Philipp Hessel
London School of Economics
Department of Social Policy/LSE Health
Houghton Street
London, WC2A 2AE
p.hessel@lse.ac.uk

Is retirement really bad for Europeans' health?

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Abstract

Background: The view that retirement would have negative effects on health is widespread, both in the academic literature as well as in the political and public debate. However, very little conclusive evidence exists to support this hypothesis. A major reason is that previous research, which has not taken into account the problem of negative health selection into retirement, has been limited by the inability to distinguish between causes and effects of retirement.

Design and method: Based on a large longitudinal dataset for 77,926 men and 58,725 women from 15 Western European countries this study uses random-effects (RE) and well as instrumental variables (IV) regressions to assess potentially (causal) effects of retirement on health. Thereby country- and sex-specific early- and full state pension ages (SPA) are used as instruments.

Results: In clear contrast to the random-effects models, least this study finds strong evidence that retirement does not lead to a worsening in health. In contrary, the results from the IV-regressions suggest that retirement increases the chances of reporting better self-rated health (SRH) (0.034 points) as well as having no limitations in ADL (0.040 points). The results are particularly pronounced for men as well as lower educated individuals.

Implications: Methodologically, this study highlights the importance of taking into account the negative health selection in models trying to identify effects of retirement on health. Furthermore the results point out that uniform increases in retirement ages may have important trade-offs as these may exacerbate health-declines at older ages.

6,400 words

Introduction

Whereas researchers of many disciplines have devoted much attention to the question how health affects individuals' retirement-behaviours (e.g., Bound, Schoenbaum et al. 1999; Hagan, Jones et al. 2009; Kerkhofs, Lindeboom et al. 1999; McGarry 2004), very little conclusive evidence exists on the question how retirement affects health. This is surprising since retirement itself is often associated with changes in social networks, health behaviours or socio-economic status (Henkens, van Solinge et al. 2008; Lahti, Laaksonen et al. 2011; Slingerland, van Lenthe et al. 2007), thus dimensions which have repeatedly been linked to health outcomes. It is even more surprising given that in most of the OECD-world increasing the retirement age has a prominent place on the political agenda. If delaying retirement would lead to a deterioration of individuals' health, then increases in the retirement could equally increase the demand for health-care and the expenditures associated to it.

Thereby, the notion that retirement would be bad for health is widespread and has an old legacy for a number of reasons (Ekerdt 1987; Minkler 1981). As such anecdotal evidence from popular or clinical observations often relate negative health-events of retirees such as death or hearth disease to retirement itself (Casscells, Evans et al. 1980; González 1980). As many have argued, some of the reasons may be that that retirement would represent a stressful life-event (Carp 1967; Eisdorfer and Wilkie 1997) eventually involving a major loss of a central role (Atchley 1975), influence or recognition (Bradford 1979). In a context of a cultural ideology which highlights the importance of work for individual identity (Ekerdt, Baden et al. 1983), retirement and its potential health-effects are often compared to unemployment or involuntary job-loss (Waddell and Burton 2006), while work is being regarded as beneficial for the maintenance of income or cognitive functioning (e.g., Fratiglioni, Paillard-Borg et al. 2004; Roberts, Fuhrer et al. 2010; Rohwedder and Willis 2010; Waddell and Burton 2006).

However, much of the existing research suffers from the inability to distinguish correlation from causality due to limited attempts to address the issues arising from the endogenous relationship between health and retirement. Since suboptimal health is a major predictor of earlier retirement (Bound et al. 1999; McGarry 2004), studies applying ordinary least square (OLS) regressions to cross-sectional data likely are likely to be biased. Similarly, results based in studies using fixed-effects (FE) approaches with longitudinal data may also be biased in the presence of time-varying confounding factors and thus cannot rule out the presence of reverse causality. This inherent methodological problem may be one reason why up to date research has produced very conflicting results.

Only rather recently a series of studies have explicitly addressed this issue by applying more rigid identification strategies. One common approach thereby uses age-specific retirement incentives defined by the state pension ages (SPA) in several countries as instruments to adjust for health-selection into retirement. For example for the US Neuman (2008) finds positive effects of retirement on self-rated health (SRH) for men and women and Charles found (2004) positive effects on well-being for men. For England, both using a regression discontinuity design (RDD), Bound and Waidman (2007) found evidence of positive health-effects of retirement for men but not for women, whereas Johnston and Lee (2009) found improvements in SRH but not for physical health outcomes. In contrast, using a matching- as well as instrumental variable- (IV) design, Behncke (2011) found retirement to increases the risk of being diagnosed with several chronic conditions as well as to report limitations in activities and a worsening of SRH. A study by Coe and Zamarro (2011) using a similar IV-approach as the US-studies with a sample of men from eleven European countries found that retirement led to a decreased probability in reporting bad-SRH as well as an improvement in a global summary measure of health.

Although in tendency most of these recent studies found positive effects of retirement at least on SRH, the findings are partly conflicting and far from conclusive. One reason is that, partly due to limited sample sizes, existing studies have not been able to systematically assess to what extend the effects of retirement on heath may vary between socio-economic groups. By using a large longitudinal database for 15 Western European countries (N=140,952) this study adds to the existing literature in several important ways. First, with the exception of Germany, this study includes representative data for all Western European member states of the European Union (+ Norway) and thus greatly increasing its external validity. Secondly, the use of longitudinal data makes it possible to observe individuals before and after they retire(d) increasing the robustness of the results. Thirdly, the comparatively large sample size is particularly suited for in the IV-context as the latter is known to converge to the population parameter in large samples (Angrist and Krueger 2001). Lastly, the relatively large sample size also makes it possible to stratify the sample by socio-economic groups such as gender and educational attainment and thereby analyse in how far the effects of retirement on health are heterogeneous.

The following paper is structured as follows: in the following section the *data and methods* are described in detail. The succeeding section presents the *results* and discusses their robustness. The last section offers a *discussion* of the results and their *implications*. Tables are included in the *appendix* (pp. 28-38).

Data and Methods

Data

The data for this analysis come from the European Union Statistics of Income and Living Conditions (EU-SILC).[1] The main purpose of EU-SILC is to provide nationally representative, comparable, cross-sectional as well as longitudinal data on income, poverty, social exclusion and living conditions of the population residing in private households aged 16 and over. Thereby EU-SILC is a major source of official statistics from which a number of so called structural indicators on population and social conditions are derived (European Commission 2006).[2] Although not originally being a survey on health, EU-SILC contains the Minimum European Health Module (MEHM) including questions on general self-rated health, chronic health problems and global activity limitation.[3]

The collection of data for EU-SILC started in 2003 in six EU-member states and is implemented since 2005 in all 25 member states (Bulgaria and Romania joined in 2007). In addition Norway, Iceland, Turkey as well as Switzerland have participated in the data collection since 2004. The sampling of EU-SILC follows a four-year rotational design in which households remain in the sample for four years (waves) and one quarter of the sample is replaced each year. For the longitudinal component of EU-SILC, the achieved annual sample size ranges from about 5,000 individuals in the smaller member states (e.g. Luxemburg, Ireland and Denmark) to around 11,000 in the larger ones (e.g. Spain, the United Kingdom and Italy). The comparatively large sample size makes EU-SILC particularly suitable in the context of instrumental variables as estimates of the latter are generally

[1] http://circa.europa.eu/Public/irc/dsis/eusilc/library
[2] http://epp.eurostat.ec.europa.eu/portal/page/portal/microdata/eu_silc
[3] http://www.eurohex.eu/index.php?option=welcome

more consistent in larger samples (Angrist and Krueger 2001; Martens, Pestman et al. 2006).

This study includes data for the years 2005 to 2008 for 15 Western European countries (see Table 1). Germany was excluded from the sample as up to date no comparable longitudinal data are integrated into EU-SILC. The sample is thus an unbalanced panel with a minimum of two and a maximum of four observations per individual. For the purpose of the analysis only individuals aged between 50 and 74 years were included. Furthermore, to be included in the sample, individuals had to be either working full-time, working part-time or retired according to their self-reported activity status. The sample for this study includes 77,926 men and 58,725 women.

Data on state pension ages

Micro data from EU-SILC were supplemented with information about the state pension ages (SPA) of the 15 countries included in this study. The data for country-specific early and standard retirement ages have been derived mainly from the Mutual Information System on Social Protection (MISSOC) (European Commission 2005-2008) and refer to the years 2005 to 2008. As Table 2 shows, the 15 European countries differ with regard to the age-thresholds for claiming full state pensions and especially with regard to the thresholds for early retirement. With regard to the standard retirement ages for men, there is little variation across Europe. With the exception of France (60 years) and Norway (67) years, in general men are eligible to claim a full state pension at the age of 65. For women the age-thresholds for claiming the full state pension vary to a much larger extend. While in Austria, France, Italy and the United Kingdom women are eligible for a full state pension at age 60; in the majority of countries the latter is only possible at age 65. Similar to men, Norwegian women are only eligible for a full state pension at age 67. Comparing the age-thresholds for early retirement shows that the latter are lower in some countries (e.g. age 55 for men and women in Portugal or 57 for men and women both in France and Greece) and higher in others (e.g. age 62 for men in Austria or age 62 for women in Finland). Thereby Denmark, Ireland, Norway and the United Kingdom do not have any provisions for claiming a state pension before reaching the full pension age. For the purpose of this analysis, the age for the early retirement threshold was set to the same value as the full retirement age in these cases.

Health outcomes

Information on individual's health for this study is based on three questions: First, EU-SILC contains a question on general self-rated health (SRH) in the form of a standardised question recommended by the World Health Organisation.[4] The originally five answer-categories to the question were collapsed into a binary indicator capturing whether individuals reported 'less than good' ('bad' or 'very bad') or 'good' ('very good', 'good' and 'fair') health. Thereby SRH is one of the most widely used measure of health in population surveys (Simon, De Boer et al. 2005) and has been found to be a strong predictor of a range of more objective health outcomes including mortality (Heistaro, Jousilahti et al. 2001; Marja 2009). Secondly, a question about global chronic morbidity asked respondents whether suffered from or had any chronic (long-standing) illness or conditions in the form of health problems. Answers to this question were kept in its original binary coding ('no' or 'yes)'. Thirdly, respondents were asked if they had been limited in activities, which people normally do, in the last six months due to health problems. The answer categories ranged from 'severely limited', 'limited but not severely' to 'not limited at all'. The answers to this question were collapsed into a binary indicator showing if individuals had 'no' limitations or 'any' limitations at all. The question on limitations with activities (also called the Global Activity Limitation Index) was specifically designed as a basis for the calculation of healthy life expectancy across Europe and has been shown to be in good agreement with other

[4] World Health Organization-Regional Office for Europe. *Third consultation to develop common methods and instruments for health interview surveys*. Voorburg: Netherlands Central Bureau of Statistics, 1992.

indicators of physical functioning such as (Instrumental) Activities of Daily Living (I)ADL (Jagger, Gillies et al. 2010).

Control variables

In principal, covariates do not play a major role in the IV-framework since the latter can be conceptualised as a form of a randomised trial. One of the central assumptions of the latter is that, under the condition that treatment is randomly assigned, the treatment-effects will be the same for all participants irrespectively of other individual characteristics. However, the conditional independence as well as the exclusion restriction on which IV-estimation is based may be more likely to be valid after controlling for certain covariates which could determine the likelihood to respond to an instrument (Angrist and Pischke 2009). Another reason for including covariates is that these may reduce some of the variance in the dependent variable and by doing so improve the precision of the 2SLS estimates.

In this background, to account for factors which on the one side may affect the likelihood to retire and on the other side are associated with health, the following sets of controls were included in the analysis: Regarding demographic characteristics, respondents' age as well as marital status ('married', 'never married' or 'separated, divorced' or widowed'). As socio-demographic controls the highest educational level attained according to three categories of the International Standard Classification of Education (ISCED) ('primary education', secondary education' or 'tertiary education') as well as quintiles of (adjusted) disposable household income were included.

Statistical approach

Traditionally studies assessing the relationship between retirement and health have used cross-sectional as well as longitudinal micro-data. Thereby cross-sectional studies typically compare the health of retirees with that of workers whereas longitudinal studies have compared changes in health outcomes between individuals retiring in a given time period and those in continuous employment. Studies of this kind have typically estimate equations of the form:

$$Y_{i(t)} = \alpha + \beta D_{i(t)} + \beta X_{i(t)} + \mu_{i(t)} \quad (1)$$

whereas $Y_{i(t)}$ is an individual health outcome, α an intercept, $D_{i(t)}$ a dummy whether an individual *i* is working or retired (at time *t*), $\beta X_{i(t)}$ a set of individual- (and time-)specific covariates and $\mu_{i(t)}$ an error term. However, both, the Ordinary Least Square (OLS) approach with cross-sectional data as well as the random/fixed-effects approach with longitudinal data pose a problem to the identification of the effects of retirement on health due to the circumstance that individuals self-select themselves into retirement. Thus the main regressor of interest $D_{i(t)}$ may be correlated with the unobservables $\mu_{i(t)}$. Given that health has been found to be a major determinant of individuals' labour force participation and retirement behaviour (e.g. Bound et al. 1999; Disney, Emmerson et al. 2006) there is particular reason to assume that estimates of the effect of retirement on health relying traditional identification strategies are not consistent. Furthermore, as individuals with comparatively worse health are more likely to retire earlier – and *vice versa* – estimates of the effects of retirement on health are likely to be biased upwards, i.e. overestimating the negative effects of retirement on health.

In situations in which consistent estimation of an explanatory variable is not possible as in the above case the IV-approach, which is widely used by economists, but has only recently been introduced in the medical and gerontological literature[5], can produce consistent estimates of $D_{i(t)}$. More specifically, the approach exploits variation in a third variable (instrument) which is not part of the main equation but correlated with the endogenous variable ($D_{i(t)}$) conditional on other covariates. Thereby the IV-approach is based on two central

[5] For an application in Gerontology see: http://psychsocgerontology.oxfordjournals.org/content/early/2012/03/15/geronb.gbs033.full

assumptions, namely that the instrument needs to be sufficiently correlated with the endogenous regressor of interest and that the instrument may not be correlated with the error term (Hernán and Robins 2006; Martens et al. 2006). Whereas the first assumption (or relevance) can be assessed empirically (Angrist and Krueger 2001; Stock, Wright et al. 2002) the second assumption (or exclusion restriction) cannot. As a consequence, the choice of an instrument relies predominantly on a convincing theoretical argument.

As argued in the next paragraph, SPA presents a valid instrument for the estimation of the effects of retirement on health as the latter can be shown to be sufficiently correlated with individuals' probability of retirement and also since there is little reason to assume that being below or above the SPA would influence health directly. Based on these assumptions, the following estimation strategy exploits the circumstance that being above the country-specific age-threshold of the SPA leads to a discontinuous increase in the probability of retiring. Using a standard two-step estimation procedure, first, the individual probability of being retired ($D_{i(t)}$) at time t is estimated conditional on a binary indicator of whether an individual is below or above the country-specific early- and full-retirement ages ($Z_{i(t)}$) as well as a set of covariates ($\beta X_{i(t)}$), including age:

$$D_{i(t)} = \gamma + \beta_1 Z_{i(t)} + \beta_2 Z_{i(t)} + \beta X_{i(t)} + \varepsilon_{i(t)} \quad (2)$$

The predicted values of this first stage ($\hat{D}$) are then used to estimate:

$$Y_{i(t)} = \alpha + \beta \hat{\mathrm{D}}_{i(t)} + \beta X_{i(t)} + \mu_{i(t)} \quad (3)$$

Since there are more instruments than endogenous regressor in equation 2 the above estimation approach can be conceptualised as a two-stage least square (2SLS) approach (Wooldridge 2009). The models estimated thereby use a linear probability model for binary outcomes as it is more robust to specification errors than non-linear approaches and therefore common practice in the IV-framework (Angrist 2001).[6] Thereby all models include country-dummies (results not shown).

State pension ages as a credible instrument

As mentioned in the previous paragraph, for any instrument to be valid it has to satisfy the assumption of being uncorrelated with the error term, i.e. that the instrument has no direct effect on the outcome except through its effect on the endogenous regressor (or treatment). Since this central assumption cannot be verified directly from the data, one has to rely mainly on a convincing theoretical argument. State pension ages have been used as instrument for retirement behaviour in several recent studies and have been found to be valid as well as relevant (e.g.: Coe and Zamarro 2011; Neuman 2008; Rohwedder and Willis 2010).

Thereby the motivation for using age related eligibility thresholds as instruments is derived from the empirical observation that that there exists a strong relationship between social-security incentives to quit work and the labour force (Blöndal and Scarpetta 1999; Disney and Johnson 2001; Duval 2003; Gruber and Wise 1998; Gruber and Wise 1999, 2004). When looking at cross-national differences one finds that older workers' employment rates are lower in Central or Southern Europe with relatively higher retirement incentives than in English-speaking or Nordic countries (Hofäcker 2010). Furthermore on the individual level studies by Gruber, Wise et al. (Gruber and Wise 2004) have shown empirically that there is a significant relationship between the availability of (early) retirement benefits and the age pattern of retirement. Thus in nearly all countries included in their studies

[6] To assess the robustness of the linear probability model, the following checks were performed: Firstly, an analysis of the predicted probabilities from the linear probability model showed that practically all probabilities fell into the 0-1 bounds of probability, reducing potential concerns with the chosen specification. Secondly, the IV-models presented in the following paragraph were calculated using the IV Probit technique. However, the marginal effects as well as the significance were qualitatively similar. These findings are in general agreement with those of Rassen et al. (2009) who re-analysed three studies which had used linear probability (2SLS) models for binary outcomes using a logistic method, concluding that few substantive differences between the two methods.

a large proportion of individuals retires around the legal retirement ages (Gruber and Wise 2004: 21). Since retirement is undoubtedly a highly complex phenomenon depending on individuals as well as contextual circumstances, using the legal retirement ages as instrument does not assume retirement would be perfectly predicted by these provisions. Much more it is assumed that the eligibility thresholds have a significant effect on individuals' retirement behaviour as being above the age-specific thresholds represents a discontinuous increase in the incentives to retire. That the latter is indeed the case in the present sample will be discussed in the next section.

Whereby legal retirement ages are assumed to have an effect on individuals' retirement timing, there seems to be no reason to assume that being above this threshold should have a direct effect on health. Furthermore there seems to be little reason to assume that there would be discontinuous changes in health status around the legal retirement age in a country which are not picked up by controlling for age.

Results

First stage results

As discussed above, the instruments in order to be relevant have to be sufficiently correlated with the endogenous regressor. In this case the question is whether being above or below the country-specific early and standard retirement ages is a sufficiently strong predictor for whether individuals are retired or working. In order to test the validity of one or several instruments, one can regress the exogenous regressor (being retired) on all right hand variables in the equation. Table 3 thus presents the results of estimating equation 2 whereby a positive coefficient indicates that it is associated with a higher probability of being retired. As expected, older individuals are generally more likely to be out of the workforce than their younger individuals. Never married, separated, single or divorced women are more likely to be in paid employment than their married peers. For men marital status does not seem to be significantly related to labour market participation at older ages. Both, for men and women individuals with secondary or tertiary education are less likely to be retired than individuals with only primary education as the negative coefficients suggest. Similarly, individuals with higher household incomes are less likely to be retired than individuals whose household income falls into the lowest quintile. Part time working women and men are less likely to be retired than individuals working full time. Looking at the coefficients for being above the country-specific early and/or state pension ages one can see that for men as well as women both indicators are highly significantly related to labour market participation in the expected direction. Thus for men as well as women, being above the early retirement threshold increases the probability of being retired by about 0.15 points. In addition, being above the state pension increases the likelihood of being retired by 0.82 points for men and 0.13 points for women. Furthermore, the F-statistics of the endogenous regressor in the first stage regression, both for women (69.87) and men (37.18), and the associated p-value of <0.00 of an F-test of excluded instruments show that the endogenous regressor is not weakly identified by the instruments. Besides tests to assess the relevancy of an instrument, the availability of two instruments makes it also possible to assess whether one of the instruments is correlated with the error term. However, results of the Sargan-test of overidentifying restrictions (Baum, Schaffer et al. 2003) show that the instruments are uncorrelated with the error term and thus correctly excluded from the estimation.

Instrumental variables results

Table 4 show the results of estimating equations 2 and 3 for the entire sample, thus including men as well as women. Thereby the first three columns display the coefficients of the linear probability models for the three health outcomes (equation 2). The last three columns show the results of the IV-estimation as shown in equation 3. A positive sign of a covariate means that it is associated with better health and *vice versa*.

By looking first at the results of the linear probability models for the entire sample in the first three columns (Table 4), one can see that older individuals have in average worse health than younger ones. Never married individuals as well as separated, widowed or divorced individuals are in average in worse health than their married counterparts. Throughout having more than primary education is significantly associated with reporting better health. Similarly, being in a higher quintile of household income is associated with better health. Individuals reporting themselves as working part-time are in worse health than those working full-time. The coefficients of the random-effects models for the dummy of being retired show that the latter is significantly associated with reduced probabilities of reporting good SRH (-0.045 points), no limitations in ADL (-0.090 points) as well as having no chronic conditions (-0.099 points). The results of the IV-estimation, displayed in the three right-hand columns, show that the point-estimates for all covariates except for being working part time or retired are unchanged. Thus when controlling for the endogeneity of retirement timing, being retired leads to higher chances of reporting better SRH (0.034 points) as well as having no limitations in ADL (0.040 points). No significant association exists for the relationship between being retired and chronic conditions.

Looking at the results for men (Table 5) one can see that the coefficients of the covariates are comparable to those in the previous models. Similarly to the combined models, also for men being retired is significantly associated with reduced probabilities of reporting good SRH (-0.046 points), no limitations in ADL (-0.096 points) as well as having no chronic conditions (-0.104 points). However, when adjusting for health-selection into retirement in the IV-models, one can see that retirement leads to higher chances of reporting better SRH (0.034 points) as well as having no limitations in ADL (0.068 points). The sizes of these effects are thereby comparable to those for the entire sample. Also for men only, no significant effects of retirement exist for chronic conditions.

Table 6 shows the results of estimating equation 2 for women only. As their male counterparts, working part time or being retired is significantly associated with reporting worse health for all three health-outcomes (SRH=-0.047; ADL=-0.087; Chronic=-0.094). Thereby the strength of the association between being retired and the three health outcomes is practically identical as that for men. Looking at the results of the IV-models in the three right-hand columns, one can see that for women being retired does not lead to significant changes in health as the simple random-effects models would suggest. As such estimates for all other covariates are almost identical to the estimation of equation 2 and also to the results for men.

In addition to separate analyses for men and women, Table 7 shows the results of the IV-models separately for individuals with primary or secondary education and tertiary education. As the results show, for individuals with comparatively lower educational attainment, retirement leads to higher chances of reporting good-SRH (0.037 points) as well as reporting no limitations in ADL (0.058 points). Thereby no significant effects of retirement on chronic conditions seem to exist. For higher educated individuals, no significant effects of retirement exist on either SRH or ADL. Nevertheless the results suggest that for this group retirement significantly increases the likelihood of having a chronic condition (-0.106 points).

Robustness checks

To assess the robustness of the results, a number of checks were performed. First, respondents' self-defined activity status was checked against the information about the actual hours worked. Individuals were classified as working full-time if they reported working at least 35 hours per week and as working part time if they worked less than 35 hours. Individuals were classified as retired if they reported no hours of actual work per week. This check only led to very marginal changes in the classification of economic activities and the results of the IV-models were virtually unchanged. Secondly, besides the linear term for age, the latter was also included as an exponential term as well as logarithmic term. However, only the exponential term of age was significantly related to SRH, but the effect size was very small and did not affect the main results. Furthermore the two instruments – early- as well as full-SPA, were used individually to estimate the effects of retirement on health. Thereby the results produced by both instruments are very robust and similar to those using both instruments at the same time. In addition, reducing the age-band to ages 50 to 60 did not affect the main results. Likewise, changing the reference category for the labour market status from working full-time to working full- or part-time, did not affect the results to a noteworthy degree. Lastly, also excluding those countries which do not have explicit provisions for early-retirement from the analysis did not significantly affect the robustness of the results.

Discussion and implications

Interpretation and relationship to other studies

The principal aim of this study was to analyse if retirement has effects on individuals' health. Drawing on a large longitudinal dataset of individual data for 15 European countries, this study found that when using a standard random-effects approach, for both men and women retirement was significantly associated with higher chances of reporting bad SRH, limitations in ADL as well as chronic conditions. However, when using an IV-approach which adjusts for selection into retirement due to health, the negative relationship between retirement and health is significantly weakened or even reversed. Thus in average this study found that retirement leads to significant improvements in SRH as well as ADL whereas these effects seem to be driven by men and comparatively lower educated individuals.

The positive effects of retirement on health may be explained through a series of factors. For example retirement has been linked to several positive changes in health related behaviours such as increases in leisure-time physical activity (e.g. Evenson, Rosamond et al. 2002; Henkens et al. 2008; Sjösten, Kivimäki et al. 2012), smoking cessation (Lang, Rice et al. 2007) or decreased alcohol consumption (Brennan, Schutte et al. 2010). In this context a study of older Dutch workers found that many regarded retirement as a health investment strategy (Henkens 1999). Especially older workers in manual jobs with comparatively lower job-control may disproportionally suffer from detrimental health-effects (Rodin 1986; Schieman 2001) and retirement thus have a health-preserving effects. Retirement may also increase individuals' engagement in social activities, which have been linked to positive health outcomes (Smith and Christakis 2008). One study amongst older individuals in eleven European countries found that retiring significantly increased the engagement in formal social connections such as memberships to clubs or organisations (Kohli, Hank et al. 2009).

Thereby, the circumstance that the IV-regression did not show any significant effects of retirement on health for women may be related to women's lower attachment to the labour market, especially for the cohorts currently retiring. For example a comparative analysis of life-histories of women above the age of 50 in eleven European countries showed that less than 50 percent had been working full-time since the age of 20 (Lyberaki, Papadoudis et al. 2011). Another explanation may be related to gender differences in the exposure to hazardous working conditions. In the European Union more than 70% of the jobs as in crafting, plant or machine operating[7] are exercised by men (Fagan and Burchell 2002). Also men are much more likely to be exposed to material and physical environmental hazards. Although this should not hide the complex labour market situation of women and the negative health effects of precarious employment, overall for women retirement may have less of a protective effect than for men.

[7] ISCO-codes 7 and 8.

The circumstance that the positive effects of retirement on health are particularly pronounced for lower educated individuals may also be explained by differences in occupations and related working conditions. In this context it is well documented that individuals with comparatively lower education are significantly more likely to be working in manual- or blue-collar-jobs than higher educated individuals. Occupations can thereby affect health directly, e.g. through physical working conditions (Baker 1985; Karasek, Baker et al. 1981), or indirectly for example via occupational prestige, income or job-control (Bosma, Marmot et al. 1997; Stansfeld, Fuhrer et al. 2002). Numerous studies have found that occupation has a significant impact on health, generally showing a marked social gradient (Ferrie, Martikainen et al. 2005; Marmot, Ryff et al. 1997). There is also evidence that these disparities widen over the life-span as a result of risk-accumulation (Mirowsky and Ross 2008) and also that occupation-related chronic stress may lead to an overproduction of cortisol and thereby result into accumulative (negative) health-effects (Seeman, McEwen et al. 1997). Also, in average individuals employed in lower occupational categories are significantly more likely to report poor-SRH (Gueorguieva, Sindelar et al. 2009). The finding that retirement has positive effects on SRH as well as limitations in ADL for lower educated individuals may indicate that for this group retirement may represent a partial relief from the burden of poor health and working conditions.[8]

Although individuals in retirement are significantly more likely to report chronic conditions, with the exception of the effects for higher educated individuals, the results of this study suggest that these are not causal. Whereas for certain individuals later life events linked to retirement may amplify specific (pre-)conditions, this should only be the case for those individuals with the particular

[8] Very few studies have looked at differences between occupations. One study of the French GAZEL-cohort by Westerlund et al. (Westerlund, Mika et al. 2009) found that "A poor work environment and health complaints before retirement were associated with a steeper yearly increase in the prevalence of suboptimum health while still in work, and a greater retirement-related improvement."

preconditions and exposures (Ben-Shlomo and Kuh 2002). Rather than being triggered directly by retirement, chronic conditions - which in general have complex aetiologies which develop over a longer time-period – may be the more a result of cumulative exposures over the life-course. In general the connection between retirement and chronic diseases, reported in other studies (e.g. Behncke 2011) may be overestimated since retired individuals may be more likely to be diagnosed with certain conditions as a result of increased use of primary care services after retirement found in several studies (e.g. Wallman, Burell et al. 2004; Weaver 1996).

The results of this study are largely consistent with a number of previous studies using exogenous variation in retirement. For example Neuman (2008) contrasts the results of an OLS- with that of an IV-approach with a sample from the US. Whereas the OLS-results showed that for both women and men retirement was associated with worse SRH, higher numbers of ADL as well as chronic conditions, the IV-results showed that retirement led to significant improvements in SRH for men and women as well as a lowered risk of reporting limitations in ADL for women. Similarly Coe and Zamarro (2011) use a representative sample of men from 11 European countries finding that retirement led to a decrease in the probability of reporting fair, bad or very bad health. Also Coe and Lindeboom (2008) for the US find that for men retirement led to improvements in SRH, whereas no significant effects were found for ADL or chronic conditions.

Whereas the majority of recent studies using IV- or related approaches have found that retirement leads to improvements in health, notably two studies have come to different conclusions. For example Behncke (2011) used longitudinal data for England finding that amongst others retirement led to a significantly increased risk of experiencing several chronic conditions such as cancer or diabetes. However, in how far retirement was indeed the cause of these conditions may be questionable for some of the reasons mentioned above. Furthermore Dave et al. (2008) for the US found that retirement led to an increase in the number of limitations in ADL and mobility as well as the probability to report poor-SRH. Nevertheless, results from fixed-effects approaches, as the one by Dave et al. (2008), which condition on good-health before retirement may still be subject to bias if sources of endogeneity change over time (Neuman 2008).

Limitations

This study used IV-techniques to overcome the problem of endogeneity in the relationship between health and retirement. Thereby it has been argued that the latter is a clear improvement over standard regression methods which may lead to severe biases when applied to the above question. However, in how far IV is in fact an improvement depends on the question if the assumptions introduced by this approach are met. On the one hand, the central assumption thereby is that the chosen instruments have no direct effect on the outcome. As it has been argued, there is no reason to assume that being over the SPA in a given country would have a direct effect on an individual's health after controlling for age. On the other hand the included instruments have to be significantly related to endogenous regressor of interest. In agreement to several other studies which have found similar results (references), the first-stage results showed that the country-specific SPA indeed significantly predict if an individual is retired. In the light of existing criteria to evaluate the use of IV-applications, SPA therefore represent a valid and relevant set of instruments. However, even if these two assumptions are met, there may still be limits to which the results obtained by this approach can be generalised. To answer this question it is important to distinguish between the so called average treatment effect of the treated (ATET) and the so called local average treatment effect (LATE). IV-regression, as it is commonly accepted (Angrist and Imbens 1995; Imbens and Angrist 1994), estimates a LATE which is the effect of the treatment for the subpopulation of compliers. In consequence the results of this study should be interpreted as the effects of retirement on health for individuals who retired because they reached the SPA

This study relied on self-reported health rather than objective measures which may potentially lead to biases especially in a comparative perspective. Whereas future research should aim to test the robustness of the results by using objective health measures such as biomarkers, numerous studies have found that SRH is a very useful summary measure of physical health (more references: (Heistaro et al. 2001). However, studies have found that the measure may be sensitive to the cultural environment (Eikemo, Bambra et al. 2008; Jylhä, Guralnik et al. 1998; Marja 2009). The strength of this study is that the information all comes from the same survey using very strict translation procedures. Furthermore, although it may be problematic to compare the health-status on a population level based on the SRH-categories, on an individual level using 'fair health' as the cut-off-point between 'good' and 'bad' health is widely regarded as a sensible approach (Eikemo et al. 2008). For example Jürges (2007) comparing the congruence between the SRH-categories with several objective health outcomes using data for 11 European countries showed that the variation around the above cut-off-point is relatively small.

One potential source of bias is the fact that SPA are fully predictable by individuals. As a result workers may for example adjust their health-behaviours already prior to their retirement. In this case the effects of retirement on health may be negligible. In addition, as discussed by Coe and Lindeboom (2008) potential effects of retirement on health may not entirely coincide with the actual timing of retirement. For example (mental-) health may already start to improve or equally worsen in anticipation of retirement, similar to the so called "Ashenfelter-dip" (Ashenfelter and Card 1985). However, for the US Coe and Lindeboom (2008) compare the IV-estimates of a model using SPA and one using the offering of early-retirement windows by employers. Since the latter is generally unexpected, this provides a good test of the robustness of using the SPA as instrument. Their findings show that the (positive health-) effects found when using the SPA as instruments are smaller than in the models using the offers of early-retirement windows. In this light it thus seems rather likely that the results of this study may in tendency rather underestimate potential positive effects of retirement.

Implications

How retirement affects health is an important question in the context of rising costs for elderly care and planned increases in the retirement ages in most Western European countries, in particular given the imminent retirement of the large cohorts of baby boomers. Thereby, the view that retirement would have negative effects on health is widespread, both in the academic literature as well as in the political and public debate.[9] As expected the results of this study show that – in contrary to the simple models – the IV-estimates in most cases do not support this hypothesis. At the very least, this study provides strong evidence against the widespread notion that retirement would be bad for the health of older individuals. Despite limitations, two main implications may be drawn from this. On the one hand, this study further highlights the importance of taking into account the negative health selection in models trying to identify effects of retirement on health. On the other hand, the finding that particularly for men and lower educated individuals retirement may have health-preserving effects, points out that uniform increases in retirement ages may have trade-offs as these may exacerbate health-declines at older ages and finally lead to higher costs for health- and elderly-care.

[9] Some news-headlines even suggest that 'retirement could kill you' (http://www.telegraph.co.uk/health/healthnews/6327956/Could-early-retirement-kill-you.html); or that 'complete retirement would be bad for you' (http://news.bbc.co.uk/1/hi/health/8307750.stm).

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ANNEX

Table 1: Early- and Full-State Pension Ages (SPA) for Men and Women in 15 European Countries

Country	Men	Women
Austria	65 (62)	60 (57)
Belgium	65 (60)	64 (60)
Denmark	65 (NE)	65 (NE)
Finland	65 (62)	65 (62)
France	60 (57)	60 (57)
Greece	65 (57)	65 (57)
Ireland	65 (NE)	65 (NE)
Italy	65 (57)	60 (57)
Luxemburg	65 (57)	65 (57)
Netherlands	65 (60)	65 (60)
Norway	67 (NE)	67 (NE)
Portugal	65 (55)	65 (55)
Spain	65 (60)	65 (60)
Sweden	65 (61)	65 (61)
United Kingdom	65 (NE)	60 (NE)

Notes: *Early-State Pension Ages in brackets. NE indicates that there exists no Early-SPA in the respective country.*
Source: *Mutual Information System on Social Protection (MISSOC) (European Commission 2005-2008) for to the years 2005 to 2008.*

Table 2: Sample Characteristics

	Men		Women	
	n	*% (mean)*	*n*	*% (mean)*
Age	77,926	(61)	58,725	(60.92)
50-54	18,379	23.59	14,414	24.54
55-59	16,981	21.79	12,491	21.27
60-64	15,991	20.52	11,674	19.88
65-69	14,335	18.40	10,861	18.49
70-74	12,240	15.71	9,285	15.81
Marital status				
Married	63,207	81.11	38,774	66.03
Never Married	6,124	7.86	4,960	8.45
Separated, Widowed, Divorced	8,595	11.03	14,991	25.53
Education				
Primary Education	21,057	27.02	15,400	26.22
Secondary Education	38,433	49.32	30,060	51.19
Tertiary Education	18,436	23.66	13,265	22.59
Income				
Income quint. 1	10,574	13.57	7,869	13.40
Income quint. 2	13,533	17.37	10,064	17.14
Income quint. 3	15,148	19.44	10,934	18.62
Income quint. 4	16,923	21.72	12,885	21.94
Income quint. 5	21,748	27.91	16,973	28.90
Labour market status				
Working full time	47.95	47.95	19,782	33.69
Working part time	3,507	4.50	9,922	16.90
Retired	37,050	47.55	29,021	49.42
SRH				
bad	6,651	8.54	5,744	9.78
good	71,275	91.46	52,981	90.22
ADL				
limited	19,640	25.20	17,084	29.09
not limited	58,286	74.80	41,641	70.91
Chronic				
yes	26,287	33.73	21,696	36.95
no	51,639	66.27	37,029	63.05

Countries				
AT	4,778	6.13	4,325	7.36
BE	4,112	5.28	3,135	5.34
DK	2,100	2.69	1,987	3.38
ES	9,066	11.63	4,677	7.96
FI	2,350	3.02	2,372	4.04
FR	9,962	12.78	9,081	15.46
GR	4,687	6.01	2,943	5.01
IE	2,791	3.58	1,423	2.42
IT	16,297	20.91	10,644	18.13
LU	4,038	5.18	2,055	3.50
NL	3,644	4.68	2,747	4.68
NO	2,013	2.58	1,699	2.89
PT	3,395	4.36	2,466	4.20
SE	2,262	2.90	2,315	3.94
UK	6,431	8.25	6,856	11.67
N	77,926		58,725	

Table 3: First-Stage Results for Being Retired

	Men & Women	Men	Women
Female	0.067***		
	(0.002)		
Age	0.031***	0.034***	0.028***
	(0.000)	(0.00)	(0.00)
Never Married (ref.: Married)	-0.015***	0.010	-0.040***
	(0.004)	(0.005)	(0.005)
Separated, Widowed, Divorced	-0.015***	0.004	-0.026***
	(0.003)	(0.004)	(0.003)
Secondary Education (ref.: Primary)	-0.013***	-0.006	-0.023***
	(0.003)	(0.00)	(0.00)
Tertiary Education	-0.044***	-0.034***	-0.057***
	(0.003)	(0.00)	(0.00)
Income quint. 2 [ref.: 1st quint.]	-0.005*	-0.005	-0.007*
	(0.002)	(0.00)	(0.00)
Income quint. 3	-0.022***	-0.022***	-0.023***
	(0.002)	(0.00)	(0.00)
Income quint. 4	-0.043***	-0.042***	-0.046***
	(0.002)	(0.00)	(0.00)
Income quint. 5	-0.068***	-0.069***	-0.069***
	(0.002)	(0.00)	(0.00)
Working part-time	-0.320***	-0.357***	-0.309***
	(0.003)	(0.00)	(0.00)
Above early retirement age	0.160***	0.165***	0.150***
	(0.003)	(0.00)	(0.00)
Above standard retirement age	0.103***	0.082***	0.132***
	(0.003)	(0.00)	(0.00)
Constant	-1.361***	-1.510***	-1.139***
	(0.014)	(0.02)	(0.02)
N	160779	91611	69168
R-squared:	0.637	0.604	0.686
F for excluded instruments	33.61	37.18	69.87

Notes: The table shows the regression coefficients from a linear random-effects regression of being retired vs. working full-time for the entire sample as well as separately for men and women. All models include country-dummies (results not shown).

Table 4: Random-Effects and Instrumental Variables Results showing the Effects of Retirement on Health (Men & Women)

	Random Effects			Instrumental Variables		
	SRH	**ADL**	**Chronic**	**SRH**	**ADL**	**Chronic**
	(bad vs. good)	*(limited vs. not limited)*	*(yes vs. no)*	*(bad vs. good)*	*(limited vs. not limited)*	*(yes vs. no)*
Retired	-0.045***	-0.090***	-0.099***	0.034**	0.040*	-0.020
	(0.003)	(0.004)	(0.004)	(0.012)	(0.018)	(0.019)
Working part-time (ref.: working full-time)	-0.021***	-0.059***	-0.056***	0.007	-0.014	-0.028***
	(0.003)	(0.005)	(0.005)	(0.005)	(0.008)	(0.008)
Female	-0.009***	-0.025***	-0.006	-0.014***	-0.034***	-0.011**
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.004)
Age	-0.003***	-0.006***	-0.007***	-0.006***	-0.012***	-0.010***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Never Married (ref.: Married)	-0.017***	-0.025***	-0.017**	-0.015***	-0.023***	-0.016**
	(0.004)	(0.005)	(0.006)	(0.004)	(0.005)	(0.006)
Separated, Widowed, Divorced	-0.020***	-0.040***	-0.040***	-0.019***	-0.037***	-0.038***
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)
Secondary Education (ref.: Primary)	0.052***	0.063***	0.037***	0.053***	0.064***	0.038***
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)
Tertiary Education	0.064***	0.099***	0.057***	0.068***	0.104***	0.061***
	(0.003)	(0.005)	(0.005)	(0.003)	(0.005)	(0.005)

Income quint. 2 [ref.: 1st quint.]	0.015***	0.012**	0.003	0.015***	0.012**	0.003
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)
Income quint. 3	0.025***	0.030***	0.012**	0.027***	0.033***	0.014**
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)
Income quint. 4	0.037***	0.049***	0.023***	0.041***	0.055***	0.027***
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)	(0.005)
Income quint. 5	0.048***	0.069***	0.040***	0.055***	0.080***	0.046***
	(0.003)	(0.004)	(0.005)	(0.003)	(0.005)	(0.005)
Constant	1.034***	0.990***	1.069***	1.201***	1.266***	1.236***
	(0.013)	(0.019)	(0.020)	(0.028)	(0.041)	(0.045)
N	140952	140864	140906	140952	140864	140906
R-squared:	0.086	0.109	0.096	0.073	0.093	0.090

Notes: *The table shows the regression coefficients from a linear random-effects as well as instrumental variables regression (using country-specific SPA as instruments) of being retired vs. working full-time for the entire sample. All models include country-dummies (results not shown).*

Table 5: Random-Effects and Instrumental Variables Results Showing the Effects of Retirement on Health (Men)

	Random Effects			Instrumental Variables		
	SRH	**ADL**	**Chronic**	**SRH**	**ADL**	**Chronic**
	(bad vs. good)	*(limited vs. not limited)*	*(yes vs. no)*	*(bad vs. good)*	*(limited vs. not limited)*	*(yes vs. no)*
Retired	-0.046***	-0.096***	-0.104***	0.034*	0.068**	-0.016
	(0.00)	(0.01)	(0.01)	(0.02)	(0.03)	(0.03)
Working part-time (ref.: working full-time)	-0.029***	-0.100***	-0.087***	0.004	-0.036**	-0.053***
	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)	(0.01)
Age	-0.002***	-0.006***	-0.006***	-0.006***	-0.013***	-0.010***
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Never Married (ref.: Married)	-0.020***	-0.024***	-0.011	-0.021***	-0.025***	-0.011
	(0.005)	(0.007)	(0.008)	(0.005)	(0.007)	(0.008)
Separated, Widowed, Divorced	-0.014***	-0.029***	-0.016*	-0.014***	-0.029***	-0.016*
	(0.004)	(0.006)	(0.006)	(0.004)	(0.006)	(0.006)
Secondary Education (ref.: Primary)	0.045***	0.049***	0.030***	0.046***	0.052***	0.031***
	(0.00)	(0.01)	(0.01)	(0.00)	(0.00)	(0.01)
Tertiary Education	0.060***	0.093***	0.059***	0.064***	0.102***	0.062***
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)

Income quint. 2 [ref.: 1st quint.]	0.016***	0.015**	0.006	0.016***	0.014**	0.005
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
Income quint. 3	0.023***	0.025***	0.006	0.025***	0.027***	0.008
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
Income quint. 4	0.038***	0.046***	0.019**	0.042***	0.053***	0.023***
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
Income quint. 5	0.049***	0.070***	0.035***	0.056***	0.083***	0.042***
	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)	(0.01)
Constant	0.978***	0.898***	1.012***	1.167***	1.265***	1.210***
	(0.02)	(0.02)	(0.03)	(0.04)	(0.06)	(0.06)
N	78,192	78,193	78,194	78,192	78,193	78,194
R-squared:	0.058	0.075	0.070	0.048	0.060	0.066

Notes: *The table shows the regression coefficients from a linear random-effects as well as instrumental variables regression (using country-specific SPA as instruments) of being retired vs. working full-time for men only. All models include country-dummies (results not shown).*

Table 6: Random-Effects and Instrumental Variables Results Showing the Effects of Retirement on Health (Women)

	Random Effects			Instrumental Variables		
	SRH	**ADL**	**Chronic**	**SRH**	**ADL**	**Chronic**
	(bad vs. good)	*(limited vs. not limited)*	*(yes vs. no)*	*(bad vs. good)*	*(limited vs. not limited)*	*(yes vs. no)*
Retired	-0.047***	-0.087***	-0.094***	0.026	-0.003	-0.037
	(0.005)	(0.007)	(0.007)	(0.017)	(0.025)	(0.027)
Working part-time (ref.: working full-time)	-0.020***	-0.043***	-0.042***	0.005	-0.014	-0.022*
	(0.004)	(0.006)	(0.007)	(0.007)	(0.010)	(0.011)
Age	-0.003***	-0.006***	-0.007***	-0.006***	-0.010***	-0.009***
	(0.000)	(0.000)	(0.000)	(0.001)	(0.001)	(0.001)
Never Married (ref.: Married)	-0.010	-0.023**	-0.024**	-0.007	-0.020*	-0.021*
	(0.006)	(0.008)	(0.009)	(0.006)	(0.008)	(0.009)
Separated, Widowed, Divorced	-0.024***	-0.047***	-0.055***	-0.021***	-0.044***	-0.053***
	(0.004)	(0.005)	(0.006)	(0.004)	(0.005)	(0.006)
Secondary Education (ref.: Primary)	0.061***	0.079***	0.046***	0.062***	0.080***	0.047***
	(0.004)	(0.006)	(0.007)	(0.004)	(0.006)	(0.007)
Tertiary Education	0.069***	0.105***	0.058***	0.073***	0.110***	0.061***
	(0.005)	(0.008)	(0.008)	(0.005)	(0.008)	(0.008)

Income quint. 2 [ref.: 1st quint.]	0.014***	0.008	-0.001	0.015***	0.009	-0.001
	(0.004)	(0.006)	(0.007)	(0.004)	(0.006)	(0.007)
Income quint. 3	0.029***	0.038***	0.019**	0.032***	0.040***	0.020**
	(0.004)	(0.007)	(0.007)	(0.004)	(0.007)	(0.007)
Income quint. 4	0.035***	0.052***	0.027***	0.040***	0.057***	0.030***
	(0.004)	(0.007)	(0.007)	(0.004)	(0.007)	(0.007)
Income quint. 5	0.048***	0.068***	0.044***	0.055***	0.076***	0.049***
	(0.005)	(0.007)	(0.007)	(0.005)	(0.007)	(0.008)
Constant	1.014***	0.931***	1.050***	1.144***	1.084***	1.156***
	(0.020)	(0.029)	(0.031)	(0.036)	(0.053)	(0.057)
N						
R-squared:	0.073	0.083	0.075	0.206	0.299	0.327

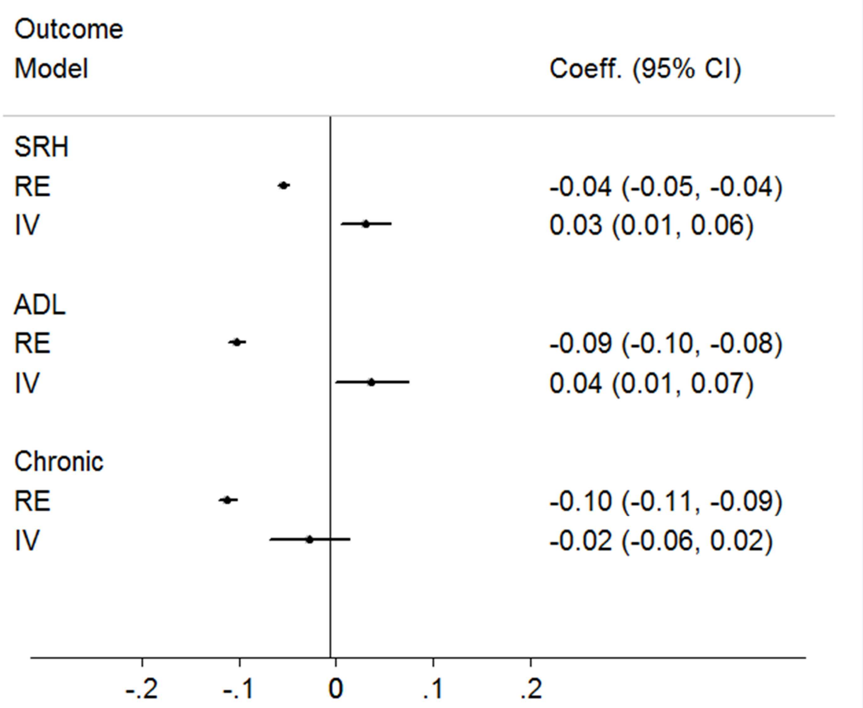
Notes: The table shows the regression coefficients from a linear random-effects as well as instrumental variables regression (using country-specific SPA as instruments) of being retired vs. working full-time for women only. All models include country-dummies (results not shown).

Table 7: Instrumental Variables Results Showing the Effects of Retirement on Health by Educational Attainment (Men & Women)

	Primary or Secondary Education			Tertiary Education		
	SRH	**ADL**	**Chronic**	**SRH**	**ADL**	**Chronic**
	(bad vs. good)	*(limited vs. not limited)*	*(yes vs. no)*	*(bad vs. good)*	*(limited vs. not limited)*	*(yes vs. no)*
Retired	0.037**	0.058**	-0.004	0.008	-0.058	-0.106*
	(0.014)	(0.020)	(0.021)	(0.020)	(0.038)	(0.046)
Working part-time (ref.: working full-time)	0.009	-0.008	-0.020*	-0.005	-0.044**	-0.062***
	(0.006)	(0.009)	(0.010)	(0.007)	(0.014)	(0.017)
Constant	1.240***	1.313***	1.281***	1.110***	1.108***	1.072***
	(0.032)	(0.045)	(0.048)	(0.049)	(0.092)	(0.111)
N	108,684	108,584	108,620	32,268	32,280	32,286
R-squared:	0.052	0.063	0.068	0.017	0.046	0.058

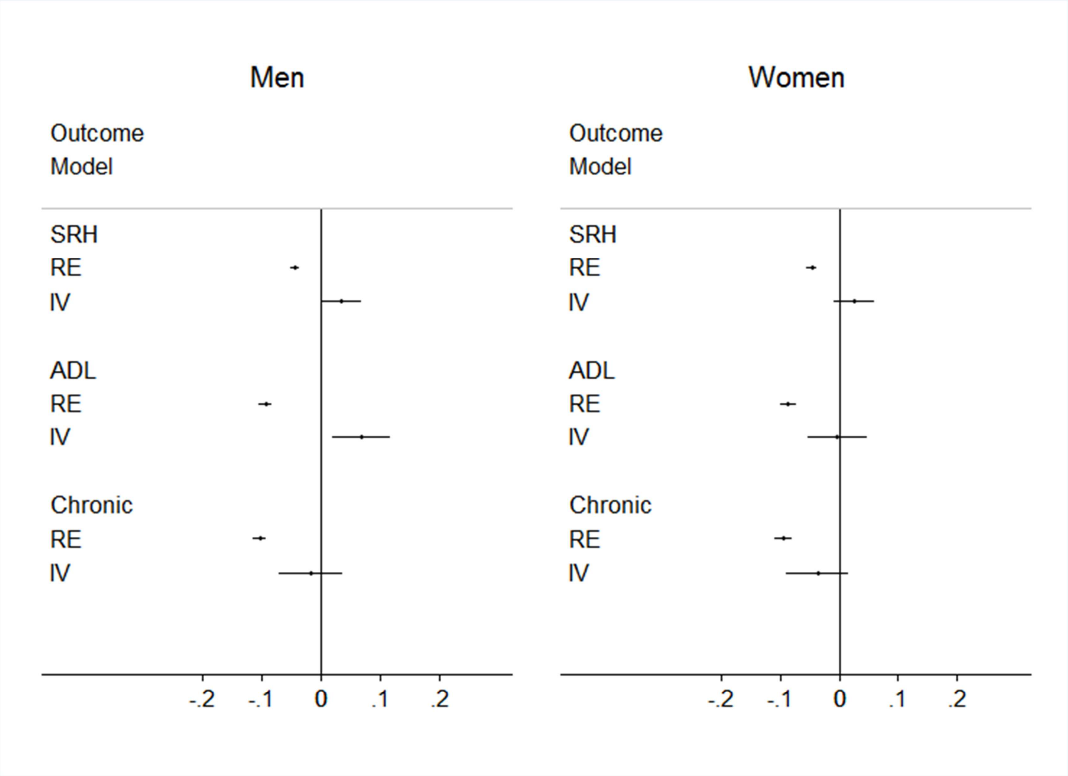
Notes: The table shows the regression coefficients from a linear instrumental variables regression (using country-specific SPA as instruments) of being retired vs. working full-time separately for individuals with primary or secondary vs. individuals with tertiary education. All models include country-dummies (results not shown).

Figure 1: Random-Effects and Instrumental Variables Results showing the Effects of Retirement on Health (Men & Women)



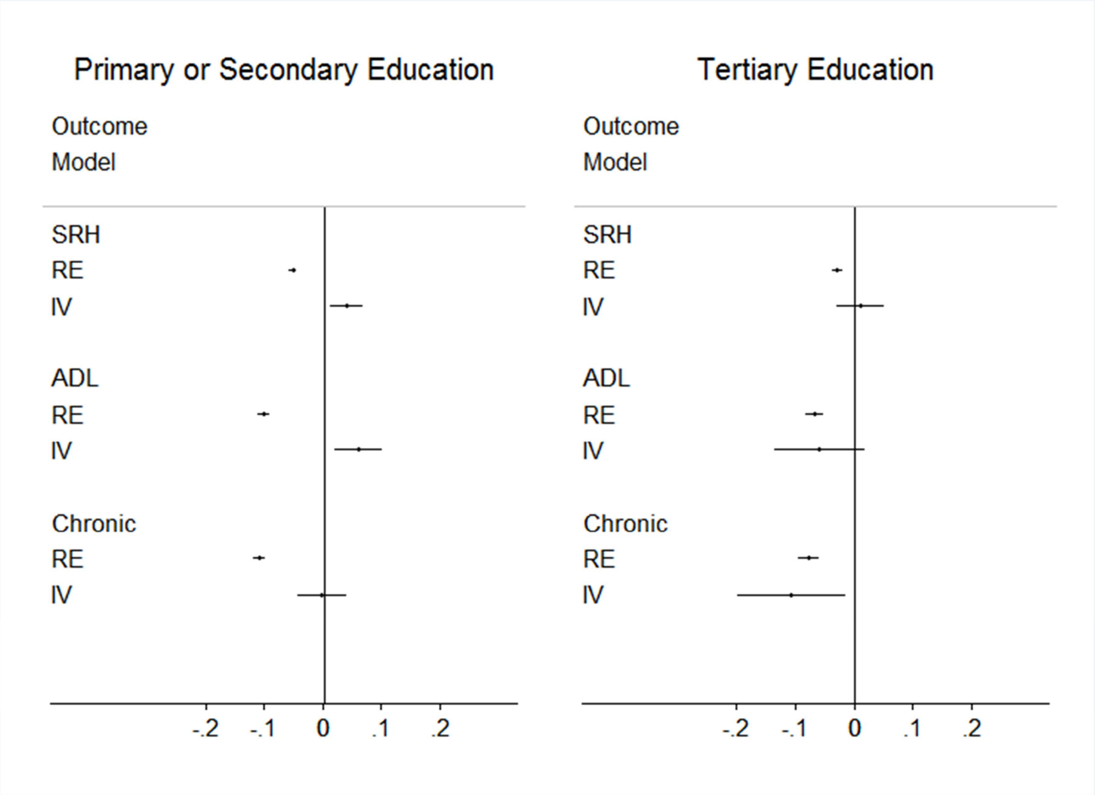
Notes: The figure compares the point estimates and 95% confidence intervals for the three health-outcomes between the random-effects (RE) and instrumental variables (IV) models as shown in Table 4.

Figure 2: Random-Effects and Instrumental Variables Results Showing the Effects of Retirement on Health (Men and Women Separately)



<u>Notes:</u> The figure compares the point estimates and 95% confidence intervals for the three health-outcomes between the random-effects (RE) and instrumental variables (IV) models as shown in Tables 5 and 6.

Figure 3: Instrumental Variables Results Showing the Effects of Retirement on Health by Educational Attainment (Men & Women)



<u>Notes:</u> The figure compares the point estimates and 95% confidence intervals for the three health-outcomes between the random-effects (RE) and instrumental variables (IV) models as shown in Table 7.