UNIVERSITÀ DEGLI STUDI DI PADOVA

Dipartimento di Scienze Economiche ed Aziendali "Marco Fanno"

HEALTHIER LIFESTYLES AFTER RETIREMENT IN EUROPE? EVIDENCE FROM SHARE

MARTINA CELIDONI
University of Padova

VINCENZO REBBA
University of Padova

September 2015

"MARCO FANNO" WORKING PAPER N.201

Healthier lifestyles after retirement in Europe?
Evidence from SHARE

Martina Celidoni[*] and Vincenzo Rebba[**]

This version: 21/09/2015

Abstract

This paper investigates changes in health behaviours upon retirement, using data drawn from the Survey of Health Aging and Retirement in Europe (SHARE). By exploiting changes in eligibility rules for early and normal retirement, we identify the causal effect of retiring from work on smoking, alcohol drinking, engagement in physical activity and visits to the general practitioner or specialist. We provide evidence about heterogeneous effects related to gender, education, net wealth, early-life conditions and job characteristics. Results show that changes in health behaviours occur upon retirement and may be a key mechanism through which the latter affects health. We find heterogenous effects related especially to gender, education and job characteristics.

Keywords: retirement, health behaviour, fixed effects, instrumental variables
JEL codes: I12, J14, J26

[*] *Corresponding author. University of Padua, Department of Economics and Management "Marco Fanno", Via del Santo 33, 35123 Padua, Italy. E-mail: martina.celidoni@unipd.it; tel: (+39) 049 8274255*
[**] *University of Padua, Department of Economics and Management "Marco Fanno", Via del Santo 33, 35123 Padua, Italy. E-mail: vincenzo.rebba@unipd.it.*

Acknowledgments. We thank Daniel Avdic, Marco Bertoni, Eric Bonsang, Giorgio Brunello, Emilia Del Bono, Mariacristina De Nardi, Peter Eibich, Fabrizio Mazzonna, Luca Salmasi, Elisabetta Trevisan, Guglielmo Weber, the participants at the 11th iHEA World Congress in Health Economics, Milan, Italy, 12-15 July 2015, the Essen Health Conference, Essen, Germany, 29-31 May 2015 and the XIX AIES Conference, Venice, Italy, 27-28 October 2014. Funding from the University of Padua and Farmafactoring Foundation is gratefully acknowledged.
This paper uses data from SHARE wave 4 release 1.1.1, as of March 28th 2013 (DOI: 10.6103/SHARE.w4.111) or SHARE wave 1 and 2 release 2.6.0, as of November 29 2013 (DOI: 10.6103/SHARE.w1.260 and 10.6103/SHARE.w2.260) or SHARELIFE release 1, as of November 24th 2010 (DOI: 10.6103/SHARE.w3.100). The SHARE data collection has been primarily funded by the European Commission through the 5th Framework Programme (project QLK6-CT-2001-00360 in the thematic programme Quality of Life), through the 6th Framework Programme (projects SHARE-I3, RII-CT-2006-062193, COMPARE, CIT5- CT-2005-028857, and SHARELIFE, CIT4-CT-2006-028812) and through the 7th Framework Programme (SHARE-PREP, N° 211909, SHARE-LEAP, N° 227822 and SHARE M4, N° 261982). Additional funding from the U.S. National Institute on Aging (U01 AG09740-13S2, P01 AG005842, P01 AG08291, P30 AG12815, R21 AG025169, Y1-AG-4553-01, IAG BSR06-11 and OGHA 04-064) and the German Ministry of Education and Research as well as from various national sources is gratefully acknowledged (see www.share-project.org for a full list of funding institutions).

1. Introduction

Most developed countries have recently passed legislation to increase retirement ages, in order to ensure the financial sustainability of social security systems. However, whether delaying retirement would actually reduce government expenditure on welfare programmes is still a matter of debate, given the potentially negative impact of such a policy on the health of the population.

It may be that workers' health, especially for those who have been in strenuous occupations, deteriorates both physically and mentally, generating increases in health care costs that are larger than savings in expenditure on pensions. If instead work is a better guarantee of preserving individuals' health than retirement, increasing retirement ages may have additional benefits besides reducing the cost of pensions. The literature has tried to distinguish empirically between the two scenarios but findings vary widely.

Some authors found, on the basis of physical or mental health indicators, that retirement helps to preserve good health (e.g. Charles 2004, Bound and Waidmann, 2007; Neuman, 2008; Coe and Zamarro, 2011; Insler, 2014), while others estimated a negative or nil effect of retirement on health (e.g. Kerkhofs and Lindeboom, 1997; Dave *et al*., 2008, Lindeboom *et al.*, 2002; Johnston and Lee, 2009; Behncke, 2012; Celidoni *et al*., 2013). Mixed findings can be explained by different outcomes or empirical strategies used, as well as by the existence of several competing channels through which retirement affects health.

The contribution of this paper is twofold. First, we analyse retirement and health behaviours in Europe within a multi-country framework, exploiting the variability of public pension eligibility rules that reflect gender, time of retirement and country of residence. By focusing on behavioural adjustments upon retirement, rather than health outcomes, we can shed more light on the mechanisms that could explain previous mixed findings on the impact of retirement on health. Then we investigate heterogeneous effects on retirees' health behaviours that are related to gender, education, early-life conditions and job characteristics.

There is evidence about the importance of health behaviours such as not smoking, moderate alcohol consumption and physical activity, as well as weight control, to reduce mortality and improve functional capacity, among middle-aged and elderly adults (Adams *et al*., 1990; Davis *et al*., 1994). Promoting healthy lifestyles has therefore been one of the policy strategies that international organisations and national governments have pursued to influence individual behaviours. Examples of such policies are information campaigns about risk factors, health education and *ad hoc* incentives through taxation, regulations (e.g. labelling rules or smoking bans) or nudging (Muraro and Rebba, 2010) These interventions are mainly targeted at younger generations, who are considered to be less aware of health risks (Fulponi, 2009). However, although elderly people may be better informed, they are less prone to change their lifestyle; they have had more time to develop habits and may be particularly set in their ways (see Heien and Durham, 1991, with regard to food expenditure, for instance), suggesting that such policies will have less effect on them than on younger individuals.

According to Cutler and Glaeser (2005), nevertheless, large behavioural changes may occur after retirement, which is almost always a remarkable life event, as a consequence of shocks to time discounting, incomes or beliefs about the future.

For this reason, we focus on the role of retirement in shaping lifestyles in later life. We will analyse smoking, alcohol consumption and low engagement in physical activity, which are three modifiable risk factors contributing to more than a quarter of the disease burden in developed countries, according to the World Health Organization (Cappelen and Norheim, 2005).[1] We consider also two measures of health care used as proxies for prevention: the number of visits to the general practitioner and whether the individual has had consultations with a specialist during the last 12 months.[2]

Given this background, we attempt to answer the following questions. Do individuals change their lifestyle upon retirement? Who are those more likely to invest in their health by pursuing healthy behaviours after retirement? The latter information can be useful for targeting purposes when designing policies relating to people in later life.

The paper is organised as follows. Section 2 reviews the literature, section 3 presents data and some descriptive statistics, section 4 describes the empirical strategy, section 5 comments on our results and section 6 concludes.

2. Literature Review

In the last decades, the economic literature has investigated the relationship between health and retirement, but, as noted above, the findings are not unambiguous, for various reasons.

According to Insler (2014) and Eibich (2015), on one hand, retirement could have a negative impact on health because of a decrease in work-related physical exercise, loss of ambition or less engagement in social or intellectual activities, accelerating the decline in health due to ageing. On the other hand, retirement provides individuals with less job-related stress and more leisure time. For example, Bound and Waidmann (2007), drawing on the standard Grossman's model of demand for health (Grossman, 1972), highlight that, since non-work time increases after retirement, we would expect that individuals spend more time investing in their health, especially in activities that are time-intensive (e.g. time spent in health-promoting behaviours). As the authors point out, because of different job characteristics, these effects vary from one individual to another: some may experience positive effects, others negative or no effects of retirement on health. Since health behaviours may play a key role in explaining health upon retirement, some studies (Perreira and Sloan, 2001; Lang *et al*., 2007; *et al*., 2008) investigated behavioural changes in later life while considering retirement as exogenous.

To our knowledge, there are three studies that specifically consider retirement and health behaviours accounting for an endogeneity bias. Looking at US data, drawn from the Health and Retirement Study (HRS), Insler (2014) used an instrumental variables strategy based on individuals' predicted probability of working past ages 62 and 65 reported in the period in which they entered the sample, and found that retirement positively affects health through a reduction in smoking and an increase in exercise. Eibich (2015), within a regression discontinuity framework, found that, in Germany, retirement affects smoking, sleep duration, engagement in activities and alcohol consumption. Zhao *et al*. (2012) used data from the Health and Retirement Survey, a longitudinal study conducted by the National Institute of Population and Social Security (IPSS) in Japan to show that, on retirement, individuals significantly reduce their level of smoking and are more likely to exercise.

---

[1] These risk factors, together with unhealthy diets, have a strong impact on the onset of cardiovascular and respiratory diseases, cancers and diabetes, which account for 82% of chronic diseases (WHO, 2014a).

[2] Higher access to medical care may provide a measure of an increased attitude for (or more time devoted to) prevention, since we control for individual heterogeneity in wealth and health status (presence of chronic diseases and of functional limitations in activities of daily living).

The novelty of this paper is to analyse retirement and health behaviours in Europe within a multi-country framework, exploiting the variability of public pension eligibility that reflects gender, time of retirement and country of residence. We contribute to the literature also by investigating further whether there are heterogeneous effects according to gender, education, early-life conditions, household net wealth and job characteristics.

3. Data

We use data drawn from SHARE, a multi-disciplinary survey which collects information on individuals aged 50 or over, plus their partner, regardless of age. The first wave of SHARE took place in 2004 and involved 11 European countries. Other countries have been added in the following waves but in this paper we select only those that participated in all SHARE regular waves from 2004 to 2012 – the first, second and fourth wave – to exploit the longitudinal dimension of the survey: Austria, Belgium, Denmark, France, Germany, Italy, the Netherlands, Spain, Sweden and Switzerland.[3] The third wave, called SHARELIFE, collects retrospective information, e.g. early-life conditions, that we will use to investigate heterogeneous effects related to retirement. We select individuals who self-report being retired from work or employed/self-employed and whose age is between 45 and 85,[4] with no missing information about employment status, gender, education, age, marital status, number of grandchildren and health behaviours defined according to three dimensions: smoking, physical inactivity and alcohol consumption.

Smoking is a dummy variable that acquires value 1 if the individual currently smokes, and zero otherwise. Engagement in activities is captured by two dummies: *no activities*, which takes value 1 if the person reports never or almost never practising any activity requiring either a moderate or substantial level of energy; *no vigorous activities*, which equals 1 if the respondent reports never or almost never taking part in sports or vigorous activities. This distinction can be suggestive of physical exercise intensity. Regarding alcohol consumption, since the questions have been changed over time, we are able to exploit only information about drinking frequency for all waves; we therefore define a variable *drink every day*, which takes value 1 if the person reports drinking alcohol almost every day.[5]

We consider also two measures of health care use, which, given certain hypotheses, may be interpreted as proxies for prevention: the number of visits to the general practitioner and a 0-1 dummy for having consulted a specialist in the last 12 months.

Table 1 presents the summary statistics of health behaviour variables, socio-economic and demographic covariates.

- Table 1 here -

[3] Among the 11 countries in the first wave of SHARE, Greece is the only country that has not continuously participated.

[4] Individuals whose age is lower than 50 are typically spouses of the sampled person, who, according to the survey eligibility rules, is 50 or older. By focusing on individuals whose age is between 45 and 85, we do not include very young spouses and older people, who are typically very selected.

[5] The possible responses to this question are: '*Almost every day*', '*Five or six days a week*', '*Three or four days a week*', '*Once or twice a week*', '*Once or twice a month*', '*Less than once a month*', '*Not at all in the last three months*'.

In Figures 1 to 6, we illustrate the relationship between health behaviours and age, distinguishing between higher and lower education levels,[6] pooling data from wave 1 to wave 4.

- Figure 1 here -

- Figure 2 here -

- Figure 3 here -

- Figure 4 here -

- Figure 5 here -

- Figure 6 here -

Figure 1 shows the proportion of smokers by age for individuals with higher and lower education respectively: among the latter, we can see a general negative association between smoking and age (possibly due to selection, as argued in Aro *et al*., 2005), but no marked changes can be noticed around typical retirement ages.

Figures 2 and 3 show the proportion of inactive individuals, i.e. those who do not practise any activity (Figure 2) or any vigorous activity (Figure 3), by age. The two graphs highlight a positive association with age, as might be expected, but it is notable that, among highly educated individuals, there is a decrease in the proportion of inactive people at age 57 when looking at activities requiring a moderate level of energy and age 65 in terms of vigorous activities. Among poorly educated individuals, the proportion of inactive people increases at 55 when considering vigorous activities. Figure 4 shows the proportion of individuals, by age, who drink alcohol almost every day, revealing a slight increase after age 60 for both highly educated and less well educated people. Figures 5 and 6 show the average number of visits to the general practitioner and the proportion of individuals who have had at least one consultation with specialists in the last year, by age and education level: significant increases in the average number of visits to the general practitioner are seen after age 65, for both highly educated and less well educated individuals, and the figure for those who have had consultations with a specialist increases significantly around the age of 70 for less well educated individuals.[7]

The figures provide a first descriptive evidence of possible changes in health behaviours around retirement age. In the next section, we will explain the empirical strategy used to identify the causal effect of retirement on health behaviours.

[6] ISCED 5-6 (International Standard Classification of Education) identifies individuals with tertiary education.

[7] Less well educated people generally show a lower probability of contacting a specialist at all ages; this is probably due to their reduced access to this type of health care, owing to a lack of information or of economic resources.

4. Empirical Strategy

4.1 The effect of retirement on health behaviours

This study aims to discover whether individuals change their health behaviours upon retirement. To this end, we propose the following specification:

$$y_{it} = \alpha_1 retired_{it} + X_{it}\,\beta + u_{it} \quad (1)$$

$$u_{it} = \mu_i + \varepsilon_{it} \quad (2)$$

where y_{it} is the outcome of interest (i.e. the health behaviour variable), X_{it} is a vector of individual characteristics (e.g. age or marital status); the error term u_{it} can be decomposed into unobserved time-invariant heterogeneity (μ_i) and an idiosyncratic error term (ε_{it}). We are interested in α_1, the coefficient associated with *retired*. Standard ordinary least squares (OLS) estimates of α_1 yield unbiased results if the orthogonality condition is satisfied. However, this is unlikely to hold. As pointed out in the literature (e.g. Charles, 2004; Bound and Waidmann, 2007; Neumann, 2008; Coe and Zamarro 2011), when assessing the role of retirement on health, endogeneity issues have to be taken into account. The same applies to health behaviours, since retirement is a choice that individuals make for several unobservable reasons that could also affect lifestyles. To control for observed and unobserved time-invariant individual heterogeneity, we estimate individual fixed-effects (FE) panel data models.[8]

By exploiting the variation within individuals, we control for characteristics (such as gender, country, birth cohort and educational attainment) that may be important sources of bias,[9] as well as for unobserved time-invariant factors that could confound our estimates. However, controlling for the time-invariant individual heterogeneity is not enough to permit causal interpretations, since we need to account also for time-varying individual unobserved factors and reverse causality: health behaviours affect health, which may induce retirement. We account for this source of bias by adopting an instrumental variable (IV) approach. We exploit the information about changes in eligibility rules for early retirement and old-age pension across several European countries and over time as instruments for retirement (see Appendix A for a detailed description). For completeness, we run both pooled two-stage least squares (2SLS) and fixed-effect two-stage least squares (FE-2SLS). In the latter case, since we exploit the within-individual variability to be able to identify the effect of retirement, we need a sufficient number of respondents who switch from employment to retirement. In our sample we have 1999 transitions into retirement.[10] Exploiting changes in pension eligibility rules as instruments for retirement is a widespread methodological choice in the literature: see, for instance, Angelini *et al*. (2009), Mazzonna and Peracchi (2012) and Coe and Zamarro (2011).[11]

---

[8] We also performed a Hausman test in order to ascertain the inconsistency of random effects (RE) estimates. The results obtained support the inconsistency of RE.

[9] See, for instance, Bingley and Martinello (2013), who argue the relevance of education not only as a determinant of health in later life but also as an appropriate control when using retirement ages as an instrument for the retirement decision: differences in retirement ages across countries are positively associated with multi-country differences in average educational levels.

[10] Of these, 5.10% of transitions occurred in Austria, 9.20% in Germany, 17.36% in Sweden, 10.66% in the Netherlands, 4.85% in Spain, 8.75% in Italy, 13.76% in France, 11.71% in Denmark, 6.15% in Switzerland and 12.46% in Belgium.

[11] Similarly to Mazzonna and Peracchi (2012), in Appendix B, we show in Figures B1 and B2 the histograms of retirement age by country for males and females, highlighting in blue/red the range of early/normal retirement eligibility ages. Figures B1 and B2 show

The relevance of our instruments is directly tested by looking at F-statistics for the excluded instruments (Staiger and Stock, 1997) and Stock and Yogo's (2005) critical values for weak identification (see section 5 below).[12] The validity assumption, which requires that the instruments affect health behaviours only through retirement (and can be therefore excluded from the structural equation) is supported by the fact that changes in eligibility rules arguably represent a source of exogenous variability in social security regulations that are unlikely to have a direct effect on our outcomes.

Thus, based on retirement eligibility criteria among countries, over time and between genders, we define as instruments two zero-one dummies indicating whether the individual is eligible or not either for early (*eligibleER*) or normal (statutory) retirement (*eligibleSR*), respectively.

For binary outcomes, we specify a linear probability model where we control for marital status (having a partner), age, age squared, household net wealth quartile[13] and the number of grandchildren (to account for grandparenting effects). The same set of covariates is used when looking at the continuous variable *number of visits to the general practitioner*.

Mazzonna and Peracchi (2012) and Zamarro *et al.* (2008), looking at the effect of retirement on health using SHARE data, noticed that panel attrition may be a problem, because people in poor health are more likely to exit the panel, and this may lead to invalid inference. Attrition in our case is problematic as long as the probability of dropping out of the panel depends on retirement status and is more likely for individuals in bad health due to unhealthy behaviours.

In Appendix C (Tables C1 and C2) we therefore report a robustness analysis to take into account possible attrition bias.[14]

4.2 Heterogeneous effects

We investigate in greater detail heterogeneity in retirement effects related to gender, education, early-life conditions, household net wealth and job features. To this end, we estimate our models separately for *males* and *females*, poorly (*isced0_4)* and highly (*isced5_6)* educated individuals. The sample is split also according to an indicator of early-life conditions, *few books*, representing the presence of fewer than 25 books at the parental home at age ten.[15] We consider heterogeneity related to wealth by providing estimates for individuals having household net wealth below or above a country-specific yearly median value.

Finally, to understand whether job characteristics play a crucial role in explaining how individuals change their behaviours upon retirement, we exploit work quality and job information collected in

---

that there is significant variability across countries and gender in eligibility criteria and that we are able to predict important peaks in the retirement age. This evidence supports our identification strategy.

[12] Even if critical values do not refer to cases when standard errors are clustered, according to Baum et al. (2007), they can nevertheless be used to reveal weak identification issues.

[13] Net wealth quartiles are based on imputed data. See *www.share-project.org* for detailed documentation about the imputation procedure.

[14] If attrition depends on time-invariant characteristics, an assumption that is reasonable in short panels (Wooldridge, 2010), with our FE strategy we are able to eliminate also that source of bias: in fact, survey response variables in Table C1 are always not significant in our FE specifications, with the exception of smoking behaviour. In general, Verbeek and Nijman (1992) show that panel attrition is less severe with fixed-effects estimates. Refreshment samples (used also in SHARE) help in further reducing the potential selection bias without having to identify the attrition function (Hirano *et al*., 2001). Mazzonna and Peracchi (2014), looking at the effect of retirement on health in the first two waves of SHARE, used interviewers' characteristics (age, gender and education level) as predictors of non-response to compute inverse-probability weights, but that information is available only in wave 1 and, for a large part of the sample (about one third of it), interviewers' characteristics are missing.

[15] This information, collected in SHARELIFE, can be considered a proxy for parental education and economic status during childhood. It has been used also by Brunello *et al*. (2015), who highlight the importance of early-life interventions to capture lower returns to college for individuals who grew up in disadvantaged households.

SHARELIFE and regular waves (first, second and fourth). Retirement may indeed be beneficial for those working in physically demanding and stressful occupations, based on the evidence that working in manual jobs negatively affects health (see for instance Case and Deaton, 2005) and may induce people to adopt unhealthy behaviours such as smoking. In SHARE, a battery of work quality questions is asked, differing between SHARELIFE and regular waves. In order to make use of comparable information available in all waves, we take account of two specific questions related to strenuousness and time pressure. Work quality indicators are related to the main job for retired individuals, and to the last job for those still in work.[16] Respondents are asked whether the job was/is physically demanding and whether it exerted/exerts heavy time pressure.[17] Based on the answers, we consider separately those individuals who agree (or strongly agree) with the statement and those who disagree (or strongly disagree). To support the evidence based on self-reported job characteristics, which may suffer from differences in reporting style (see for instance Bonsang and Van Soest, 2012, and Angelini *et al*., 2014) or justification bias, we classify individuals as either blue/white collar or low/high skilled workers,[18] using job descriptions provided by the respondent. The related question in the SHARE questionnaire is able to capture mainly the first digit of the International Standard Classification of Occupations (ISCO-88 code).[19]

5. Results

In Tables 2 and 3, we report pooled OLS, fixed effects, pooled 2SLS and fixed-effect 2SLS estimates for each health behaviour considered as an outcome. The estimated standard errors are robust to clustering at the country and cohort level.

Table 2 column 1 represents only a partial (not significant) association between retirement and smoking. column 2 shows that, when we account for time-invariant heterogeneity, transiting into retirement is associated with a higher probability of quitting smoking. Columns 3 and 4 report 2SLS estimates: when we account for the endogeneity of retirement, we find no statistically significant effects on the probability of smoking.[20] In Table 2 we report also first-stage estimates showing the relevance and strength of our instruments: the coefficients of being eligible for early and normal retirement are always highly significant (at the 1% level) and the F-statistics[21] on the excluded instruments are well above 10 (Staiger and Stock, 1997) and the critical values for weak identification testing (Stock and Yogo, 2005). As in previous studies (Gruber and Wise, 1998; Angelini *et al*., 2009; Mazzonna and Peracchi; Coe and Zamarro, 2011), our results therefore confirm that eligibility rules are important determinants of retirement decisions.

[16] This has to be taken into account when interpreting our results, since we are combining at the same time long exposure to particular job characteristics and the more recent effects of the last job. Short-term exposure is for those who changed job characteristics at the end of their work career.

[17] According to Siegrist and Wahrendorf (2011), the two questions are related to the dimensions of physical and psychosocial work quality.

[18] Based on the job description provided, we use the following classification: high skilled white collar (legislator, senior official, manager, professional, technician or associate professional); low skilled white collar (clerk, service worker, shop and market sales worker, armed forces); high skilled blue collar (skilled agricultural or fishery worker, craft and related trade workers, plant and machine operator or assembler); low skilled blue collar (elementary occupation).

[19] Even if not influenced by reporting heterogeneity, these second job categorisations have been criticised for being too coarse and unable to capture the multi-dimensional burden of a job (Mazzonna and Peracchi, 2014). Detailed ISCO coding could be used to construct a physical or a psycho-social job burden index, as proposed by Kroll (2011), but unfortunately this information is available only in wave 1 for the last/current job.

[20] In Appendix D (Table D1, columns 1 and 2), we provide reduced form estimates, showing that only eligibility for normal (statutory) retirement is significant at the 10% level, if we do not exploit the within-individual variability in the data.

[21] The reported F-statistic is the Kleibergen-Paap rk Wald F-statistic, which deals with clustered standard errors and corresponds to the standard F-statistic on the excluded instruments when there is a single endogenous variable.

With regard to engagement in activities (Table 2 columns 5-8), we find a significant effect in the pooled OLS regression (column 5), where retirement is associated with a reduction in the probability of being inactive, while no significant effects are estimated in the fixed-effect model (column 6). Columns 7 and 8 of Table 2 show that, accounting for endogeneity, retirement causes a highly significant reduction in the probability of being inactive. We stress that the identification strategy, especially with regard to FE-2SLS estimates, relies on those individuals who switch between waves from employed or self-employed to retired; therefore, we are able to estimate a short- (or medium-) rather than long-term effect of retirement on health behaviours.

It can be seen that 2SLS point estimates are larger than OLS. One possible explanation is that we capture the effect of retirement for those individuals who are driven into retirement by the pension eligibility rules we use as instruments, leading to a Local Average Treatment Effect interpretation (Imbens and Angrist, 1994).[22] Additionally, fixed-effects estimates are also susceptible to attenuation bias if the retirement variable is affected by a measurement error (Griliches and Hausman, 1986). In fact, some respondents may self-report being retired simply because they left their main or career job, even though they are still working full- or part-time (Coe and Zamarro, 2011),[23] or they may misreport the retirement year (Korbmacher, 2014).

First-stage estimates and the F-statistic show again that the instruments are relevant and not weakly correlated with the endogenous variable. In columns 9 to 12 of Table 2, we focus on the effect of retirement on sports and vigorous activities. 2SLS estimates show that retirement causes a reduction in the probability of being inactive, in line with what we have seen when looking at activities requiring a moderate level of energy.[24]

Table 3 columns 1-4 report estimates for the probability of consuming alcohol every day. OLS and FE estimates are confirmed by FE-2SLS results: the transition into retirement causes changes in drinking behaviour, in line with the literature. Eibich (2015), for instance, finds that in Germany retirement causes a statistically significant increase in the probability of regular drinking and a reduction in the probability of no alcohol consumption. The effect is, however, significant only at the 10% level, and reduced form estimates (Table D1, columns 7 and 8, in Appendix D) do not show significant effects of eligibility for early and normal retirement.

In columns 5 to 8 of Table 3, we focus on the number of visits to a general practitioner in the last 12 months. Retirement is associated with a higher number of visits in the OLS specification, but no significant causal effects are estimated by 2SLS. The last four columns of Table 3 show that retirement is associated with a higher probability of having contact with a specialist in the last 12 months (column 9) but the causal effect is not confirmed when exploiting the within-individual variability in the data (column 12).

As anticipated in section 4.1, in Appendix C, Tables C1 and C2, we investigate whether non-random attrition affects the estimates in Tables 2 and 3. Table C1 shows that there is a statistical association between survey response variables and our outcome measures. One possible strategy to see whether this might be problematic for our results is to compare estimates between the balanced

[22] As suggested by Angrist and Pischke (2009, p. 167), with multiple instruments, one can run overidentification tests as formal tests of treatment effect homogeneity. For all outcomes considered in Tables 2 and 3, the Sargan-Hansen test of overidentifying restriction does not reject the null of the J test; results are available upon request.

[23] Related to this point, in Table 4 we will provide additional estimates using an alternative definition of retirement, taking into account the point made here about self-reported retirement (Coe and Zamarro, 2011).

[24] It may be argued that intensity of physical activity is not well captured by our two indicators: especially for those in physically demanding occupations, it may be that, although transiting into retirement leads to a higher probability of exercising, this does not translate into an increased burning of calories (Zantinge *et al*., 2014). But, as we will see later, this behavioural change is attributable to white collar workers who usually have more sedentary jobs.

and the unbalanced panel sample (see Jones *et al*., 2013, and Cheng and Trivedi, 2015). In the absence of non-response bias, these estimates should be comparable, as can be seen in Table C2.

- Table 2 here -

- Table 3 here -

In Table 4 we report additional robustness analysis for our 2SLS estimates. We first include health controls in our baseline specification: number of chronic diseases and limitations in the basic and instrumental activities of daily living (ADLs and IADLs); these were originally excluded, since they could be determined at the same time, generating potential endogeneity in the model. Comparing the first row of Table 4 with the corresponding columns in Tables 2 and 3, it can be seen that the results do not change.

In the second row of Table 4, we allow the non-linear age effect to be country-specific, as a possible strategy to capture any national health policy or condition that has not been considered so far. Also in this case, Tables 2 and 3 results are confirmed; in addition, the transition into retirement has a statistically significant positive effect – at the 10% level – on quitting smoking and the probability of having contact with a specialist.

We also exclude older individuals, aged over 75: the third row of Table 4 shows that results relating to activities are robust to this restricted sample.

Finally, we use an alternative definition of retirement, considering as retired those individuals that not only self-report being retired but also did not do any paid work in the four weeks before the interview. The last row of Table 4 shows that results do not change and point estimates are larger compared to Tables 2 and 3, as might be expected.[25]

- Table 4 here -

In Table 5 we investigate heterogeneity in retirement effects by estimating the FE-2SLS model of Tables 2 and 3 in subgroups defined according to gender, education, early-life condition, household net wealth and job characteristics.

According to our estimates, heterogeneous retirement effects in smoking behaviour may be observed, specifically a statistically significant (at 5% level) negative effect for individuals with physically demanding jobs or classified as blue collar. For less well educated individuals, a negative significant (at 10% level) effect of transiting into retirement is estimated, as well as for those having high parental socio-economic status (having more than 25 books at the parental home when aged ten). Significant effects among lesser-educated individuals are estimated, likely because smoking prevalence, especially in later life, is higher in this subgroup of the population (77% of smokers in our sample are less well educated). In addition, the fact that smoking reduces significantly due to

[25] The estimates shown are based on pooled data from the selected ten European countries. We also run 2SLS estimates separately by country (available upon request) to see whether there are country-specific significant differences from our baseline results. Even if estimates are not always statistically significant, no substantially significant deviations are observed from the analysis on the pooled data. The only exceptions are the following: in some countries (Italy and Denmark), transiting into retirement significantly increases the probability that the individual will quit smoking; in the Netherlands, transiting into retirement causes a significant increase in the probability of not practising any sport or vigorous activity; in Sweden, transiting into retirement significantly increases the number of visits to the general practitioner.

retirement among those having high parental socio-economic status suggests that this behavioral change is more related to education than to income. Indeed, if we define subgroups according to both own and parental education, we find that only less well educated individuals with high parental socio-economic background show significant (at 5% level) effects of retirement on smoking cessation (coefficient estimate: -0.0739; standard error: 0.0353). The transition into retirement causes a significant (at 5% level) reduction in the probability of being inactive among individuals with a partner, with high parental socio-economic status during childhood, whose job entailed time pressure, or who has been classified as white collar or highly skilled.[26]

Table 5 shows also that retirement has a negative and significant effect on the probability of never or almost never practising vigorous activities among females, individuals who have a partner, those who are highly educated or with high parental socio-economic status during childhood, or those whose job was not physically demanding or was classified as white collar/highly skilled. This confirms some descriptive evidence (Chung *et al*., 2009; Zantinge *et al*., 2014) about the role of job characteristics in determining heterogeneity of the retirement effect.[27] A significant increase in drinking behaviour (at the 5% level) due to retirement is estimated only for individuals without a partner; transiting into retirement has a significant positive effect (at the 10% level) on the probability of drinking every day for males, individuals with low parental socio-economic status during childhood or whose job entailed time pressure. While smoking and inactivity are undoubtedly unhealthy behaviours, changes in alcohol drinking habits, captured by our binary indicator, cannot be clearly evaluated, since we do not have an indicator of drinking intensity for all waves. However, our result can be suggestive of a potential vulnerable sector of the population. Although previous studies suggest that regular alcohol consumption does not necessarily have a negative effect on health (Ziebarth and Grabka, 2009; Eibich, 2015), the alcohol-related burden of disease among older age groups, owing to a lower ability to handle the same levels and patterns of alcohol consumption they had had in their younger days, is an increasing public health concern (WHO, 2014b).

Regarding visits to the general practitioner and the probability of having a consultation with a specialist in the last 12 months, no significant effects are estimated.

- Table 5 here -

6. Conclusions

In this paper, we have focused on behavioural adjustments upon retirement, to shed more light on the mechanisms that could explain previous mixed findings about the impact of retirement on health.

Accounting for the endogenous choice of retirement, we are able to estimate the causal effect of retirement on smoking, drinking behaviour, engagement in activities and contacts with doctors (general practitioner and specialists).

---

[26] In addition, comparing the effect of retirement on the probability of being inactive between highly educated and less well educated individuals, we can see that the point estimate for the former is larger.

[27] For individuals with physically demanding jobs in particular, transiting into retirement reduces the probability of practising sports and vigorous activities, but there is a significant increase — at the 10 % level — in moderate physical activity; it is, however, unclear whether this change in behaviour corresponds to an increase in calorie expenditure for this subgroup of the population. This is in line with the effect of early retirement on body mass index estimated in Godard (2014).

Our baseline estimates show that the probability of being inactive or not doing any vigorous physical activity decreases with retirement: individuals provided with more leisure time change their behaviour in terms of engagement in activities; this corresponds to the so-called *honeymoon phase* (Atchley, 1976, 1982). Our findings therefore underline the importance of time constraints as a major barrier to engaging in regular physical activity, especially for highly educated individuals. Our estimates, moreover, show limited effects of retirement on utilising access to health care; Gorry *et al*. (2015) provide similar evidence for the United States.

We contributed to the literature by looking at heterogeneous effects of retirement related to gender, education, early-life conditions, net wealth and job characteristics. In particular, our finding is that educated people are more likely to change lifestyles after retirement in terms of engaging in activities. This is in line with the so-called ‘education gradient’ (Cutler and Lleras-Muney, 2010), in which health behaviours can be seen as mediating factors through which education influences health (Brunello *et al*., 2011). Job characteristics play a role in relation to physical exercise: retirement from physically demanding occupations reduces the probability of engagement in sports or vigorous activities. Also, heterogeneity related to gender is observed, especially for sports and drinking behaviour. Females are more likely to engage in sports after retirement, whereas males are more likely to drink every day when they retire, as has already found in the literature (Eibich, 2015).

Our results provide important information for the design of policies aiming to promote healthy lifestyles in later life, by identifying those who are potential targeted individuals and which factors affect behaviours. According to our study, poorly educated individuals are less likely to engage in activities after retirement. This provides support for active ageing policies, particularly in the field of participation for that group of the population (e.g. adapted physical activity programmes responsive to older adults’ educational levels and cultural preferences; see King *et al*., 1998; King and King, 2010; Yancey *et al*., 2006).

Our results suggest also that the retirement and pre-retirement period may well offer a suitable opportunity to provide support for adopting a healthy lifestyle later in life. In this respect, our findings are in line with certain general policy proposals put forward by the World Health Organization (WHO, 2002) about active aging: ‘Provide education and learning opportunities throughout the life course; and recognize and enable the active participation of people in economic development activities, formal and informal work and voluntary activities as they age, according to their individual needs, preferences and capacities.’ Regarding physical activity, the WHO (2002) suggests the importance of supporting culturally appropriate community programmes that stimulate activity and are organised and led by older people themselves. However, evidence that strenuous physical work may hasten disabilities, preventing physical exercise, additionally requires health promotion efforts already at work aimed at providing relief from repetitive, strenuous tasks and making adjustments to avoid unsafe physical movement.

REFERENCES

Adams W L, Garry P J, Rhyne R, Hunt W C, Goodwin J S. 1990. Alcohol intake in the healthy elderly: changes with age in a cross-sectional and longitudinal study. *Journal of American Geriatric Society* **38**:211–216.

Angelini V, Brugiavini A, Weber G. 2009. Ageing and unused capacity in Europe: is there an early retirement trap?. *Economic Policy*, 24: 463–508.

Angelini V, Cavapozzi D, Corazzini L, Paccagnella O. 2014. Do Danes and Italians rate life satisfaction in the same way? Using vignettes to correct for individual-specific scale biases. *Oxford Bulletin of Economics and Statistics* **76**: 643–666.

Angrist J D, Pischke J. 2009. *Mostly Harmless Econometrics: An Empiricist's Companion*. Princeton University Press: Princeton.

Aro A R, Avendano M, Mackenbach J. 2005. Health behaviour. In A Börsch-Supan, A Brugiavini, H Jürges, J Mackenbach, J Siegrist and G Weber (Eds.) Mannheim Research Institute for the Economics of Aging (MEA): Mannheim.

Atchley R C. 1976. *The Sociology of Retirement*. Halsted Press: New York.

Atchley R C. 1982. Retirement as a social institution. *Annual Review of Sociology* **8**: 263–287.

Behncke S. 2012. Does retirement trigger ill health?", *Health Economics* **21**: 282–300.

Bingley P, Martinello A. 2013. Mental retirement and schooling. *European Economic Review* **63**: 292–298.

Bonsang E, Van Soest A. 2012. Satisfaction with job and income among older individuals across European countries. *Social Indicators Research* **105**: 227–254.

Bound J, Waidmann T. 2007. Estimating the health effect of retirement. *University of Michigan Retirement Research Center Working Paper 2007–168*.

Brunello G, Fort M, Schneeweis N, Winter-Ebmer R. 2011. The causal effect of education on health: what is the role of health behaviors? *IZA Discussion Papers 5944, Institute for the Study of Labor (IZA).*

Brunello G, Weber G, Weiss C T. 2015. Books are forever: early life conditions, education and lifetime earnings in Europe. *The Economic Journal*, *forthcoming*.

Cappelen A W, Norheim O F. 2005. Responsibility in health care: a liberal egalitarian approach. *Journal of Medical Ethics* **31**: 476–480.

Case A, Deaton A. 2005. Broken down by work and sex: how our health declines. In D A Wise (Ed.) *Analyses in the Economics of Aging*. University of Chicago Press: Chicago.

Celidoni M, Dal Bianco C, Weber G. 2013. Early retirement and cognitive decline: a longitudinal analysis on SHARE data. Marco Fanno Working Paper no. 174 – 2013, University of Padua.

Charles K K. 2004. Is retirement depressing? Labor force inactivity and psychological well-being in later life. *Research in Labor Economics* **23**: 269–299.

Cheng T C, Trivedi P K. 2015. Attrition bias in panel data: a sheep in wolf's clothing? A case study based on the Mabel Survey. *Health Economics*, *forthcoming*.

Chung S, Domino M E, Popkin B M, Stearns S. 2009. Retirement and physical activity: analyses by occupation and wealth. *American Journal of Preventive Medicine* **36**: 422–428.

Coe N B, Zamarro G. 2011. Retirement effects on health in Europe. *Journal of Health Economics* **30**(1): 77–86.

Cutler D M, Glaeser E. 2005. What explains differences in smoking, drinking, and other health-related behaviors? *American Economic Review* **95**: 238–242.

Cutler D M, Lleras-Muney A. 2010. Understanding differences in health behaviour by education. *Journal of Health Economics* **29**: 1–28.

Dave D, Rashad I, Spasojevic J. 2008. The effects of retirement on physical and mental health outcomes. *Southern Economic Journal* **75**: 497–523.

Davis M A, Neuhaus J M, Moritz D J, Lein D, Barclay J D, Murphy S P. 1994. Health behaviours and survival among middle-aged and older men and women in the NHANES Follow-up Study. *Preventive Medicine* **23**: 369–376.

Eibich P. 2015. Understanding the effect of retirement on health: mechanisms and heterogeneity. *Journal of Health Economics, forthcoming.*

Fulponi L. 2009. Policy initiatives concerning diet, health and nutrition. OECD Food, Agriculture and Fisheries Working Papers, 14, OECD Publishing.

Godard M. 2014. Gaining weight through retirement? Results from the SHARE survey. Laboratoire d'Economie de Dauphine WP no. 7/2014.

Gorry A, Gorry D, Slavov S. 2015. Does retirement improve health and life satisfaction?. NBER Working Paper no. 21326.

Griliches Z, Hausman J. 1986. Errors in variables in panel data. *Journal of Econometrics* **31**: 93–118.

Grossman M. 1972. The demand for health: a theoretical and empirical investigation. NBER Books, National Bureau of Economic Research, Inc: New York.

Gruber J, Wise D A. 1998. Social security and retirement: an international comparison. Papers and Proceedings of the Hundred and Tenth Annual Meeting of the American Economic Association, **88**: 158–163.

Heien D, Durham C. 1991. A test of the habit formation hypothesis using household data. *Review of Economics and Statistics* **73**(2): 189–199.

Henkens K, Van Solinge H, Gallo W. 2008. Effects of retirement voluntariness on changes in smoking, drinking and physical activity among Dutch older workers. *European Journal of Public Health* **18**(6): 644-649.

Insler M. 2014. The health consequences of retirement. *The Journal of Human Resources* **49**: 195–233.

Johnston D W, Lee W S. 2009. Retiring to the good life? The short-term effects of retirement on health. *Economics Letters* **103**: 8–11.

Jones A M, Rice N, Bago d'Uva T, Balia S. 2013. *Applied Health Economics*. Second Edition. Routledge: London.

Kerkhofs M, Lindeboom M. 1997. Age related health dynamics and changes in labour market status. *Health Economics* **6**: 407–423.

King A C, Rejeski J, Buchner D M. 1998. Physical activity interventions targeting older adults: a critical review and recommendations. *American Journal of Preventive Medicine* **15**(4): 316–333.

King A C, King D K. 2010. Physical activity for an aging population. *Public Health Reviews* **32**(2): 401–426.

Korbmacher J. 2014. Recall error in the year of retirement. SHARE Working Paper Series 21–2014.

Kroll L. 2011. Construction and validation of a general index of job demands in occupations based on ISCO-88 and KldB-92. *Methoden – Daten – Analysen* **5**: 63–90.

Lang I, Rice N, Wallace R, Guralnik J, Melzer D. 2007. Smoking cessation and transition into retirement: analyses from the English Longitudinal Study of Ageing. *Age and Aging* **36**: 638–643.

Lindeboom M, Portrait F, van den Berge G J. 2002. An econometric analysis of the mental-health effects of major events in the life of older individuals. *Health Economics* **11**(6): 505–520.

Mazzonna F, Peracchi F. 2012. Ageing, cognitive abilities and retirement. *European Economic Review* **56**: 691–710.

Mazzonna F, Peracchi F. 2014. Unhealthy retirement? Evidence of occupation heterogeneity. EIEF Working Paper 09/14.

Muraro G, Rebba V. 2010. Individual rights and duties in health policy. *Rivista Internazionale di Scienze Sociali* **3**: 379–396.

Neuman K. 2008. Quit your job and live long? The effect of retirement on health. *Journal of Labor Research* **29**(2): 177–201.

Perreira K, Sloan F. 2001. Life events and alcohol consumption among mature adults: a longitudinal study. *Journal of Studies on Alcohol* **62**: 501–508.

Siegrist J, Wahrendorf M. 2011. Quality of work, health and early retirement: European comparisons. In A Börsch-Supan, M Brandt, K Hank, M Schröder (Eds.) *The Individual and the Welfare State – Life Histories in Europe*. Springer: Heidelberg.

Staiger D, Stock J. 1997. Instrumental variables regression with weak instruments. *Econometrica* **65**: 557-586.

Stock J, Yogo M. 2005. Testing for weak instrument in linear IV regression. In D W K Andrews. *Identification and Inference for Econometric Models* (pp. 80–108). Cambridge University Press: New York.

Verbeek M, Nijman T. 1992. Testing for selectivity bias in panel data models. *International Economic Review* **33**: 681–703.

WHO. 2002. *Active Ageing: A Policy Framework*. World Health Organization: Geneva.

WHO. 2014a. *Global Status Report on Non Communicable Diseases 2014*. World Health Organization: Geneva.

WHO. 2014b. *Global Status Report on Alcohol and Health 2014*. World Health Organization: Geneva.

Wooldridge J M. 2010. *Econometric Analysis of Cross Section and Panel Data*. Second Edition. The MIT Press: Cambridge, MA.

Yancey A K, Ory M G, Davis S M. 2006. Dissemination of physical activity promotion interventions in underserved populations. *American Journal of Preventive Medicine* **31**(4S): S82–S91.

Zamarro G, Meijer E, Fernandes M. 2008. Mental health and cognitive ability. In A Börsch-Supan, A Brugiavini, H Jürges, A Kapteyn *et al*. (Eds.) *First Results from the Survey of Health, Ageing and Retirement in Europe (2004–2007). Starting the Longitudinal Dimension*. Mannheim Research Institute for the Economics of Aging (MEA): Mannheim.

Zantinge E, van den Berg M, Smit H A, Picavet H S. 2014. Retirement and a healthy lifestyle: opportunity or pitfall? A narrative review of the literature. *European Journal of Public Health* **24**(3): 433–439.

Zhao M, Konishi Y, Noguchi H. 2013. *Retiring for Better Health? Evidence from Health Investment Behaviors in Japan*. Mimeo.

Ziebarth N R, Grabka M M. 2009. In vino pecunia? The association between beverage-specific drinking behavior and wages. *Journal of Labor Research* **30**: 219–244.

FIGURES

Figure 1. Proportion of smokers, by age and education level.

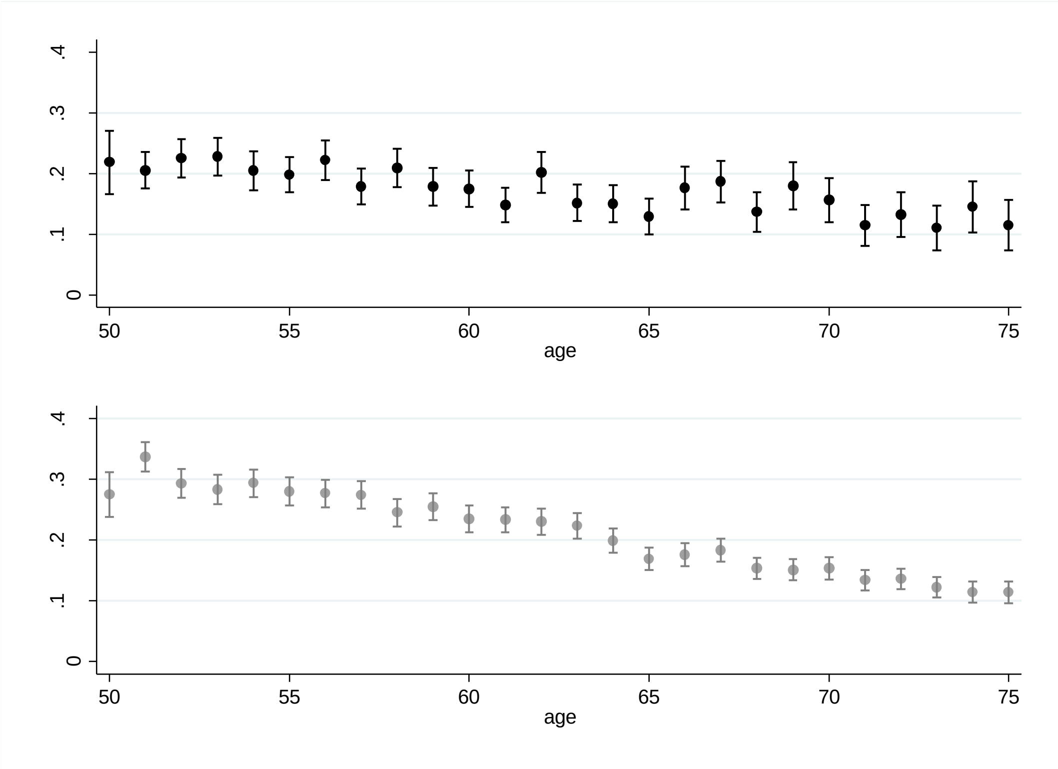


Figure 2. Proportion of individuals not practising any activity, by age and education level.

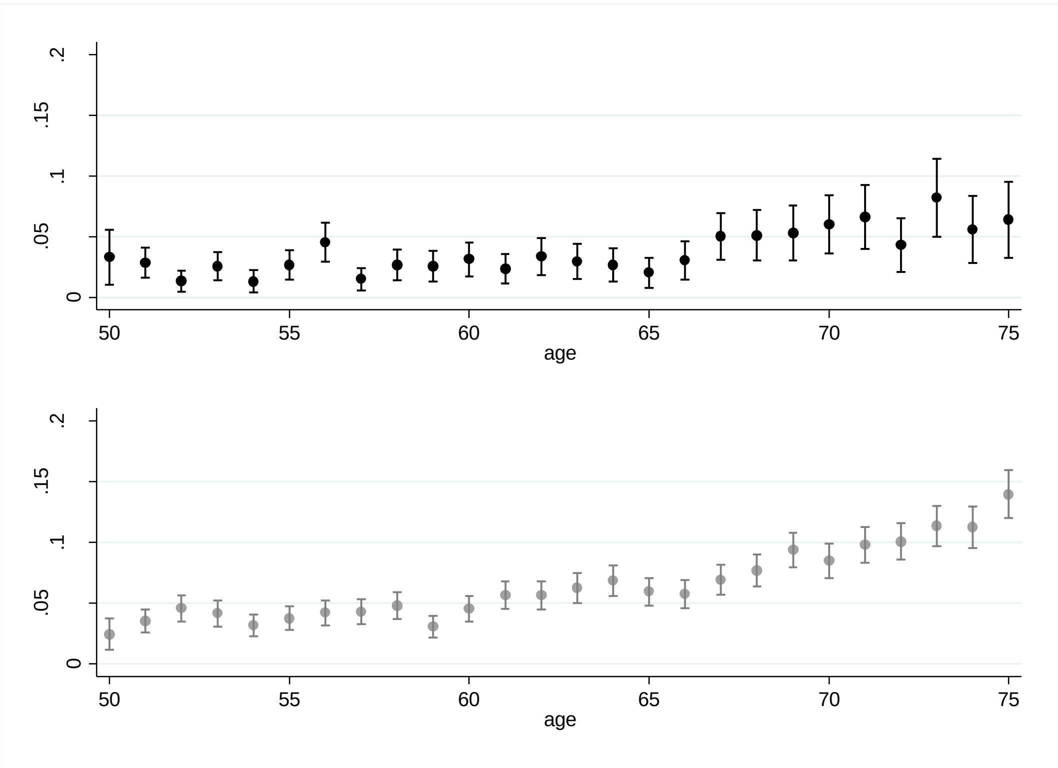


Figure 3. Proportion of individuals not practising any vigorous activity, by age and education level.

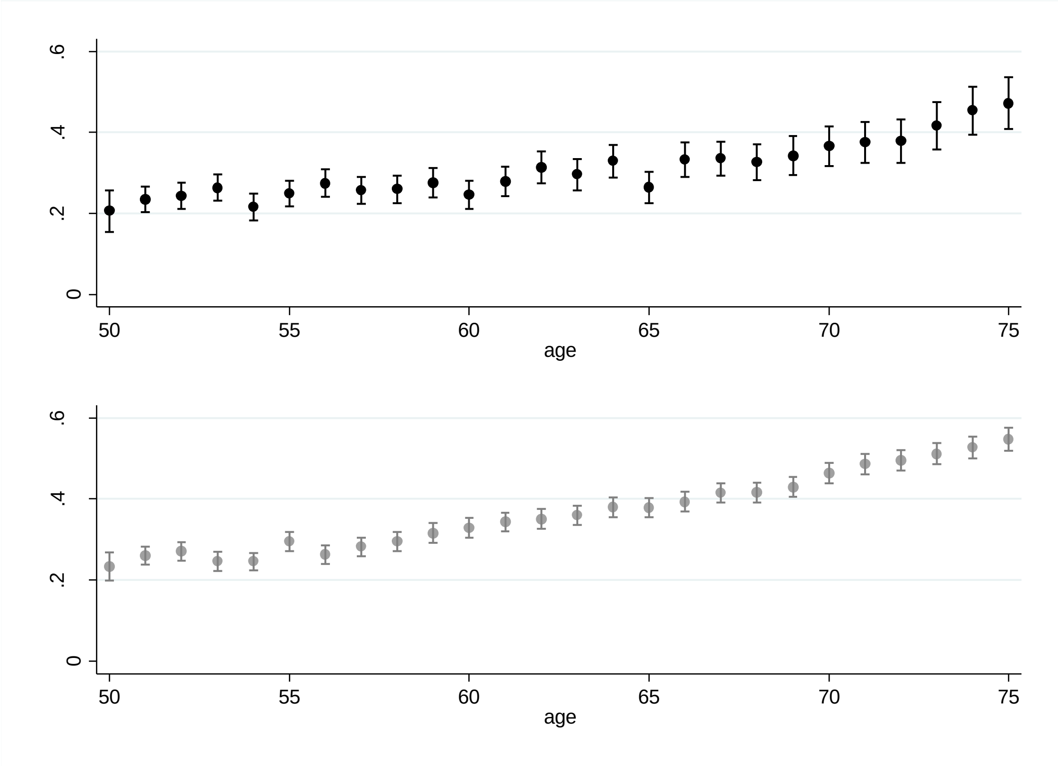


Figure 4. Proportion of individuals drinking every day, by age and education level.

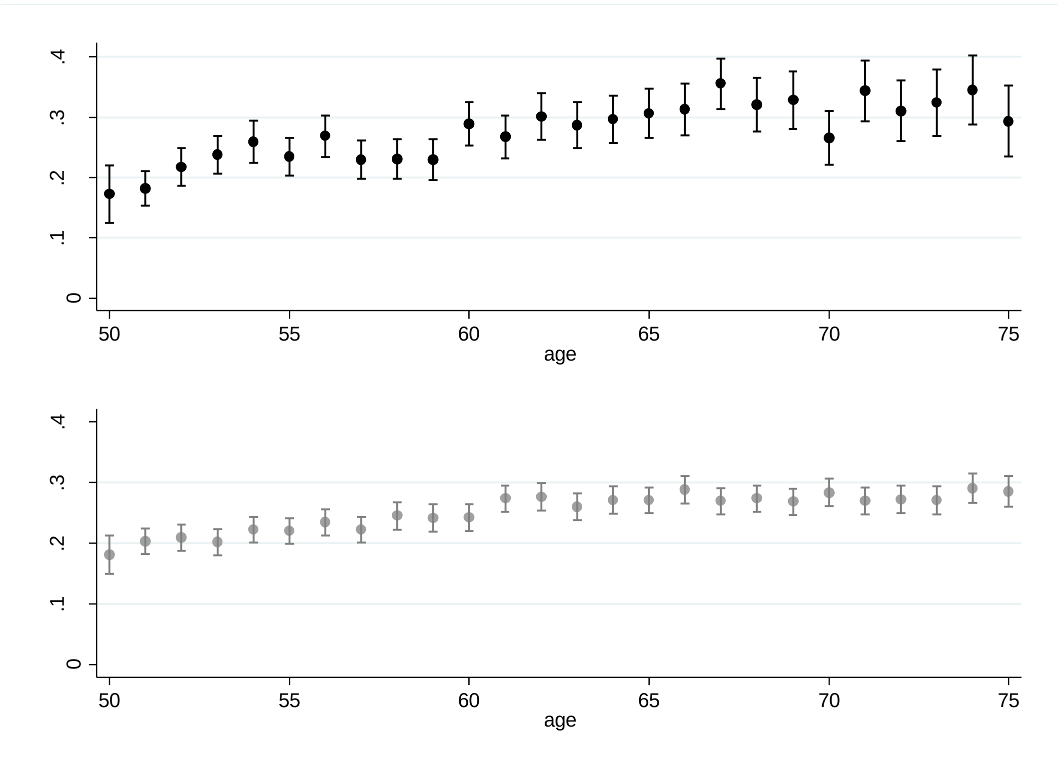


Figure 5. Number of visits to the general practitioner, by age and education level.

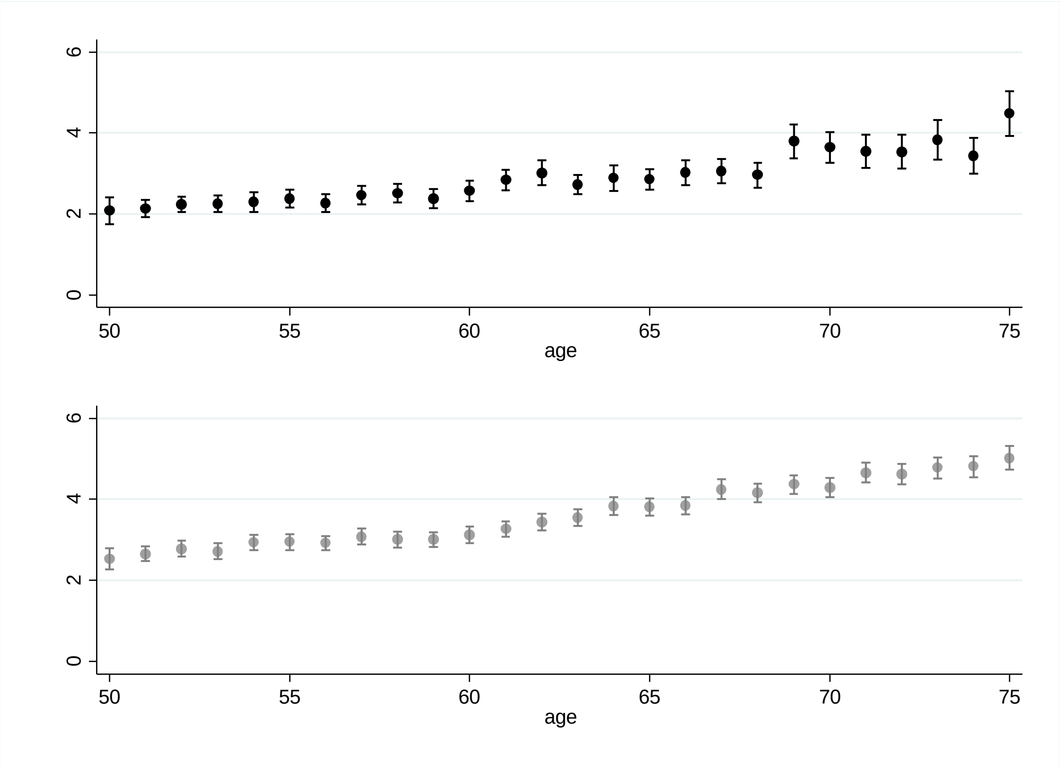
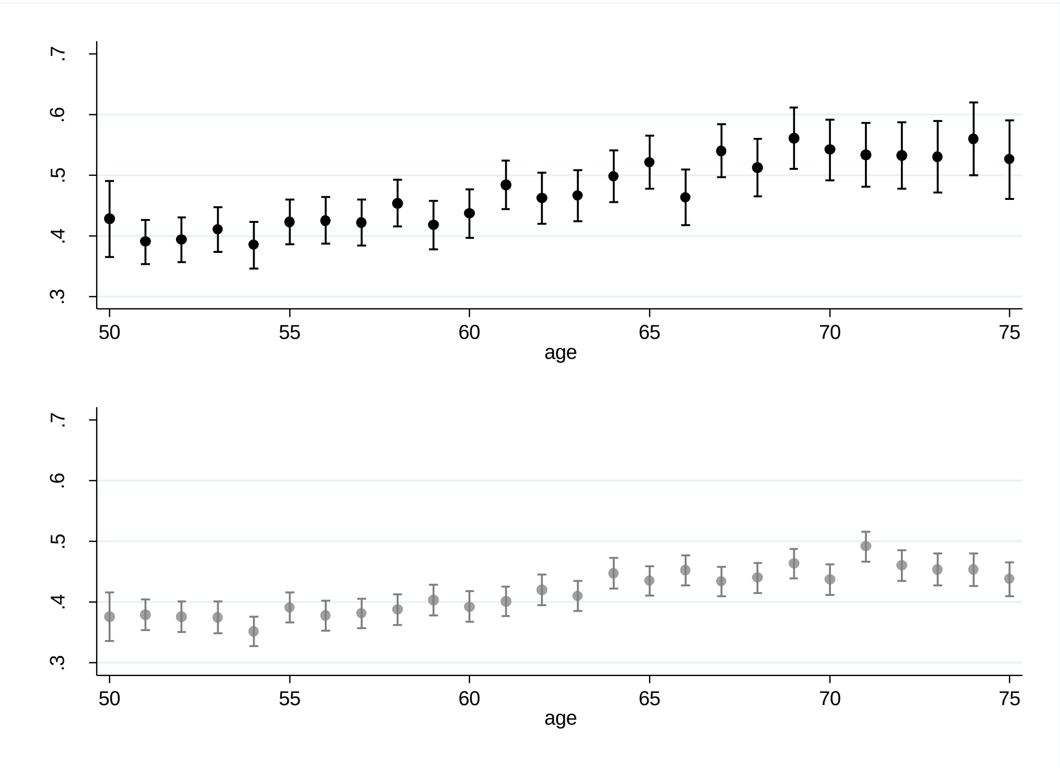


Figure 6. Proportion of individuals having had consultations with specialists, by age and education level.



TABLES

Table 1. Summary statistics

Variable	Obs	%	Mean	SD
Health behaviours				
Smoking	32420	17.2		
No activities	32413	6.3		
No vigorous activities	32416	37.3		
Everyday drinking	32424	27.1		
Number of visits to the general practitioner	32172		3.61	4.23
Visits to the specialist (yes/no)	32409	44.1		
Covariates				
Retired	32424	60.9		
Retired wave 1		52.7		
Retired wave 2		58.8		
Retired wave 4		70.7		
Early retirement age (among males)	17429		59.73	2.45
Early retirement age (among females)	14995		59.10	2.66
Normal retirement (among males)	17429		64.30	1.87
Normal retirement (among females)	14995		63.04	2.79
Partner	32424	77.16		
# grandchildren	32424		2.41	2.91
Age	32424		65.05	9.05
Chronic	32424		1.42	1.37
# adl	32424		0.11	0.53
# iadl	32424		0.17	0.66
Wave 1	32424	29.68		
Wave 2	32424	37.03		
Wave 4	32424	33.29		
Female	32424	46.25		
ISCED5_6	32382	26.29		
Few books	28034	38.63		
Above median (household net wealth)	32424	56.13		
Time pressure due to heavy workload	26495	49.19		
Physically demanding job	26508	47.55		
Blue collar	27740	34.01		
Low skilled	27740	49.48		

Table 2. The effect of retirement on the probability of smoking and being inactive

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Smoking				No activities				No vigorous activities			
	OLS	FE	2SLS	FE-2SLS	OLS	FE	2SLS	FE-2SLS	OLS	FE	2SLS	FE-2SLS
Retired	-0.006	-0.017**	-0.031	-0.027	-0.008**	-0.006	-0.049***	-0.042***	0.046***	-0.002	-0.052**	-0.084***
	(0.009)	(0.007)	(0.024)	(0.023)	(0.004)	(0.006)	(0.012)	(0.016)	(0.011)	(0.013)	(0.026)	(0.031)
# Grandchildren/10	-0.001	-0.046***	-0.000	-0.045***	-0.006	-0.015	-0.004	-0.012	-0.029**	-0.035	-0.025**	-0.027
	(0.011)	(0.017)	(0.011)	(0.017)	(0.008)	(0.021)	(0.008)	(0.021)	(0.011)	(0.028)	(0.011)	(0.029)
Partner	-0.047***	-0.015*	-0.047***	-0.015*	-0.001	0.005	-0.000	0.005	0.002	0.025	0.004	0.025
	(0.008)	(0.009)	(0.008)	(0.009)	(0.004)	(0.010)	(0.004)	(0.010)	(0.008)	(0.020)	(0.008)	(0.020)
Age	-0.000	-0.011**	0.005	-0.009	-0.027***	-0.043***	-0.018***	-0.039***	-0.036***	-0.034***	-0.015**	-0.025**
	(0.005)	(0.005)	(0.007)	(0.006)	(0.003)	(0.006)	(0.003)	(0.006)	(0.005)	(0.011)	(0.007)	(0.012)
Age^2/100	-0.005	0.004	-0.008*	0.004	0.024***	0.035***	0.018***	0.032***	0.036***	0.041***	0.023***	0.035***
	(0.004)	(0.003)	(0.005)	(0.004)	(0.002)	(0.003)	(0.002)	(0.003)	(0.004)	(0.005)	(0.005)	(0.006)
Qrtnetwealth_1	0.043***	0.001	0.043***	0.001	0.030***	-0.003	0.030***	-0.002	0.066***	0.003	0.066***	0.005
	(0.008)	(0.006)	(0.008)	(0.006)	(0.005)	(0.006)	(0.005)	(0.006)	(0.009)	(0.011)	(0.009)	(0.011)
Qrtnetwealth _3	-0.024***	-0.005	-0.024***	-0.005	-0.010***	-0.003	-0.010***	-0.003	-0.016**	0.011	-0.016**	0.011
	(0.006)	(0.004)	(0.006)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)	(0.007)	(0.010)	(0.007)	(0.010)
Qrtnetwealth _4	-0.038***	-0.013**	-0.039***	-0.013**	-0.017***	0.001	-0.019***	0.001	-0.048***	0.012	-0.052***	0.011
	(0.007)	(0.006)	(0.007)	(0.006)	(0.004)	(0.006)	(0.004)	(0.006)	(0.007)	(0.012)	(0.008)	(0.012)
Female	-0.042***		-0.041***		0.016***		0.016***		0.083***		0.085***	
	(0.007)		(0.007)		(0.003)		(0.003)		(0.007)		(0.007)	
ISCED3_4	-0.003		-0.003		-0.012***		-0.012***		-0.016**		-0.017**	
	(0.008)		(0.008)		(0.004)		(0.004)		(0.008)		(0.008)	
ISCED5_6	-0.026***		-0.027***		-0.014***		-0.016***		-0.015*		-0.020**	
	(0.009)		(0.009)		(0.004)		(0.004)		(0.008)		(0.009)	
Country dummies	✓		✓		✓		✓		✓		✓	
Wave dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Observations	32,375	32,375	32,375	32,375	32,367	32,367	32,367	32,367	32,372	32,372	32,372	32,372
Individuals	13,465	13,465	13,465	13,465	13,464	13,464	13,464	13,464	13,466	13,466	13,466	13,466
R-squared	0.040	0.003	0.040	0.003	0.069	0.022	0.067	0.020	0.108	0.017	0.105	0.015
F-test statistic			379.643	145.669			380.511	146.467			380.088	146.135
First stage:												
EligibleER			0.235***	0.163***			0.236***	0.164***			0.236***	0.164***
			(0.021)	(0.022)			(0.021)	(0.022)			(0.021)	(0.022)
EligibleSR			0.351***	0.301***			0.351***	0.301***			0.351***	0.301***
			(0.021)	(0.024)			(0.021)	(0.024)			(0.021)	(0.024)

Note: Clustered standard errors in parentheses by cohort and country. F-test statistic on the excluded instruments corresponds to the Kleibergen-Paap rk Wald F-statistic which deals with clustered standard errors. Stock and Yogo's (2005) critical values are (10%, 15%, 20%, 25% maximal IV size): 19.93, 11.59, 8.75, 7.25.*** p<0.01, ** p<0.05, * p<0.1.

Table 3. The effect of retirement on the probability of drinking every day, on the number of visits to the general practitioner and the probability of having contacts with a specialist

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Drink every day				Number of visits to the general practitioner				Visits to the specialist			
	POLS	FE	P2SLS	FE-2SLS	POLS	FE	P2SLS	FE-2SLS	POLS	FE	P2SLS	FE-2SLS
Retired	0.045***	0.029***	0.017	0.041*	0.421***	-0.005	-0.153	-0.301	0.047***	0.009	0.089***	0.069
	(0.009)	(0.009)	(0.023)	(0.024)	(0.085)	(0.096)	(0.203)	(0.279)	(0.011)	(0.014)	(0.023)	(0.044)
# Grandchildren/10	-0.022*	0.016	-0.021*	0.015	0.143	-0.198	0.168	-0.168	-0.007	0.001	-0.009	-0.006
	(0.011)	(0.023)	(0.012)	(0.023)	(0.119)	(0.257)	(0.120)	(0.259)	(0.012)	(0.031)	(0.012)	(0.031)
Partner	0.040***	0.019	0.040***	0.019	-0.065	-0.314**	-0.053	-0.314**	0.015*	-0.051***	0.014*	-0.051***
	(0.008)	(0.014)	(0.008)	(0.014)	(0.077)	(0.142)	(0.077)	(0.142)	(0.008)	(0.019)	(0.008)	(0.019)
Age	0.011**	-0.002	0.018***	-0.003	-0.100*	-0.131	0.025	-0.099	0.004	-0.015	-0.005	-0.021*
	(0.005)	(0.007)	(0.007)	(0.008)	(0.051)	(0.087)	(0.064)	(0.090)	(0.005)	(0.012)	(0.007)	(0.012)
Age^2/100	-0.007*	-0.008*	-0.011**	-0.007	0.131***	0.096*	0.054	0.075	-0.001	0.005	0.005	0.009
	(0.004)	(0.004)	(0.005)	(0.005)	(0.039)	(0.051)	(0.045)	(0.054)	(0.004)	(0.007)	(0.005)	(0.007)
Qrtnetwealth _1	-0.005	0.005	-0.006	0.005	0.287***	0.026	0.285***	0.030	0.005	-0.011	0.005	-0.011
	(0.008)	(0.008)	(0.008)	(0.008)	(0.085)	(0.099)	(0.085)	(0.100)	(0.008)	(0.012)	(0.008)	(0.012)
Qrtnetwealth _3	0.014*	0.002	0.014*	0.002	-0.297***	-0.023	-0.299***	-0.024	0.009	0.008	0.009	0.009
	(0.007)	(0.007)	(0.007)	(0.007)	(0.065)	(0.074)	(0.065)	(0.074)	(0.008)	(0.010)	(0.007)	(0.010)
Qrtnetwealth _4	0.050***	0.022***	0.049***	0.022***	-0.619***	-0.054	-0.637***	-0.058	0.031***	0.017	0.032***	0.017
	(0.008)	(0.008)	(0.008)	(0.008)	(0.078)	(0.092)	(0.079)	(0.092)	(0.008)	(0.013)	(0.008)	(0.013)
Female	-0.146***		-0.146***		0.247***		0.257***		0.082***		0.081***	
	(0.009)		(0.009)		(0.061)		(0.061)		(0.008)		(0.008)	
ISCED3_4	0.023***		0.023***		-0.239***		-0.244***		0.041***		0.042***	
	(0.008)		(0.008)		(0.065)		(0.065)		(0.008)		(0.008)	
ISCED5_6	0.064***		0.063***		-0.433***		-0.461***		0.088***		0.090***	
	(0.009)		(0.009)		(0.075)		(0.077)		(0.009)		(0.010)	
Country dummies	✓		✓		✓		✓		✓		✓	
Wave dummies	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Obs	32,382	32,382	32,382	32,382	32,011	32,011	32,011	32,011	32,358	32,358	32,358	32,358
Individuals	13,468	13,468	13,468	13,468	13,343	13,343	13,343	13,343	13,459	13,459	13,459	13,459
R-squared	0.117	0.002	0.117	0.002	0.142	0.009	0.140	0.008	0.067	0.010	0.067	0.009
F-test statistic			379.989	146.098			377.215	146.602			378.231	146.185
First stage:												
EligibleER			0.236***	0.164***			0.235***	0.164***			0.236***	0.164***
			(0.021)	(0.022)			(0.021)	(0.022)			(0.021)	(0.022)
EligibleSR			0.351***	0.302***			0.353***	0.304***			0.351***	0.302***
			(0.021)	(0.024)			(0.021)	(0.024)			(0.021)	(0.024)

Note: Clustered standard errors in parentheses by cohort and country. F-test statistic on the excluded instruments corresponds to the Kleibergen-Paap rk Wald F-statistic which deals with clustered standard errors. Stock and Yogo's (2005) critical values are (10%, 15%, 20%, 25% maximal IV size): 19.93, 11.59, 8.75, 7.25. *** p<0.01, ** p<0.05, * p<0.1.

Table 4. The effect of retirement on health behaviours – Robustness – 2SLS estimates

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
		Smoking		No activities		No vigorous activities		Drink every day		Number of visits to the general practitioner		Visits to the specialist	
		2SLS	FE-2SLS	2SLS	FE-2SLS	2SLS	FE-2SLS	2SLS	FE-2SLS	2SLS	FE-2SLS	2SLS	FE-2SLS
With health controls	Retired	-0.030	-0.027	-0.033***	-0.035**	-0.042	-0.082***	0.013	0.040	-0.140	-0.302	0.083***	0.066
		(0.024)	(0.023)	(0.010)	(0.015)	(0.026)	(0.032)	(0.023)	(0.024)	(0.195)	(0.275)	(0.023)	(0.043)
	Obs	32,375	32,375	32,367	32,367	32,372	32,372	32,382	32,382	32,011	32,011	32,358	32,358
	Individuals	13,465	13,465	13,464	13,464	13,466	13,466	13,468	13,468	13,343	13,343	13,459	13,459
	F-test statistic	381.790	145.760	382.693	146.553	382.247	146.223	382.152	146.186	379.322	146.727	380.350	146.280
Country-specific age effects	Retired	-0.036	-0.034*	-0.023**	-0.036**	-0.028	-0.078**	0.046**	0.036	0.083	-0.243	0.097***	0.071*
		(0.023)	(0.020)	(0.010)	(0.016)	(0.025)	(0.031)	(0.023)	(0.024)	(0.182)	(0.274)	(0.023)	(0.039)
	Obs	32,375	32,375	32,367	32,367	32,372	32,372	32,382	32,382	32,011	32,011	32,358	32,358
	Individuals	13,465	13,465	13,464	13,464	13,466	13,466	13,468	13,468	13,459	13,343	13,459	13,459
	F-test statistic	408.441	160.598	409.454	161.529	408.821	161.271	408.786	161.218	406.537	161.673	407.249	161.305
Age ≤ 75	Retired	-0.027	-0.023	-0.022*	-0.035**	-0.039	-0.083**	0.038	0.033	-0.113	-0.390	0.090***	0.066
		(0.026)	(0.023)	(0.011)	(0.017)	(0.028)	(0.032)	(0.024)	(0.026)	(0.219)	(0.293)	(0.025)	(0.046)
	Obs	27,377	26,311	27,371	26,304	27,376	26,309	27,384	26,318	27,146	26,088	27,368	26,302
	Individuals	11,100	11,100	11,099	11,099	11,101	11,101	11,103	11,103	11,019	11,019	11,096	11,096
	F-test statistic	357.849	142.845	358.675	143.647	358.140	143.305	358.121	143.266	354.403	143.637	356.218	143.389
Alternative definition of retirement	Retired	-0.043	-0.051	-0.060***	-0.077***	-0.069**	-0.160***	0.020	0.077*	-0.140	-0.481	0.113***	0.128*
		(0.030)	(0.041)	(0.015)	(0.030)	(0.033)	(0.061)	(0.029)	(0.045)	(0.254)	(0.515)	(0.028)	(0.078)
	Obs	32,375	32,375	32,367	32,367	32,372	32,372	32,382	32,382	32,011	32,011	32,358	32,358
	Individuals	13,465	13,465	13,464	13,464	13,466	13,466	13,468	13,468	13,343	13,343	13,459	13,459
	F-test statistic	187.803	76.566	187.653	76.419	188.035	76.311	187.985	76.337	186.108	76.158	187.309	76.276

Note: All FE-2SLS regressions include age, age squared(/100), a binary indicator for having a partner, household net wealth quartiles dummies, the number of grandchildren, and wave dummies. 2SLS regressions include additionally education indicators, gender and country dummies. Clustered standard errors in parentheses by cohort and country. F-test statistic on the excluded instruments corresponds to the Kleibergen-Paap rk Wald F-statistic which deals with clustered standard errors. Stock and Yogo's (2005) critical values are (10%, 15%, 20%, 25% maximal IV size): 19.93, 11.59, 8.75, 7.25. *** p<0.01, ** p<0.05, * p<0.1.

Table 5. Fixed effects – IV estimates – Heterogeneous effects – FE-2SLS

Dep. Var.		Gender		Partner		Education		Few books when aged 10		Net wealth	
		Males	Females	No	Yes	ISCED 0-4	ISCED 5-6	No	Yes	Below median	Above median
Smoking	Retired	-0.0565	0.00837	-0.0309	-0.0156	-0.0468*	0.0149	-0.0447*	-0.0336	-0.0544	-0.0215
		(0.0367)	(0.0242)	(0.0537)	(0.0254)	(0.0277)	(0.0328)	(0.0268)	(0.0521)	(0.0393)	(0.0298)
	Obs	17,401	14,974	6,665	24,399	23,864	8,511	17,185	10,809	11,678	15,046
	Individuals	7,229	6,236	2,750	10,260	9,951	3,514	7,028	4,384	5,096	6,467
	R-squared	0.001	0.002	0.002	0.003	0.003	0.003	0.002	0.004	0.003	0.004
	F-test statistic	98.280	120.605	41.705	147.912	126.857	91.355	179.356	72.286	93.972	130.002
No activities	Retired	-0.0447**	-0.0416*	0.0173	-0.0463***	-0.0342*	-0.0519**	-0.0354**	-0.0601	-0.0149	-0.0155
		(0.0214)	(0.0215)	(0.0402)	(0.0176)	(0.0206)	(0.0214)	(0.0159)	(0.0500)	(0.0296)	(0.0193)
	Obs	17,402	14,965	6,661	24,395	23,861	8,506	17,184	10,804	11,675	15,041
	Individuals	7,230	6,234	2,748	10,260	9,952	3,512	7,029	4,383	5,095	6,466
	R-squared	0.022	0.020	0.038	0.016	0.025	0.006	0.020	0.023	0.030	0.015
	F-test statistic	98.748	121.899	43.132	148.085	127.224	91.869	180.372	72.272	95.406	130.780
No vigorous activities	Retired	-0.0778	-0.0873**	-0.0257	-0.0963***	-0.0571	-0.135**	-0.101***	-0.0275	0.0201	-0.0844*
		(0.0473)	(0.0416)	(0.0905)	(0.0352)	(0.0351)	(0.0579)	(0.0346)	(0.0836)	(0.0628)	(0.0431)
	Obs	17,404	14,968	6,661	24,398	23,861	8,511	17,187	10,804	11,675	15,046
	Individuals	7,231	6,235	2,748	10,261	9,952	3,514	7,030	4,383	5,095	6,468
	R-squared	0.016	0.015	0.032	0.011	0.019	0.011	0.018	0.021	0.022	0.016
	F-test statistic	98.320	121.907	43.132	148.084	127.224	91.520	91.520	72.272	95.406	130.175
Drink every day	Retired	0.0740*	0.00589	0.103**	0.0318	0.0259	0.0587	0.00636	0.124*	0.0703	0.0443
		(0.0389)	(0.0285)	(0.0513)	(0.0295)	(0.0309)	(0.0453)	(0.0320)	(0.0650)	(0.0446)	(0.0390)
	Obs	17,405	14,977	6,666	24,405	23,869	8,513	17,189	10,809	11,679	15,052
	Individuals	7,231	6,237	2,750	10,263	9,953	3,515	7,030	4,384	5,096	6,470
	R-squared	0.001	0.003	0.003	0.002	0.003	0.002	0.002	0.003	0.003	0.003
	F-test statistic	98.324	121.890	43.146	148.021	127.227	91.473	179.494	72.286	95.408	130.199
Number of visits to the general practitioner	Retired	-0.284	-0.436	-0.493	-0.266	-0.409	-0.112	-0.136	-0.911	-0.332	-0.590*
		(0.431)	(0.303)	(0.642)	(0.321)	(0.356)	(0.406)	(0.288)	(0.876)	(0.495)	(0.357)
	Obs	17,196	14,815	6,578	24,140	23,540	8,471	17,070	10,607	11,480	14,942
	Individuals	7,161	6,182	2,720	10,173	9,841	3,502	6,994	4,319	5,020	6,426
	R-squared	0.013	0.006	0.007	0.008	0.007	0.015	0.010	0.005	0.009	0.009
	F-test statistic	99.351	121.821	43.664	149.242	127.232	91.822	180.983	71.889	94.535	131.929
Visits to the specialist	Retired	0.100*	0.0277	-0.0492	0.0864*	0.0548	0.112	0.0618	-0.00399	0.0195	0.0751
		(0.0595)	(0.0571)	(0.1000)	(0.0456)	(0.0519)	(0.0703)	(0.0450)	(0.102)	(0.0704)	(0.0552)
	Obs	17,390	14,968	6,662	24,386	23,854	8,504	17,177	10,803	11,669	15,044
	Individuals	7,226	6,233	2,748	10,256	9,948	3,511	7,025	4,383	5,092	6,467
	R-squared	0.016	0.004	0.012	0.007	0.008	0.014	0.009	0.013	0.012	0.009
	F-test statistic	98.473	121.692	43.122	148.192	127.402	91.354	179.348	72.237	95.423	130.111

- Continued on next page –

Dep. Var.		Time pressure No	Time pressure Yes	Physically demanding No	Physically demanding Yes	White collar	Blue collar	High skilled	Low skilled
Smoking	Retired	-0.0287	-0.0479	-0.0282	-0.0838**	-0.0162	-0.125**	-0.0291	-0.0493
		(0.0405)	(0.0356)	(0.0324)	(0.0417)	(0.0244)	(0.0575)	(0.0328)	(0.0304)
	Obs	12,067	11,889	12,806	11,631	18,109	9,353	13,818	13,557
	Individuals	4,951	4,895	5,222	4,785	7,367	3,831	5,623	5,532
	R-squared	0.002	-0.000	0.002	0.001	0.003	-0.008	0.004	0.002
	F-test statistic	98.929	113.600	109.603	108.154	177.571	64.202	106.374	121.225
No activities	Retired	-0.0218	-0.0657**	-0.0216	-0.0570*	-0.0364**	-0.0261	-0.0424**	-0.0248
		(0.0276)	(0.0301)	(0.0199)	(0.0326)	(0.0171)	(0.0453)	(0.0199)	(0.0284)
	Obs	12,063	11,886	12,802	11,628	18,103	9,353	13,819	13,550
	Individuals	4,950	4,895	5,221	4,785	7,366	3,832	5,625	5,530
	R-squared	0.020	0.023	0.016	0.027	0.020	0.023	0.017	0.027
	F-test statistic	99.509	113.745	110.259	108.255	178.752	64.247	106.525	122.223
No vigorous activities	Retired	-0.00344	-0.0175	-0.123**	0.0483	-0.0868**	-0.0325	-0.171***	0.0640
		(0.0604)	(0.0529)	(0.0524)	(0.0561)	(0.0352)	(0.0791)	(0.0490)	(0.0518)
	Obs	12,065	11,887	12,804	11,629	18,106	9,353	13,820	13,552
	Individuals	4,951	4,895	5,222	4,785	7,367	3,832	5,625	5,531
	R-squared	0.019	0.019	0.013	0.026	0.017	0.022	0.007	0.021
	F-test statistic	98.910	113.747	109.593	108.256	177.686	64.247	106.525	121.222
Drink every day	Retired	-0.0443	0.0850*	-0.0112	0.0270	0.0342	0.00891	0.0249	0.0323
		(0.0453)	(0.0468)	(0.0393)	(0.0485)	(0.0316)	(0.0627)	(0.0402)	(0.0389)
	Obs	12,067	11,891	12,806	11,633	18,111	9,355	13,822	13,557
	# individuals	4,951	4,896	5,222	4,786	7,368	3,832	5,625	5,532
	R2	0.003	0.002	0.003	0.004	0.002	0.005	0.002	0.003
	F-test statistic	98.929	113.748	109.603	108.255	177.691	64.247	106.533	121.225
Number of visits to the general practitioner	Retired	-0.322	0.0999	-0.425	0.140	-0.367	-0.330	0.187	-0.682
		(0.469)	(0.571)	(0.355)	(0.607)	(0.301)	(0.827)	(0.418)	(0.425)
	Obs	11,953	11,738	12,711	11,459	17,993	9,171	13,687	13,392
	# individuals	4,914	4,850	5,192	4,732	7,331	3,775	5,582	5,482
	R2	0.008	0.012	0.010	0.008	0.010	0.008	0.013	0.006
	F-test statistic	100.310	113.675	110.600	107.590	175.753	63.390	104.829	121.661
Visits to the specialist	Retired	0.0798	0.0876	0.0205	0.0838	0.0453	0.0793	0.0953	0.0171
		(0.0664)	(0.0733)	(0.0680)	(0.0738)	(0.0513)	(0.0950)	(0.0634)	(0.0586)
	Obs	12,060	11,882	12,804	11,621	18,099	9,349	13,812	13,549
	# individuals	4,948	4,893	5,221	4,782	7,364	3,830	5,622	5,529
	R2	0.013	0.009	0.013	0.008	0.011	0.009	0.013	0.009
	F-test statistic	98.577	113.910	109.385	108.365	177.381	64.263	106.486	121.110

Note: All regressions include age, age squared(/100), a binary indicator for having a partner, household net wealth quartiles dummies, the number of grandchildren, and wave dummies . Clustered standard errors in parentheses by cohort and country. F-test statistic on the excluded instruments corresponds to the Kleibergen-Paap rk Wald F-statistic which deals with clustered standard errors. Stock and Yogo's (2005) critical values are (10%, 15%, 20%, 25% maximal IV size): 19.93, 11.59, 8.75, 7.25. *** p<0.01, ** p<0.05, * p<0.1.

APPENDIX

Appendix A

The initial sources of information about eligibility criteria are Gruber and Wise (1999, 2010) and Wise (2012). Other country-specific auxiliary data sources are given below. ER = early retirement. SR = normal (statutory) retirement.

Austria (see Staubli and Zweimüller, 2011)
ER: 60 for men and 55 for women until 2001. From 2001 until 2004, early retirement depends on year of birth. For men it is 61 until 1942 and 62 from 1943 onwards. For women it is 56 for those born in 1947, 57 for those born between 1948 and 1951, 58 for those born from 1952 onwards. From 2005, it is 62 for men and women.
SR: 65 for men and 60 for women.

Belgium (see Jousten *et al*., 2010)
ER: No early retirement until 1966, 60 afterwards for men, for women 55 until 1986 and 60 from 1987.
SR: 65 for men, for women 60 until 1996, 61 from 1997 to 1999, 62 from 2000 to 2002, 63 from 2003 to 2005, 64 from 2006 to 2008, 65 from 2009.

Denmark (see Bingley *et al*., 2010)
ER: 60 for both men and women consistently, except from 1992 to 1993, when the ER was lowered to 55, and from 1994 to 1995, when it was 50.
SR: 67 until 2003, 65 from 2004, for both men and women.

France (see Hamblin, 2013)
ER: No early retirement until 1963. 60 from 1963 to 1980, 55 from 1981 onwards.
SR: 65 until 1982 and 60 from 1983 to 2010; from 2011 60 for those born up to 1952, 61 for those born between 1953 and 1954 and 62 for those born since 1955.

Germany (see Berkel and Börsch-Supan, 2004, and Mazzonna and Peracchi., 2014)
ER: For men, no early retirement until 1972, 60 from 1973 until 2003, 63 from 2004 onwards. For women, no early retirement in 1961, 60 from 1962 until 2003, 62 from 2004 until 2005, 63 from 2006.
SR: 65 for all.

Italy
See Angelini *et al*., 2009.

Netherlands (see Euwals *et al*., 2010)
ER: No early retirement until 1974. 60 from 1975 onwards, for both men and women.
SR: 65 for both men and women.

Spain (see Blanco, 2000)

ER: 64 until 1982, 60 from 1983 to 1993, 61 from 1994 onwards, for both men and women.
SR: 65 for both men and women.

Sweden (see Mazzonna and Peracchi, 2014)
ER: No early retirement until 1962, 60 from 1963 to 1997, 61 from 1998 onwards.
SR: 67 for both men and women until 1994, 65 from 1995 onwards.

Switzerland (see Dorn and Sousa-Poza, 2003)
ER: No early retirement until 1996 for men and until 2000 for women. Then, 64 for men from 1997 until 2000 and 63 from 2001, for women 62 from 2001.
SR: 65 for men, for women 63 until 1963, 62 from 1964 until 2000, 63 from 2001 to 2004, 64 from 2005.

Additional references for retirement ages

Angelini V, Brugiavini A, Weber G. 2009. Ageing and unused capacity in Europe: is there an early retirement trap? *Economic Policy* **24**(59): 463–508.

Berkel B, Börsch-Supan A. 2004. Pension reforms in Germany: the impact on retirement decisions. MEA Discussion Paper 62 – 2004.

Bingley P, Datta Gupta N, Pedersen P J. 2010. Social security, retirement and employment of the young in Denmark. In J Gruber, D Wise. *Social Security Programs and Retirement around the World. The Relationship to Youth Employment*. University of Chicago Press: Chicago.

Blanco A. 2000. The decision of early retirement in Spain. FEDEA Working Paper no. 76.

Dorn D, Sousa-Poza A. 2003. Why is the employment rate of older Swiss so high? An analysis of the social security system. The Geneva Papers on Risk and Insurance **28**(4): 652–672.

Euwals R, van Vuuren D, Wolthoff R. 2010. Early retirement behaviour in the Netherlands: evidence from a policy reform. *De Economist* **158**(3): 209–236.

Gruber J, Wise D A. 1999. *Social Security and Retirement around the World*. University of Chicago Press: Chicago.

Gruber J, Wise D A. 2010. *Social Security Programs and Retirement around the World: The Relationship to Youth Employment*. University of Chicago Press: Chicago.

Hamblin K A. 2013. *Active Ageing in the European Union. Policy Convergence and Divergence*. Palgrave Macmillan: London.

Jousten A, Lefèbvre M, Perelman S, Pestieau P. 2010. The effects of early retirement on youth unemployment: the case of Belgium. In J Gruber, D Wise. *Social Security Programs and*

Retirement around the World. The Relationship to Youth Employment. University of Chicago Press: Chicago.

Mazzonna F, Peracchi F. 2014. Unhealthy retirement? EIEF Working Paper 09/14.

Staubli S, Zweimüller J. 2011. Does raising the retirement age increase employment of older workers? IZA Discussion Paper 5863.

Wise D A. 2012. *Social Security Programs and Retirement around the World: Historical Trends in Mortality and Health, Employment, and Disability Insurance Participation and Reforms*. University of Chicago Press: Chicago.

Appendix B

Figure B1. Early and normal eligibility ages for pension benefits (males)

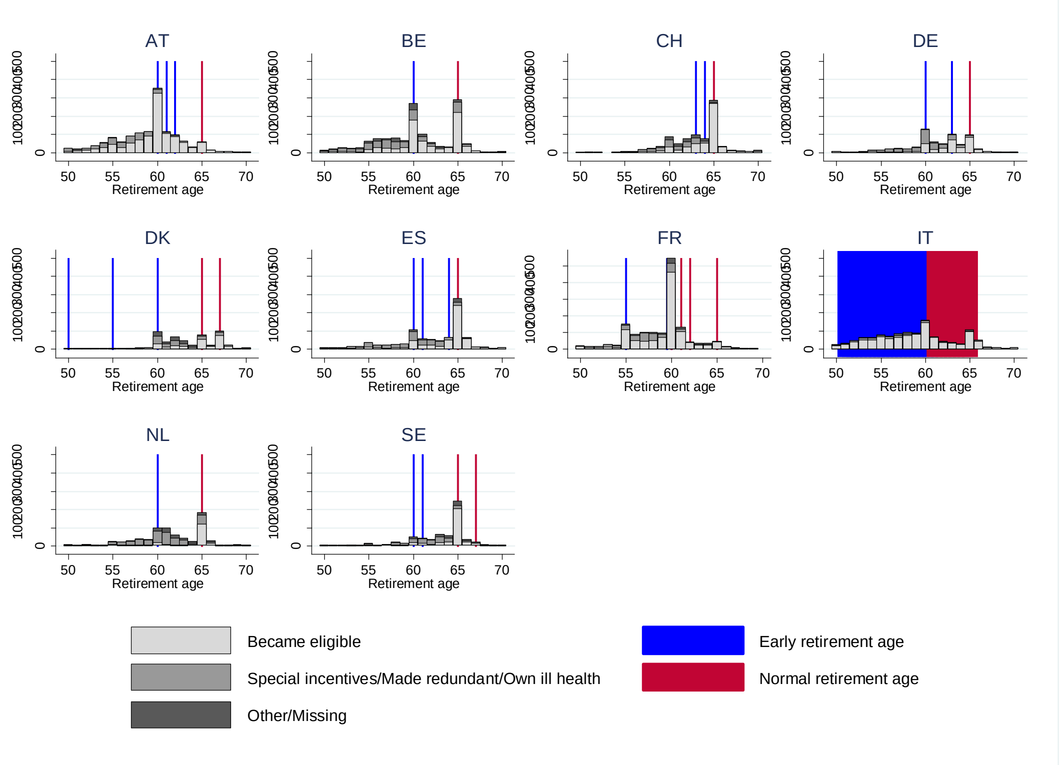
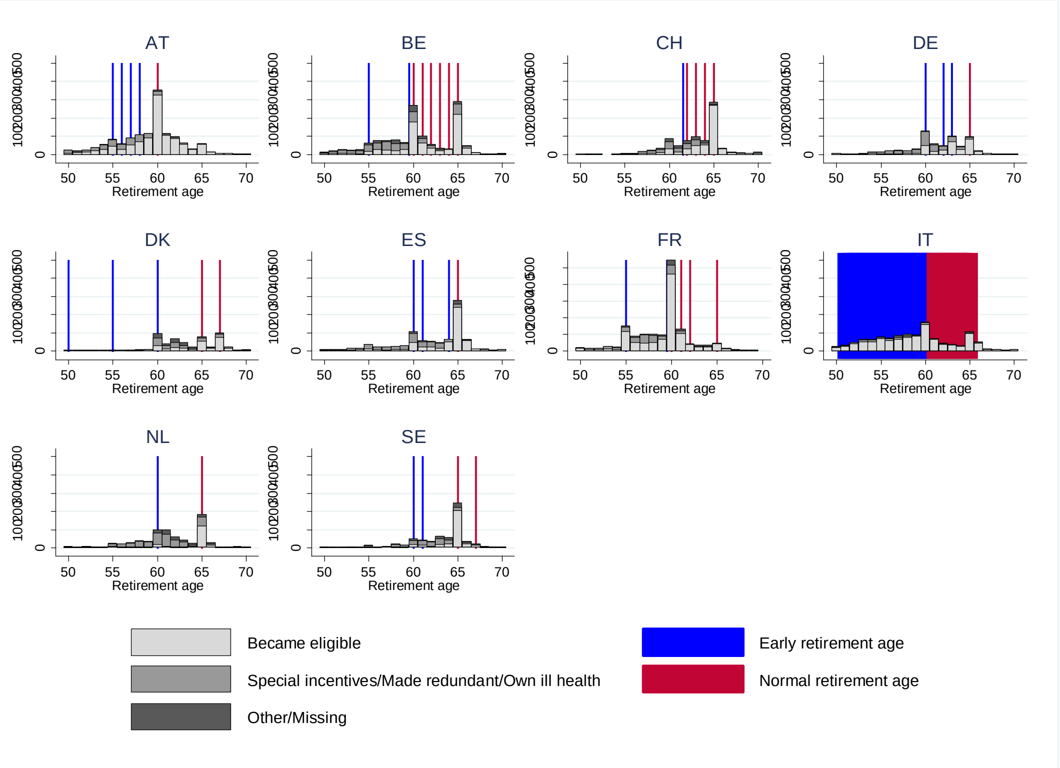


Figure B2. Early and normal eligibility ages for pension benefits (females)



Appendix C

Following Jones *et al*. (2013) and Verbeek and Nijman (1992), an initial test for non-response bias is to include in our 2SLS specification two variables describing the pattern of survey response: *nextwave* and *allwaves*. The former indicates whether the individual participated in the next wave, the latter identifies individuals who participated in all three waves. In the FE-2SLS, only *nextwave* is included, since *allwaves* is a time-invariant characteristic. As Jones *et al*. (2013) suggested, there should be no intrinsic reason why the survey response should have an effect on individuals' health behaviours, but in the presence of selection bias there will be a statistical association between survey response variables and our outcome measures. Table C1 shows that there is a statistical association between survey response variables and our outcome measures, but generally not for our FE-2SLS specifications. One possible strategy to see whether attrition might be problematic for our results is to compare estimates between balanced and unbalanced panel sample (see Jones *et al*., 2013, and Cheng and Trivedi, 2015). In the absence of non-response bias, these estimates should be comparable, as may be seen in Table C2.

Table C1. The effect of retirement on health behaviours – Robustness – Attrition I

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Smoking		No activities		No vigorous activities		Drink every day		Number of visits to the general practitioner		Visits to the specialist	
	2SLS	FE-2SLS	2SLS	FE-2SLS	2SLS	FE-2SLS	2SLS	FE-2SLS	2SLS	FE-2SLS	2SLS	FE-2SLS
Retired	-0.029	-0.026	-0.049***	-0.042***	-0.052**	-0.084***	0.018	0.042*	-0.132	-0.301	0.090***	0.069
	(0.024)	(0.023)	(0.012)	(0.016)	(0.026)	(0.031)	(0.023)	(0.024)	(0.204)	(0.279)	(0.023)	(0.044)
Nextwave	-0.030***	-0.012**	-0.012*	-0.005	-0.005	0.007	-0.009	-0.004	-0.208**	0.014	0.004	-0.002
	(0.009)	(0.006)	(0.006)	(0.007)	(0.012)	(0.014)	(0.010)	(0.010)	(0.099)	(0.101)	(0.012)	(0.015)
Allwaves	-0.006		-0.011***		-0.018***		0.007		0.055		0.019***	
	(0.006)		(0.003)		(0.007)		(0.006)		(0.061)		(0.007)	
Obs	32,375	32,375	32,367	32,367	32,372	32,372	32,382	32,382	32,011	32,011	32,358	32,358
Individuals	13,465	13,465	13,464	13,464	13,466	13,466	13,468	13,468	13,343	13,343	13,459	13,459
F-test statistic	377.330	145.682	378.155	146.475	377.773	146.147	377.667	146.111	375.122	146.588	376.003	146.197

Note: All FE-2SLS regressions include age, age squared(/100), a binary indicator for having a partner, household net wealth quartiles dummies, the number of grandchildren, and wave dummies. 2SLS regressions include additionally education indicators, gender and country dummies. Clustered standard errors in parentheses by cohort and country. F-test statistic on the excluded instruments corresponds to the Kleibergen-Paap rk Wald F-statistic which deals with clustered standard errors. Stock and Yogo's (2005) critical values are (10%, 15%, 20%, 25% maximal IV size): 19.93, 11.59, 8.75, 7.25. *** p<0.01, ** p<0.05, * p<0.1.

Table C2. The effect of retirement on health behaviours – Robustness – Attrition II

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	Smoking				No activities				No vigorous activities			
	2SLS		FE-2SLS		2SLS		FE-2SLS		2SLS		FE-2SLS	
	Balanced	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced
Retired	-0.026	-0.031	-0.031	-0.027	-0.048***	-0.049***	-0.033*	-0.042***	-0.065**	-0.052**	-0.079*	-0.084***
	(0.030)	(0.024)	(0.025)	(0.023)	(0.015)	(0.012)	(0.020)	(0.016)	(0.032)	(0.026)	(0.041)	(0.031)
Obs	20,409	32,375	20,409	32,375	20,403	32,367	20,403	32,367	20,404	32,372	20,404	32,372
Individuals	7,482	13,465	7,482	13,465	7,482	13,464	7,482	13,464	7,482	13,466	7,482	13,466
F-test statistic	298.448	379.643	128.570	145.669	298.761	380.511	129.108	146.467	298.845	380.088	129.111	146.135
	Drink every day				Number of visits to the general practitioner				Visits to the specialist			
	2SLS		FE-2SLS		2SLS		FE-2SLS		2SLS		FE-2SLS	
	Balanced	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced	Balanced	Unbalanced
Retired	0.043	0.017	0.019	0.041*	-0.005	-0.153	-0.245	-0.301	0.090***	0.089***	0.070	0.069
	(0.028)	(0.023)	(0.031)	(0.024)	(0.269)	(0.203)	(0.338)	(0.279)	(0.031)	(0.023)	(0.050)	(0.044)
Obs	20,412	32,382	20,412	32,382	20,177	32,011	20,177	32,011	20,402	32,358	20,402	32,358
Individuals	7,483	13,468	7,483	13,468	7,426	13,343	7,426	13,343	7,481	13,459	7,481	13,459
F-test statistic	298.809	379.989	129.114	146.098	294.577	377.215	128.464	146.602	297.101	378.231	129.143	146.185

Note: All FE-2SLS regressions include age, age squared(/100), a binary indicator for having a partner, household net wealth quartiles dummies, the number of grandchildren and wave dummies. 2SLS regressions include additionally education indicators, gender and country dummies. Clustered standard errors in parentheses by cohort and country. F-test statistic on the excluded instruments corresponds to the Kleibergen-Paap rk Wald F-statistic which deals with clustered standard errors. Stock and Yogo's (2005) critical values are (10%, 15%, 20%, 25% maximal IV size): 19.93, 11.59, 8.75, 7.25. The balanced sample includes individuals that participated in all the three waves.*** p<0.01, ** p<0.05, * p<0.1.

Appendix D

Table D1. The effect of retirement on health behaviours – Reduced form estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Dep. Var.	Smoking		No activities		No vigorous activities		Drink every day		Number of visits to the general practitioner		Visits to the specialist	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE	OLS	FE
EligibleER	0.003	-0.001	-0.014**	-0.006	-0.000	-0.002	0.006	0.004	-0.167	-0.150	0.012	0.008
	(0.009)	(0.007)	(0.005)	(0.006)	(0.012)	(0.012)	(0.010)	(0.008)	(0.104)	(0.094)	(0.012)	(0.015)
EligibleSR	-0.017*	-0.010	-0.016***	-0.013**	-0.026**	-0.031**	0.005	0.014	0.031	-0.040	0.037***	0.023
	(0.011)	(0.007)	(0.005)	(0.006)	(0.011)	(0.012)	(0.010)	(0.009)	(0.091)	(0.099)	(0.011)	(0.015)
Obs	32,375	32,375	32,367	32,367	32,372	32,372	32,382	32,382	32,011	32,011	32,358	32,358
Individuals	13,465	13,465	13,464	13,464	13,466	13,466	13,468	13,468	13,343	13,343	13,459	13,459

Note: Clustered standard errors in parentheses by cohort and country.*** p<0.01, ** p<0.05, * p<0.1.