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DISCUSSION PAPER SERIES

IZA DP No. 12791

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ISSN: 2365-9793

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ABSTRACT

The Mental Health Effects of Retirement*

We study the retirement effects on mental health using a fuzzy regression discontinuity design based on the eligibility age to the state pension in the Netherlands. We find that the mental effects are heterogeneous by gender and marital status. Retirement of partnered men positively affects mental health of both themselves and their partners. Single men retiring experience a drop in mental health. Female retirement has hardly any effect on their own mental health or the mental health of their partners. Part of the effects seem to be driven by loneliness after retirement.

JEL Classification: H55, J14, J26

Keywords: retirement, health, well-being, happiness, regression discontinuity design

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* We thank CentERdata of Tilburg University for providing us with the LISS (Longitudinal Internet Studies for the Social sciences) panel data on which we based our empirical analysis. The LISS panel data were collected by CentERdata through its MESS project funded by the Netherlands Organization for Scientific Research. We also thank Isabella Giorgetti and participants at the 33rd Italian Association of Labour Economics (AIEL) conference (Ancona, 2018), the 59th Italian Economic Association (SIE) conference (Bologna, 2018) and seminar participants at the University of Bath, Monash University (Melbourne), LISER (Luxembourg), Deakin University (Melbourne), University of Technology Sydney and Erasmus School of Economics (Rotterdam) for helpful comments and suggestions.

1 Introduction

Like in many European countries, in the Netherlands the standard retirement age is going up because of concerns about the financial burden related to the increasing number of retired inactive people. Although the increase in retirement age seems necessary for reasons of sustainability of the pension system, it does raise questions about the consequences for workers who may have to stay in the labor market longer than they anticipated when they were young. In particular, if retirement improves health, postponing retirement may not be welfare improving. As we discuss in more detail below, studies investigating the health effects of retirement usually focus on mental health because this seems more likely to be affected immediately by retirement, whereas physical health may be more gradually changing after retirement. Our study is also on the mental health effects of retirement.

To establish the causal effect of retirement on mental health one has to take into account that the link between these variables may also be caused by joint unobserved characteristics and reverse causality. An unobservable characteristic affecting both retirement and mental health might be preference for leisure time that affects both mental health and the desire to retire. Reverse causality may play a role if the mental condition affects the retirement decision. Association through joint time-invariant unobserved characteristics can be removed by introducing individual fixed effects. To deal with potential reverse causality two methods are generally used, instrumental variables (IV) and a regression discontinuity design (RDD). Eligibility ages for early retirement or retirement related social security benefits are popular instrumental variables. RDD analysis typically exploits the sudden increase in the retirement probability as soon as an individual attains the age for pension eligibility. Sometimes an increase in standard retiring age is exploited to establish causality.

The empirical evidence on the effects of retirement on mental health is somewhat mixed. Some studies find a positive effect, other studies conclude that there is no effect or a negative effect. This may have to do with the nature of the retirement decision, i.e. whether retirement is voluntary or mandatory. Bassanini and Caroli (2015) for example find that voluntary retirement often has a positive effect on mental health, whereas involuntary job loss has a negative effect on mental health. The difference in effects may be related to the sense of control that people have over their retirement decision. As we discuss in more detail in the next section, the variation in the results from previous studies may also have to do with differences in terms of identification method, the nature of the data or the dependent variable of interest.

In our paper, we study the effect of retirement on mental health using Dutch data. Since in the Netherlands early retirement programs are vanishing and employment rates among older workers are relatively high, there are many workers for whom the transition to retirement can be observed at the standard retirement age which recently has been slowly increasing. Our contribution to the literature is threefold. First, we add to the existing literature on retirement effects using an RDD but with a shifting retirement age, which supports identification of causal effects. Second, we allow for spillover effects between partners, i.e. retirement of one partner potentially affecting the mental health of the other partner. Retirement decisions of working couples are often but not always coordinated.[1] Third, we investigate heterogeneities in the effect of retirement on mental health by focusing on gender and marital status.

The set-up of our paper is as follows. In Section 2 we present an overview of previous studies on the mental health effects of retirement. There is a wide variety in terms of data used, specific topic and identification strategy. Section 3 describes the Dutch pension system and elucidates which features are exploited to identify the causal effect of retirement on outcome variables of interest. Our identification strategy is based on the age at which individuals are entitled to state pensions. In the Netherlands this age had been 65 across the board for a long time but, in recent years, the age of entitlement to the state pension has been slowly increasing. In Section 4 we present the econometric model, the identification assumptions and the sample used in the econometric analysis. Section 5 reports and comments on the main estimation results. Retirement of partnered and single women has hardly any effect on their mental health. Retirement of partnered men has positive effects on mental health of both themselves and their partner. However, single men retiring experience a drop in mental health. In section 6 we discuss possible explanations for our main findings, in particular the differences in the mental health effects of retirement between partnered and single individuals. For this, we investigate the effects of retirement on measures of leisure time satisfaction, volunteer work, social contacts and loneliness. Section 7 concludes arguing that retirement affects mental health but, since there is substantial heterogeneity across gender and marital status, it is hard or even impracticable to draw strong policy conclusions other than that retirement should not be enforced but allowed to be flexible, i.e. in line with personal preferences.

2 Previous Studies on Retirement and Mental Health

Studies on the mental health effects of retirement differ in many ways, i.e. in terms of the method of identification, whether cross-country data or individual country data are used and in the nature of the dependent variable.[2] In this section, we provide a brief overview of previous

[1]From an overview of the literature, Coile (2015) concludes that in about one-third of working couples partners retire within one year of each other. Bloemen et al. (2019) also find cross-partner retirement effects of retiring. By contrast, we find no indication of coordinated retirement decisions.

[2]Some studies focus on the effects of retirement on physical health or health behaviors. See for example Nielsen (2019) and Celidoni and Rebba (2017). There are also studies that investigate the effects of retirement on

Table 1: Overview of Previous Studies on the Mental Health Effects of Retirement

Study	Data	C	Time	Age	Dependent variable	Method	Effect of retirement	Het
a. Cross-country studies								
Rohwedder and Willis (2010)	Various	13	2004	60-64	Cognitive skills	IV – RA	–	No
Horner (2014)	Various	17	2004-2006	50-70	Well-being	IV – RA	+ (temporary)	No
Fonseca et al. (2014)	SHARE	11	2004-2010	50+	Depression	IV – RA	–	No
Belloni et al. (2016)	SHARE	10	2004-2013	55-70	Mental Health	IV – RA	+ (men), 0 (women)	O
Hessel (2016)	EU-SILC	12	2009-2012	50-74	Self-reported health	IV	+	No
Mazzonna and Peracchi (2017)	SHARE	10	2004-06	50-70	Health & Cogn. skills	IV – RA	–	O
Celidoni et al. (2017)	SHARE	10	2004-2011	50+	Cognitive skills	IV – RA	–	No
Heller-Sahlgren (2017)	SHARE	10	2004-2012	50+	Mental Health	IV – RA	0 (SR), – (LR)	E,G,O
Müller and Shaikh (2018)	SHARE	19	2004-2013	45-91	Subjective health	RDD – RA	0 (males), – (females)	No
Kolodziej and García-Gómez (2019)	SHARE	11	2004-2013	55-69	Mental health	IV – RA	+	G,H,M
b. Single country studies								
Bonsang et al. (2012)	HRS	US	1998-2008	51-75	Cognitive ability	IV – RR	–	No
Bonsang and Klein (2012)	GSOEP	DE	1995-2010	50-70	Life satisfaction	FE	0 (voluntary), – (invol.)	No
Abolhassani and Alessie (2013)	GSOEP	DE	1994-2009	50-70	Life satisfaction	FE	0 (voluntary), – (invol.)	No
Eibich (2015)	GSOEP	DE	2002-2009	55-70	Mental health	RDD	+	E
Kesavayuth et al. (2016)	BHPS	UK	2005-2012	50-75	Well-being	IV – RR	0	G,P
Fé and Hollingsworth (2016)	BHPS	UK	1991-2005	50-80	Health indicators	RDD	0	No
Bertoni and Brunello (2017)	PPS	JP	2008-2013	42-69	Mental Health	D – RR	–	No
Gorry et al. (2018)	HRS	US	1992-2014	50-93	Health & Life satisf.	IV – RA	+	No
Messe and Wolff (2019)	LFS	FR	2013-2016	50-70	Self-reported health	D	+	O
Atalay et al. (2019)	HILDA	Oz	2012	55-74	Cognitive skills	FD-IV	–	G

Notes: Information about calendar time period and age range is sometimes based on a "guesstimate" as not all papers are clear about this information.
Data: Admin = Administrative data; BHPS = British Household Panel Survey including its continuation Understanding Society; EU-SILC = European Union Statistics on Income and Living Conditions; LFS = Labor Force Survey; GSOEP = German Socio-Economic Panel; HRS = Health and Retirement Study; HILDA = Household, Income and Labor Dynamics in Australia; LISA = Longitudinal Integration Database for Health Insurance and Labor Market Studies; PPS = Preference Parameters Study; SHARE = Survey of Health Aging and Retirement in Europe
C = Country/countries: panel a number of countries; panels b and c – AT = Austria, DE = Germany, FR = France, IL = Israel,JP = Japan, NL = Netherlands, NO = Norway, Oz = Australia, SE = Sweden, UK = United Kingdom, US = United States
Method: D – RR = Difference in differences using a retirement reform; FE = Fixed effects; IV – RA = Instrumental variables using retirement age eligibility; RDD = Regression Discontinuity Design; FD-IV = First difference IV
Het = Heterogeneity: E = Educational attainment, Ex = Experience, G = Gender, M = Marital status, H = (mental) Health status, I = Income, O = Occupation, P = Personality traits, R = Race

work starting with multi-country studies followed by individual country studies and concluding with an attempt to summarize the main findings (see also van Ours, 2019). We do not present an exhaustive overview but rather a selection of recent studies focusing on differences in set-up, identification strategy, dependent variables and analysis of heterogeneity of the retirement effects. Table 1 provides a summary overview of the papers on retirement and mental health.[3]

a composite indicator of health that includes mental health. These are also discussed below.

[3]Quite a few studies investigate the relationship between retirement and mortality. These studies are all based on administrative data. The results are all over the place. Hernaes et al. (2013) find that a retirement reform in Norway induced some workers to indeed retire early, but their mortality was not affected. Hallberg et al. (2015) find that a retirement reform for Swedish army personnel increased early retirement and reduced mortality. Bloemen et al. (2017) using a temporary change in the rules for early retirement of older civil servants in the Netherlands finds that early retirement reduces mortality. Fitzpatrick and Moore (2018) on the other hand find that early retirement in the U.S. increased male mortality but for females there is no significant increase in mortality after retirement. Kuhn et al. (2018) use Austrian administrative data finding that retirement increased mortality for men but not for women.

2.1 Multi-Country Studies

Using cross-country data from the US, England and eleven European countries, Rohwedder and Willis (2010) find that early retirement has negative effects on cognitive skills of people in their early 60s. Using similar cross-country data, Horner (2014) concludes, from an instrumental variable analysis based on retirement age eligibility, that well-being improves through retirement but this is a temporary effect. Fonseca et al. (2014) analyze data from various European countries and, using an instrumental variable approach based on pension eligibility ages, conclude that there is weak evidence of retirement reducing depression. Belloni et al. (2016), using data from ten European countries and an instrumental variable approach, conclude that retirement has a positive effect on mental health of men while women are unaffected. The positive mental health effect is stronger for blue-collar men in areas that were strongly hit by the Great Recession. Hessel (2016) uses data from twelve European countries to study the effect of retirement on self-reported and physical health finding an improvement. The positive health effects of retirement occur for males and females at all educational levels. From an international comparative study on the effects of retiring on health and cognitive skills in ten European countries, Mazzonna and Peracchi (2017) conclude that these are negative and increasing with years after retiring. The effects are also heterogeneous in the sense that for physical demanding occupations retiring has a positive and immediate effect on both health and cognitive skills. Using similar data and identification strategy, Celidoni et al. (2017) find that retirement causes a decline of cognitive abilities, measured as a sharp 20% drop in the number of words recalled between interview waves, for individuals who retired at the statutory pension eligibility age. It has instead a protective effect for those who retired on an early retirement scheme. Heller-Sahlgren (2017) uses SHARE-data from 10 countries to study the effects of retirement on mental health. These turn out to be absent in the short run but large and negative on the long-run. The effects are not heterogeneous with respect to gender, educational attainment and occupation. Müller and Shaikh (2018) use data from various European countries to investigate the causal health effects of the retirement of a partner. They use an RDD based on retirement eligibility ages, finding that subjective health is negatively affected by the retirement of the partner and positively by own retirement. These effects are heterogeneous: male health is not affected by the retirement of his spouse, while female health is negatively affected by the retirement of her partner. Kolodziej and García-Gómez (2019) use cross-country data to investigate the heterogeneity of causal positive effects of retirement on mental health. They find that they are larger for those in poor mental health.

2.2 Single Country Studies

Bonsang et al. (2012) investigate the effects of retirement on cognitive functioning of older Americans using an instrumental variable approach based on the eligibility age for social security to account for endogeneity of the retirement decision. They find that retirement has a significant negative, though not instantaneous, effect on cognitive functioning as measured by a word learning and recall test. Bonsang and Klein (2012) study well-being effects of retirement in Germany distinguishing between voluntary and involuntary retirement. They find that voluntary retirement has no effect on life satisfaction, while involuntary retirement has a negative effect on life satisfaction. Abolhassani and Alessie (2013) studying the same German data finds similar effects of retirement. They also find that individuals have an accurate anticipation about the effects of retirement on life satisfaction. Eibich (2015) uses an RDD based on age related financial incentives in the German pension system to explain changes in measures of self-reported and mental health. Because of financial incentives, there are discontinuities in the age-retirement profile at 60 and 65. The author finds positive effects on mental health, which he attributes to relief from work-related stress and strain, to an increase in sleep duration and to a more active lifestyle. Lower educated workers benefit especially in physical health; for higher educated workers mental health improves at retirement. Kesavayuth et al. (2016) use an instrumental variable approach based on retirement eligibility ages for the UK basic state pension to study well-being effects of retirement. They find that on average there is no effect. However, the effect is heterogeneous and related to personality traits. For females the well-being effect of retiring is high if they score high in openness or low in conscientiousness. Fé and Hollingsworth (2016) investigate the retirement effects on health and health-care utilization for UK males. Using an RDD for the short-run effects and a panel data model for the long-run effects, they find that retirement neither has short-run nor long-run health effects. Bertoni and Brunello (2017) examine cross-partner health effects of retirement. Using Japanese data they investigate the so called "Retired Husband Syndrome" suggesting that wives of retiring man experience a negative mental health shock. Gorry et al. (2018) also use age-related retirement eligibility to establish a causal effect from retirement to health and life satisfaction for US workers. The impact of retirement on happiness turns out to be immediate, while health effects show up later on. Retirement does not seem to affect health-care utilization. Messe and Wolff (2019) analyzing French labor force survey data make a distinction between the retirement effects on the health of the retiree but also the health of the partner. They find positive effects of retirement but only for workers in jobs with low physical burden. No cross-partner spillover effects of retirement on health are found. Atalay et al. (2019) studies the effects of retirement of Australian workers on their cognitive skills. To establish a causal effect they use an instrumental variable based on the changing pension eligibility age. They find that the retirement effect for women is moderate. For men they find a negative effect of retirement on reading performance.

2.3 What to Learn from Previous Studies

In addition to the separate studies, there are also a couple of recent overview studies confirming the variability in the health effects of retirement. Van der Heide et al. (2013) focus on longitudinal studies concluding that the effects on general health and physical health are unclear, while there seem to be beneficial effects on mental health. Nishimura et al. (2018) investigate the differences in the retirement effects across various studies concluding that the choice of the estimation method is the key factor in explaining these differences. Redoing several earlier studies using a fixed effects instrumental variable analysis the authors conclude that results are more stable indicating positive health effects of retirement, though some cross-country heterogeneity remains.

Quite a few studies do not consider heterogeneity in the mental health effects of retirement. The studies that investigate heterogeneous effects do so for gender, type of occupation, marital status or education. Retirement of women often has smaller health effects while the health effects of retiring from physically demanding occupations or for lower educated workers are bigger. Only a few studies consider cross-partner effects of retirement. All in all, it is clear that the effects of retirement on mental health vary from study to study depending on the method of analysis and the country or countries involved in the studies.

3 Institutional Set-up

The Dutch pension system consists of three pillars: state pensions (called AOW), collective pensions and individual pensions. The state pension is paid from a certain predefined age onward. Collective pensions are paid through pension funds to which employers pay monthly contributions on behalf of their employees. Collective pension funds are organized by industry, individual firms or professional organizations. Usually, contributions to collective pension funds are mandatory and more than 90% of the workers in the Netherlands contribute to a collective pension fund via their employer. Individual pension arrangements are often used by self-employed or workers who do not contribute to a collective pension fund.

Whereas there is a possibility for early or late retirement using benefits from the collective pension funds or individual pension funds, the state pension has a fixed age for benefit collection which depends on birth cohort only. Therefore, we focus on how the state pension induced retirement affects health and happiness of individuals. The state pension was introduced in 1957 and is intended for everyone who lived or worked in the Netherlands between ages 15 and 65. It provides benefits of up to 70% of the net minimum wage. The level of the state pension depends on the family situation (married or single) and on how many years an individual lived in the Netherlands. For example, in 2018 the regular monthly old-age net benefit for a single person was €1,107, while a couple received €1,434 per month.[4] Individuals are not obliged to retire at the state pension age but many workers do so. Whether they like it or not, in many situations through collective agreements on the day they reach the state pension age workers lose their job. Therefore, in practice, hardly anyone keeps working after reaching the state pension age.

The start of the state pension only depends on age and birth cohort. For many decades this had been age 65. The exact date at which an individual received the state pension changed recently. Up to 1 January 2012, the pension benefits were received from the first day of the month in which someone reached the pension age. From 1 January 2012 onward, the benefit is received from the actual pension age date. Up to 1 January 2015, couples in which one person reached the old-age pension age while the other person was younger could get a means-tested benefit until the partner would reach the old-age pension age.

Whereas collective pensions and individual pensions are funded by contributions from employees through their employers, state pensions are funded through a pay-as-you-go system financed by payroll taxes and government funds. Because of the aging of the Dutch population the contributions to the state pensions have increased and will keep on increasing in the years to come. To improve the sustainability of the pay-as-you-go system, the government decided some years ago to gradually increase the state pension age. Table 2 provides an overview of the changes in the eligibility age for the state pension. It shows that, for all individuals born before January 1, 1948, the state pension age was 65. For those born in 1948, the state pension age was 65 years and 1 month. Over the years, there was a further increase in the state pension age. For individuals born from January 1, 1953 onward, the state pension age is 66 years and 4 months. This will stay like this until for the birth cohort born from September 1, 1955 onward the state pension age is increased to 66 years and 7 months. The state pension age of later birth cohorts will depend on future life expectancy of the Dutch population and will be calculated accordingly.

Whereas the state pension age only depends on birth cohort, there are substantial differences in the actual timing of retirement. People who can afford to retire earlier than the state pension age often do so. For many individuals the state pension age is an upper limit to the actual

[4] For adults, the net monthly minimum wage in the Netherlands in 2018 was €1,440.

Table 2: Entitlement age to the Dutch state pension

		State pension age		
Born from (included)	up to (excluded)	Year	Month	Retirement in
–	1 January 1948	65	0	
1 January 1948	1 December 1948	65	1	2013
1 December 1948	1 November 1949	65	2	2014
1 November 1949	1 October 1950	65	3	2015
1 October 1950	1 July 1951	65	6	2016
1 July 1951	1 April 1952	65	9	2017
1 April 1952	1 January 1953	66	0	2018
1 January 1953	1 September 1955	66	4	2019-2021

retirement age as in quite a few collective agreements an individual retires by default when reaching the state pension age. In short, there is flexible retirement in the Netherlands but it is asymmetric. People can retire earlier than the state pension age but are not allowed to retire later unless they are willing to postpone retirement by finding another job.

4 Method

4.1 Regression Discontinuity Design

The retirement status cannot easily be assumed to be an exogenous variable when studying its impact on outcomes like mental health. A first reason is self-selection into retirement. There might be individual characteristics unobserved by the analyst both affecting the retirement and outcomes like mental health. Potential unobservables causing this selectivity are labor market attachment, labor market experiences, working conditions across the career, wealth, physical and mental conditions, grand-parenthood and family circumstances. A second reason is reverse causality. Mental health conditions of an individual and their evolution over time may affect the decision to retire.

In our study, the identification of the effect of retirement on mental health is based on the discontinuity in the propensity to retire in the month that an individual attains the age for the entitlement to the state pension. As indicated before, in the Netherlands individuals are entitled to the state pension when they reach a certain age. This eligibility age varied across years depending on the year and month of birth. Since the jump in the probability of retiring when individuals reach the eligibility age is typically less than 1, our identification strategy to establish the causal effect of retirement is based on a fuzzy RDD. As discussed in Section 2, eligibility ages for the state pension are popular instrumental variables in this kind of literature.

Measures of mental health are usually collected by asking individuals to indicate a discrete value reflecting their situation, within a limited range of positive and ordered integers, where each integer has its own explained meaning. In modeling the impact of retirement on such type of outcome variables we use ordered response models for the probability that an individual indicated a discrete value in the set of possible responses, conditional on the retirement status and other observables. The probabilities are nonlinear functions of a set of parameters, but they depend on a linear index of the observables. We adapt the usual fuzzy RDD to this nonlinear framework. In a linear model, the fuzzy RDD boils down to a Two Stage Least Squares (2SLS) estimate, with the binary indicator for being above or below the discontinuity as the instrument and flexible continuous functions of the forcing variable specified both in the first and second stage. In our ordered response index model, the fuzzy RDD approach consists in estimating by maximum likelihood (ML) an IV ordered response model, with the binary indicator for being above or below the discontinuity as excluded instrument and flexible continuous functions of the forcing variable. The forcing variable is months to pension state eligibility, specified in the indexes determining both the retirement probability and the probability of each discrete outcome.

Both in the linear case and in the nonlinear counterpart, assumptions are needed for the RDD to credibly identify the retirement effect near the discontinuity. Hahn et al. (2001) formally studied the identification issues of the RDD. They show that the key assumption of a valid RDD is that all the other factors determining the realization of the outcome variable must be evolving smoothly with respect to the forcing variable (Lee and Lemieux, 2010). If further variables would jump at the threshold values, we would not be able to disentangle the effect of retirement from the one induced by the other jumping variables. When this continuity assumption is satisfied, in the absence of the treatment, the persons close to the cutoff point are similar (Hahn et al., 2001) and the average outcome of those right below the cutoff is a valid counterfactual for those right above the cutoff (Lee and Lemieux, 2010). Identification is therefore attained only for individuals who are close to the cutoff point of the forcing variable (Hahn et al., 2001; Van der Klaauw, 2002). A further assumption is that individuals should not be able to precisely control the forcing variable. It would fail if the individual can anticipate what would happen if (s)he is below or above the threshold and can modify the realization of the forcing variable. In our framework, it is plausible to assume that individuals cannot manipulate their age. Both identifying assumptions will be tested in Appendix B, providing robustness to our findings.

Denote by dis_i an indicator variable equal to one if the age of individual i is above the pension state eligibility age, hence to the right of the discontinuity point. In our study, we allow for spillover effects between partners, i.e. retirement of one partner may affect the outcome variable of the other partner. Hence, we also define as dis_i^p the indicator variable equal to one if the age of individual i's partner is above the pension state eligibility age. The forcing variables which fully determine the values taken by these two indicators are the number of months from the moment in which, respectively, individual i and his/her partner become eligible to the state pension. We indicate these two forcing variables with m_i and m_i^p.[5] The treatment indicator, equal to 1 if individual i has already retired and 0 otherwise, is denoted by D_i. The dummy variable for the retirement status of the partner of individual i is D_i^p. We denote by y_i the ordered response variable taking on the values $\{1, 2, \ldots, J\}$, and by y_i^* its latent counterpart, such that $y_i^* \in \mathbb{R}$. Finally, we collect into $\mathbf{x}_i$ the set of covariates which we will use to control for heterogeneity across individuals and across their partners.

The following equation system describes, for individuals living in a couple, the process determining the outcome variable and the two endogenous retirement indicators by treating properly the ordinal nature of the choices:

$$\begin{aligned}
y_i^* &= \mathbf{x}_i'\boldsymbol{\beta} + \delta D_i + \delta^p D_i^p + f(m_i; \boldsymbol{\theta}) + f^p(m_i^p; \boldsymbol{\theta}^p) + v_i, && (1)\\
D_i^* &= \mathbf{x}_i'\boldsymbol{\beta}_1 + \gamma_1 dis_i + \gamma_1^p dis_i^p + k_1(m_i; \boldsymbol{\theta}_1) + k_1^p(m_i^p; \boldsymbol{\theta}_1^p) + u_{1i}, && (2)\\
D_i^{p*} &= \mathbf{x}_i'\boldsymbol{\beta}_2 + \gamma_2 dis_i + \gamma_2^p dis_i^p + k_2(m_i; \boldsymbol{\theta}_2) + k_2^p(m_i^p; \boldsymbol{\theta}_2^p) + u_{2i}, && (3)\\
y_i &= j \cdot \mathbb{1}[\alpha_{j-1} < y_i^* \leq \alpha_j], \text{ for } j \in \{1, \ldots, J\}, \alpha_0 = -\infty \text{ and } \alpha_J = +\infty, && (4)\\
D_i &= \mathbb{1}[D_i^* \geq 0], && (5)\\
D_i^p &= \mathbb{1}[D_i^{p*} \geq 0], && (6)
\end{aligned}$$

where:

- $\mathbf{x}_i$ is a vector of covariates (dummies for education of both partners, year dummies, a dummy for the presence of dependent children in the household and indicators for the urban density of the place of residence).
- $\mathbb{1}(\cdot)$ is the indicator function, which returns 1 if the argument is true and 0 otherwise.
- $\alpha_1 < \alpha_2 < \cdots < \alpha_{J-1}$ are threshold parameters to be estimated.
- $(v_i, u_{1i}, u_{2i}) \sim N(\mathbf{0}, \boldsymbol{\Sigma})$ are random error terms with

$$\boldsymbol{\Sigma} = \begin{bmatrix} 1 & \sigma_{12} & \sigma_{13} \\ \cdot & 1 & \sigma_{23} \\ \cdot & \cdot & 1 \end{bmatrix} \quad (7)$$

.

[5] They take value 0 when individual i (or his/her partner) is interviewed in the month in which (s)he becomes eligible to the state pension.

- $f(\cdot;\boldsymbol{\theta})$, $f^p(\cdot;\boldsymbol{\theta}^p)$, $k_1(\cdot;\boldsymbol{\theta}_1)$, $k_1^p(\cdot;\boldsymbol{\theta}_1^p)$, $k_2(\cdot;\boldsymbol{\theta}_2)$, and $k_2^p(\cdot;\boldsymbol{\theta}_2^p)$ are continuous functions at the cutoff with different profiles below and above the cutoff. In the benchmark model, we will use a polynomial of order one, with different slope below and above the cutoff. In a sensitivity analysis, we will use a spline continuous function with two knots below and two knots above the cutoff.[6]

When we study the impact of retirement for singles, the model in Equations (1)-(6) simplifies to:

$$
\begin{aligned}
y_i^* &= \mathbf{x}_i'\boldsymbol{\beta} + \delta D_i + f(m_i;\boldsymbol{\theta}) + v_i, \\
D_i^* &= \mathbf{x}_i'\boldsymbol{\beta}_1 + \gamma dis_i + k(m_i;\boldsymbol{\theta}_1) + u_i, \\
y_i &= j \cdot \mathbb{1}[\alpha_{j-1} < y_i^* \leq \alpha_j], \text{ for } j \in \{1,\ldots,J\}, \alpha_0 = -\infty \text{ and } \alpha_J = +\infty, \\
D_i &= \mathbb{1}[D_i^* \geq 0],
\end{aligned}
$$

where (v_i, u_i) is assumed to have a zero mean bivariate normal distribution.

4.2 Estimation

Given the distributional assumption on the idiosyncratic error terms, Equations (1)-(6) fully characterize the individual density. The individual contribution to the log-likelihood function, and therefore the sample log-likelihood, depend on a finite number of parameters and the model can be estimated by ML. Equations (1)-(6) and the joint normality of the error terms define an IV ordered probit model, with two discrete endogenous variables. Its estimation by ML is the nonlinear counterpart of the 2SLS estimation of a linear specification of both the equation for y_i and of the reduced form equations for the endogenous retirement dummies.[7]

The model is estimated using the *cmp* program for Stata (Roodman, 2011), separately for men and women. For partnered individuals, we will focus our discussion on the results coming from the bandwidth set to $bw = 42$ months (42 excluded) and satisfied simultaneously by both partners, with a local linear specification of the different functions of the forcing variables. In a sensitivity analysis , we check the sensitiveness of our results by trying different bandwidths ($bw = 36, 60$), simultaneously satisfied by both partners. For singles, we use similar definition

[6]Following the advice in Gelman and Imbens (2019), we keep low the order of the polynomials and use local estimation.

[7]We could enumerate the discrete response choices of the outcome variables, assign them a cardinal meaning, specify linear probability models for the retirement indicators and estimate the resulting linear model by 2SLS. However, the results would be affected by the arbitrary assignment of a cardinal value to each ordered choice. Bond and Lang (2019) criticize the use of ordered variables like happiness scores because it is difficult to compare these variables across individuals. We assume that our RDD approach makes the comparison between individuals a valid one.

of the benchmark specification and run the same robustness checks, with the only difference that singles are included into the estimation sample only on the basis of their own distance from the cutoff. Hence, we do not base the bandwidth choices on data driven optimal criteria, but we rather try different bandwidths and check the sensitivity of the findings to different choices. With continuous outcomes, data driven criteria for an optimal choice of the bandwidth were recently proposed by Imbens and Kalyanaraman (2012) and Calonico et al. (2014). However, their criteria become suboptimal or cannot be applied with categorical dependent variables (Xu, 2017). Through the general approach of local likelihood, Xu (2017) derived an optimal criterion for discrete outcomes. However, it focuses on single treatment effect only, whereas in our framework we seek to identify the effect of multiple treatments with multiple discontinuities.

4.3 Data and Sample

Dataset

The data used in our paper are from a Dutch panel, the Longitudinal Internet Studies for the Social Sciences (LISS) panel. The LISS panel is collected and administered by CentERdata of Tilburg University. A representative sample of households is drawn from a population register by Statistics Netherlands and asked to join the panel by Internet interviewing. Households are provided with a computer and/or an Internet connection if they do not have one.[8] Some background information on general characteristics, like demography, family composition, education, labor market position, retirement status and earnings, is measured on a monthly basis from November 2007. Ten core studies are instead carried out once a year, in different moments of each year. They survey individuals on a wide set of topics, like health, religion and ethnicity, social integration and leisure, work and schooling, personality, politics and economic situation.[9]

In our study we use monthly information on the background variables, from which we derive the age in month and the retirement status. We define an individual as retired if (s)he reports to be a pensioner as primary occupation in each month of the year. Therefore, retirement is not necessarily from employment but could also be from unemployment. We also use the core study on health, from which we retrieve measures of mental health at the month of data collection. The core study on health surveyed individuals in November-December of each year from 2007 until 2017, with the only exception of 2014. The study contains a variable with the exact information on the month of the interview. We can therefore link the health

[8] See Knoef and de Vos (2009) for an evaluation of the representativeness of the LISS panel and Scherpenzeel (2011, 2010) and Scherpenzeel and Das (2010) for methodological notes on the design of the LISS panel.

[9] See https://www.dataarchive.lissdata.nl/study_units/view/1 for the full list of studies of the LISS panel.

measures collected in a given month with the corresponding information on age (in months) and retirement status available with a monthly frequency from the background variables. This results in 10 waves with information on health, age in months and retirement status. Details of our sample selection are provided in Appendix A.

4.3.1 The discontinuity in the retirement probability

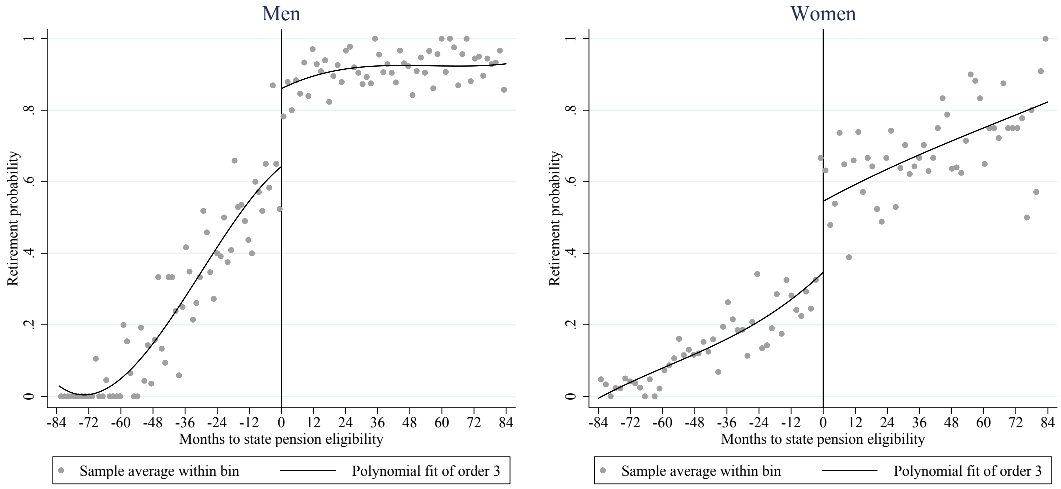
Our strategy for identifying the effect of retirement on different outcome variables hinges on the discontinuity in the retirement probability at the moment in which an individual attains the state pension eligibility age. This discontinuity is supposed to be exogenous with respect to the outcome measures, which should not jump in the absence of the discontinuity. Hence, individuals locally above and below the eligibility age should be randomized. However, in order to be a valid instrument, the discontinuity must also be a strong predictor of the retirement decision. Figure 1 displays the relation between the time to state pension eligibility and the retirement probability, obtained by regression functions with uniform kernel weights on a 3rd-order polynomial function, fitted separately above and below the cutoff. It shows that, for both men and women, at the moment of the state pension eligibility, the retirement probability significantly jumps. For those in a couple, the jump is 21.8 percentage points (pp) for men and 19.9 pp for women. For singles, it is 22.3 pp for men and 37.5 pp for women. Differently from Müller and Shaikh (2018), who detected strong explanatory power of the discontinuity at the cutoff on partner's retirement, we find that the impact of the discontinuity on partner's retirement probability is small and not significantly different from 0: the retirement probability of a wife increases by 5.7 pp at the eligibility age of her husband, whereas husbands' retirement probability decreases by 1.2 pp at the eligibility age of his wife. It is also noteworthy to mention that the discontinuity doubles when moving from women in a couple to single women, whereas it does not depend on the marital status for men. This is very likely due to the difference in terms of labor market participation between single women and those living in a couple.

Figure 1 shows that at the state pension eligibility age there are clear discrete jumps in the labor supply at the extensive margins for every group, i.e in the probability of retirement. These jumps could have a different meaning for men and women in terms of hours of work. Figure 2 shows the relationship between pension eligibility age and the intensive margin of labor supply, i.e. hours of work conditional on working.[10] We notice three important features. First, there are no clear discontinuities in the relationship at the state pension eligibility age. This suggests that the adjustment of labor supply is mainly at the extensive margin. Some individuals stop working if they reach the pension eligibility age; other individuals keep on working and, if

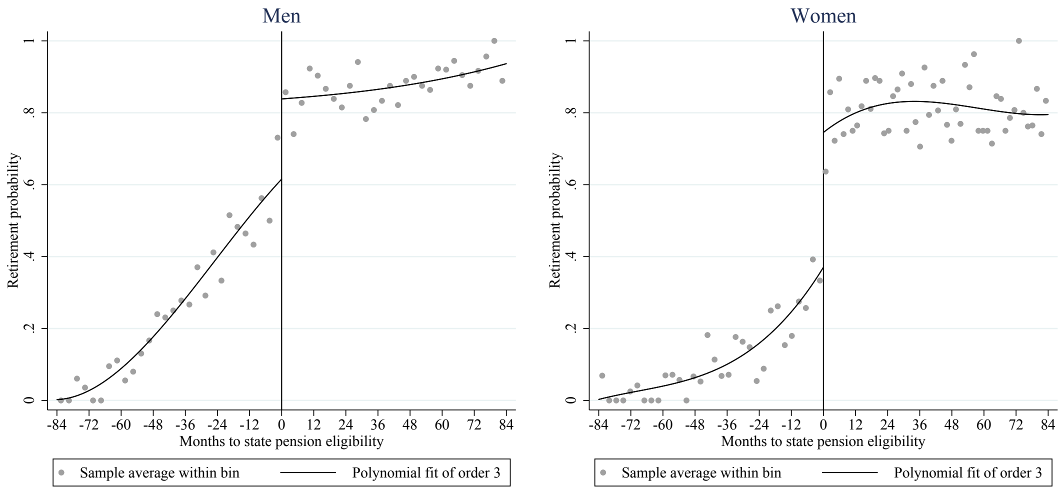
[10]Hours of work are defined as usual weekly working hours.

Figure 1: Graphical illustration of discontinuity in the retirement probability

(a) Couples



(b) Singles



Notes: The solid lines are obtained by regression functions based on a 3rd-order polynomial regression (with uniform kernel) of the retirement indicator on the running variable (time until age pension eligibility), fitted separately above and below the cutoff. The dots represent local sample means of disjoint bins of the running variable reported in the mid point of the bin. The number of bins and their lengths are chosen optimally using the mimicking variance integrated mean-squared error criterion. The sample is limited to couples and singles within the bandwidth of 84 months: 3,177 couples and 3,844 singles. The discontinuity in the retirement probability amounts to: a) for couples, 21.8 (19.9) percentage points for men (women), significantly different from zero with a p-value equal to 0.000 (0.001); b) for singles, 22.3 (37.5) percentage points for men (women), significantly different from zero with a p-value equal to 0.008 (0.000). The p-values are robust to within-individual correlation.

they do, they do not adjust their hours of work. Second, the variance in hours of work is higher to the right of the pension eligibility age due to the limited number of observations of individuals working after reaching the pension eligibility age. Third, before the pension eligibility age, there is a big difference in the average number of working hours between men, partnered women and single women. On average, men work about 35 hours per week, which roughly corresponds to a full-time job. For partnered women the working week on average has a little over 20 hours per week, showing that these are predominantly part-time jobs. For single women the average weekly working hours is close to 30 suggesting that some single women work part-time while others work full-time.

When interpreting gender differences in the effect of retirement on health and happiness, these differences in pre-retirement working hours have to be taken into account. Roughly speaking, retirement for men means a reduction of weekly working hours from 40 to zero, for partnered women it is a reduction from 20 to zero and for single women from 30 to zero. Retirement in terms of magnitude of effects on personal life is less substantial for partnered women than it is for single women or for men.

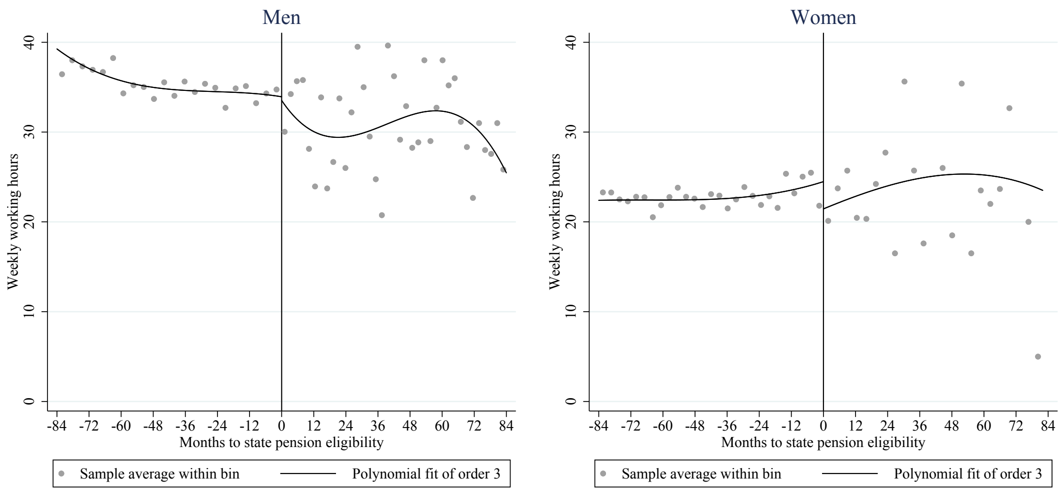
4.3.2 Measures of mental health

From the dataset on health we extracted a set of outcome variables describing mental health under different perspectives. In reporting and commenting on the estimation results, we will devote a special attention to one measures of mental health: happiness in the last month. We will then enrich the picture by estimating the impact of retirement on further measures of mental health: calmness, anxiety, depression and feeling down in the last month, as well as a summary measure like the five-item Mental Health Inventory (MHI-5) (Berwick et al., 1991). The MHI-5 is constructed using the scoring rules for the RAND 36 item health survey 1.0.[11] The scores span from 0 to 100, where larger values mean better conditions. We study whether retirement affects the probability of good mental health which is defined as an MHI-5 value greater than 60. We also investigate how retirement affects self-perceived health. Appendix A reports the full list of outcome variables, the discrete values they can take, the meaning of each discrete outcome and more details on the construction of MHI-5. This appendix also displays summary statistics of the outcome variables, the fraction of observations that at the moment of the interview were already retired and summary statistics of the covariates. Figures A.3–A.6 show the discontinuity in happiness, self-perceived health and Good mental health at the age of state pension eligibility.

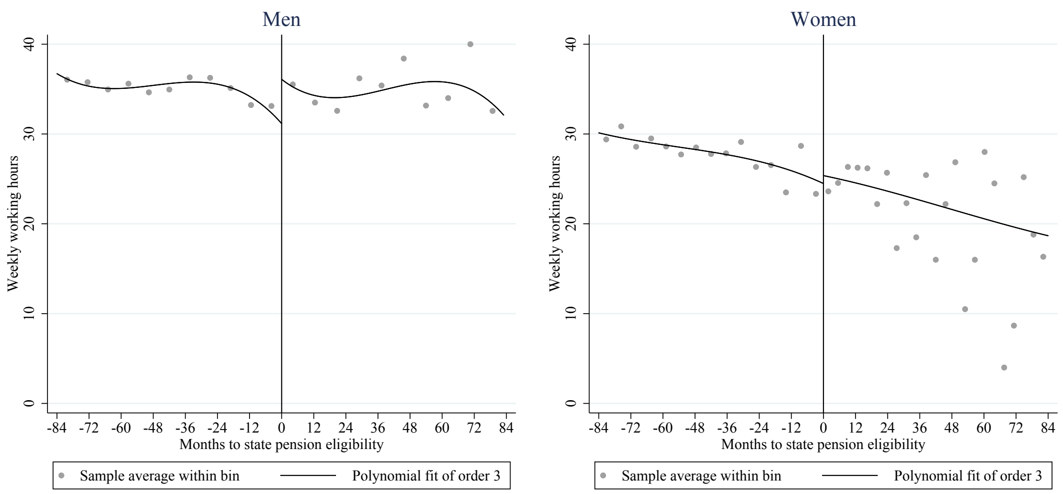
[11] See https://www.rand.org/health-care/surveys_tools/mos/36-item-short-form.html.

Figure 2: Graphical illustration of discontinuity in weekly working hours (conditional on working)

(a) Couples



(b) Singles



Notes: The solid lines are obtained by regression functions based on a 3rd-order polynomial regression (with uniform kernel) of the weekly working hours on the running variable (time until age pension eligibility), fitted separately above and below the cutoff. The dots represent local sample means of disjoint bins of the running variable reported in the mid point of the bin. The number of bins and their lengths are chosen optimally using the mimicking variance integrated mean-squared error criterion. The sample is limited to couples and singles within the bandwidth of 84 months that are still at work: 1,200 (1,094) partnered men (women), 569 male singles and 858 female singles.

5 Estimation Results

In this section we present our main estimation results. We first start with an overview of our baseline parameter estimates, distinguishing between partnered individuals and singles. For partnered individuals, we also present estimates on cross-partner effects of retirement. Second, to investigate the persistence of our main effects, we present parameter estimates of the effects one year after retirement. Third, we present some robustness checks.

5.1 Baseline Parameter Estimates

To illustrate our estimation set-up, Table 3 reports the main parameter estimates for the effects of retirement on happiness for couples. Panel a) shows the relationship between the position with respect to the eligibility age for the state pension and the retirement status. Clearly, being to the right of the cutoff for men has significant effects on the retirement probability for men. The same holds for women. There are no partner spillover effects. If men are to the right of their eligibility cutoff, this does not have a significant effect on the retirement status of their wives and vice versa. Apparently, couples do not decide to retire jointly. As shown at the bottom of the table, the excluded instruments are highly significant. Panel b) shows how the retirement status affects happiness. The retirement of men has a significant positive effect on their happiness and the happiness of their partners. These effects are quite substantial. The average marginal effects of the retirement of men increases the probability that they are continuously happy by 11 pp and that their wife is continuously happy by 18 pp. For men at retirement the probability to be mostly or continuously happy increases by almost 20 pp, while for their wives the probability to be mostly or continuously happy increases by almost 37 pp. If women retire, their own happiness is not affected, while the effect on their husbands is positive although not significantly different from zero, as the parameter is estimated with a low precision.

Table 4 reports the relevant parameter estimates for the happiness effects of retiring for single men and women. Panel a) shows that the eligibility age for the state pension is an important determinant of retirement. Being to the right of the cutoff has a positive and significant effect on the probability to be retired. At retirement, single men experience a positive effect on their happiness. This effect is quite substantial but the parameter is imprecisely estimated and does not differ significantly from zero. For single women the retirement effect on happiness is significantly negative. Their probability to be continuously happy drops by about 8 pp at retirement, while the probability to be never or seldom happy increases by 8 pp. The probability to be mostly or continuously happy decreases at retirement for single women by almost 20 pp.

Table 3: Parameter estimates retirement and happiness of couples

	Men			Women		
	Coeff.		Std. Err.	Coeff.		Std. Err.
a) Probability of retirement						
Husband's retirement						
Husband to right of cutoff	0.913	**	0.156	0.922	***	0.149
Wife to right of cutoff	0.000		0.161	0.038		0.168
Wife's retirement						
Husband to right of cutoff	0.135		0.148	0.164		0.156
Wife to right of cutoff	0.692	***	0.181	0.708	***	0.144
b) Effects on happiness						
Estimated coefficients of ordered probit model						
Husband's retirement	0.556	**	0.252	1.036	***	0.317
Wife's retirement	0.560		0.959	-0.117		1.064
Average marginal effects of husband's retirement on the probability of happiness in the last month						
Never or seldom	-0.058		0.035	-0.109	**	0.048
Sometimes	-0.076	*	0.040	-0.145	***	0.038
Often	-0.062		0.044	-0.114	***	0.022
Mostly	0.083		0.055	0.192	***	0.040
Continuously	0.113	**	0.051	0.176	***	0.068
Average marginal effects of wife's retirement on the probability of happiness in the last month						
Never or seldom	-0.063		0.129	0.012		0.112
Sometimes	-0.082		0.116	0.016		0.149
Often	-0.067		0.077	0.013		0.117
Mostly	0.089		0.107	-0.022		0.198
Continuously	0.122		0.214	-0.020		0.181
Log-likelihood	-2,710.01			-2,691.37		
Power of excluded instruments for husband's retirement	$\chi^2(2) = 34.22$			$\chi^2(2) = 38.45$		
Power of excluded instruments for wife's retirement	$\chi^2(2) = 14.76$			$\chi^2(2) = 26.29$		
Bandwidth satisfied by both husband and wife (months)	42			42		
Number of observations (individuals)	1,221 (438)			1,220 (438)		

Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are robust to within-individual correlation. The full set of estimation results are reported in Appendix D, Tables D1 and D2.

The analysis is done in a similar way for the other indicators for mental health, for the summary measure of mental health (MHI-5) and for self-perceived health. Table 5 provides an overview with panel I showing the parameter estimates and panel II presenting the marginal effects for each of the mental health indicators and for self-assessed health.[12]

The mental health of a retiring partnered man improves also along other dimensions than their happiness, i.e. calmness goes up and depression, anxiety and feeling down are reduced. Not all parameter estimates are significantly different from zero but the effects are sometimes substantial, as it can be seen in the tables in Appendix E. When a partnered man retires the probability that he is never depressed goes up by 38 pp. At retirement the probability that a partnered man is never feeling down increases by 32.5 pp. In combination these effects significantly increase partnered man's probability to have a good mental health by 23.5 pp. The retirement of a partnered man also has clear spillover effects on his wife. Their directions are always the same as those for the partnered man, although there are some differences in terms of

[12] Appendix E provides further estimation details similar to those in Tables 3 and 4.

Table 4: Parameter estimates retirement and happiness of singles

	Men			Women		
	Coeff.		Std. Err.	Coeff.		Std. Err.
a) Probability of retirement						
To right of cutoff	0.761	***	0.213	1.218	***	0.160
b) Effects on happiness						
Estimated coefficients of ordered probit model						
Retirement	0.503		0.498	-0.512	***	0.187
Average marginal effects of retirement on the probability of happiness in the last month						
Never or seldom	-0.095		0.100	0.080	**	0.032
Sometimes	-0.077		0.068	0.094	***	0.031
Often	-0.013		0.013	0.024	**	0.010
Mostly	0.127		0.112	-0.116	***	0.037
Continuously	0.058		0.066	-0.081	**	0.034
Log-likelihood	-1,529.92			-2,178.40		
Power of excluded instrument for retirement	$\chi^2(1) = 12.83$			$\chi^2(1) = 57.66$		
Bandwidth (months)	42			42		
Number of observations	802 (254)			1,162 (392)		

Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are robust to within-individual correlation. The full set of estimation results are reported in Appendix D, Tables D3 and D4.

significance. For partnered women with a retiring husband the probability of feeling calm and peaceful mostly or continuously increases by about 30 pp, while the probability of never feeling down increases by 33 pp. All this significantly increases for partnered women the probability to be in good mental health by almost 19 pp if their husbands retire.

Retirement of a partnered woman has hardly any effect on her mental health with different directions for the various components. Happiness and calmness go down while depression and feeling down go up. However anxiety is also going down. In combination the probability to have a good mental health goes down a bit but not significantly so. For the partners of the retiring women the mental health effects are all positive but insignificant with the exception of feeling down which increases significantly. The probability for husbands of retiring women to never feel down increases by almost 20 pp. The probability to have a good mental health increases slightly but not significantly for partners of retiring women.

The last two columns of Table 5 provide parameter estimates for singles. For some of the dependent variables the effects of retirement are quite different. Although none of the separate mental health indicators is significantly different from zero, for single men retiring, overall mental health goes down. The probability to have a good mental health decreases significantly by about 40 pp when single men retire. For single women retiring, apart from the significant negative effects on happiness, there is no significant effect on mental health. Overall, the probability to have a good mental health decreases somewhat but not significantly.

The last row of Table 5 displays the estimated effect of retirement on self-perceived health for couples and singles. Clearly, we see that whilst husband's retirement has a positive effect

Table 5: Summary of main parameter estimates of mental health effects of retirement by gender and partnership status (bandwidth equal to 42)

	Couples					
	Man retires		Woman retires		Singles	
	Own effect	Wife	Own effect	Husband	Man	Woman
I. Parameter estimates						
a. Happiness	0.556 **	1.036 ***	-0.117	0.560	0.503	-0.512 ***
b. Calmness	0.470	0.809 *	-0.228	0.475	-0.094	-0.141
c. Depression	-1.068 ***	-0.346	0.396	-0.182	-0.043	0.188
d. Anxiety	-0.669	-0.141	-0.349	-0.374	-0.289	-0.358
e. Feeling down	-0.965 **	-0.913 **	0.043	0.584 *	0.006	0.019
f. Good mental health	1.309 ***	0.908 **	-0.350	0.462	-1.416 ***	-0.157
g. Self-perceived health	0.755 ***	0.545 *	-0.180	-0.311	-1.120 ***	-0.416
II. Marginal effects						
a. Happiness						
Never or seldom	-0.058	-0.109**	0.012	-0.063	-0.095	0.080***
Sometimes	-0.076*	-0.145***	0.016	-0.082	-0.077	0.094***
Often	-0.062	-0.114***	0.013	-0.067	-0.013	0.024**
Mostly	0.083	0.192***	-0.022	0.089	0.127	-0.116***
Continuously	0.113**	0.176***	-0.020	0.122	0.058	-0.081**
b. Calmness						
Never or seldom	-0.063	-0.117	0.033	-0.063	0.013	0.022
Sometimes	-0.041	-0.110**	0.031	-0.041	0.013	0.022
Often	-0.055	-0.075***	0.021	-0.055	0.001	0.010
Mostly	0.061	0.177***	-0.050	0.061	-0.022	-0.035
Continuously	0.098	0.125	-0.035	0.098	-0.013	-0.020
c. Depression						
Never	0.381***	0.131	-0.150	0.065	0.016	-0.068
Seldom	-0.115***	-0.022	0.025	-0.020	-0.003	0.004
Sometimes	-0.145***	-0.062	0.071	-0.025	-0.007	0.035
Often/Mostly/Continuously	-0.121**	-0.047	0.053	-0.021	-0.007	0.029
d. Anxiety						
Never	0.247	0.048	0.120	0.138	0.105	0.123
Seldom	-0.070	-0.000	-0.001	-0.039	-0.019	0.002
Sometimes of more often	-0.177	-0.048	-0.119	-0.099	-0.086	-0.125
e. Feeling down						
Never	0.325**	0.334***	-0.016	-0.197*	-0.002	-0.007
Seldom	-0.116***	-0.130***	0.006	0.070**	0.001	0.002
Sometimes of more often	-0.208**	-0.204**	0.010	0.126*	0.002	0.005
f. Good mental health						
No	-0.235***	-0.188**	0.072	-0.083	0.401**	0.041
Yes	0.235***	0.188**	-0.072	0.083	-0.401***	-0.041
g. Self-perceived health						
Poor or moderate	-0.207***	-0.163*	0.053	0.085	0.341***	0.131
Good	0.009	0.026	-0.009	-0.004	-0.037	-0.028
Very good or excellent	0.198***	0.138*	-0.045	-0.081	-0.304***	-0.103

Notes: Good mental health = MHI-5>60. Further estimation details for the other rows are presented in Appendix E. * Significant at 10%; ** significant at 5%; *** significant at 1%. Inference is robust to heteroskedasticity and within-individual correlation. The number of observations (individuals) is 1,221 (438) for partnered individuals, 802 (254) for male singles and 1,162 (392) for female singles.

both on his own perceived health and on his wife's perceived health, the retirement of women does not significantly impact her own perceived health or the health of the partner. The average partial effect presented at the bottom of the table indicates that the positive impact of retirement on health is quite sizable: when a man retires the probability that his own health is very good or excellent increases by almost 20 pp, while the probability that the health of his wife is very good or excellent raises by almost 14 pp. If a woman retires the effect on the self-perceived health of her male partner is negative, with an effect on very good or excellent health of about -8 pp, which is not however significantly different from zero. The effect of a partnered woman retiring on her own health is negligible. For single men, the effect is opposite to those of partnered men. Retiring has a substantial and significant negative effect on their perceived health: on average, the probability that a single man is in very good or excellent health drops by 30 pp at retirement. For single women retirement also has a negative effect on self-perceived health, but the magnitude is much smaller and not significantly different from zero.

5.2 Persistence of the Effects

Because in many of the estimates presented in Table 5 the separate indicators for mental health are very much in line with each other, in what follows we restrict the attention on the effects of retirement on the probability to be in good mental health and on self-perceived health for the sake of clarity and brevity.

An important question in assessing the health and happiness effects of individual retirement is the extent to which the effects are persistent. It could be that at retirement there are immediate effects but these may fade away after a while. To investigate the persistence of the effects, we re-estimated our model with the dependent variables measured one year after retirement. The relevant parameter estimates are presented in Table 6.

Table 6: Main parameter estimates of mental health effects of retirement by gender and partnership status one year ahead (bandwidth equal to 60)

	Couples					
	Man retires		Woman retires		Singles	
	Own effect	Wife	Own effect	Husband	Man	Woman
a. Good mental health	0.937 *	0.734 *	-0.139	0.284	-0.671	-0.243
b. Self-perceived health	0.622 **	0.391	-0.112	-0.106	-0.191	-0.203

Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%. Inference is robust to heteroskedasticity and within-individual correlation. We enlarge the bandwidth to 60 to have a large enough sample: when measuring the mental health one year ahead we lose indeed one wave. The number of observations (individuals) is 1,780 (514) for partnered individuals, 939 (259) for male singles and 1,409 (400) for female singles. The full estimation results are available from the authors upon request.

Fewer parameters are significantly different from zero when the health and happiness effects are measured one year later. However, by and large, for couples the main conclusions do not change. For single men the effects are reduced one year after retirement while for single women the parameter estimates are similar to the immediate effects. For wives of retiring men the effect on self-perceived health is no longer significantly different from zero but the point estimate is not very different from the baseline parameter estimate.

5.3 Robustness checks

To investigate the robustness of our findings, we first assess the implications of weighting observations on the basis of their distance from the cutoff. In the benchmark analysis, we do not weigh observations and do not give more importance to individuals closer to the cutoffs. For couples there are indeed two cutoffs and how to jointly take into account both distances might be a source of arbitrariness. In this sensitivity analysis, we check the robustness of our findings by using weights. For singles, we use the usual triangular weights computed as $w_i \equiv 1 - \frac{|m_i|}{bw}$, where bw is the chosen bandwidth for local estimation. For partnered individuals, we first define the triangular weight as usual at individual level for each component of the couple and then denote the triangular weight for individual i's partner as $w_i^p \equiv 1 - \frac{|m_i^p|}{bw}$. Finally, the weight for partnered individual i is given by the product of his/her own triangular weight and the one of his/her partner. By doing so, we give more importance to couples in which both partners are close to the cutoff. Panel I of Table 7 reports the parameter estimates for the retirement effects if we weight observations. Most of the parameter estimates are very much in line with those reported in Table 5. The magnitude of some of the estimates may differ somewhat and so does the significance. Nevertheless, they are qualitatively the same.

As a further sensitivity analysis, we explore the implications of our bandwidth choice. Panels II and III of Table 7 display the estimated retirement parameters if we change the bandwidth and fix it to 36 and 60 months, respectively. Also in these cases, the results are very close to the benchmark specification, especially when the bandwidth is further restricted to 36 months. The number of observations increases with the bandwidth, but the basic conclusions do not change.

6 What Explains Our Findings?

There are clear differences between males and females in the mental health effects of retirement. Whereas for couples, the retirement of males has mental health effects on both the males themselves and their wives, there are hardly any mental health effects of the retirement of partnered women. These gender differences could be related to differences in the pre-retirement working hours. As suggested by Figure 2, the drop in working hours at retirement for males

Table 7: Robustness checks

	Couples				Singles	
	Man retires		Woman retires			
	Own effect	Wife	Own effect	Husband	Man	Woman
I. Bandwidth 42 and triangular kernel						
a. Good mental health	1.332 ***	0.851 *	-0.128	1.295 ***	-1.434 ***	-0.177
b. Self-perceived health	0.855 ***	0.687 **	0.036	-0.168	-1.208 ***	-0.218
II. Bandwidth 36						
a. Good mental health	1.377 ***	0.948 **	-0.459	0.757 **	-1.416 ***	-0.157
b. Self-perceived health	0.814 ***	0.492	-0.257	-0.500	-1.120 ***	-0.416
III. Bandwidth 60						
a. Good mental health	1.401 ***	0.964 ***	-0.463	0.123	0.543	-0.382
b. Self-perceived health	0.749 ***	0.456 *	-0.295	-0.398	-0.903 **	-0.228

Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%. Inference is robust to heteroskedasticity and within-individual correlation. In panel I, the number of observations (individuals) is 1,221 (438) for partnered individuals, 802 (254) for male singles and 1,162 (392) for female singles. In panel II, the number of observations is 966 (388) for partnered individuals, 689 (223) for male singles and 977 (344) for female singles. In panel III, the number of observations is 2,093 (595) for partnered individuals, 1,114 (312) for male singles and 1,657 (483) for female singles. The full estimation results are available from the authors upon request.

is on average twice as large as the one for partnered females. Hence, the daily life of retiring men may change much more than the one of retiring women. Furthermore, there are important differences in mental health effects of retirement between couples and singles. Whereas for couples there are often positive mental health effects, the mental health effects of retirement for singles are frequently negative, especially for male singles. It could be that these differences are related to couples still having a normal social life because of their partnership, while for singles work is a focal element of their social relationships.

To explore possible explanations for these differences in the retirement effect between singles and couples, we performed additional estimates focusing on leisure time satisfaction, social life and loneliness. These estimates are presented in Table 8. Appendix C reports details on the construction and definitions of these additional dependent variables.[13]

Table 8 shows that there are clear similarities and differences between couples and singles in the effects of retirement on these additional outcome variables. Except for single women, retirement leads to an increase in satisfaction with the amount of leisure time, as well as satisfaction about how leisure time is spent. Husbands of retiring women are less likely to be involved in voluntary work while retiring single men are more likely to get into voluntary work. Satisfaction with social contacts improves for retiring men but deteriorates for husbands of retiring women. The effect of retiring on loneliness varies, but it is only significant negative for retiring men. This effect is due to retiring having a lowering effect on emotional loneli-

[13]We also investigated whether retirement has effects on personal net income finding that only for partnered women who retire there is a positive significant income effect while for the others there is no significant income effect.

Table 8: Summary of parameter estimates of the effect of retirement on social life and satisfaction by gender

	Couples				Singles	
	Man retires		Woman retires			
	Own effect	Wife	Own effect	Husband	Man	Woman
a. Satisfaction with amount of leisure time	1.029 ***	0.534	1.063 *	1.116 ***	1.089 ***	0.148
b. Voluntary work (Yes/no)	0.243	0.145	-0.696	-0.756 *	0.774 *	-0.090
c. Satisfaction with social contacts	0.594 *	0.006	0.564	-0.926 ***	0.592	-0.321
d. De Jong Gierveld loneliness score	-0.803 ***	-0.123	0.198	0.810	0.629	0.116
e. Social loneliness score	-0.024	-0.122	0.369	0.754	0.240	0.185
f. Emotional loneliness score	-1.241 ***	-0.173	-0.359	0.725	0.889 *	0.079

Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%. Inference is robust to heteroskedasticity and within-individual correlation. The bandwidth is equal to 42 and the number of observations (individuals) is 1,294 (462) for partnered individuals, 838 (261) for male singles and 1,252 (419) for female singles. Fuzzy RDD performed by an IV ordered probit model estimate, except for panel b. which is a fuzzy RDD performed by an IV probit model estimate.

ness. This is the opposite for retiring single men, for whom the emotional loneliness increases significantly (at 10%). This differential impact of retirement on emotional loneliness between partnered and single men could in part explain why retiring partnered men experience an increase in happiness and self-perceived health (as well as on other measures of mental health), while retiring single men do not.

7 Conclusions

Due to aging populations, in many countries retirement is postponed by abolishing early retirement programs and increasing standard retirement ages. To the extent that the increase in retirement age is voluntary, there is no need to worry about welfare implications. However, if individuals lack financial resources to retire early should they wish to do so, an increase in retirement age is involuntary and welfare may be negatively affected. Welfare implications of postponing retirement will depend, among others, on the consequences for health and happiness of the individuals involved, i.e. the workers that are forced to retire later and, in case they are not single, also their partners.

In previous studies, the empirical evidence on the mental health effects of retirement is mixed. Some studies find a positive effect, other studies conclude that there is no effect or a negative effect. We use Dutch data to study how retirement affects mental health. To establish the causal effect of retirement, we use a fuzzy RDD which exploits the age of eligibility to the state pension. Since this eligibility age is determined only by year and month of birth, it has an exogenous effect on the retirement decisions. For both men and women, there is a clear discontinuity in the probability to retire at the eligibility age for the state pension. Therefore, we can identify the effects of the retirement of men and women on their own health and happiness and on those of their partners if any.

Our main findings are the following. The retirement of a man has quite a few significant mental health effects on him and his partner. Self-perceived health improves substantially and significantly for both the retiree and his partner. Furthermore, mental health and self-assessed health of him and his wife improve. Contrary to the health effects of a man retiring, retirement of a woman has hardly any effect on mental health or self-assessed health of herself or her husband. All in all, it seems that increasing the state pension age has negative effects on the mental health of male workers and their wives. For females workers increasing the eligibility age of the state pension is less of an issue. Of course, this may be related to the drop in working hours which is far more substantial for retiring men than it is for retiring women.

Our findings on single men and women sometimes differ substantially from those on partnered men and women. For example, for single women the drop in happiness at retirement is significantly negative. Single men retiring experience a drop in self-perceived health but also in other indicators of mental health. For single women, the health effects are much smaller. In an additional analysis focusing on satisfaction about leisure and on feelings of loneliness, we find that satisfaction about the amount of leisure time increases across the board but feelings of loneliness increase for retiring single men while decreasing for retiring partnered men. Clearly, increasing the state pension age might have positive effects on health and happiness of single workers, because it prevents feelings of loneliness to occur or to increase.

Because of the heterogeneity in the retirement effects according to gender and marital status, it is difficult to draw uniform policy conclusions. Whereas for partnered men retirement has positive mental health effects, for single men the mental health effects are negative. Taking into account the differences in mental and self-assessed health effects of retiring, we conclude that allowing for more flexibility in retiring would have welfare improving effects. Currently, for many individuals the state pension age is an upper limit to the actual retirement age, as in quite a few collective agreements an individual has to retire when reaching the state pension age. People who can afford doing so can retire earlier than the state pension age but people who would like to continue working are not allowed to retire later unless they are willing to change jobs. Removing barriers to continue working after the state pension age seems to be welfare-improving.

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Appendix

A. Details on Our Data and Sample

A.1. Sample Selection

Between 5,072 and 6,698 individuals were interviewed each year for the core study on health from 2007 until 2017, resulting in a total of 58,103 records. We matched each record on the basis of the information on the year and month of interview to the corresponding information about the retirement status and age in months coming from the background variables. We were able to match 57,445 records, belonging to 12,832 different individuals.[14] Given the aim of this paper, we restricted the sample to individuals close to the moment of the state pension eligibility. After defining according to the rules outlined in Table 2 a variable that measures the distance in months from the month in which an individual becomes eligible to the state pension, we kept all the observations who were within 84 months away from the month of the state pension eligibility at the moment of the interview. The sample size shrank therefore to 15,024 observations. Since the aim is, not only to unveil the effect of retirement on his/her-own mental health, but also to identify the impact on partner's outcome variables, we restricted the sample to couples in which both partners answered the questionnaire on health (3,212 couples) and to singles (3,863 observations).

Finally, we dropped from the samples 35 couples for which at least one partner is interviewed in the month in which the eligibility to the state pension was attained. Similarly, we eliminated 19 singles interviewed in the month in which the eligibility was attained. This refinement is due to a kind of heaping problem (Barreca et al., 2016) or rounding error (Dong, 2015). From 1 January 2012, the state pension eligibility is indeed received from the day in which one satisfies the age requirement. Since we do not have the day of birth, but only the month in which an individual becomes eligible to the state pension, we cannot be sure, for those interviewed in the month in which they become eligible to the state pension, whether they are already eligible at the moment of the interview or they will be soon eligible to the state pension. Although this kind of error is likely to be randomly distributed across those observations interviewed in the month of state pension eligibility, it is present only above the cutoff (Lee and Card, 2008). Given the small number of such observations, omitting them from the sample is the easiest way of facing the problem and getting unbiased estimates of the treatment effect for all the others (Barreca et al., 2016). The remaining sample has 3,177 records of couples and 3,844 singles. Along the paper, we used different subsamples, depending on the chosen band-

[14] Since not all the respondents to the health survey responded in the same month also to the monthly background variables, we could not match 658 observations.

width. For example, when the chosen bandwidth is 42 (for couples satisfied by both partners), the sample is made up of 1,221 couples and 1,964 singles (802 men and 1,162 women).

A.2. Definition of Variables and Descriptive Statistics

Table A.1 clarifies the discrete nature of the outcome variables and the meaning attached to the numeric values. Information on happiness, calmness, depression, anxiety and feeling down in the last month is collected by asking individuals whether in the last month they felt, respectively, "happy", "calm and peaceful", "depressed and gloomy", "very anxious" and "so down that nothing could cheer me up". They could choose one the following six: (1) never, (2) seldom, (3) sometimes, (4) often, (5) mostly and (6) continuously. Since the top or the bottom categories were sometimes indicated rarely by respondents, we had to group them as detailed in the last column of Table A.1. These five variables measuring mental health, with their original scores from 1 to 6, are the ones used to build the MHI-5 scale.[15] We summed up the scores of the five mental health variables after reversing depression, anxiety and feeling down, subtracted 5 and multiplied by 4. By doing so, the resulting MHI-5 scale spans from 100, for those reporting all 6s, to 0, for those reporting all 1s. Larger numbers represent therefore better mental health conditions. Figure A.1 displays the distribution of MHI-5 by gender for people living in a couple and for singles. In line with the approach of Statistics Netherlands, we consider people with MHI-5>60 to have good mental health. Clearly, from the graph it appears that women living in couples are more likely to have mental health problems than men living in couples. For singles there is no difference between women and men.

Self-perceived health collects information on the response to the question "How would you describe your health, generally speaking?". People could reply choosing between: (1) poor, (2) moderate, (3) good, (4) very good and (5) excellent. Since very few observations reported a poor or excellent health, we grouped the extreme categories with the closest one, so that the resulting order response variable takes 3 different values.

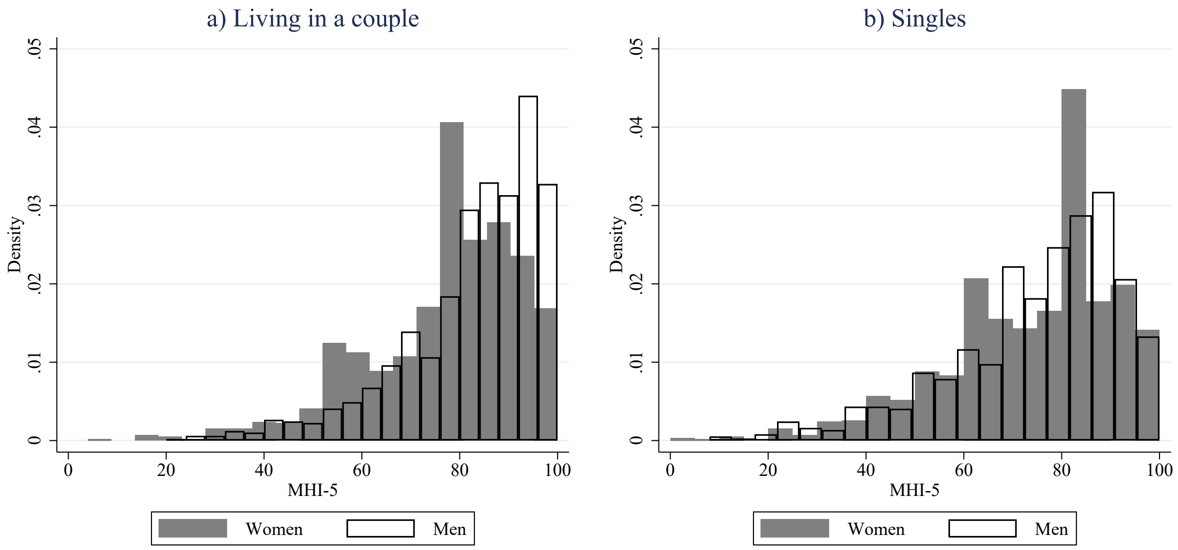
Table A.2 provides descriptive statistics of the outcome variables. Table A.3 reports summary statistics of the retirement indicator, the number of months from the age of state pension eligibility and the other control variables used in the econometric analysis. Finally, Figure A.2 shows the distribution of the age difference between husbands and wives in the sample used for our baseline estimates. The age difference is predominantly positive: males are on average older than their female partners. In almost 77% of the couples the male is older than the female. For 30% of the couples the male is at least two years older.

[15]The Cronbach's alpha of these five variables suggests relatively high internal consistency. It is equal to 0.837 (0.852) for (wo)men living in a couple and 0.868 (0.855) for (fe)male singles.

Table A.1: Outcome indicators

Measure	Question	Ordered values
a. Happiness in the last month	I felt happy...	1. never or seldom – 2. sometimes 3. often – 4. mostly – 5. continuously
b. Calmness in the last month	I felt calm and peaceful...	1. never or seldom – 2. sometimes 3. often – 4. mostly – 5. continuously
c. Depressed in the last month	I felt depressed and gloomy...	1. never – 2. seldom – 3. sometimes 4. often, mostly, or continuously
d. Anxiety in the last month	I felt very anxious...	1. never – 2. seldom 3. sometimes or more often
f. Feeling down in the last month	I felt so down that nothing could cheer me up...	1. never – 2. seldom 3. sometimes or more often
k. Good mental health	Based on MHI-5 built on the previous 5 measures.	0. MH problems (MHI-5$<$60) 1. Good mental health (MHI-5$\geq$60)
g. Self-perceived health	How would you describe your health, generally speaking?	1. poor or moderate 2. good 3. very good or excellent

Figure A.1: Distribution of MHI-5 by gender for people living in a couple and singles



Note: Observations are restricted to those used in the baseline estimates. The number of observations is 1,221 for partnered individuals, 802 for male singles and 1,162 for female singles.

Table A.2: Descriptive statistics of the outcome variables

	Couples			Singles		
	Means		p-value of t test on the equality of the means	Means		p-value of t test on the equality of the means
	Not retired	Retired		Not retired	Retired	
Men's happiness	3.338	3.623	0.000	2.899	3.105	0.012
Women's happiness	3.460	3.514	0.342	3.155	3.159	0.945
Men's calmness	3.566	3.632	0.314	3.250	3.459	0.007
Women's calmness	3.265	3.505	0.000	3.165	3.342	0.006
Men's depression	1.729	1.674	0.309	2.054	1.911	0.043
Women's depression	1.946	1.842	0.057	2.068	1.998	0.212
Men's anxiety	1.794	1.711	0.090	1.966	1.806	0.004
Women's anxiety	2.054	1.893	0.001	2.054	1.967	0.068
Men's feeling down	1.480	1.414	0.139	1.720	1.549	0.003
Women's feeling down	1.619	1.457	0.000	1.715	1.632	0.074
Men Good mental health	0.908	0.924	0.351	0.774	0.867	0.001
Women Good mental health	0.870	0.886	0.413	0.814	0.824	0.668
Men's self-perceived health	1.923	2.003	0.043	1.889	1.966	0.098
Women's self-perceived health	1.902	2.000	0.008	1.863	1.964	0.007

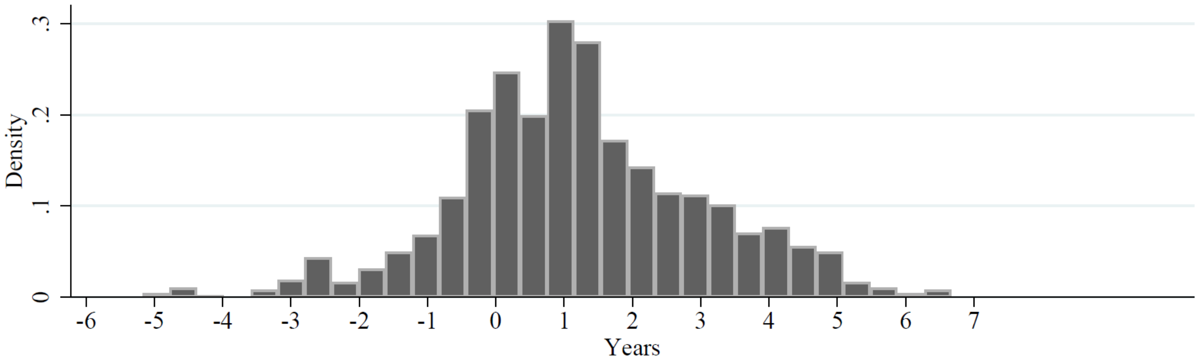
Notes: Observations are restricted to those used in the baseline estimates. The number of observations is 1,221 for partnered individuals, 802 for male singles and 1,162 for female singles.

Table A.3: Descriptive statistics of the covariates

	Couples				Singles			
	Men		Women		Men		Women	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Retirement	0.734	0.442	0.374	0.484	0.631	0.483	0.503	0.500
Months to state pension eligibility	6.722	21.760	-7.686	21.583	-0.569	23.813	0.515	24.428
Education								
Primary or intermediate secondary	0.378	0.485	0.649	0.478	0.431	0.496	0.483	0.500
Secondary or tertiary	0.142	0.349	0.083	0.276	0.163	0.370	0.161	0.368
Vocational	0.480	0.500	0.269	0.443	0.405	0.491	0.356	0.479
Wave								
2007	0.079	0.269	0.079	0.269	0.062	0.242	0.066	0.249
2008	0.088	0.284	0.088	0.284	0.071	0.257	0.076	0.265
2009	0.102	0.303	0.102	0.303	0.103	0.305	0.090	0.287
2010	0.108	0.311	0.108	0.311	0.102	0.303	0.095	0.293
2011	0.100	0.300	0.100	0.300	0.099	0.298	0.088	0.283
2012	0.114	0.318	0.114	0.318	0.110	0.313	0.102	0.302
2013	0.111	0.315	0.111	0.315	0.102	0.303	0.106	0.308
2015	0.109	0.312	0.109	0.312	0.120	0.325	0.129	0.335
2016	0.096	0.294	0.096	0.294	0.110	0.313	0.117	0.322
2017	0.093	0.290	0.093	0.290	0.121	0.326	0.132	0.338
Presence of dependent children in the household	0.041	0.198	0.041	0.198	0.070	0.255	0.046	0.211
Urban density of place of residence								
1,500 or + inhabitants per km^2	0.352	0.478	0.352	0.478	0.438	0.496	0.517	0.500
1,000 to 1,500 inhabitants per km^2	0.219	0.414	0.219	0.414	0.234	0.424	0.222	0.416
Less than 1,000 inhabitants per km^2	0.429	0.495	0.429	0.495	0.328	0.470	0.261	0.439
Observations	1,221		1,221		802		1,162	

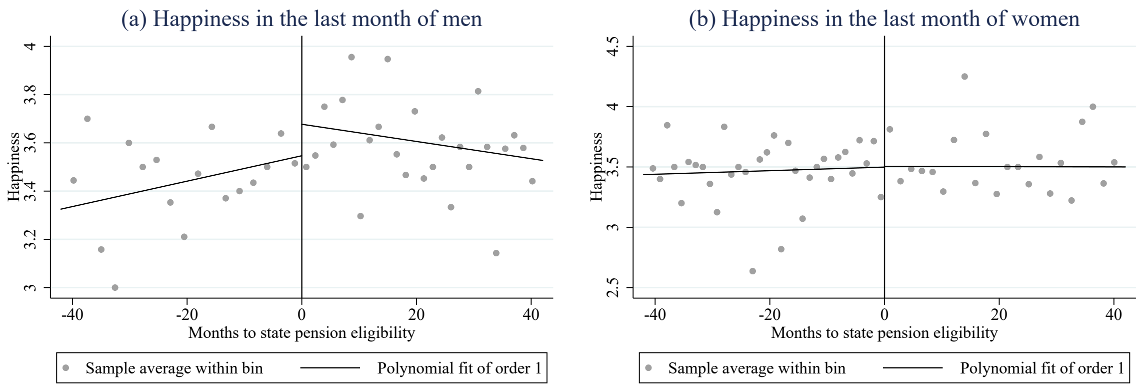
Notes: Observations are restricted to those used in the baseline estimates with bandwidth equal to 42.

Figure A.2: Distribution of the age difference between partners are within the bandwidth of 42 months; age man minus age woman



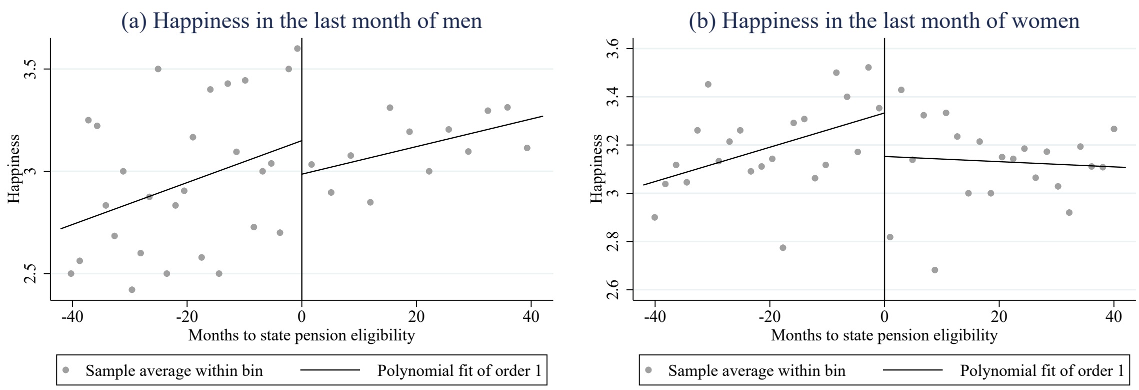
Note: The sample is limited to 1,221 couples with both partners within the bandwidth of 42 months.

Figure A.3: Graphical illustration of discontinuity in happiness for couples



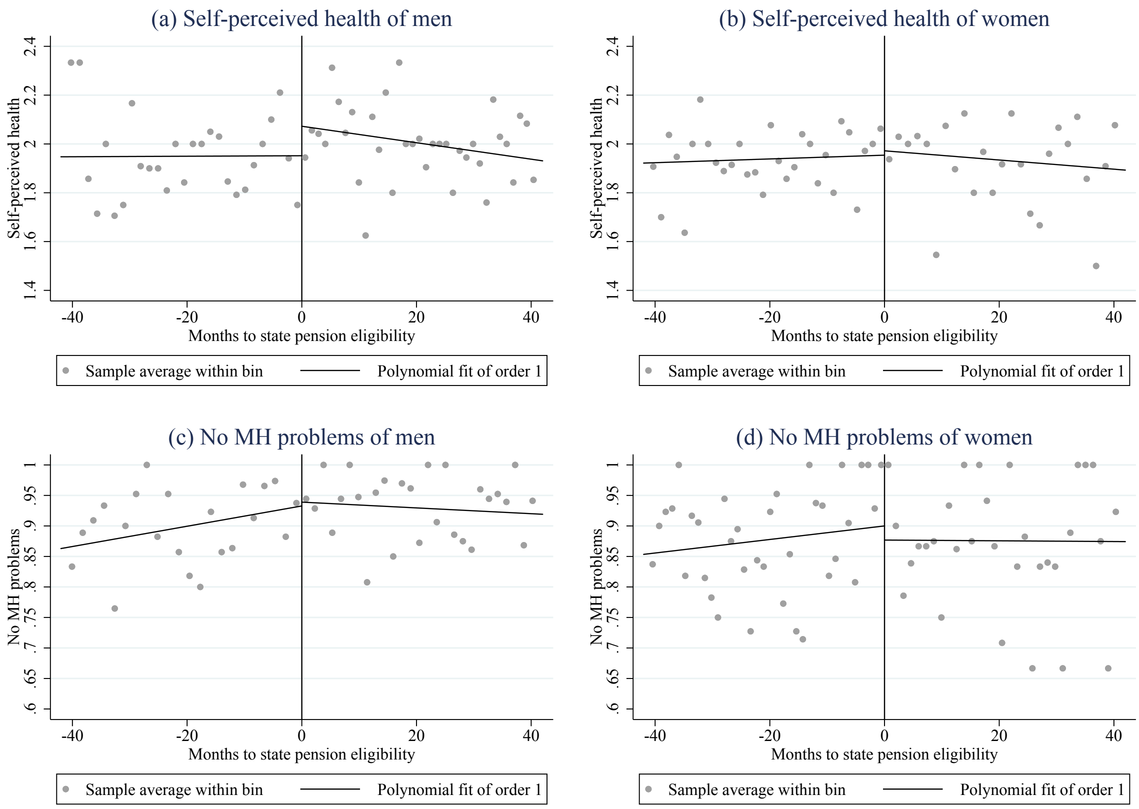
Notes: The solid lines are obtained by regression functions based on a linear polynomial regression (with uniform kernel) of the dependent variables on the running variable (time until age pension eligibility), fitted separately above and below the cutoff. The dots represent local sample means of disjoint bins of the running variable reported in the mid point of the bin. The number of bins and their lengths are chosen optimally using the mimicking variance integrated mean-squared error criterion. The sample is limited to observations within the bandwidth of 42 months like in the baseline estimations.

Figure A.4: Graphical illustration of discontinuity in happiness for singles



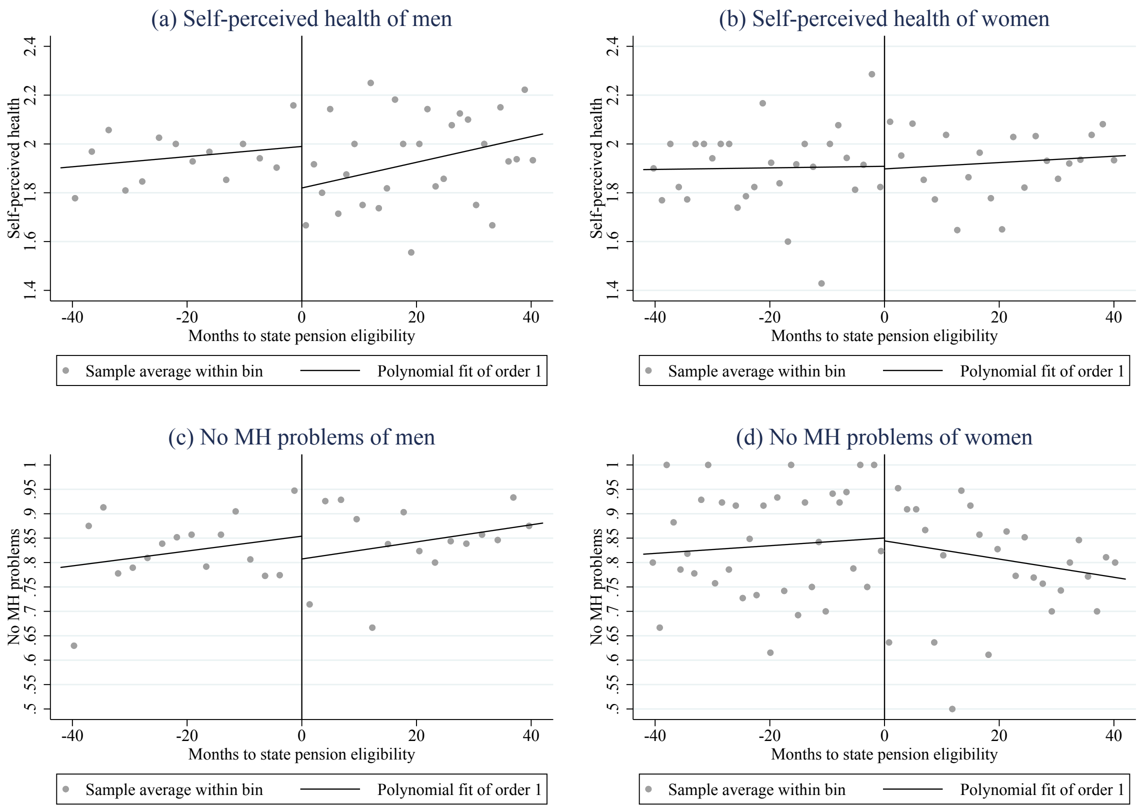
Notes: See notes of Table A.3.

Figure A.5: Graphical illustration of discontinuity in self-perceived health and good mental health for couples



Notes: See notes of Table A.3.

Figure A.6: Graphical illustration of discontinuity in self-perceived health and good mental health for singles



Notes: See notes of Table A.3.

B. Validity and Falsification Tests

As suggested by McCrary (2008), a jump in the density of the running variable at the threshold would be direct evidence of the failure of the local randomization assumption. Figure B.1 displays the local polynomial density estimate of the running variable described in Cattaneo et al. (2018). The graphs show that there is no evidence of discontinuity in the population density at the cutoff, for both genders and whether living in a couple or not.

If the retirement probability is locally randomized near the cutoff, then the treatment should not have an effect on the pre-treatment covariates, i.e. the treated units should be similar to control units in terms of observed characteristics. We follow Lee and Lemieux (2010) and test if the discontinuity influences our predetermined variables, by estimating a seemingly unrelated regression (SUR) with one equation for each of the predetermined variables, with the same bandwidth (42 months) and local polynomial regression as in the baseline estimates. After the estimation of the SUR model, we performed joint and individual tests of the significance of the discontinuities. They are reported in Table B.1. The single tests do not show systematic jumps at the cutoff: only 1 discontinuity out of 37 is significantly different from 0 at the usual 5% confidence level. All the joint tests do not reject the null hypothesis. Since we are testing the presence of discontinuities for many covariates, the joint tests suggest that only one significant discontinuity is so by random chance (Lee and Lemieux, 2010).

C. Social life and Leisure Time Satisfaction

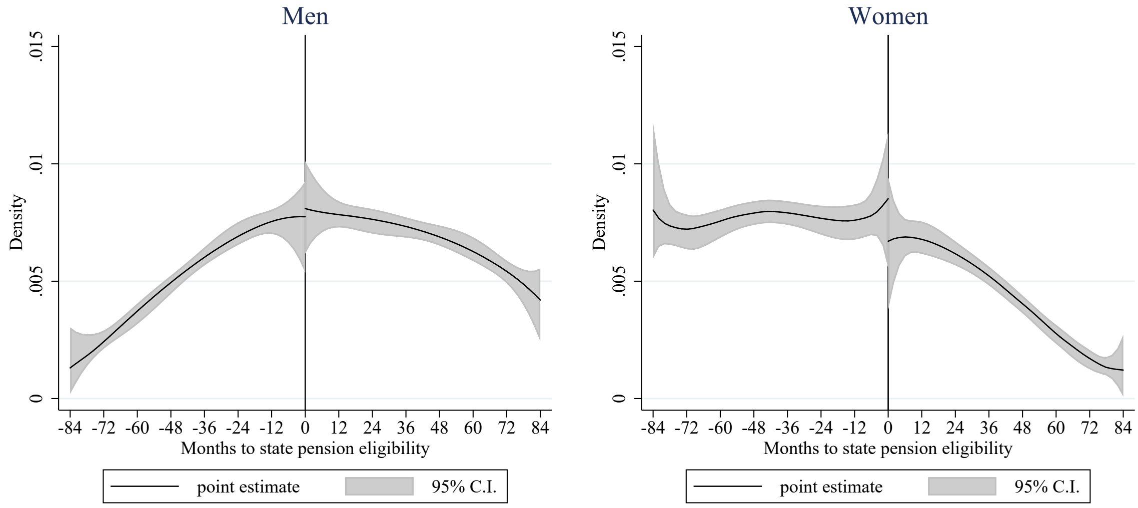
In Table 8, we reported the estimated impact of retirement on measures related to social life and leisure time satisfaction from IV probit models or IV ordered probit models, depending on the nature of the categorical dependent variable. The outcome variables measuring different aspects of social life and satisfaction with the use of leisure time come from the core study on "Social Integration and Leisure", of which we used the 10 waves from 2008 until 2017. We linked these waves to the background variables collected monthly and applied the same sample selection criteria as for the baseline core study on "Health". We ended up with 1,294 couples, 838 male singles and 1,252 female singles.

The dependent variables taken from the core study on "Social Integration and Leisure" are:

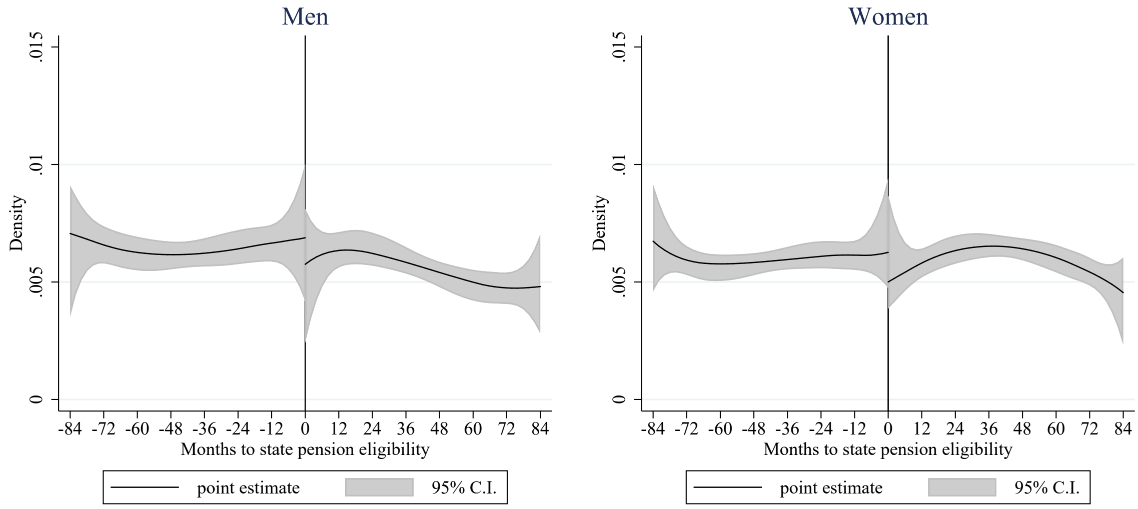
a. *Satisfaction with amount of leisure time.* The question from which this variable derives is "How satisfied are you with the amount of leisure time that you have?". Respondents could reply by indicating an integer from 0 to 10, where 10 meant "completely satisfied". Because of the very small number of observations indicating low values, we grouped into one category the replies lower than or equal to 7. The resulting outcome variable is a

Figure B.1: Graphical density test of the running variable

(a) Couples



(b) Singles



Notes: The solid line is the the local polynomial density estimate of the running variable described in Cattaneo et al. (2018). The local polynomial is of order 3. The robust bias-corrected test proposed in Cattaneo et al. (2018) cannot reject the null hypothesis of the absence of discontinuity: p-value equal to 0.557 (0.377) for men (women) for couples; p-value equal to 0.384 (0.648) for men (women) for singles.

Table B.1: Falsification test: discontinuity of the predetermined variables at the cutoff for couples (SUR estimation, bandwidth equal to 42)

	Couples				Singles	
Significance test of discontinuity at:[(a)]	male cutoff		female cutoff		cutoff	
	t-stat	p-value	t-stat	p-value	t-stat	p-value
Husband's education						
Primary/Intermediate secondary	1.17	0.242	1.09	0.277	0.09	0.931
Higher secondary/Tertiary	-0.16	0.874	0.61	0.543	-0.45	0.652
Vocational	-1.00	0.320	-1.46	0.144	0.26	0.797
Wife's education						
Primary/Intermediate secondary	-0.75	0.451	-0.31	0.754		
Higher secondary/Tertiary	0.51	0.610	1.09	0.276		
Vocational	0.46	0.643	-0.40	0.689		
Year of the survey						
2007	-0.69	0.493	-0.45	0.650	1.17	0.241
2008	-1.34	0.180	1.16	0.247	-0.21	0.837
2009	1.45	0.147	0.92	0.358	-1.29	0.196
2010	-1.23	0.217	-1.29	0.198	-0.55	0.585
2011	0.09	0.926	-0.58	0.561	2.50	0.012
2012	1.02	0.307	1.81	0.071	-0.12	0.907
2013	-0.50	0.614	0.02	0.983	-0.58	0.564
2015	0.81	0.417	-1.38	0.168	-0.77	0.441
2016	0.56	0.573	-0.58	0.560	0.82	0.411
2017	-0.21	0.834	0.43	0.666	-0.65	0.513
Degree of urbanization of place of residence						
Very or extremely urban	-0.67	0.505	0.31	0.757	0.06	0.950
Moderately urban	1.17	0.241	0.23	0.821	1.05	0.295
Slightly or not urban	-0.26	0.798	-0.78	0.436	-1.18	0.236
Presence of children in the household	1.00	0.317	0.07	0.945	1.50	0.133
Joint significance test of discontinuities[(a)]	$\chi^2(17) = 12.96$		$\chi^2(17) = 16.01$		$\chi^2(15) = 16.52$	
	p-value $= 0.739$		p-value $= 0.523$		p-value $= 0.349$	
Observations (individuals)	1,221 (438)				1,964 (646)	

[(a)] The test statistics are robust to heteroskedasticity and within-individual correlation.

discrete variable taking on 4 ordered values increasing in satisfaction.

b. *Voluntary work (Yes/no).* This variable is equal to 1 if the answer to the question "Considered all together, how much time do you spend on voluntary work per week, on average? (including hours that you possibly spend on informal care)" was a strictly positive number, and 0 otherwise.

c. *Satisfaction with social contacts.* The question from which this variable derives is "How satisfied are you with social contacts". The survey participants could answer choosing an integer from 0 to 10, where 10 meant "completely satisfied". Because of the very small number of observations indicating low values, we grouped into one category the replies lower than or equal to 6. The resulting outcome variable is a discrete variable taking on 5 ordered values increasing in satisfaction.

d. *De Jong Gierveld loneliness scale.* This is a 6-item scale built on 3 statements on emotional loneliness and 3 on social loneliness. Respondents were asked to indicate among the choices "yes", "no" or "more or less" to what degree the following statements applied to them, based on how they felt at the moment of the interview: i) "I have a sense of emptiness around me"; ii) "I miss having people around me"; iii) "I often feel deserted"; iv) "There are enough people I can count on in case of misfortune"; v) "I know a lot of people that i can fully rely on"; vi) "There are enough people to whom I feel closely connected". Statements i)-iii) are negatively worded and related to emotional loneliness. Statements iv)-vi) are positively worded and related to social loneliness (De Jong Gierveld and Van Tilburg, 2010). To questions i)-iii) it is a given a score equal to 1 if the answer was "yes" or "more or less". To questions iv)-vi) it is a given a score equal to 1 if the answer was "no" or "more or less". The De Jong Gierveld loneliness score is obtained by summing up these scores, giving a possible range of integers from 0 to 6, where 0 means least lonely and 6 means most lonely (De Jong Gierveld and Van Tilburg, 2006).

e. *Social loneliness scale.* It ranges from 0 to 3 and it is given by the sum of the 0/1 scores from statements iv)-vi) above.

f. *Emotional loneliness scale.* It ranges from 0 to 3 and it is given by the sum of the 0/1 scores from statements i)-iii) above.

D. Full Set of Estimation Results for Happiness

Table D.1: Full-set of estimation results for happiness of men living in a couple

Endogenous variables	Husband's retirement			Wife's retirement			Happiness		
Covariates	Coeff.		Std. Err.	Coeff.		Std. Err.	Coeff.		Std. Err.
Husband's retirement	–		–	–		–	0.556	**	0.252
Wife's retirement	–		–	–		–	0.600		0.959
Husband to the right of cutoff	0.913	***	0.156	0.135		0.148	–		–
Wife to the right of cutoff	0.000		0.161	0.692	***	0.181	–		–
Months to/since husband's state pension eligibility									
to the right of cutoff	0.004		0.006	-0.004		0.005	-0.001		0.003
to the left of cutoff	0.023	***	0.006	0.001		0.006	0.002		0.005
Months to/since wife's state pension eligibility									
to the right of cutoff	0.009		0.008	0.009		0.006	-0.011		0.009
to the left of cutoff	0.005		0.005	0.015	***	0.005	-0.010		0.008
Husband's education - Reference: Secondary or tertiary									
Primary or intermediate secondary	0.024		0.222	-0.103		0.237	-0.246		0.173
Vocational	-0.005		0.210	-0.068		0.225	-0.026		0.162
Wife's education - Reference: Secondary or tertiary									
Primary or intermediate secondary	-0.031		0.268	-0.237		0.277	0.223		0.180
Vocational	0.061		0.277	0.597	**	0.292	-0.052		0.274
Wave - Reference: 2017									
2007	0.470	*	0.256	0.226		0.214	-0.106		0.174
2008	0.437	**	0.224	0.068		0.204	0.026		0.149
2009	0.505	**	0.217	0.114		0.192	0.247		0.156
2010	0.273		0.199	-0.087		0.183	0.174		0.128
2011	0.067		0.197	0.030		0.183	0.214		0.135
2012	0.008		0.191	0.036		0.179	0.200		0.140
2013	-0.165		0.189	-0.111		0.170	0.170		0.125
2015	-0.280	*	0.159	-0.022		0.137	0.213	**	0.107
2016	-0.084		0.117	-0.112		0.125	0.130		0.106
Presence of dependent children in the household	0.059		0.293	-0.306		0.288	0.213		0.223
Urban density of place of residence - Reference: 1,500 or + inhabitants per km^2									
1,000 to 1,500 inhabitants per km^2	-0.231		0.202	-0.069		0.173	0.092		0.140
Less than 1,000 inhabitants per km^2	-0.232		0.146	-0.030		0.145	0.140		0.108
Ordered probit thresholds									
α_1	–		–	–		–	-0.793		0.648
α_2	–		–	–		–	-0.070		0.564
α_3	–		–	–		–	0.605		0.490
α_4	–		–	–		–	2.115	***	0.365
Constant	0.373		0.315	-0.415		0.329	–		–
Log-likelihood							-2,710.01		
Power of excluded instruments for husband's retirement							$\chi^2(2) = 34.22$		
Power of excluded instruments for wife's retirement							$\chi^2(2) = 14.76$		
ρ_{12} (Std. Err.)							-0.244 (0.186)		
ρ_{13} (Std. Err.)							-0.374 (0.579)		
ρ_{23} (Std. Err.)							0.521 (0.073)		
Bandwidth satisfied by both husband and wife (months)							42		
Number of observations (individuals)							1,221 (438)		

Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are robust to within-individual correlation.

Table D.2: Full-set of estimation results for happiness of women living in a couple

Endogenous variables	Husband's retirement			Wife's retirement			Happiness		
Covariates	Coeff.		Std. Err.	Coeff.		Std. Err.	Coeff.		Std. Err.
Husband's retirement	–		–	–		–	1.036	***	0.317
Wife's retirement	–		–	–		–	-0.117		1.064
Husband to the right of cutoff	0.922	***	0.149	0.164		0.156	–		–
Wife to the right of cutoff	0.038		0.168	0.708	***	0.144	–		–
Months to/since husband's state pension eligibility									
to the right of cutoff	0.004		0.006	-0.004		0.005	-0.002		0.003
to the left of cutoff	0.023	***	0.006	0.001		0.006	-0.016	***	0.006
Months to/since wife's state pension eligibility									
to the right of cutoff	0.008		0.008	0.009		0.006	0.000		0.011
to the left of cutoff	0.005		0.005	0.015	***	0.005	0.000		0.009
Husband's education - Reference: Secondary or tertiary									
Primary or intermediate secondary	0.028		0.219	-0.111		0.236	-0.044		0.165
Vocational	0.006		0.210	-0.072		0.222	0.010		0.153
Wife's education - Reference: Secondary or tertiary									
Primary or intermediate secondary	-0.047		0.271	-0.214		0.269	0.322	*	0.177
Vocational	0.042		0.278	0.630	**	0.269	0.187		0.257
Wave - Reference: 2017									
2007	0.482	*	0.255	0.221		0.213	-0.189		0.181
2008	0.397	*	0.218	0.091		0.199	-0.238		0.147
2009	0.485	**	0.210	0.136		0.186	-0.136		0.156
2010	0.271		0.198	-0.077		0.182	-0.107		0.135
2011	0.063		0.195	0.040		0.201	0.162		0.133
2012	0.011		0.192	0.064		0.179	0.182		0.131
2013	-0.161		0.187	-0.089		0.163	0.145		0.128
2015	-0.279	*	0.162	-0.029		0.141	0.101		0.117
2016	-0.107		0.118	-0.135		0.114	-0.019		0.116
Presence of dependent children in the household	0.085		0.290	-0.312		0.292	0.234		0.182
Urban density of place of residence - Reference: 1,500 or + inhabitants per km^2									
1,000 to 1,500 inhabitants per km^2	-0.229		0.200	-0.085		0.180	0.255	*	0.134
Less than 1,000 inhabitants per km^2	-0.202		0.146	-0.032		0.148	0.222	*	0.110
Ordered probit thresholds									
α_1	–		–	–		–	-0.511		0.539
α_2	–		–	–		–	0.242		0.533
α_3	–		–	–		–	0.942	*	0.530
α_4	–		–	–		–	2.560	***	0.534
Constant	0.355		0.320	-0.454		0.312	–		–
Log-likelihood							-2,691.37		
Power of excluded instruments for husband's retirement							$\chi^2(2) = 38.45$		
Power of excluded instruments for wife's retirement							$\chi^2(2) = 26.29$		
ρ_{12} (Std. Err.)							-0.374 (0.203)		
ρ_{13} (Std. Err.)							0.004 (0.635)		
ρ_{23} (Std. Err.)							0.524 (0.070)		
Bandwidth satisfied by both husband and wife (months)							42		
Number of observations (individuals)							1,221 (438)		

Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are robust to within-individual correlation.

Table D.3: Full-set of estimation results for happiness of single men

Endogenous variables	Retirement			Happiness		
Covariates	Coeff.		Std. Err.	Coeff.		Std. Err.
Retirement	–		–	0.503		0.498
To the right of cutoff	0.761	***	0.213	–		–
Months to/since state pension eligibility						
to the right of cutoff	-0.001		0.007	-0.001		0.004
to the left of cutoff	0.031	***	0.006	0.000		0.008
Education - Reference: Secondary or tertiary						
Primary or intermediate secondary	-0.513	**	0.225	-0.104		0.198
Vocational	-0.587	***	0.222	0.177		0.193
Wave - Reference: 2017						
2007	1.156	***	0.338	-0.092		0.286
2008	1.021	***	0.271	0.250		0.251
2009	0.751	***	0.216	-0.121		0.186
2010	0.399	*	0.210	-0.021		0.169
2011	0.416	**	0.204	0.125		0.167
2012	0.259		0.187	0.024		0.124
2013	0.396	**	0.189	0.000		0.157
2015	0.109		0.142	0.086		0.115
2016	0.126		0.110	-0.103		0.108
Presence of dependent children in the household	-0.382		0.338	-0.634	***	0.233
Urban density of place of residence - Reference: 1,500 or + inhabitants per km^2						
1,000 to 1,500 inhabitants per km^2	0.204		0.203	-0.140		0.162
Less than 1,000 inhabitants per km^2	-0.061		0.202	0.275	*	0.162
Ordered probit thresholds						
α_1	–		–	-0.883	*	0.452
α_2	–		–	-0.088		0.426
α_3	–		–	0.567		0.406
α_4	–		–	1.993	***	0.375
Constant	0.460	*	0.255	–		–
Log-likelihood				-1,529.92		
Power of excluded instrument for retirement				$\chi^2(1) = 12.83$		
ρ_{12} (Std. Err.)				-0.270 (0.276)		
Bandwidth (months)				42		
Number of observations (individuals)				802 (254)		

Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are robust to within-individual correlation.

Table D.4: Full-set of estimation results for happiness of single women

Endogenous variables	Retirement			Happiness		
Covariates	Coeff.		Std. Err.	Coeff.		Std. Err.
Retirement	–		–	-0.512	***	0.187
To the right of cutoff	1.218	***	0.160	–		–
Months to/since state pension eligibility						
to the right of cutoff	0.010	**	0.005	0.001		0.003
to the left of cutoff	0.030	***	0.005	0.011	***	0.004
Education - Reference: Secondary or tertiary						
Primary or intermediate secondary	-0.463	**	0.227	-0.025		0.143
Vocational	0.297		0.210	0.072		0.141
Wave - Reference: 2017						
2007	0.264		0.243	-0.032		0.148
2008	0.148		0.217	0.172		0.151
2009	0.405	**	0.201	0.044		0.145
2010	0.142		0.195	0.114		0.138
2011	-0.133		0.197	0.085		0.131
2012	-0.241		0.179	0.171		0.131
2013	-0.298	*	0.174	-0.098		0.120
2015	-0.485	***	0.146	-0.040		0.102
2016	-0.226	*	0.125	0.039		0.088
Presence of dependent children in the household	-0.665	*	0.344	0.068		0.172
Urban density of place of residence - Reference: 1,500 or + inhabitants per km^2						
1,000 to 1,500 inhabitants per km^2	0.010		0.167	0.098		0.139
Less than 1,000 inhabitants per km^2	-0.354	**	0.180	0.006		0.118
Ordered probit thresholds						
α_1	–		–	-1.666	***	0.183
α_2	–		–	-0.814	***	0.180
α_3	–		–	-0.155		0.183
α_4	–		–	1.094	***	0.199
Constant	-0.097		0.229	–		–
Log-likelihood				-2,178.40		
Power of excluded instrument for retirement				$\chi^2(1) = 57.66$		
ρ_{12} (Std. Err.)				0.325 (0.094)		
Bandwidth (months)				42		
Number of observations (individuals)				802 (254)		

Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are robust to within-individual correlation.

E. Further Estimation Results on Retirement Effects on Mental Health Reported in Table 5

Table E.1: Retirement effects on feeling calm and peaceful in the last month

	Men			Women		
	Coeff.		Std. Err.	Coeff.		Std. Err.
a) Couples						
Estimated coefficients of ordered probit model						
Husband's retirement	0.470		0.331	0.809	*	0.429
Wife's retirement	0.475		0.381	-0.228		0.526
Average marginal effects of husband's retirement on the probability of feeling calm and peaceful in the last month						
Never or seldom	-0.063		0.049	-0.117		0.079
Sometimes	-0.041		0.027	-0.110	**	0.046
Often	-0.055		0.035	-0.075	***	0.027
Mostly	0.061		0.040	0.177	***	0.067
Continuously	0.098		0.071	0.125		0.083
Average marginal effects of wife's retirement on the probability of feeling calm and peaceful in the last month						
Never or seldom	-0.063		0.057	0.033		0.080
Sometimes	-0.041		0.031	0.031		0.070
Often	-0.055		0.038	0.021		0.046
Mostly	0.061		0.042	-0.050		0.110
Continuously	0.098		0.083	-0.035		0.085
Log-likelihood	-2,642.15			-2,768.93		
Power of excluded instruments for husband's retirement	$\chi^2(2) = 33.61$			$\chi^2(2) = 31.40$		
Power of excluded instruments for wife's retirement	$\chi^2(2) = 28.79$			$\chi^2(2) = 27.44$		
Bandwidth satisfied by both husband and wife (months)	42			42		
Number of observations (individuals)	1,221 (438)			1,220 (438)		
b) Singles						
Estimated coefficients of ordered probit model						
Retirement	-0.094		0.504	-0.141		0.204
Average marginal effects of retirement on the probability of feeling calm and peaceful in the last month						
Never or seldom	0.013		0.070	0.022		0.033
Sometimes	0.013		0.069	0.022		0.032
Often	0.001		0.049	0.010		0.015
Mostly	-0.022		0.118	-0.035		0.049
Continuously	-0.013		0.071	-0.020		0.030
Log-likelihood	-1,435.26			-2,108.30		
Power of excluded instrument for retirement	$\chi^2(1) = 17.18$			$\chi^2(1) = 52.80$		
Bandwidth (months)	42			42		
Number of observations	802 (254)			1,162 (392)		

Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are robust to within-individual correlation.

Table E.2: Retirement effects on feeling depressed and gloomy in the last month

	Men			Women	
	Coeff.		Std. Err.	Coeff.	Std. Err.
a) Couples					
Estimated coefficients of ordered probit model					
Husband's retirement	-1.068	***	0.294	-0.346	0.276
Wife's retirement	-0.182		0.303	0.396	0.693
Average marginal effects of husband's retirement on the probability of feeling depressed and gloomy in the last month					
Never	0.381	***	0.092	0.131	0.103
Seldom	-0.115	***	0.022	-0.022	0.018
Sometimes	-0.145	***	0.030	-0.062	0.049
Often/Mostly/Continuously	-0.121	**	0.050	-0.047	0.040
Average marginal effects of wife's retirement on the probability of feeling depressed and gloomy in the last month					
Never	0.065		0.108	-0.150	0.257
Seldom	-0.020		0.032	0.025	0.039
Sometimes	-0.025		0.041	0.071	0.116
Often/Mostly/Continuously	-0.021		0.035	0.053	0.103
Log-likelihood	-2,448.20			-2,633.14	
Power of excluded instruments for husband's retirement	$\chi^2(2) = 27.80$			$\chi^2(2) = 36.94$	
Power of excluded instruments for wife's retirement	$\chi^2(2) = 27.69$			$\chi^2(2) = 20.48$	
Bandwidth satisfied by both husband and wife (months)	42			42	
Number of observations (individuals)	1,221 (438)			1,220 (438)	
b) Singles					
Estimated coefficients of ordered probit model					
Retirement	-0.043		0.798	0.188	0.277
Average marginal effects of retirement on the probability of feeling depressed and gloomy in the last month					
Never	0.016		0.297	-0.068	0.101
Seldom	-0.003		0.046	0.004	0.007
Sometimes	-0.007		0.123	0.035	0.051
Often/Mostly/Continuously	-0.007		0.128	0.029	0.043
Log-likelihood	-1,382.12			-1,961.82	
Power of excluded instrument for retirement	$\chi^2(1) = 16.73$			$\chi^2(1) = 46.30$	
Bandwidth (months)	42			42	
Number of observations	802 (254)			1,162 (392)	

Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are robust to within-individual correlation.

Table E.3: Retirement effects on feeling anxious in the last month

	Men		Women	
	Coeff.	Std. Err.	Coeff.	Std. Err.
a) Couples				
Estimated coefficients of ordered probit model				
Husband's retirement	-0.669	0.420	-0.141	0.340
Wife's retirement	-0.374	0.489	-0.349	0.703
Average marginal effects of husband's retirement on the probability of feeling anxious in the last month				
Never	0.247	0.145	0.048	0.116
Seldom	-0.070	0.034	-0.000	0.002
Sometimes or more often	-0.177	0.115	-0.048	0.116
Average marginal effects of wife's retirement on the probability of feeling anxious in the last month				
Never	0.138	0.175	0.120	0.238
Seldom	-0.039	0.045	-0.001	0.006
Sometimes or more often	-0.099	0.131	-0.119	0.237
Log-likelihood	-2,398.98		-2,467.96	
Power of excluded instruments for husband's retirement	$\chi^2(2) = 23.29$		$\chi^2(2) = 34.78$	
Power of excluded instruments for wife's retirement	$\chi^2(2) = 28.13$		$\chi^2(2) = 23.41$	
Bandwidth satisfied by both husband and wife (months)	42		42	
Number of observations (individuals)	1,221 (438)		1,220 (438)	
b) Singles				
Estimated coefficients of ordered probit model				
Retirement	-0.289	0.705	-0.358	0.243
Average marginal effects of retirement on the probability of feeling anxious in the last month				
Never	0.105	0.254	0.123	0.082
Seldom	-0.019	0.044	0.002	0.006
Sometimes or more often	-0.086	0.210	-0.125	0.084
Log-likelihood	-1,238.54		-1,747.77	
Power of excluded instrument for retirement	$\chi^2(1) = 17.17$		$\chi^2(1) = 54.23$	
Bandwidth (months)	42		42	
Number of observations	802 (254)		1,162 (392)	

Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are robust to within-individual correlation.

Table E.4: Retirement effects on feeling down in the last month

	Men			Women		
	Coeff.		Std. Err.	Coeff.		Std. Err.
a) Couples						
Estimated coefficients of ordered probit model						
Husband's retirement	-0.965	**	0.441	-0.913	**	0.365
Wife's retirement	0.584	*	0.311	0.043		0.395
Average marginal effects of husband's retirement on the probability of feeling down in the last month						
Never	0.325	**	0.137	0.334	***	0.119
Seldom	-0.116	***	0.037	-0.130	***	0.035
Sometimes or more often	-0.208	**	0.104	-0.204	**	0.087
Average marginal effects of wife's retirement on the probability of feeling down in the last month						
Never	-0.197	*	0.105	-0.016		0.145
Seldom	0.070	**	0.036	0.006		0.056
Sometimes or more often	0.126	*	0.072	0.010		0.089
Log-likelihood	-2,140.40			-2,288.79		
Power of excluded instruments for husband's retirement	$\chi^2(2) = 30.27$			$\chi^2(2) = 36.91$		
Power of excluded instruments for wife's retirement	$\chi^2(2) = 23.15$			$\chi^2(2) = 26.61$		
Bandwidth satisfied by both husband and wife (months)	42			42		
Number of observations (individuals)	1,221 (438)			1,220 (438)		
b) Singles						
Estimated coefficients of ordered probit model						
Retirement	0.006		1.005	0.019		0.298
Average marginal effects of retirement on the probability of feeling anxious in the last month						
Never	-0.002		0.371	-0.007		0.116
Seldom	0.001		0.111	0.002		0.034
Sometimes or more often	0.002		0.261	0.005		0.082
Log-likelihood	-1,238.54			-1,657.55		
Power of excluded instrument for retirement	$\chi^2(1) = 17.84$			$\chi^2(1) = 52.40$		
Bandwidth (months)	42			42		
Number of observations	802 (254)			1,162 (392)		

Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are robust to within-individual correlation.

Table E.5: Retirement effects on good mental health in the last month

	Men			Women		
	Coeff.		Std. Err.	Coeff.		Std. Err.
a) Couples						
Estimated coefficients of probit model						
Husband's retirement	1.309	***	0.328	0.908	**	0.355
Wife's retirement	0.462		0.310	-0.350		0.375
Average marginal effects of husband's retirement on the probability of						
Good mental health	0.235	***	0.071	0.188	**	0.078
Average marginal effects of wife's retirement on the probability of						
Good mental health	0.083		0.058	-0.072		0.080
Log-likelihood	-1,471.09			-1,596.66		
Power of excluded instruments for husband's retirement	$\chi^2(2) = 33.07$			$\chi^2(2) = 38.41$		
Power of excluded instruments for wife's retirement	$\chi^2(2) = 26.51$			$\chi^2(2) = 26.84$		
Bandwidth satisfied by both husband and wife (months)	42			42		
Number of observations (individuals)	1,221 (438)			1,220 (438)		
b) Singles						
Estimated coefficients of probit model						
Retirement	-1.416	***	0.091	-0.157		0.314
Average marginal effects of retirement on the probability of						
Good mental health	-0.401	***	0.023	-0.041		0.081
Log-likelihood	-728.41			-1,037.84		
Power of excluded instrument for retirement	$\chi^2(1) = 8.64$			$\chi^2(1) = 52.53$		
Bandwidth (months)	42			42		
Number of observations	802 (254)			1,162 (392)		

Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are robust to within-individual correlation.

Table E.6: Retirement effects on self-perceived health

	Men			Women		
	Coeff.		Std. Err.	Coeff.		Std. Err.
a) Couples						
Estimated coefficients of ordered probit model						
Husband's retirement	0.755	***	0.222	0.545	*	0.280
Wife's retirement	-0.311		0.323	-0.180		0.415
Average marginal effects of husband's retirement on the probability that health is						
Poor or moderate	-0.207	***	0.061	-0.163	*	0.084
Good	0.009		0.017	0.026		0.017
Very good or excellent	0.198	***	0.061	0.138	*	0.074
Average marginal effects of wife's retirement on the probability that health is						
Poor or moderate	0.085		0.090	0.053		0.125
Good	-0.004		0.009	-0.009		0.021
Very good or excellent	-0.081		0.085	-0.045		0.105
Log-likelihood	-2,245.02			-2,279.72		
Power of excluded instruments for husband's retirement	$\chi^2(2) = 39.66$			$\chi^2(2) = 38.64$		
Power of excluded instruments for wife's retirement	$\chi^2(2) = 27.59$			$\chi^2(2) = 26.65$		
Bandwidth satisfied by both husband and wife (months)	42			42		
Number of observations (individuals)	1,221 (438)			1,221 (438)		
b) Singles						
Estimated coefficients of ordered probit model						
Retirement	-1.120	***	0.300	-0.416		0.295
Average marginal effects of retirement on the probability that health is						
Poor or moderate	0.341	***	0.093	0.131		0.093
Good	-0.037		0.026	-0.028		0.020
Very good or excellent	-0.304	***	0.086	-0.103		0.076
Log-likelihood	-1,144.01			-1,594.15		
Power of excluded instrument for retirement	$\chi^2(1) = 17.79$			$\chi^2(1) = 42.97$		
Bandwidth (months)	42			42		
Number of observations	802 (254)			1,162 (392)		

Notes: * Significant at 10%; ** significant at 5%; *** significant at 1%. Standard errors are robust to within-individual correlation. The full set of estimation results are reported in Appendix D.