sample	RD	Coeff.	-10.389	10.731	137.860***	88.978**	12.613	10.610	190.049	-27.619***	-3.550***	7.002***	15.758***
		SE	(22.232)	(11.451)	(43.411)	(35.909)	(13.354)	(14.616)	(218.382)	(2.536)	(0.637)	(2.216)	(4.146)
		N	3,635	3,635	3,635	3,635	2,686	2,686	3,635	3,637	3,654	3,676	3,619
Age 60-70	RD	Coeff.	1.501	29.505*	73.519	91.310*	-0.879	30.440	357.370	-19.611***	-1.129	-3.085	25.235*
		SE	(32.642)	(16.690)	(62.968)	(52.485)	(47.409)	(53.005)	(307.335)	(3.822)	(0.858)	(8.488)	(14.287)
		N	4,215	4,215	4,215	4,215	1,928	1,928	4,215	4,202	4,206	2,614	2,595
Work hours	RD	Coeff.	0.006	0.001	-3.161***	-2.148**	-0.414	-0.408	-5.490	1.000***	0.116***	-0.241***	-0.552***
		SE	(0.615)	(0.314)	(1.158)	(0.953)	(0.523)	(0.564)	(5.718)	(0.000)	(0.014)	(0.078)	(0.141)
		N	5,701	5,701	5,701	5,701	2,677	2,677	5,701	5,769	5,742	3,637	3,612
Full retirement	RD	Coeff.	5.784	4.530	102.011***	72.759***	12.849	14.597	238.603	-29.159***	-3.227***	7.564***	17.229***
		SE	(17.737)	(9.162)	(33.786)	(27.703)	(14.073)	(15.442)	(165.728)	(1.984)	(0.444)	(2.454)	(4.507)
		N	5,815	5,815	5,815	5,815	2,751	2,751	5,815	5,769	5,787	3,676	3,651
Paid work	RD	Coeff.	3.390	1.227	69.846**	52.971**	9.716	5.934	55.178	-29.540***	-3.710***	6.616***	16.878***
		SE	(15.323)	(7.939)	(28.785)	(23.780)	(13.156)	(14.065)	(142.727)	(1.386)	(0.392)	(1.853)	(3.668)
		N	4,774	4,774	4,774	4,774	2,238	2,238	4,774	4,755	4,747	2,985	2,959
FT work to	RD	Coeff.	5.178	1.026	101.816***	68.184**	19.162	2.563	131.392	-27.028***	-3.293***	6.731***	15.749***
Full retirement		SE	(17.970)	(9.291)	(34.117)	(27.620)	(16.745)	(17.616)	(172.115)	(2.137)	(0.488)	(2.434)	(4.582)
		N	4,486	4,486	4,486	4,486	2,149	2,149	4,486	4,423	4,455	2,837	2,815
C_{it+1}	RD	Coeff.	-37.277*	0.966	56.352	100.537***	30.494	46.508*	-115.764	-19.871***	-2.417***	3.075	17.255***
		SE	(22.094)	(11.404)	(42.981)	(33.578)	(20.559)	(23.905)	(191.351)	(2.215)	(0.489)	(3.278)	(5.761)
		N	3,318	3,318	3,318	3,318	1,325	1,325	3,318	3,297	3,309	1,978	1,961

* denotes significant at the 10% level, ** at the 5% level and *** at the 1% level. Amounts are expressed in 2015 euros. Control variables are included.

Table 6. *Heterogeneous effects of retirement on spending and time use*

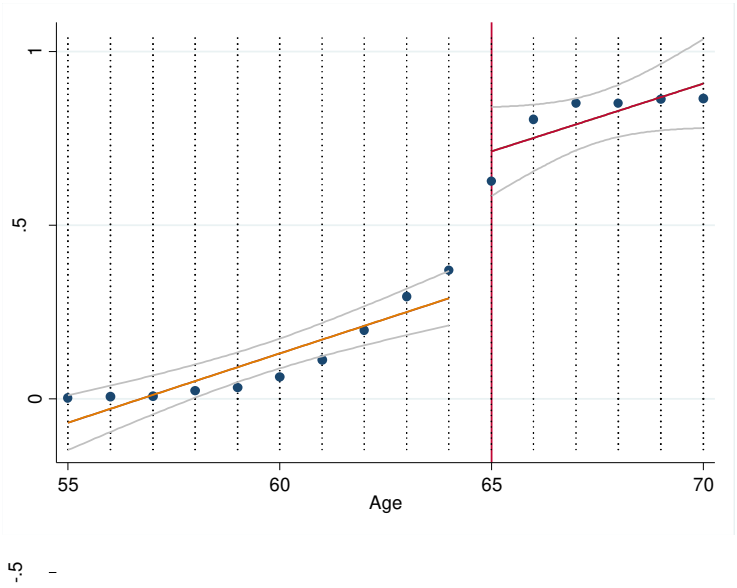
			Spending							Time use			
			Transport	**Cleaning**	**Food in**	**Holiday**	**Food out**	**Leisure**	**Total**	**Work**	**Commute**	**Home**	**Leisure**
Men	RD	Coeff.	24.780	10.818	132.421***	102.412***	20.564	18.515	298.671*	-28.462***	-3.572***	5.279**	13.674***
		SE	(19.996)	(9.372)	(35.974)	(31.343)	(15.429)	(17.279)	(180.316)	(1.991)	(0.502)	(2.094)	(4.439)
		N	3,791	3,791	3,791	3,791	1,873	1,873	3,791	3,736	3,761	2,448	2,431
Single	RD	Coeff.	7.407	-2.618	51.726	-0.650	37.188	-10.474	389.135**	-20.822***	-2.529***	6.377	11.812
		SE	(22.652)	(13.496)	(40.712)	(15.689)	(24.796)	(24.479)	(193.606)	(2.689)	(0.645)	(4.475)	(7.819)
		N	2,034	2,034	2,034	2,034	879	879	2,034	2,043	2,042	1,201	1,202
Couple	RD	Coeff.	10.819	6.892	113.034***	99.914***	11.599	23.806	98.888	-28.017***	-2.933***	7.425***	17.196***
		SE	(20.474)	(9.972)	(39.428)	(35.988)	(15.205)	(17.030)	(195.402)	(2.141)	(0.502)	(2.462)	(4.724)
		N	3,781	3,781	3,781	3,781	1,872	1,872	3,781	3,726	3,745	2,475	2,449
Dual-earner	RD	Coeff.	10.130	9.653	94.938	137.086**	-5.350	-69.256	264.269	-25.859***	-2.387***	-6.478	13.111
		SE	(40.138)	(16.246)	(68.169)	(66.264)	(38.341)	(45.773)	(338.524)	(3.805)	(0.847)	(6.571)	(11.835)
		N	1,852	1,852	1,852	1,852	957	957	1,852	1,859	1,858	1,196	1,178
Single-earner	RD	Coeff.	-7.746	1.704	77.600**	37.701	7.382	35.689**	232.404	-25.720***	-2.969***	8.286***	17.956***
		SE	(16.624)	(9.291)	(32.603)	(24.812)	(15.546)	(16.852)	(161.334)	(1.930)	(0.457)	(2.402)	(4.501)
		N	3,963	3,963	3,963	3,963	1,794	1,794	3,963	3,910	3,929	2,480	2,473
Women	RD	Coeff.	-8.659	4.767	7.649	4.239	-0.905	-3.423	222.004	-16.916***	-0.943	10.542**	11.203
		SE	(21.573)	(15.429)	(48.362)	(30.594)	(24.165)	(24.972)	(234.073)	(2.423)	(0.608)	(5.140)	(7.649)
		N	2,024	2,024	2,024	2,024	878	878	2,024	2,033	2,026	1,228	1,220
Low-edu	RD	Coeff.	-9.143	0.970	71.598	24.571	6.270	35.150	90.702	-20.745***	-2.799***	11.415***	11.325*
		SE	(24.444)	(12.087)	(53.766)	(40.080)	(21.829)	(24.796)	(244.826)	(3.258)	(0.726)	(4.095)	(6.729)
		N	1,850	1,850	1,850	1,850	1,014	1,014	1,850	1,837	1,839	1,262	1,250
Low-inc $_{it-1}$	RD	Coeff.	17.163	21.216	246.721**	83.542	-23.333	44.890	516.935	-4.854	0.922	-2.993	11.515
		SE	(51.956)	(25.659)	(106.205)	(82.905)	(51.206)	(58.321)	(494.513)	(5.434)	(1.079)	(10.628)	(15.775)
		N	2,559	2,559	2,559	2,559	1,201	1,201	2,559	2,550	2,555	1,629	1,617
No debt	RD	Coeff.	4.047	1.172	103.566***	72.714***	10.354	13.144	190.774	-26.225***	-3.061***	7.023***	14.798***

		SE	(17.243)	(8.879)	(32.977)	(27.302)	(14.495)	(15.781)	(161.247)	(1.917)	(0.439)	(2.419)	(4.435)
		N	5,216	5,216	5,216	5,216	2,436	2,436	5,216	5,117	5,133	3,259	3,236
No rent	RD	Coeff.	11.288	8.236	96.404***	88.685***	8.510	9.141	172.220	-27.796***	-3.293***	7.439***	17.801***
		SE	(19.649)	(10.184)	(36.935)	(31.111)	(14.914)	(16.542)	(184.328)	(2.057)	(0.474)	(2.408)	(4.579)
		N	4,359	4,359	4,359	4,359	2,031	2,031	4,359	4,272	4,283	2,715	2,690

* denotes significant at the 10% level, ** at the 5% level and *** at the 1% level. Amounts are expressed in 2015 euros. Control variables are included. Low income is below the p25 which is the bottom quartile of gross income of non-retirees aged 55-75: 1,500 euros per month. p75 is the top quartile of gross income of non-retirees aged 55-75: 3,500 euros per month.

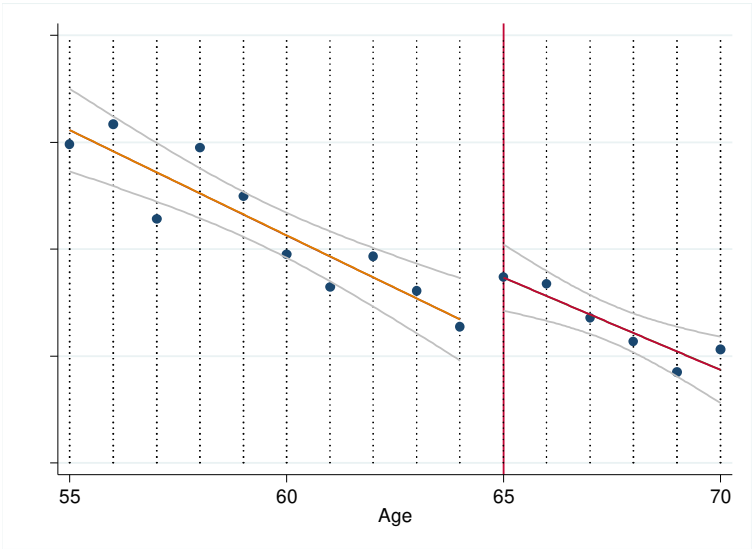
Figures

Figure 1. *Retirement (%) by age.*[35]



Notes: Lower- and upper bounds of the 95%-interval are presented in light grey lines.

Figure 2. *Average total household consumption spending (euros per month) by age.*



Notes: Lower- and upper bounds of the 95%-interval are presented in light grey lines.

[35] This discontinuity is robust to differentiating between the pre-retirement age increase period (<2013) and the post-retirement age increase period (>2012). See Figures B2 and B3.

Online appendix

Appendix A - Elicited Questions in LISS

A.1 Time Use & Consumption component

The following questions are about the **expenditure pattern of your household**.
Can you indicate for each type of expenditure how many euros your household spends on this on average, per month? Consider as reference period the past 12 months.
-If you do not have any expenditure in a particular category, please enter 0.
-If you don't know exactly how much, please give the best possible estimate. You can also use a calculator.
-Please answer these questions, even if you have answered similar questions at some earlier time. This is about the distribution of your total expenditure.
-Questions about your personal expenditure follow further on in this questionnaire.
How many euros does your household spend on average each month on:

- **mortgage: interest plus amortization (what matters is the gross amount, so before tax deduction)**
- **rent (NOT including costs of gas and electricity)**
- **general utilities (heating, electricity, water, telephone, Internet, etc; but NO insurances)**
- **transport and means of transport (public transport; own car: gasoline/diesel and maintenance, but NOT insurances or the purchase of e.g. a car or [motor] bike)**
- **insurances (home insurance, car insurance, health insurance, etc.)**
- **children's daycare (day care center, out-of-school supervision, guest parents, homework guidance, etc.)**
- **alimony and financial support for children not (or no longer) living at home**
- **debts and loans (but NOT the mortgage)**
- **daytrips and holidays with the whole family or part of the family (flight tickets, hotel, restaurant bills for the family, etc.)**
- **expenditure on cleaning the house or maintaining the garden**

- **eating at home (food, drinks, candy, etc.)**
- **other**

The following question is about your **personal expenditure pattern**.
For each type of expenditure, please indicate how many euros you spend on this per month, on average. Consider as reference period the past twelve months.
Note: This only concerns expenditure for your own personal consumption.
- If you had no expenditure in a certain category, please enter 0.
- If you don't know exactly how much, please give the best possible estimate. You can also use a calculator.

- **food and drinks outside the house (restaurant, café, company canteen, etc.)**
- **cigarettes and other tobacco products**
- **clothing (clothes, shoes, jewelry, etc.)**
- **personal care products and services (hair care, body care, hairdresser, manicure, etc., but NO medical care)**
- **medical care and health costs NOT covered by insurance (medicines, doctor, dentist, hospital bills, maternity care, spectacles, hearing aids, etc.)**
- **leisure time expenditure (film, theater, hobbies, sports activities, photography, books, CDs/DVDs, expenditure during daytrips or travel without family, etc.)**
- **(further)schooling (expenditure on courses, enrolment fees, etc.)**
- **donations and gifts (for family, friends, charity, etc.)**
- **other**

The following questions are about the amount of **time you spent on diverse activities** in the seven days preceding today.
Please indicate per activity how many hours you spent on the activity.
-If you did not spend any time on a certain activity, enter 0.
-If you spent for example an hour and a half on a certain activity, then enter 1 hour and 30 minutes.
-If you're not sure, then please estimate the amount of time as best as you can.

-Note: the total number of hours should equal 168 (=7 times 24, the total number of hours in one week).

How much time did you spend in the last seven days on:

- **paid work (in employment or as self-employed; do NOT include the time spent traveling to and from work, but DO count overhours)**
- **time traveling to and from work or to and from school**
- **household chores (such as cleaning, laundry, shopping, cooking, gardening, odd jobs, etc; but not personal care or care for children or parents, for example)**
- **personal care (such as washing, dressing, eating, visiting the hairdresser, seeing the doctor, etc.)**
- **if children: activities with children (such as washing, dressing, playing, reading, taking child to see doctor, taking child to school/hobby activities, etc.)**
- **helping parents (for instance assistance with administrative chores, washing, dressing, taking someone to see the doctor, etc.)**
- **helping other family members (for instance assistance with administrative chores, washing, dressing, taking someone to see the doctor, etc.)**
- **helping non-family members (for instance assistance with administrative chores, washing, dressing, taking someone to see the doctor, etc.)**
- **leisure time activities (such as watching TV, reading, sports activities, hobbies, computer as hobby, visiting friends or family, traveling, going out, etc.)**
- **(further) schooling (day or evening school, professional training, language course or other course, etc.)**
- **administrative chores and own family finances**
- **sleeping and resting (sleeping, lazing, thinking, meditating, etc.)**
- **other activities not named above**

A.2 Economic Situation: Income component

Do you expect your financial situation to get better or worse over the coming 12 months?
1 will get much better
2 will get slightly better
3 will remain more or less the same
4 will get a bit worse
5 will get a lot worse
99 I don't know

Can you indicate, on a scale from 0 to 10, whether your financial situation has gotten better or worse compared to one year ago? 0 means that your financial situation has gotten much worse compared to one year ago 10 means that it has gotten much better.

Think about the coming 12 months. Do you think that the expenditure of your household will be:
1 much higher than the income
2 higher than the income
3 approximately equal to the income
4 lower than the income
5 much lower than the income
99 I don't know

Think about the last 12 months. Was your household expenditure more than, equal to, or less than your household income?
1 expenditure was higher than the income
2 expenditure was approximately equal to the income
3 expenditure was lower than the income

A.3 Background Variables component

Primary occupation

1 Paid employment

2 Works or assists in family business

3 Autonomous professional, freelancer, or self-employed

4 Job seeker following job loss

5 First-time job seeker

6 Exempted from job seeking following job loss

7 Attends school or is studying

8 Takes care of the housekeeping

9 Is pensioner ([voluntary] early retirement, old age pension scheme)

10 Has (partial) work disability

11 Performs unpaid work while retaining unemployment benefit

12 Performs voluntary work

13 Does something else

14 Is too young to have an occupation

Table A1. *Summary statistics and LISS sources (2015 euros)*

Variable	Obs.	Mean	S.D.	Source	Waves
HH-level spending (hours)					
Mortgage	5,815	283.19	378.76	Time Use and Consumption	2009-2019
Rent	5,815	130.74	239.27	Time Use and Consumption	2009-2019
Utilities	5,815	204.89	116.18	Time Use and Consumption	2009-2019
Transport	5,815	126.48	120.12	Time Use and Consumption	2009-2019
Insurance	5,815	223.10	163.33	Time Use and Consumption	2009-2019
Alimony	5,815	17.77	77.36	Time Use and Consumption	2009-2019
Debt	5,815	20.77	76.35	Time Use and Consumption	2009-2019
Cleaning	5,815	40.06	58.50	Time Use and Consumption	2009-2019
Food in	5,815	323.55	225.34	Time Use and Consumption	2009-2019
Daycare	5,815	0.22	6.25	Time Use and Consumption	2009-2019
Holidays/Trips	5,815	120.37	194.51	Time Use and Consumption	2009-2019
Other	5,815	99.20	137.88	Time Use and Consumption	2009-2019
Total	5,815	1591.73	982.07	Time Use and Consumption	2009-2019
Pers.-level spending (hours)					
Food out	2,751	56.15	79.72	Time Use and Consumption	2009-2012
Tobacco	2,751	19.52	44.36	Time Use and Consumption	2009-2012
Clothes	2,751	100.18	110.14	Time Use and Consumption	2009-2012
Pers. Care	2,751	45.03	45.80	Time Use and Consumption	2009-2012
Med. Care	2,751	34.06	49.62	Time Use and Consumption	2009-2012
Leisure	2,751	57.67	74.14	Time Use and Consumption	2009-2012
Schooling	2,751	7.62	29.56	Time Use and Consumption	2009-2012
Donations/Gifts	2,751	56.06	64.35	Time Use and Consumption	2009-2012
Other	2,751	18.00	35.77	Time Use and Consumption	2009-2012
Total	5,493	353.36	361.35	Time Use and Consumption	2009-2019
Total HH spending	5,815	1962.91	1155.54	Time Use and Consumption	2009-2019

Table A1. *Continued*

Time Use (hours)					
Work	5,769	14.61	18.36	Time Use and Consumption	2009-2019
Commute	5,787	1.97	3.48	Time Use and Consumption	2009-2019
Home production	3,676	15.87	12.21	Time Use and Consumption	2009-2012, 2019
Pers. Care	2,772	10.63	6.88	Time Use and Consumption	2009-2012, 2019
Child care	5,809	0.58	2.88	Time Use and Consumption	2009-2019
Care parents	5,773	0.77	2.38	Time Use and Consumption	2009-2019
Care other family	5,701	2.89	5.59	Time Use and Consumption	2009-2019
Care other	5,711	1.85	4.03	Time Use and Consumption	2009-2019
Leisure	3,651	40.96	21.78	Time Use and Consumption	2009-2012, 2019
Schooling	3,684	1.00	3.30	Time Use and Consumption	2009-2012, 2019
Admin	2,759	3.55	3.59	Time Use and Consumption	2009-2012, 2019
Rest	3,663	59.93	16.13	Time Use and Consumption	2009-2012, 2019
Income & savings					
Exp. Fin. Situation (1-5)	12,010	3.13	0.95	Economic Situation: Income	2009-2019
Fin. Situation (1-10)	12,287	5.35	1.41	Economic Situation: Income	2009-2019
Exp. Savings (1-5)	11,933	3.21	1.02	Economic Situation: Income	2009-2019
Savings (1-3)	12,285	2.26	0.70	Economic Situation: Income	2009-2019
Gross income (euros)	12,057	3,418.15	22,870.53	Background Variables	2009-2019
Net income (euros)	12,573	2,053.87	5,339.51	Background Variables	2009-2019

Table A1. *Continued*

Independent variables					
Retired (0,1)	12,597	0.43	0.50	Background Variables	2009-2019
Birth year	12,597	1950.43	5.41	Background Variables	2009-2019
Age	12,597	62.93	4.60	Background Variables	2009-2019
Female (0,1)	12,597	0.36	0.48	Background Variables	2009-2019
Partner (0,1)	12,597	0.65	0.48	Background Variables	2009-2019
Number of kids	12,597	0.29	0.71	Background Variables	2009-2019
Low-educated (0,1)	12,597	0.32	0.47	Background Variables	2009-2019
High-educated (0,1)	12,597	0.36	0.48	Background Variables	2009-2019
Immigrant (0,1)	12,597	0.10	0.29	Background Variables	2009-2019
Wave 2 (0,1)	6,257	0.16	0.36	Background Variables	2009-2019
Wave 3 (0,1)	6,257	0.18	0.38	Background Variables	2009-2019
Wave 4 (0,1)	6,257	0.18	0.38	Background Variables	2009-2019
Wave 5 (0,1)	6,257	0.18	0.38	Background Variables	2009-2019
Wave 6 (0,1)	6,257	0.16	0.37	Background Variables	2009-2019

Appendix B – Figures

B.2 Responses to the statutory retirement age

Figure B2a. *Distribution of expected retirement age of non-retirees, 2008*

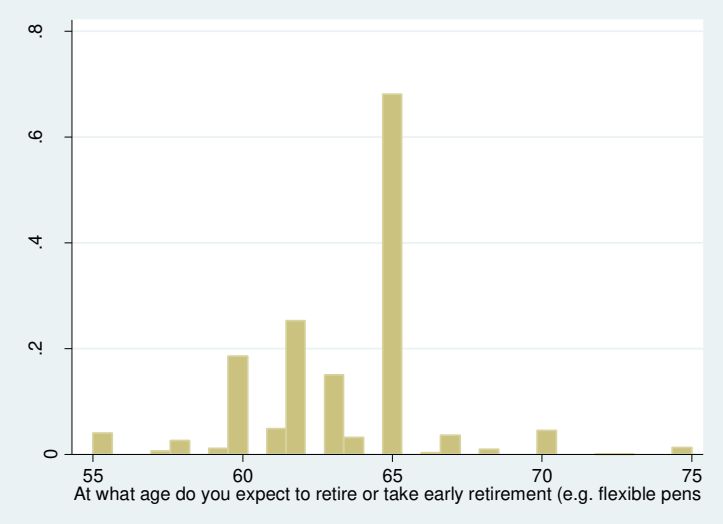
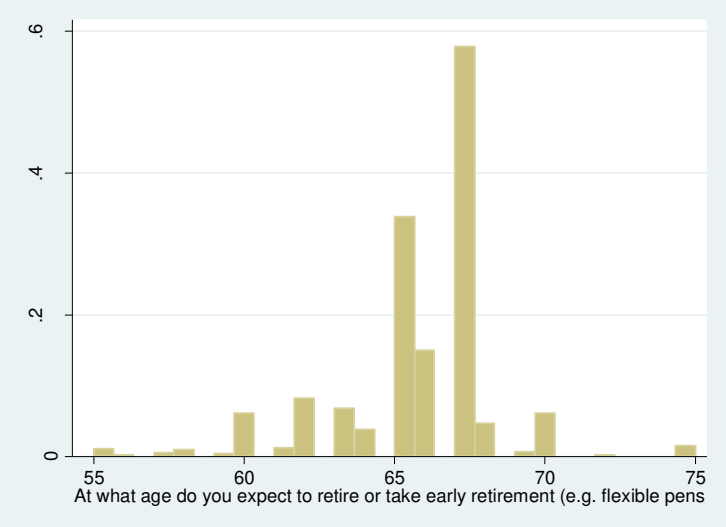
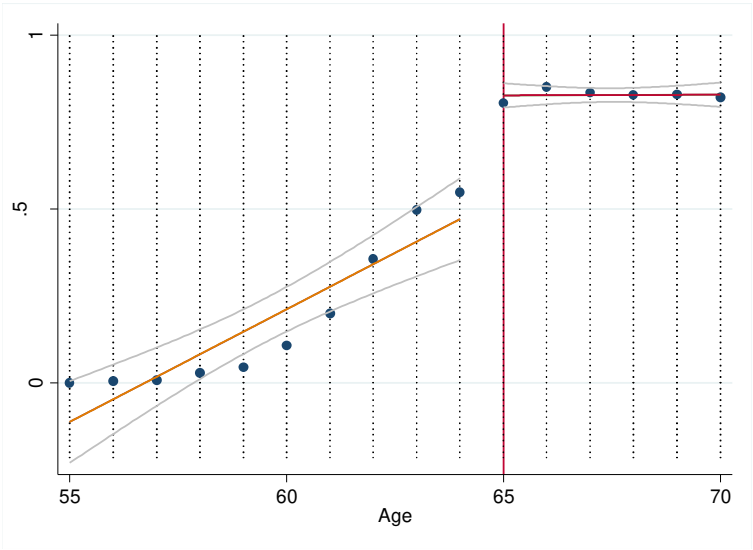


Figure B2b. *Distribution of expected retirement age of non-retirees, 2013*



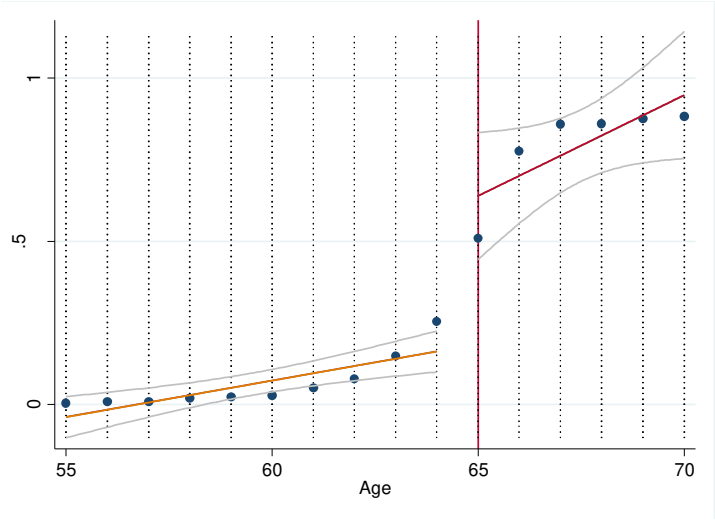
B.3 Discontinuities at the statutory retirement age

Figure B3. *Retirement (%) by age prior to increases in retirement age (<2013).*



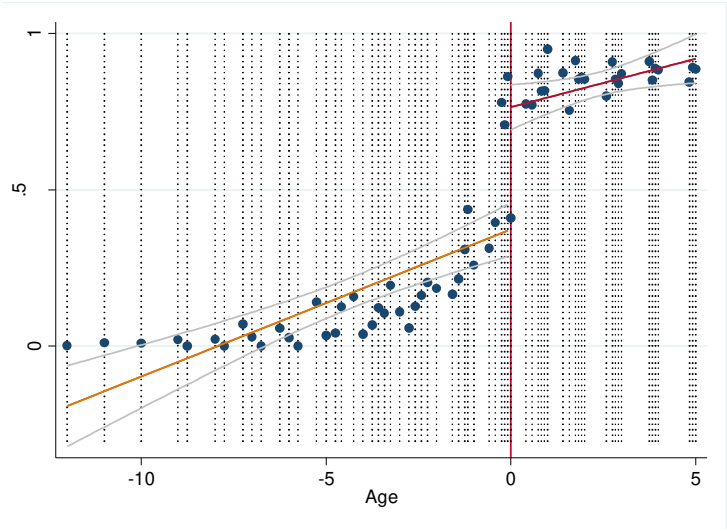
Notes: Lower- and upper bounds of the 95%-interval are presented in light grey lines.

Figure B4. *Retirement (%) by age after increases in retirement age (>2012).*



Notes: Lower- and upper bounds of the 95%-interval are presented in light grey lines.

Figure B5. *Retirement (%) by age relative to retirement age (>2012).*



Notes: Lower- and upper bounds of the 95%-interval are presented in light grey lines.

Appendix C – Full first-stage results

Table C1. *First-stage* e*stimation results Regression Discontinuity at age 65*

		Spending							Time use			
		Transport	**Cleaning**	**Food in**	**Holiday**	**Food out**	**Leisure**	**Total**	**Work**	**Commute**	**Home**	**Leisure**
D	Coeff.	0.089***	0.089***	0.089***	0.089***	-0.041	-0.041	0.089***	0.089***	0.084***	-0.017	-0.009
	SE	(0.032)	(0.032)	(0.032)	(0.032)	(0.044)	(0.044)	(0.032)	(0.032)	(0.032)	(0.040)	(0.040)
A	Coeff.	0.148***	0.148***	0.148***	0.148***	0.207***	0.207***	0.148***	0.148***	0.149***	0.177***	0.176***
	SE	(0.009)	(0.009)	(0.009)	(0.009)	(0.013)	(0.013)	(0.009)	(0.009)	(0.009)	(0.012)	(0.012)
A sq.	Coeff.	0.009***	0.009***	0.009***	0.009***	0.012***	0.012***	0.009***	0.009***	0.009***	0.011***	0.011***
	SE	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
D A	Coeff.	-0.046**	-0.046**	-0.046**	-0.046**	-0.204***	-0.204***	-0.046**	-0.048**	-0.049**	0.109***	0.106***
	SE	(0.019)	(0.019)	(0.019)	(0.019)	(0.027)	(0.027)	(0.019)	(0.019)	(0.019)	(0.024)	(0.024)
D A sq.	Coeff.	-0.022***	0.022***	0.022***	0.022***	0.012***	0.012***	0.022***	0.022***	-0.022***	0.018***	0.019***
	SE	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.005)	(0.003)	(0.003)	(0.003)	(0.004)	(0.004)
Female	Coeff.	-0.113***	0.113***	0.113***	0.113***	0.142***	0.142***	0.113***	0.114***	-0.113***	0.132***	0.131***
	SE	(0.010)	(0.010)	(0.010)	(0.010)	(0.016)	(0.016)	(0.010)	(0.010)	(0.010)	(0.014)	(0.014)
Partner	Coeff.	-0.015	-0.015	-0.015	-0.015	-0.005	-0.005	-0.015	-0.014	-0.013	-0.010	-0.014
	SE	(0.010)	(0.010)	(0.010)	(0.010)	(0.016)	(0.016)	(0.010)	(0.010)	(0.010)	(0.013)	(0.013)
# Kids	Coeff.	-0.018***	0.018***	0.018***	0.018***	0.030***	0.030***	0.018***	0.020***	-0.020***	0.026***	0.026***
	SE	(0.005)	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)	(0.005)	(0.005)	(0.005)	(0.007)	(0.007)
Low-edu.	Coeff.	-0.004	-0.004	-0.004	-0.004	0.001	0.001	-0.004	-0.003	-0.003	0.001	0.000
	SE	(0.011)	(0.011)	(0.011)	(0.011)	(0.016)	(0.016)	(0.011)	(0.011)	(0.011)	(0.014)	(0.014)
High-edu.	Coeff.	0.016	0.016	0.016	0.016	-0.008	-0.008	0.016	0.015	0.016	0.006	0.007
	SE	(0.010)	(0.010)	(0.010)	(0.010)	(0.016)	(0.016)	(0.010)	(0.010)	(0.010)	(0.014)	(0.014)
Immigrant	Coeff.	-0.010	-0.010	-0.010	-0.010	0.049	0.049	-0.010	-0.011	-0.009	0.000	-0.004
	SE	(0.016)	(0.016)	(0.016)	(0.016)	(0.033)	(0.033)	(0.016)	(0.016)	(0.016)	(0.025)	(0.025)
Wave	Coeff.	-0.032***	0.032***	0.032***	0.032***	-0.019**	-0.019**	0.032***	0.033***	-0.033***	0.031***	0.031***
	SE	(0.003)	(0.003)	(0.003)	(0.003)	(0.008)	(0.008)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Constant	Coeff.	0.772***	0.772***	0.772***	0.772***	0.970***	0.970***	0.772***	0.773***	0.778***	0.888***	0.885***
	SE	(0.030)	(0.030)	(0.030)	(0.030)	(0.043)	(0.043)	(0.030)	(0.030)	(0.030)	(0.037)	(0.037)
	N	5,815	5,815	5,815	5,815	2,751	2,751	5,815	5,769	5,787	3,676	3,651
	F-stat	151.82	151.82	151.82	151.82	98.83	98.38	151.82	148.48	148.86	81.23	83.37

Table C2. *Second-stage estimation results Regression Discontinuity at age 65*

		Spending							Time use		
		Transport	**Cleaning**	**Food in**	**Holiday**	**Food out**	**Leisure**	**Total**	**Work**	**Commute**	**Home**
Retired	Coeff.	5.837	4.071	92.646***	65.292***	11.746	12.177	216.923	-26.190***	-2.928***	7.002***
	SE	(15.930)	(8.211)	(30.211)	(24.824)	(13.160)	(14.357)	(148.485)	(1.769)	(0.405)	(2.216)
Age	Coeff.	-12.881	-6.492	-26.271	-0.062	4.209	-20.739*	-95.053	-8.132***	-1.420***	1.935
	SE	(10.382)	(5.232)	(19.694)	(16.092)	(9.776)	(10.918)	(97.432)	(1.156)	(0.260)	(1.280)
Age sq.	Coeff.	0.089	0.048	0.152	-0.046	-0.045	0.149*	0.535	0.061***	0.011***	-0.015
	SE	(0.084)	(0.043)	(0.162)	(0.131)	(0.075)	(0.084)	(0.791)	(0.009)	(0.002)	(0.011)
Female	Coeff.	-29.262***	-3.755**	8.918	-5.603	-3.930	-12.965***	-103.187***	-9.463***	-1.090***	7.523***
	SE	(3.701)	(1.910)	(6.954)	(5.508)	(3.476)	(3.841)	(34.845)	(0.475)	(0.103)	(0.553)
Partner	Coeff.	32.086***	7.476***	122.780***	160.307***	5.394*	-2.260	518.197***	-1.239***	0.046	0.326
	SE	(3.277)	(1.677)	(5.849)	(4.360)	(3.036)	(3.511)	(29.003)	(0.410)	(0.086)	(0.459)
# Kids	Coeff.	1.336	0.304	19.574***	-10.127***	18.100***	17.749***	122.261***	0.396	0.167**	0.487*
	SE	(2.679)	(1.239)	(5.060)	(3.501)	(2.777)	(3.296)	(26.224)	(0.308)	(0.077)	(0.273)
Low-edu.	Coeff.	-14.783***	-10.061***	-34.380***	-15.857***	-6.558**	-10.787***	-204.346***	-1.525***	-0.178*	1.096**
	SE	(3.321)	(1.660)	(6.777)	(5.322)	(3.102)	(3.525)	(32.566)	(0.441)	(0.098)	(0.492)
High-edu.	Coeff.	41.612***	13.972***	46.291***	47.897***	20.580***	7.395*	464.476***	1.509***	0.460***	-1.965***
	SE	(3.868)	(1.961)	(7.034)	(5.832)	(3.639)	(3.939)	(35.503)	(0.419)	(0.101)	(0.447)
Immigrant	Coeff.	-13.039***	-7.443***	-21.532**	-2.166	-2.553	1.695	-11.631	-1.630**	-0.007	2.414***
	SE	(5.043)	(2.425)	(8.821)	(7.589)	(6.561)	(8.765)	(45.722)	(0.639)	(0.152)	(0.928)
Wave	Coeff.	-2.763***	1.248**	-5.646***	-3.037*	-3.390**	-3.965**	-24.135**	0.249*	-0.019	-0.158
	SE	(1.062)	(0.572)	(2.104)	(1.712)	(1.706)	(1.934)	(10.754)	(0.127)	(0.030)	(0.131)
Constant	Coeff.	571.173*	245.666	1,258.503**	179.126	-37.155	772.233**	5,370.141*	299.026***	50.500***	-51.816
	SE	(322.697)	(160.893)	(606.224)	(498.782)	(316.840)	(352.821)	(3,032.787)	(36.494)	(8.385)	(39.043)
	N	5,815	5,815	5,815	5,815	2,751	2,751	5,815	5,769	5,787	3,676

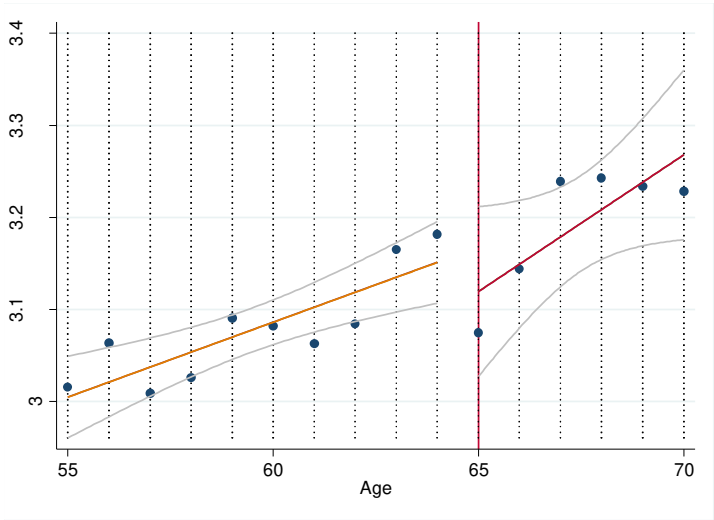
Appendix D – Sensitivity to estimation methods

Table D1. *Estimation rusts using different estimation methods*

			Spending							Time use			
			Transport	**Cleaning**	**Food in**	**Holiday**	**Food out**	**Leisure**	**Total**	**Work**	**Commute**	**Home**	**Leisu**
Logs	RD	Coeff.	-0.077	-0.056	0.157	0.308*	0.250	0.235	0.127	-1.226**	0.225	0.668***	0.516
		SE	(0.126)	(0.171)	(0.098)	(0.181)	(0.175)	(0.202)	(0.095)	(0.480)	(0.526)	(0.160)	(0.12
Tobit	RD	Coeff.	13.534	4.965	105.894***	117.397**	5.883	11.274	255.481*	-50.335***	-8.828***	6.674***	15.704
		SE	(18.590)	(12.399)	(33.292)	(46.457)	(15.694)	(18.976)	(154.334)	(4.715)	(1.225)	(2.321)	(4.13
		%	93.411	83.162	95.674	76.994	96.158	94.705	98.341	75.224	73.692	98.857	99.7

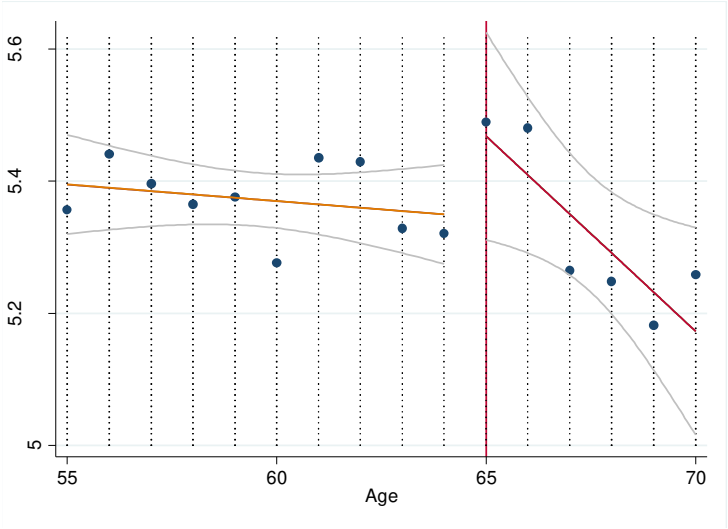
Appendix E – Effect of retirement on objective and subjective financial situation and savings

Figure E1. *Expected subjective financial situation (1 = much worse – 5 = much better) by age.*



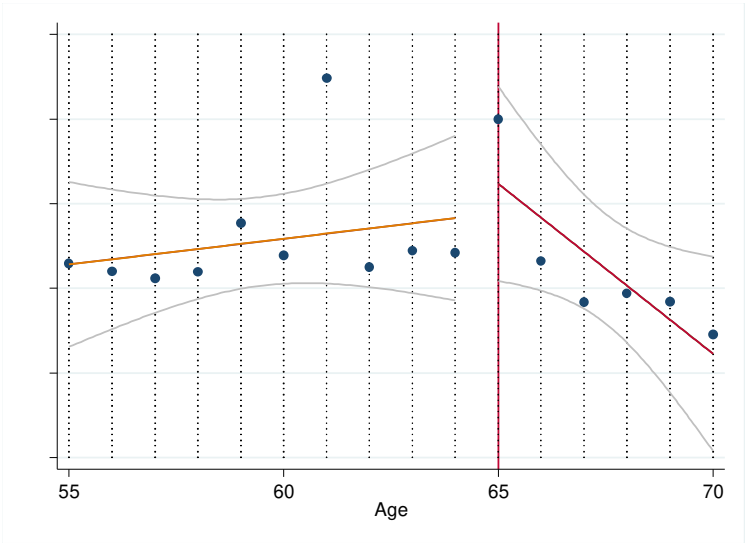
Notes: Lower- and upper bounds of the 95%-interval are presented in light grey lines.

Figure E2. *Realized subjective financial situation (0 = much worse – 10 = much better) by age.*



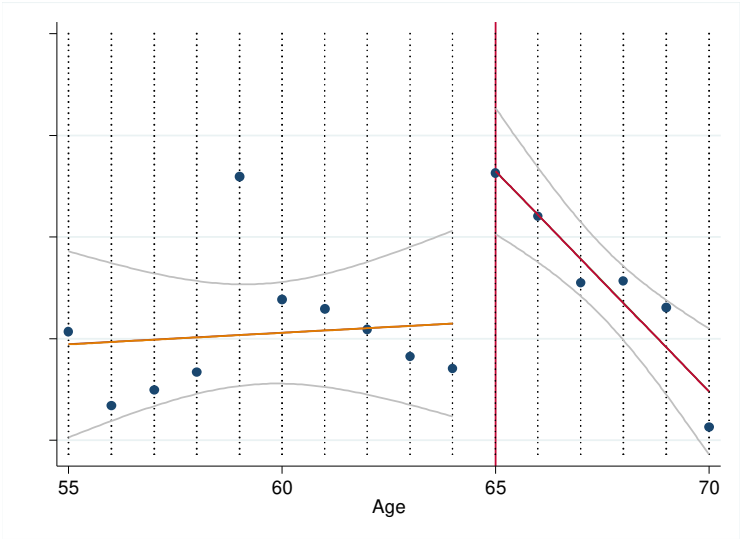
Notes: Lower- and upper bounds of the 95%-interval are presented in light grey lines.

Figure E3. *Realized gross income (euros) by age.*



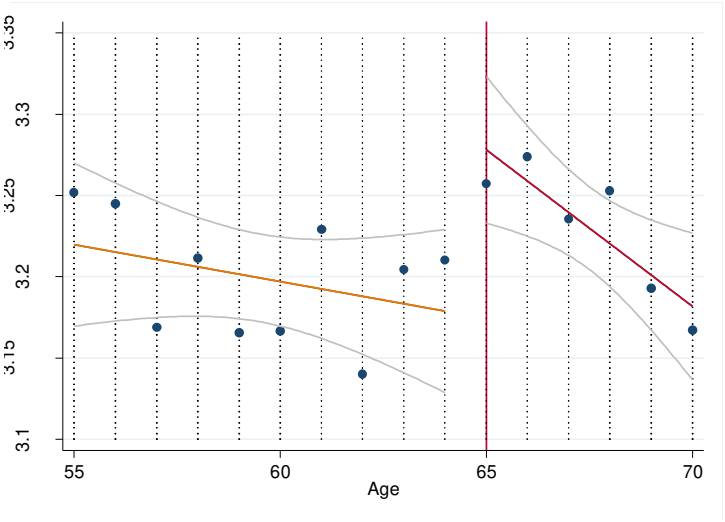
Notes: Lower- and upper bounds of the 95%-interval are presented in light grey lines.

Figure E4. *Realized net income (euros) by age.*



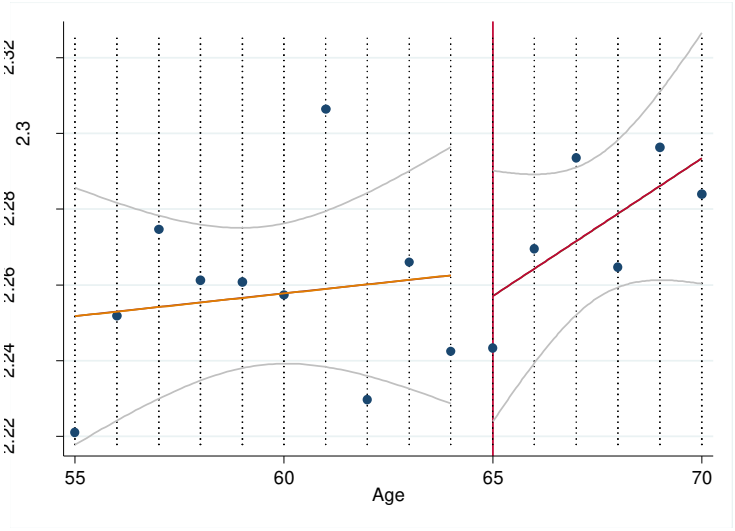
Notes: Lower- and upper bounds of the 95%-interval are presented in light grey lines.

Figure E5. *Expected saving (1 = spending much higher than income - 5 = spending much lower than income) by age.*



Notes: Lower- and upper bounds of the 95%-interval are presented in light grey lines.

Figure E6. *Realized saving (1 = spending higher than income, 2 = spending approximately equal to income, 3 = spending lower than income) by age.*



Notes: Lower- and upper bounds of the 95%-interval are presented in light grey lines.

Table E1. Estimation results of the effect of retirement on income (RD)

		Exp. Fin situation	**Fin situation**
RD	Coeff.	0.062	0.463*
	SE	(0.161)	(0.253)
	N	5,997	4,115
		Expected Savings	**Savings**
RD	Coeff.	0.541***	0.044
	SE	(0.175)	(0.119)
	N	5,966	4,115
		log Gross income	**log Net income**
RD	Coeff.	-0.185**	0.056
	SE	(0.077)	(0.067)
	N	5,768	5,751

* denotes significant at the 10% level, ** at the 5% level and *** at the 1% level. Amounts are expressed in 2015 euros. Control variables are included.