Labour Economics 76 (2022) 102185

Contents lists available at ScienceDirect

Labour Economics

journal homepage: www.elsevier.com/locate/labeco

Does retirement affect voluntary work provision? Evidence from Europe and the U.S.

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ARTICLE INFO

JEL codes:
J22
J26

Keywords:
Retirement
Voluntary work
Instrumental variables
Europe
United States

ABSTRACT

We examine whether retirement has a causal effect on the frequency of voluntary work provision in Europe and the U.S. We draw on data from the English Longitudinal Study of Ageing, The Irish Longitudinal Study on Ageing, the Survey of Health, Ageing and Retirement in Europe and the Health Retirement Study for the period 2009–2017 and use eligibility ages for old age pensions in an instrumental variable estimation to address endogeneity. We find that retirement increases the frequency of voluntary work provision in all countries.

1. Introduction

Voluntary work provision contributes to the functioning of many societies around the globe. Many non-profit organizations - such as charities, hospitals, care homes, sports clubs, or religious and political groups - rely on volunteers for their activities. Voluntary work, whether provided formally through an organization or informally between neighbours, can help maintain or even improve social cohesion (Komp et al., 2012). Volunteers benefit from their work as well by engaging in an activity that is perceived as meaningful and enhances their self-esteem (Okun et al., 1998). Volunteering is associated with better health and well-being (Luo et al., 2019; Nazroo 2015) and is thus considered part of an "active ageing" strategy (Chiao, 2019; Luo et al., 2019).

Older individuals form a vital part of the volunteer workforce. In the UK, Ireland, the European Union, and the U.S., levels of engagement in voluntary work among individuals aged 65 and above are comparable to engagement levels across the whole population. The participation rate in formal volunteering for the adult population as a whole was reported at 41%, 28%, 19% and 25%, respectively, compared to rates of 37% (UK), 28% (Ireland), 21%[1] (EU-28) and 24% (U.S.) among the over 65s (Bureau of Labor Statistics, 2016; Central Statistics Office, 2015; Eurostat, 2017; Office for National Statistics, 2017).

Academic studies have proposed activity substitution (Chambré, 1984; Mutchler et al., 2003; Tang, 2015) to explain the sustained engagement of older people in voluntary work, despite declining health. Retired individuals and those approaching retirement begin to engage or expand their engagement in voluntary work as they withdraw from paid work. However, across the lifespan individuals have complex motivations for volunteering, including career advancement (Okun et al., 1998). Many volunteers combine employment and voluntary work throughout young adulthood and middle age. Thus, activity complementarity has been proposed as another hypothesis (Mutchler et al., 2003; Tang, 2015), suggesting that individuals tend to either engage in both paid and voluntary work or refrain from both types of activities at the same time. If the activity complementarity hypothesis held for individuals around retirement age, it would imply that voluntary work provision decreases after retirement. Therefore, at this life stage, activity substitution and activity complementarity can be considered as competing hypotheses. Whether retirement affects voluntary work provision positively or negatively remains an empirical question – one that has become more salient due to population ageing.

The workforce in many high-income countries is expected to shrink due to population ageing. Policy makers across the world have enacted reforms to increase labour force participation at older ages and extend working lives (Dudel et al., 2018; Dudel and Myrskylä, 2017) to mitigate expected labour force shortages, e.g., by raising the state pension age. If older individuals substitute employment and voluntary work, then such reforms could lead to an unintended reduction of the volunteer workforce. In contrast, activity complementarity would imply that these reforms have beneficial effects on voluntary work provision.

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[1] The figure reported for the EU-28 refers to the population aged 65-74.

https://doi.org/10.1016/j.labeco.2022.102185
Received 2 February 2021; Received in revised form 17 May 2022; Accepted 19 May 2022
Available online 21 May 2022

There is an extensive literature examining both retirement as a potential determinant of voluntary work provision as well as the consequences of volunteering for older individuals, with most studies based on cross-sectional data (see, e.g., Moen and Fields 2002, van Solinge et al. 2021, Wu et al. 2005). A few previous studies have used longitudinal data to estimate the effect of retirement transitions on voluntary work engagement (Di Gessa and Grundy, 2016; Erlinghagen, 2010; Foster-Bey et al., 2007; Mutchler et al., 2003; Tang, 2015). While the results suggest that voluntary work engagement increases after retirement, these studies do not account for the potential endogeneity of the retirement decision.

However, retirement can be spuriously related to volunteering if time-invariant and/or time-varying individual factors that affect both the retirement decision and volunteering participation are not controlled for. For example, individuals who believe that providing services to others is important might be more likely to volunteer (Mutchler et al., 2003) and more likely to stay longer in the labour market. Equally, individuals who experience a health shock or whose health deteriorates are more likely to retire early (McGarry, 2004) and less likely to volunteer (Erlinghagen, 2010). Finally, while retirement may affect volunteering, the reverse is also possible, i.e. volunteering may influence retirement decisions. For instance, people who volunteer and derive satisfaction from this activity may be more likely to retire early to devote more time to volunteering if they do not derive the same level of satisfaction from engagement in the labour market.

To our knowledge, only the studies by Laferrère (2016), Atalay et al. (2019) and Zhu (2021) address the potential endogeneity of retirement to volunteering by using state pension ages for early and normal retirement in an instrumental variable (IV) analysis. Laferrère (2016) uses data from the Survey of Health, Ageing and Retirement in Europe for the years 2004–2011 and estimates the pooled effects of retirement on several different social activities, including voluntary work provision, across 10 continental European countries. Atalay et al. (2019) use data from the 2012 and 2016 waves of The Household, Income and Labour Dynamics in Australia (HILDA) study to examine the effect of retirement on cognitive functioning in Australia, and consider voluntary work provision as a potential mechanism. Zhu (2021) also uses HILDA data to estimate the effect of retirement on voluntary work provision. All three studies find that retirement significantly increases engagement in voluntary work.

Our comparative study considers the impact of retirement on formal voluntary work provision in Europe and the U.S. Formal volunteering refers to non-paid work provided in the context of an organization. We provide separate analyses for England, Ireland, Northern, Central, and Southern Europe, and the U.S. while conducting a harmonized analysis to facilitate comparisons across countries. There are notable differences across these institutional contexts, including, e.g., *(i)* participation rates in formal volunteering (discussed above), *(ii)* whether social services are predominantly provided by the government (Northern and Central Europe), by the family (Southern Europe) or by volunteer services and charitable organisations (England, Ireland, and the U.S.), and *(iii)* in the structure of the labour market. A comparative approach allows us to determine to which extent the behavioural response to the retirement transition is shaped by such institutional differences. Moreover, all of these countries face challenges from population ageing, yet it is not clear to which extent findings from one country (or set of countries) can be generalised to other institutional contexts. Thus, evidence from a wide range of countries and welfare regimes is needed.

We use data covering the period 2009–2017 from four longitudinal ageing studies - the English Longitudinal Study of Ageing (ELSA), The Irish Longitudinal Study on Ageing (TILDA), the Survey of Health, Ageing and Retirement in Europe (SHARE), and the U.S. Health and Retirement Study (HRS). We use age thresholds for state pensions and Social Security benefits as instrumental variables to address selection into retirement. The results of our analysis indicate remarkable consistency in the relationship between retirement and voluntary work in all countries: retirement leads to a substantial increase in the probability of volunteering. We also find some evidence for heterogeneity across welfare regimes. For example, in English-speaking countries the effects of retirement tend to be stronger for men and for more frequent voluntary work provision, whereas in continental Europe the effects are stronger among women.

We contribute to the literature along several dimensions. We extend the analysis by Laferrère (2016) on the relationship between retirement and volunteering to different institutional contexts and welfare systems, in which the role performed by the volunteers can be expected to differ as well. Our study compares findings for continental Europe with those for three liberal democracies, in which the institutional contribution to volunteering is limited, and the non-profit sector provides social services through volunteering. As observed by Hodgkinson (2003), in "corporativist" countries (such as in continental Europe), governments are directly involved in social services provision with high investment in social services. England, Ireland, and the U.S., which can all be considered as liberal welfare regimes (Bambra, 2007) with a long-standing tradition in volunteering and a well-developed voluntary sector but with different labour market structures, offer us a different perspective to investigate the effects of retirement on volunteering than in the continental European countries.

Moving beyond the pooled estimates reported by Laferrère (2016), we estimate separate effects for Northern, Central, and Southern Europe to account for institutional differences within continental Europe.[2] We also extend previous findings by Laferrère (2016) and Atalay et al. (2019) by investigating heterogeneity between population subgroups, assessing the generalizability of our estimates and examining the role of previous engagement in voluntary work. Finally, we examine how the effects of retirement change with duration spent in retirement, and whether there are spillover effects within couples. Thus, this is the first paper to provide comprehensive evidence on the effect of retirement on voluntary work provision across several countries and welfare regimes.

The remainder of the paper is organized as follows. In Section 2, we discuss theoretical approaches that can motivate the competing hypotheses of activity substitution and activity complementarity. In Section 3, we provide an overview of the data and measures used in our analysis. Section 4 describes the econometric methods. The results are reported in Section 5. Detailed model diagnostics for the instrumental variable estimation model are reported in Section 6. The generalizability and robustness of our findings on the effect of retirement on voluntary work provision are assessed in Sections 7 and 8. We discuss our findings in Section 9.

2. Theoretical background

2.1. Hypotheses

Two competing hypotheses have been proposed in the literature on retirement and voluntary work provision (Chambré 1984; Mutchler et al., 2003; Tang, 2015). The *substitution hypothesis* posits that paid work and voluntary work can be considered as substitutes, i.e., a decrease in paid work leads to an increase in voluntary work provision, and vice versa. In contrast, the *complementarity hypothesis* considers paid work and volunteering to be complements, hence a decrease in paid work would be accompanied by a decrease in voluntary work. These two hypotheses can be motivated from various theoretical perspectives. In the following, we provide a brief overview of these theories.

[2] Laferèrre (2016) mentions an analysis of individual countries, but does not show or discuss the magnitude of these effects.

2.2. Activity substitution

Substitution between paid work and volunteering might be a consequence of *opportunity costs of time investments,* which are a part of many standard economic models (e.g., Galama et al., 2013; Grossman 1972). Since individuals only have a fixed "time budget" available, they face trade-offs between time investment in market work and investments in non-market activities. Before retirement, individuals rely on market work to finance their expenditures, and thus the opportunity costs of alternative time investments are relatively high. Retirement relaxes this constraint, since retirees finance their costs of living through their pension and/or savings rather than paid work. Thus, retirement enables older individuals to spend more time on other activities, e.g., voluntary work. Previous studies have found evidence that retirement affects time investment decisions, e.g., participation in physical exercise (Kämpfen and Maurer, 2016), informal care (Bergeot and Fontaine, 2020; Fischer and Müller, 2020), childcare (Eibich and Siedler, 2020), or home production (Atalay et al., 2020; Bonsang and van Soest, 2020; Ciani, 2016).

Another explanation for *activity substitution* is provided by *role theory* (Mutchler et al., 2003) or *identity theory* (Akerlof and Kranton, 2000). The transition into retirement is associated with a loss (or shedding) of previously held roles and identities. As older individuals seek continuity over their life course (Atchley, 1989), they look towards substituting their previous role or identity as employee or worker with new roles, e.g., volunteer.

Older individuals' motivation to volunteer might also (in part) be driven by the perceived benefits for themselves (Okun et al., 1998). For example, as volunteering is associated with better health and well-being (Chiao, 2019; Luo et al., 2019; Mosca and Wright, 2017), older adults might decide to volunteer as part of an "active ageing " strategy to maintain their health in retirement. Voluntary work might offset the loss of social contacts and social participation associated with retirement (Smith, 2010), and therefore retirement might motivate older adults to provide (more) voluntary work.

2.3. Activity complementarity

Similarly, individuals might volunteer for work-related reasons (Okun et al., 1998; Wilson and Musick, 1997), e.g., to develop relevant skills or establish contacts. For individuals leaving the labour force, such considerations become less relevant, and they might therefore be less motivated to volunteer.

Finally, older individuals' engagement in voluntary work will likely depend on their capabilities and capacities. If retirement reduces the availability of these resources enabling voluntary work provision, then new retirees might reduce their engagement in voluntary work. For example, if retirement negatively impacts health (Heller-Sahlgren, 2017), then retirees might have fewer capacities to volunteer. Likewise, a decline in social participation upon retirement (Smith, 2010) might imply that retirees are offered fewer opportunities to volunteer.

Consequently, the effect of retirement on voluntary work provision is ultimately an empirical question. The substitution hypothesis and the complementarity hypothesis are both consistent with relevant theoretical frameworks, and it is unclear which of these potential mechanisms dominates.

3. Data

3.1. Overview and sample selection

We use data from four longitudinal ageing studies - ELSA, TILDA, SHARE, and HRS. All four studies survey individuals aged 50 and above living in private households as well as their cohabiting partners, irrespective of age. Survey participants are interviewed every two years. Data collection in HRS started in 1992. In ELSA, SHARE and TILDA, data collection started in 2002, 2004 and 2009, respectively. ELSA, SHARE and TILDA were designed to ensure comparability with the HRS. The four studies have similar structures and include questions that cover comparable domains across the economic, social and health spheres. This cross-survey comparability supports the use of harmonized measures and estimation procedures in producing comparable estimates (Adam et al., 2007; Blundell et al., 2021; Fonseca et al., 2017). For a detailed description of these studies see Sonnega et al. (2014), Taylor et al. (2007), Börsch-Supan et al. (2013) and Kearney et al. (2011).

To facilitate comparisons across studies, we restrict the analysis to the period 2009 to 2017, in which data are available for all four studies. In particular, we use ELSA waves 5–8 (2010–2017), TILDA waves 1–4 (2009–2016), SHARE waves 4–7 (2011–2017) and HRS waves 10–13 (2010–2016). For the analysis of SHARE, we only include the ten countries that collected information on volunteering in all four waves: Austria, Belgium, Czech Republic, Denmark, France, Germany, Italy, Spain, Sweden, and Switzerland.[3] Sample sizes for individual countries within SHARE are considerably smaller than for ELSA, TILDA, or HRS. We therefore aggregate countries into three groups: SHARE-Nordic (Denmark and Sweden), SHARE-Central (Austria, Belgium, Czech Republic, France, Germany and Switzerland), and SHARE-Southern (Italy and Spain). Countries within these groups have similar participation rates in formal volunteering (Eurostat, 2017) as well as similar welfare regimes (Eikemo and Bambra, 2008; Ferrera, 1996).

In all datasets, we include observations for individuals aged 50–79, i.e., around retirement age. Our final analytical samples consist of six unbalanced panels of: 7,915 individuals (22,835 observations) for ELSA; 5,965 individuals (15,738 observations) for TILDA; 20,260 individuals (55,503 observations) for HRS; 8,388 individuals (18,091 observations) for SHARE-Nordic; 29,930 individuals (64,141 observations) for SHARE-Central; and 9,523 individuals (18,176 observations) for SHARE-Southern. The average number of observations per individual is: 2.9 in ELSA; 2.6 in TILDA; 2.7 HRS; 2.1 in SHARE-Nordic and SHARE-Central; and 1.9 in SHARE-Southern.[4]

3.2. Variable definitions

3.2.1. Outcomes

Provision of formal voluntary work is assessed differently in these studies. Since information on informal voluntary work (i.e., help provided to neighbours, friends or family) is not available in all studies, we focus on formal volunteering (i.e., voluntary work provided in the context of an organization) in the analysis of this paper. In the ELSA study, respondents are asked: "*Overall, about how often over the last 12 months, since [date one year ago], have you generally done something to help this/these organisation(s) – remember to include any time spent at home or elsewhere helping this/these organisation(s)*."[5] The possible answers include "at least once a week", "less than once a week but at least once a month", "less often", "one-off activity".

In the TILDA study, respondents are asked: "*How often, if at all, do you do any of the following activities?*". A list of activities is presented

[3] In countries that did not participate in wave 3 of SHARE, the wave 7 interview was used to collect retrospective biographical information in the SHARELIFE survey rather than the main survey program. Thus, there are some countries (e.g., Estonia) that participated in all relevant waves of SHARE but are not used in this analysis, because the relevant information was not collected in wave 7.

[4] In countries that did participate in wave 3 of SHARE, the data collection process at wave 7 consisted of: a standard interview for all respondents who had already answered a SHARELIFE interview in wave 3; and a SHARELIFE interview for all respondents who did not participate in wave 3. The latter group was not asked questions on volunteering activity at wave 7. Therefore, it is not surprising the average number of observations per individual is lower in SHARE than in ELSA, TILDA or HRS.

[5] The previous question asks about the kind of voluntary work provided, and refers to "groups, clubs or organisations".

and one of the entries is "do voluntary work". Potential answers include "daily/almost daily", "once a week or more", "twice a month or more", "about once a month", "every few months", "about once or twice a year", "less than once a year", and "never".

In the SHARE study, respondents are asked: "*Which of the activities listed […] have you done in the last twelve months?*". If respondents choose "Done voluntary or charity work", they are asked: "*How often in the past twelve months did you do voluntary or charity work?*", with possible answers "almost daily", "almost every week", "almost every month", or "less often".

The HRS study asks respondents: "*Have you spent any time in the past 12 months doing volunteer work for religious, educational, health-related, or other charitable organizations?*". If they respond with "yes", they are then asked: "*Altogether, would you say the time amounted to less than 100 h, more than 100 h, or what?*". Possible answers are "less than 100 h", "about 100 h", and "more than 100 h". If they respond with "more than 100 h", the same question is repeated using a threshold of 200 h. If they respond with "less than 100 h", the same question is repeated using a threshold of 50 h.

Based on these questions, we construct three binary indicators measuring the frequency of voluntary work provision across studies. For the ELSA, TILDA and SHARE data, these indicators are: "any volunteering", "at least monthly volunteering", and "at least weekly volunteering". "Any volunteering" captures whether respondents reported doing any voluntary work, including one-off activities or volunteering less than once a year. For HRS data, the three indicators are: "any volunteering", "50+ hours of volunteering per annum (p.a.)" and "100+ hours of volunteering p.a.". It is important to note that in all studies, the three categories are not mutually exclusive. By definition, someone who volunteers at least weekly also volunteers at least monthly and provides "any" voluntary work.

We acknowledge two limitations of these outcome measures. The first limitation is that they are based on recall data and may therefore be subject to measurement error.[6] Prospectively collected information from time diaries could reduce such measurement error. However, such data is not available in the surveys considered here. The second limitation is that our measures of the frequency of voluntary work provision are relatively broad. Unfortunately, more detailed information on the intensity of voluntary work provision is not available for most studies.[7]

3.2.2. Definition of retirement and retirement duration

Individuals can exit the labour market for reasons other than old-age retirement, such as unemployment, home making and sickness. There is no clear consensus in the literature on whether such transitions should be considered as equivalent to retirement, partly because this depends on the potential mechanisms under consideration as well as the institutional setting. As a consequence, several different definitions of retirement have been adopted in the literature. Yet, a recent comparative study on the health effects of retirement found that such differences had little impact on the conclusions (Nishimura et al., 2018).

Our definition of retirement is based on self-reported labour force status. We define individuals as retired if they report their labour force status as retired or semi-retired. We define individuals as not retired if they report their labour force status to be in employment or self-employment. This implies that we exclude individuals reporting to be unemployed, permanently sick or disabled, in education or training, and homemakers from the analysis. We also exclude individuals who report to have never done any paid work.

We adopt this definition for two reasons: First, it provides a sharp distinction between individuals based on their available leisure time. For example, it is much less clear whether, e.g., unemployed individuals are comparable to retired individuals with regard to their available leisure time. Second, we also analyse the impact of time spent in retirement (i.e., retirement duration), which is defined as the difference between the current year/age and the year/age of retirement. The latter information is only available for individuals whose self-reported labour force status is "retired" or "semi-retired" in some of the datasets used in this study.

We assess the sensitivity of our findings to the retirement definition by exploring an alternative definition, in which we treat homemakers as retired and unemployed as well as permanently sick or disabled individuals as not retired (see Section 8 for details).

3.2.3. State pension ages

We use age thresholds for state pension eligibility as instrumental variables for retirement (see Section 4 for details). We distinguish between early (ERA) and ordinary (ORA) retirement age where relevant. We construct binary indicators, which take on the value of 1 if an individual is above the age threshold for pension eligibility in year t, and 0 otherwise. Fig. 1 (see also Table A.1 in section 1 of the online appendix) below visualises the variation in state pension ages both within and across countries. First, we note that state pension ages are often defined with respect to birth cohorts. To visualise state pension ages, we choose the state pension age that would apply to the cohort that became eligible for retirement in a given year. Fig. 1 shows that while state pension ages differ considerably within some countries (e.g., Austria, Czech Republic or Switzerland), in several countries state pension ages differ only across gender (i.e., ERA and ORA are the same for a given gender, e.g., in the UK), or only between ERA and ORA (and not by gender, e.g., in Belgium, Sweden, Spain, or the U.S.). Moreover, in some countries there is only a single state pension age threshold (e.g., in Denmark or Ireland). It is also important to note that there is considerable variation in state pension ages across countries. For example, the ERA varies between 55 (for Czech women) and 63 (for German men and women). Similarly, the ORA varies between 58.7 (for Czech women) and 66.6 (for Italian men). We also note considerable changes in state pension ages within countries and over time, e.g., in Czech Republic or Italy.

3.2.4. Covariates

Our empirical analyses control for a quadratic age trend as well a battery of other predetermined variables, such as education, partnership status and race/ethnicity. We include education as a categorical variable, whose three categories are broadly comparable to the International Standard Classification of Education (ISCED) classification. Specifically, we distinguish between individuals with "less than secondary education", "secondary education" and "tertiary education". We include a binary indicator for individuals who are in a partnership. For England and the U.S., we include a control variable for race/ethnicity that distinguishes between non-Hispanic whites and non-white individuals. We also include a set of dummy variables for the survey wave to account for secular trends. Finally, country fixed effects are included in our analyses for SHARE-Nordic, SHARE-Central and SHARE-Southern.

3.2.5. Attrition

Panel attrition is an important concern when using survey data drawn across several years. One particular concern for our study is that the transition into retirement might be systematically associated with survey participation, which might introduce selection bias into our analysis. Since we rely on state pension age thresholds for identification, we focus on attrition around these thresholds rather than on retirement itself. In Fig. A.1 in Section 2 of the online appendix we plot the probabil-

[6] Random measurement error would imply that the estimates are a downward-biased. An upward bias might occur if retirees are more likely to recall their voluntary work provision to justify their retirement. However, our analysis focuses on retirees retiring at the state pension age thresholds, who are less likely to feel the need to justify their absence from paid employment.

[7] The "Consumption and Activities Mail Survey" (CAMS) of the HRS includes the exact number of hours spent on voluntary work in the last month. However, the CAMS module is only administered to a subsample of the HRS respondents, i.e., using the module would considerably reduce the sample size.

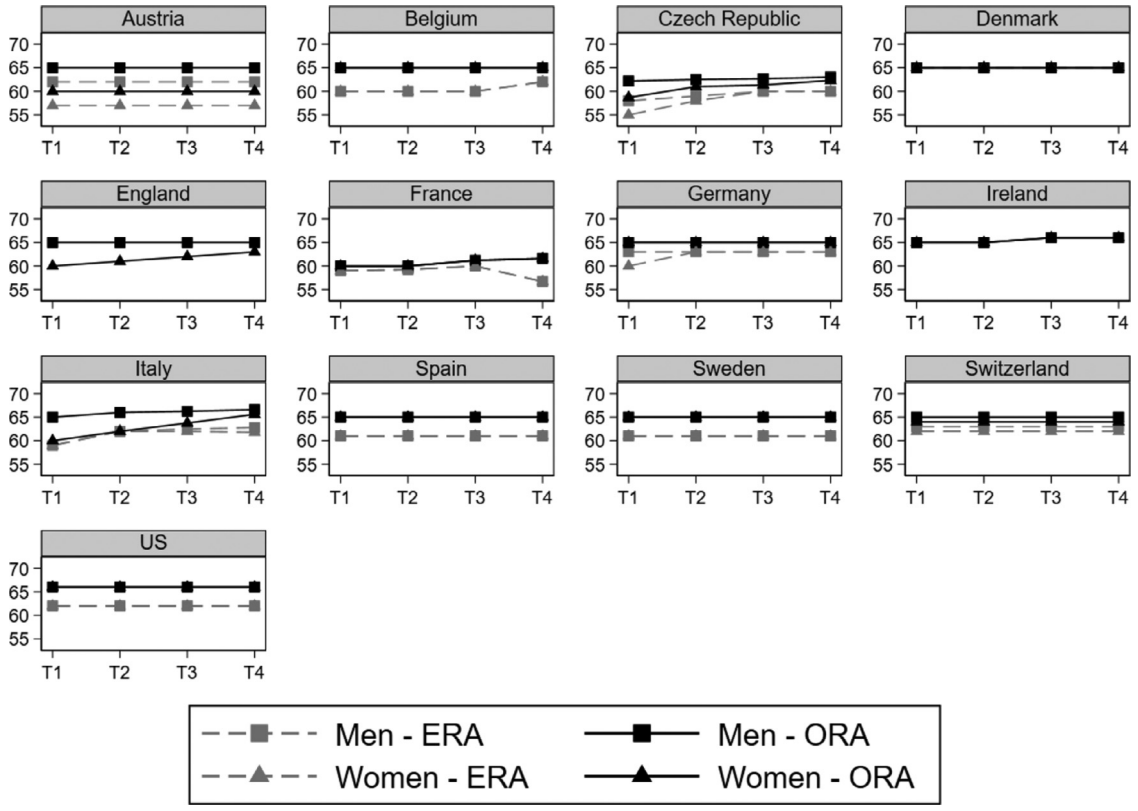

Fig. 1. State pension ages across countries

Notes: T1 = ELSA wave 5, TILDA wave 1, HRS wave 10, SHARE wave 4. T2 = ELSA wave 6, TILDA wave 2, HRS wave 11, SHARE wave 5. T3 = ELSA wave 7, TILDA wave 3, HRS wave 12, SHARE wave 6. T4 = ELSA wave 8, TILDA wave 4, HRS wave 13, SHARE wave 7. State pension age thresholds were taken from the OECD "Pensions at a glance" reports 2011, 2013, 2015, 2017, and 2019, and cross-referenced with tables derived from the Mutual Information System on Social Protection (MISSOC). For Ireland and the UK, no early retirement ages are stated. For SHARE countries, we use the same threshold for early retirement age (ERA) and ordinary retirement age (ORA) in cases where there is no early retirement age threshold given, because the aggregation into country groups requires us to define ERA and ORA for all SHARE countries.

ity of dropping out of our working sample[8] against age. There is some variation in attrition rates across countries, however, in all samples the probability of dropping out varies between 20% to 40%. Reassuringly, attrition rates do not seem to change drastically around the state pension age thresholds. We also examine whether attrition is based on selection on observables following Fitzgerald et al. (1998). We estimate probit regression models of our indicator of attrition on our lagged dependent variables as well as all included control variables. The results suggest that we cannot rule out selective attrition, since "any volunteering" is significantly associated with attrition in most samples. However, we argue (following Fitzgerald et al. (1998) and based on the pseudo-R^2 of the attrition regressions) that the impact of such attrition on our results is likely to be small.

4. Methods

We first employ ordinary least squares (OLS) regression estimation to provide initial descriptive evidence on the partial association between retirement and volunteering participation. The specification for this model can be written as:

$$y_{it} = r_{it} + Age_{it}\beta_1 + Age_{it}^2\beta_2 + X_{it}\beta_3 + Wave_{it} + \epsilon_{it} \quad (1)$$

In Eq. (1), we regress our outcomes indicating the frequency of voluntary work provision (y_{it}) on retirement status (r_{it}), the quadratic age trend, a vector of individual characteristics X_{it} that include education, partnership status and race/ethnicity and wave dummies. We estimate these models using pooled OLS estimation. Observations in our working sample may not be independent, because we pool data across waves from longitudinal surveys. We account for such dependencies in our empirical analysis (including all models discussed in the following) by clustering standard errors on the individual-level. This enables us to account for heteroskedasticity and serial correlation of the error terms. These specifications assume that conditional on the included covariates retirement can be treated as exogenous.

However, the decision to retire is typically made by the individual worker. While mandatory retirement rules exist in some countries (e.g., in the UK employers can mandate a so-called "employer-justified retirement age"), such rules only restrict an individual's ability to continue working beyond the normal retirement age. Workers can still decide to leave the labour market earlier. Hence, the retirement decision might be influenced by many factors, such as poor health (McGarry, 2004). Poor health has also been found to be a significant barrier to the provision of voluntary work (Mutchler et al., 2003; Hank and Erlinghagen, 2010; Di Gessa and Grundy 2015). Omitting factors such as poor health that influence an individual's retirement decision as well as their voluntary work provision will downward bias the OLS estimates of the effect of retirement on volunteering.

Fixed-effect (FE) estimation can be used to allow for the presence of time-invariant individual-specific effects that might influence an individual's retirement decision as well as their voluntary work provision, such as personal values and beliefs. For example, individuals who believe that providing services to others is important might be more likely to volunteer (Mutchler et al., 2003) and more likely to stay longer in the labour market. If personal values and beliefs are not observed, then re-

[8] This includes individuals who did not participate in the survey, individuals who had missing information on any of the variables included in our analysis, as well as individuals who exceeded the upper age limit of 79.

tirement may be spuriously related to voluntary work provision. Therefore, we complement OLS estimation with FE estimation, as outlined in Eq. (2). The FE estimation of Eq. (2) differs from the OLS estimation of Eq. (1) as it includes a time-invariant term (η_i) for each individual i that allows to control for time-invariant individual characteristics. Also, the vector X_{it} now only includes partnership status as education and race/ethnicity are time-invariant.

$$y_{it} = r_{it} + Age_{it}\beta_1 + Age_{it}^2\beta_2 + X_{it}\beta_3 + Wave_{it} + \varepsilon_{it} + \eta_i \quad (2)$$

However, many of the factors that potentially influence both retirement and volunteering vary over time. While we could control for some of these factors, e.g., changes in spousal labour force participation or onset of grandparenthood, we cannot observe all relevant changes. For example, if an individual experiences a health shock, such as a cardiovascular event, and transitions into retirement between two survey waves, we cannot disentangle whether the health shock occurred before or after retirement.

Therefore, we use an instrumental variable approach to address the potential bias from selection into retirement. Specifically, we use the age thresholds for receipt of state pensions or Social Security benefits as instrumental variables for retirement. These age thresholds introduce financial incentives to retire at a certain age. Therefore, we would expect to see disproportionate increases in the retirement probability at these ages, since individuals close to these age thresholds might postpone their retirement until they are eligible for pension benefits. It should be noted that these instruments only identify variation in the probability of retirement, and they do not allow us to distinguish between, e.g., full and partial retirement.

This identification strategy is closely connected to a fuzzy regression discontinuity design (RDD), because we exploit a discontinuous increase in the retirement probability at the age thresholds for state pension eligibility. We present visual evidence of the discontinuities in retirement as well as voluntary work provision in Section 5.1. We estimate our models in an IV framework using two-stage least squares (2SLS), because certain features of our data (e.g., age thresholds that vary across birth cohorts in ELSA, or multiple age thresholds for early and ordinary retirement in HRS and SHARE) can be more readily incorporated in 2SLS estimation than with nonparametric RDD estimators. Moreover, as noted by Lee and Lemieux (2010), the identifying assumptions of IV models apply to fuzzy regression discontinuity designs as well, and we therefore can draw on several tests and falsification exercises developed for IV models to test these assumptions (see Section 6).

We estimate the causal effect of retirement on voluntary work using the following model:

$$\textit{First stage}: \quad r_{it} = 1_{\{Age_{it} \geq SPA\}}\pi + Age_{it}\gamma_1 + Age_{it}^2\gamma_2 + Wave_{it} + \nu_{it} \quad (3)$$

$$\textit{Second stage}: \quad y_{it} = \hat{r}_{it}\tau + Age_{it}\beta_1 + Age_{it}^2\beta_2 + Wave_{it} + \varepsilon_{it} \cup \quad (4)$$

Intuitively, in the first stage of the model we regress retirement status of individual i in year t on a binary indicator for observations above the relevant state pension age (for the HRS and SHARE data, we use two binary indicators for ERA and ORA), $1_{\{Age_{it} \geq SPA\}}$, as well as a quadratic age trend and wave dummies to obtain a predicted value for retirement status, which is independent of any unobserved confounders (these are absorbed in the error term of the model, ν_{it}). In the second stage of the model, we regress our outcomes indicating the frequency of voluntary work provision (y_{it}) on predicted retirement status, the quadratic age trend and wave dummies to obtain an estimate of the causal effect of retirement on voluntary work, τ. This is our preferred IV specification.

However, we also estimate a second specification, which includes predetermined control variables for education, partnership status and race/ethnicity. Including predetermined covariates can increase the precision of the estimates by reducing random variation, and by comparing estimates from IV models with and without covariates we can assess the validity of our approach, since the inclusion of covariates should not affect the point estimates in our IV model substantially. We estimate IV models using two-stage least squares (2SLS) with standard errors clustered on the individual-level.[9]

Finally, we consider a fixed effects instrumental variable (IV-FE) model that takes both time-invariant unobserved heterogeneity and the endogeneity of retirement into account. If the required assumptions for IV estimation (discussed in detail in Section 6) hold, 2SLS estimation will resolve the endogeneity of retirement, regardless of whether we account for individual fixed effects or not. Although the inclusion of individual-fixed effects is not required for a causal interpretation of the estimates, it may improve the precision of the estimates by reducing variation in the outcome variables (as noted by Lee and Lemieux (2010) in the context of RDDs).

5. Results

5.1. Descriptive evidence

5.1.1. Summary statistics

Table 1 below provides summary statistics for all six samples, for men and women together. Summary statistics for men and women separately can be found in Tables A.2 and A.3 in section 3 of the online appendix. The results of Table 1 show that in England, around 40% of individuals provide "any" voluntary work, 30% volunteer at least monthly and 18% volunteer at least weekly. These compare to 61%, 33% and 19%, respectively, in Ireland. In the U.S., around 38% of individuals provide "any" voluntary work, 24% volunteer for 50 or more hours per year and 15% volunteer for 100 or more hours per year. Volunteering rates are considerably lower in continental Europe. In Nordic countries, 24% provide any voluntary work, 19% volunteer monthly and 12% of individuals volunteer weekly. In Central Europe, these figures are similar at 22%, 18% and 12%, respectively. In Southern Europe, 11% of individuals provide any voluntary work, 9% volunteer monthly and 6% volunteer on a weekly basis. These figures represent unweighted sample averages, and thus are not directly comparable to the population-wide numbers mentioned in the introduction.

5.1.2. Labour force participation by age

Figs. 2 and 3 show labour force participation for individuals aged 50 to 79 in all 13 countries, for men and women separately. We observe a relatively steep decline in the share of working individuals and an associated increase in the share of retirees in all countries between ages 60 and 70, with most of the decline occurring before age 65. This steep decline suggests that the state pension age thresholds might be strong predictors of retirement behaviour in these countries.

5.1.3. Voluntary work provision by age

Figs. A.2-A.7 in section 4 of the online appendix show trends in voluntary work provision by age in all countries separately by sex and intensity. We note that in all countries voluntary work provision either remains broadly stable between the ages of 50 and 79, or follows an inverse u-shape (e.g., in Belgium, England, France or Switzerland). In some countries, we observe an increase in volunteering rates, in particular for more frequent voluntary work provision (e.g., in Belgium, England, Ireland and Switzerland for men, or for Austria, Belgium, Germany and Sweden for women). There is wide variation in baseline levels, with some of the highest rates observed in Ireland. However, we

[9] Our outcomes are binary variables. However, we choose to estimate a linear IV models to facilitate interpretation of the results. There is considerable disagreement in the literature on the benefits and disadvantages of nonlinear IV estimation (see, e.g., Basu et al. 2018; Bhattacharya et al. 2005; Chiburis et al. 2012; Terza et al. 2008), with some studies arguing that 2SLS models are preferable to nonlinear alternatives (Basu et al. 2018; Chapman and Brooks, 2016).

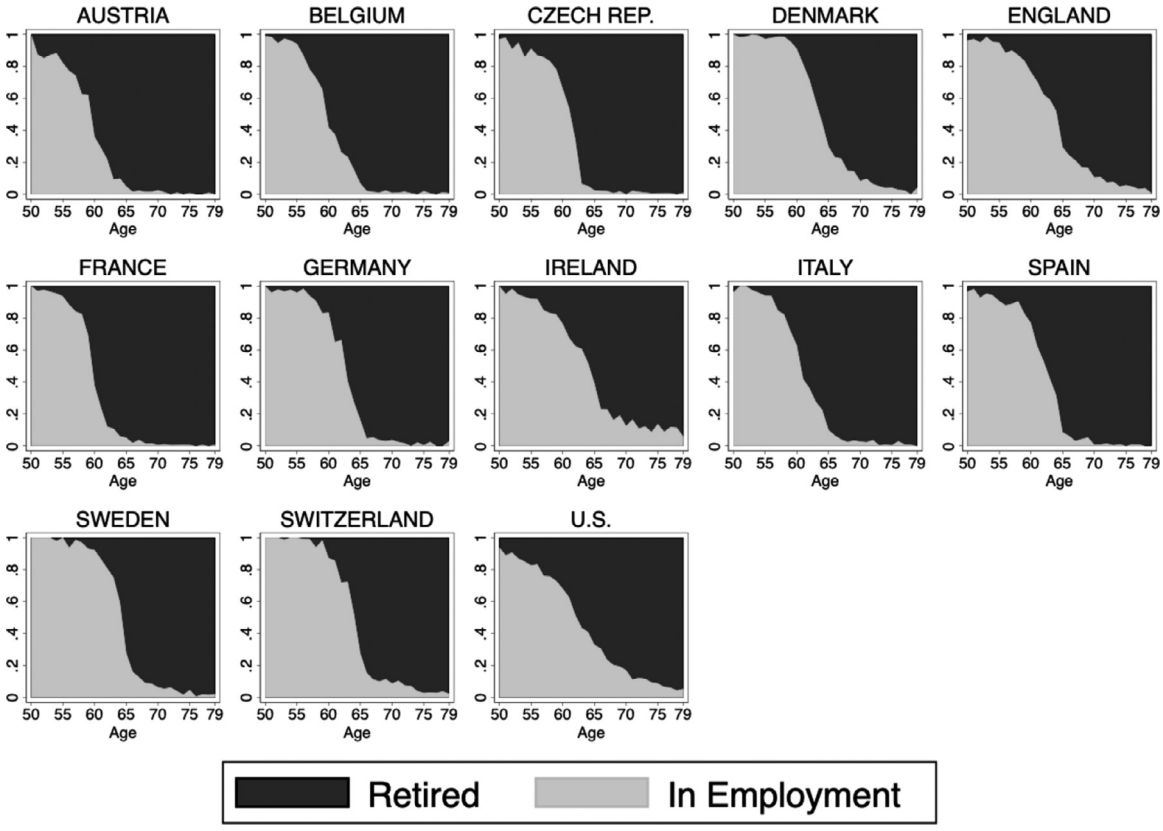

Fig. 2. Self-reported labour market status, men
Source: ELSA Waves 5–8, TILDA Waves 1–4, HRS Waves 10–13, SHARE Waves 4–7.

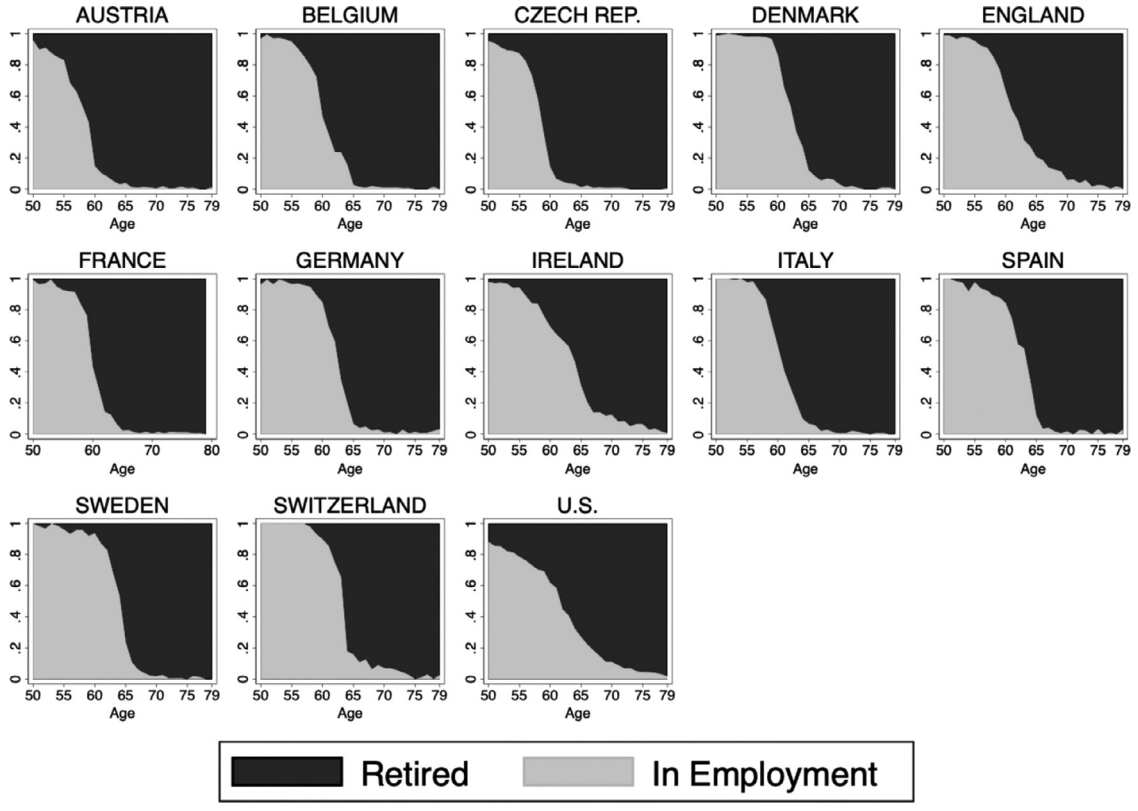

Fig. 3. Self-reported Labour Market Status, Women
Source: ELSA Waves 5–8, TILDA Waves 1–4, HRS Waves 10–13, SHARE Waves 4–7.

Table 1
Summary statistics.

	ELSA	TILDA	HRS	SHARE		
				NORDIC	CENTRAL	SOUTHERN
	Mean (Standard Deviation)					
	A. Outcomes: Volunteering Frequency					
Any	0.396	0.610	0.378	0.237	0.223	0.107
	(0.489)	(0.488)	(0.485)	(0.425)	(0.416)	(0.309)
At least monthly	0.303	0.333		0.189	0.181	0.086
	(0.459)	(0.471)		(0.391)	(0.385)	(0.280)
At least weekly	0.182	0.185		0.117	0.116	0.058
	(0.386)	(0.389)		(0.322)	(0.320)	(0.233)
50+ hours per annum			0.238			
			(0.426)			
100+ hours per annum			0.150			
			(0.357)			
	B. Covariates					
Retired	0.605	0.517	0.581	0.590	0.677	0.669
	(0.489)	(0.500)	(0.493)	(0.492)	(0.468)	(0.471)
Above state pension age (SPA)	0.613	0.458	0.445	0.567	0.604	0.576
	(0.487)	(0.498)	(0.497)	(0.496)	(0.489)	(0.494)
Age	65.368	64.063	65.000	65.836	65.110	66.009
	(7.265)	(7.638)	(8.260)	(7.611)	(7.765)	(7.922)
Female	0.523	0.479	0.558	0.530	0.529	0.415
	(0.499)	(0.500)	(0.497)	(0.499)	(0.499)	(0.493)
Less than secondary education	0.286	0.204	0.153	0.246	0.280	0.675
	(0.452)	(0.403)	(0.360)	(0.431)	(0.449)	(0.468)
Secondary education	0.515	0.599	0.601	0.361	0.461	0.203
	(0.500)	(0.490)	(0.490)	(0.480)	(0.499)	(0.402)
Tertiary education	0.200	0.197	0.246	0.393	0.259	0.123
	(0.400)	(0.398)	(0.430)	(0.488)	(0.438)	(0.328)
In a partnership	0.768	0.744	0.659	0.810	0.754	0.838
	(0.422)	(0.436)	(0.474)	(0.392)	(0.431)	(0.368)
Non-Hispanic white ethnicity	0.966		0.652			
	(0.182)		(0.476)			
N	22,835	15,738	55,503	18,091	64,141	18,176

Note: Unweighted sample characteristics from ELSA Waves 5–8, TILDA Waves 1–4, SHARE Waves 4–7, HRS Waves 10–13.
Nordic countries include Sweden and Denmark. Central countries include Austria, France, Germany, Belgium, Switzerland and Czech Republic. Southern countries include Italy and Spain.
For the HRS, above state pension age (SPA) is the full retirement age, ranging from 65 to 66 and over depending on the birth cohort. For SHARE, above SPA refers to the ordinary retirement age.

note that due to the wording of the question, it is possible that some individuals in TILDA or SHARE might have also reported informal voluntary work, while this was specifically excluded by the wording of the questions in ELSA and HRS.

5.2. Effects of retirement on voluntary work

Figs. 4 and 5 show estimates of the effect of retirement on voluntary work provision for men and women, respectively, from: a pooled ordinary least squares (OLS) regression; a fixed effects (FE) regression; a pooled IV specification (IV) and a IV fixed effects specification (IV-FE).[10] The estimates of the pooled IV specification are also shown in Tables A.4-A.6 in section 5 of the online appendix.

Figs. 4 and 5 show that the OLS and FE point estimates are considerably smaller than the point estimates of the IV and IV-FE models, which suggests the presence of a downward bias in the OLS and FE models. This could occur, e.g., if poor health is a major determinant of retirement and individuals in poor health are less likely to volunteer. Figs. 4 and 5 also show that, as expected, the pooled IV and IV-FE estimates tend to be similar. However, the IV-FE estimates are less precisely estimated, likely due to a loss of sample size from individuals that are only observed once in the data.

The results of the two IV specifications shown in Fig. 4 indicate that in the U.S., the effect of retirement on voluntary work provision among men is positive, significant and similar in magnitude across all three volunteering frequencies. In England and Ireland, the effect is primarily observed for weekly voluntary work provision. In continental Europe, effect sizes are considerably smaller and more similar across volunteering intensities. The results indicate a significant increase in voluntary work provision in Central Europe and the Nordic countries, but not in Southern Europe. Results for women in Fig. 5 are qualitatively similar, with two exceptions: The effects of the IV models for Ireland are no longer significant. In contrast, among Southern European women, we now observe a significant increase in voluntary work provision across all three frequencies in the pooled IV model.

In summary, in all samples retirement leads to an increase in voluntary work provision. In Ireland, this effect is only significant for men, whereas in Southern Europe only women show increases in volunteering rates. In England and Ireland, retirement leads to a stronger increase in voluntary work provided at higher frequencies. The size of the effects is broadly similar for men and women, with increases between 10 and 20 percentage points in English-speaking countries, and slightly smaller effects (between 5 and 10 percentage points for men, and 7 and 13 percentage points for women) in continental Europe (see Tables A.4-A.6 in section 5 of the online appendix).

As noted in Section 4, the inclusion of fixed effects is not necessary for causal identification in the IV model. In the following, we will therefore focus on the pooled IV model. Detailed model diagnostics (including first-stage estimates) are reported in Section 6. The generalizability and

[10] As outlined in Eqs. (1) and (2), the OLS and FE models include controls for quadratic age, education, partnership status, race/ethnicity (except in TILDA), and survey wave. Country fixed effects are also included in the OLS models for SHARE.

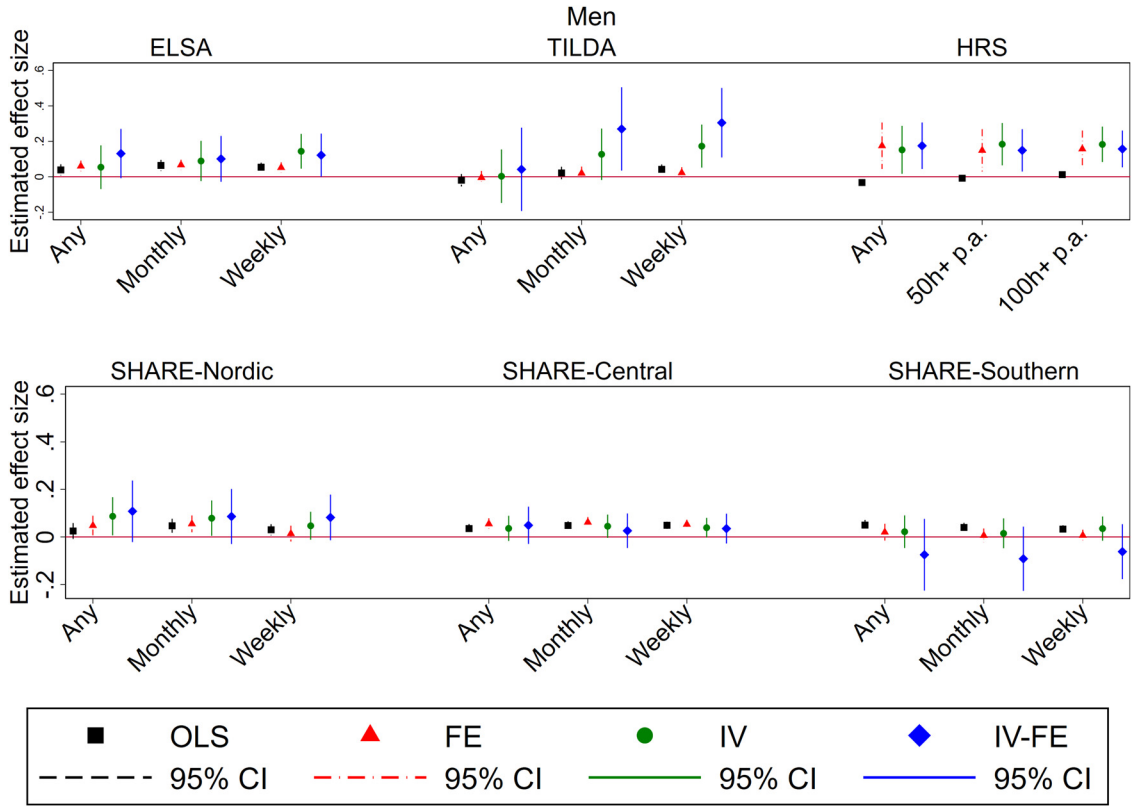

Fig. 4. The effect of retirement on voluntary work - men
Source: ELSA waves 5–8, TILDA waves 1–4, HRS waves 10–13, SHARE waves 4–7, own calculations. The markers show point estimates and the lines show 95% confidence intervals for different models. The OLS and FE models control for quadratic age, education, partnership status, race/ethnicity (ELSA and HRS only), survey wave and country fixed effects (SHARE only). The IV and IV-FE model controls for quadratic age and survey wave.

robustness of the IV estimates of the effect of retirement on volunteering are assessed in Sections 7 and 8.

6. IV Model diagnostics

Instrumental variables require three key assumptions to estimate local average treatment effects: *(i)* relevance, i.e., the instrument should predict treatment status, *(ii)* validity, i.e., the instrument should not affect the outcome other than through its effect on treatment status (this is sometimes called the "exclusion restriction"), and *(iii)* monotonicity, i.e., treatment status should be a monotonic function of the instrumental variable. The last assumption is also sometimes referred to as "no defiers" – in our context, it implies that there should be no individuals who retire if they are below the pension eligibility age, but return to work once they reach the pension eligibility age. In the following section, we present various model diagnostics and robustness checks to assess these assumptions and facilitate interpretation of our results.

6.1. First stage and reduced form results

Table 2 shows the estimates from the first-stage of our 2SLS regression model, by study and sex. In all datasets, the instruments are significant predictors of retirement status. The probability of retirement changes by between 11 (ordinary retirement of U.S. men) and 50 percentage points (ordinary retirement for women in SHARE-Nordic). Only the threshold for early retirement in SHARE-Nordic is not statistically significant, likely because this is only identified by Sweden. The Wald F-statistic on the strength of the excluded instruments is above 100 for all models, which suggests that our results should not be affected by weak instrument problems – in other words, the relevance assumption should hold.

The IV estimator can be obtained by scaling up the reduced form effect (i.e., the estimated effect of the instrument on the outcome) based on the first-stage estimate. This inherent link between the magnitude of the IV estimate and the first-stage effect implies that it is possible that small and modest first-stage effects can result in large IV estimates, even though the reduced form effect is small and (statistically or economically) insignificant. In addition, the reduced form effect is of direct relevance for policy makers, because policy makers can only manipulate pension eligibility ages rather than intervene directly on retirement status. Tables A.7–A.9 in section 6 of the online appendix show that we indeed find sizable and significant reduced form effects in line with our IV estimates.

6.2. Continuity of covariates

The validity assumption or exclusion restriction would be violated if state pension eligibility had a direct effect on other characteristics, which in turn are associated with voluntary work provision. We check the plausibility of this assumption by comparing average levels of covariates below and above the age thresholds for state pensions and Social Security benefits. If we observed a change in covariates that are (plausibly) unrelated to retirement at these age thresholds, this would suggest that the assignment of the instrument is not balanced and the validity assumption might therefore be violated. Figs. A.8-A.15 in section 7 of the online appendix show average levels of education and partnership status in all countries for men and women. Although there are clear age trends, they appear to be continuous and smooth around the age thresholds for early and ordinary retirement. As an additional check, we re-estimate our preferred IV specification while including additional covariates for education, race/ethnicity (in ELSA and HRS only) and partnership status (see Tables A.10–A.12 in section 8 of the online ap-

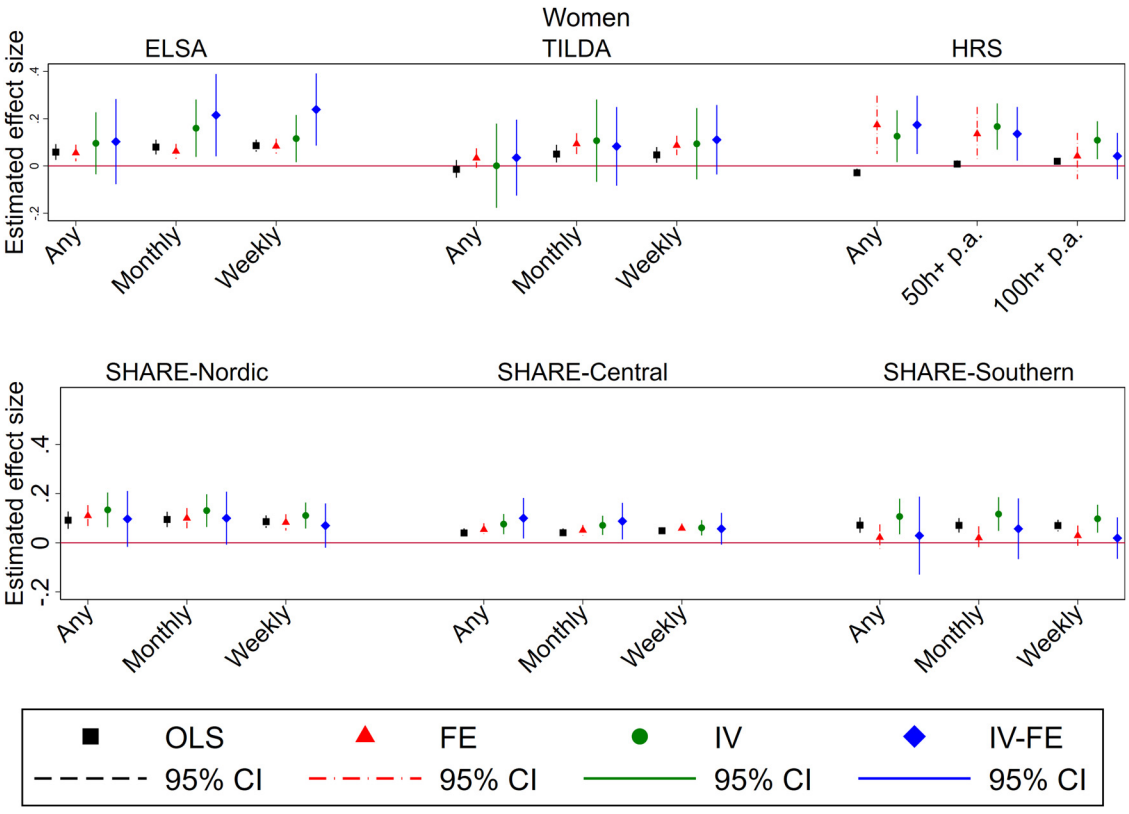

Fig. 5. The effect of retirement on voluntary work - women
Source: ELSA waves 5–8, TILDA waves 1–4, HRS waves 10–13, SHARE waves 4–7, own calculations. The markers show point estimates and the lines show 95% confidence intervals for different models. The OLS and FE models control for quadratic age, education, partnership status, race/ethnicity (ELSA and HRS only), survey wave and country fixed effects (SHARE only). The IV and IV-FE model controls for quadratic age and survey wave.

Table 2
Pension eligibility and retirement.

	ELSA	TILDA	HRS	SHARE		
				NORDIC	CENTRAL	SOUTHERN
Instrument	Dependant variable: retired					
	A. Men					
Instrument 1[a]	0.292***	0.308***	0.174***	−0.004	0.267***	0.300***
	(0.017)	(0.021)	(0.013)	(0.02)	(0.012)	(0.021)
Instrument 2[b]			0.110***	0.468***	0.256**	0.224***
			(0.013)	(0.022)	(0.010)	(0.015)
Wald F	295.35	210.43	222.94	339.95	935.16	275.60
N	10,897	8,196	24,522	8,499	30,232	10,635
	B. Women					
Instrument 1[a]	0.337***	0.268***	0.194***	−0.027	0.327***	0.211***
	(0.020)	(0.021)	(0.012)	(0.021)	(0.011)	(0.025)
Instrument 2[b]			0.120***	0.495***	0.288***	0.388***
			(0.011)	(0.019)	(0.012)	(0.025)
Wald F	293.95	157.52	373.55	478.79	1637.46	333.51
N	11,938	7,542	30,981	9,592	33,909	7,541

[a] Instrument 1 is a binary indicator defined as “above the state pension age” in ELSA and TILDA, “above 62″ in HRS, and above the corresponding early retirement age in SHARE.

[b] Instrument 2 is a binary indicator defined as “above the ordinary retirement age” in HRS and in SHARE.Source: ELSA Waves 5–8, TILDA Waves 1–4, HRS Waves 10–13, SHARE Waves 4–7. Estimates come from a linear regression model controlling for quadratic age and survey wave. SHARE regressions also include country fixed effects. Clustered standard errors on the individual-level in parentheses. “Wald F” refers to the Kleibergen-Paap F-statistic on the relevance of the instruments. Significance: † $p<0.1$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Table 3
IV validity test.

	ELSA	TILDA	HRS		SHARE					
					NORDIC		CENTRAL		SOUTHERN	
Instrument	*State Pension Age*	*State Pension Age*	*62*	*65*	*ERA*	*ORA*	*ERA*	*ORA*	*ERA*	*ORA*
Men	$p>0.1$	$p>0.1$	$p<0.01$	$p>0.1$	$p>0.1$	$p>0.1$	$p>0.1$	$p>0.1$	$p>0.1$	$p>0.1$
Women	$p<0.01$	$p>0.1$	$p<0.01$	$p>0.1$	$p>0.1$	$p>0.1$	$p>0.1$	$p>0.1$	$p>0.1$	$p>0.1$

Notes: The test is based on Mourifié and Wan (2017) and uses the intersection bounds framework. We implement the parametric version of the intersection bounds test, control for quadratic age and search over 500 grid points.

pendix). The results are qualitatively very similar to the estimates from our preferred specification. Consequently, this analysis does not provide any indication that the validity assumption is violated.

6.3. Instrument validity test

Recent advances in the econometric literature (Huber and Mellace, 2014; Kitagawa, 2015; Mourifié and Wan, 2017) allow us to jointly test the assumptions of instrument validity and monotonicity. We implement a test proposed by Mourifié and Wan (2017). The test represents the testable implications of validity and monotonicity discussed by Balke and Pearl (1997) and Heckman and Vytlacil (2005) through a set of conditional moment inequalities, which can then be tested using the intersection bounds framework (Chernozhukov et al., 2015, 2013). An important feature of this test over alternative approaches is that it can easily accommodate covariates (such as age in our case).

The results of the test are shown in Table 3 below. The table shows the p-value for the null hypothesis (validity and monotonicity assumption jointly hold). For TILDA and the SHARE samples, we fail to reject the null hypothesis for both men and women. For ELSA, we fail to reject the null hypothesis for men, but for women the test indicates that the validity or monotonicity assumption are likely violated. Finally, for HRS we reject the null hypothesis for early retirement but fail to reject it at the age threshold for normal retirement. All in all, the test shows that our results for English women and for early retirement in the U.S. should be taken with caution as the required assumptions for the validity of our IV model may not hold. However, Table A.13 in section 9 of the online appendix shows that in the U.S. the estimated effect of retirement using only the valid instrument (age 65) is larger than the estimated effect reported in Figs. 4 and 5 using both instruments.

7. IV Model extensions

7.1. Heterogeneity

We estimate treatment effect heterogeneity by re-estimating the IV model separately for subgroups defined by predetermined covariates, notably education and partnership status. If education facilitates voluntary work provision (e.g., by allowing volunteers to engage in more demanding and more satisfying tasks), then higher educated individuals might be more inclined to engage in voluntary work after retirement. Partnered individuals might prefer to spend additional time on joint activities (Stancanelli and van Soest 2012, 2016), which would reduce the potential impact of retirement on voluntary work. The partner might also represent a resource that facilitates voluntary work provision, e.g., through an extended social network (Lancee and Radl, 2014). On the other hand, a specialization perspective (Arpino and Bordone 2017; Becker, 1981) suggests that one of the partners might engage in volunteering while the other spends the additional time in different activities.

Tables A.14–A.16 in section 10 of the online appendix show differences in the effect of retirement on voluntary work between education groups. We find that the effects are stronger for medium- and high-educated individuals in all countries with one notable exception – the increase in voluntary work provision for Southern European women appears to be driven by women with less than secondary education. Tables A.17–A.19 in section 11 of the online appendix show differences by partnership status. For England, voluntary work provision increases significantly at retirement only for men and women in a partnership. For Ireland and continental Europe, the effects seem to be stronger for unpartnered men and women in a partnership. In particular, in contrast to our main results we observe a significant increase in low intensity volunteering among unpartnered continental European men. For the U.S., we observe the reverse pattern, i.e., the effects are stronger for men in a partnership and for women without a partner.

7.2. Previous voluntary work provision

The existing literature has highlighted the importance of previous engagement in voluntary work as one of the most important predictors of voluntary work provision (Di Gessa and Grundy, 2016; Erlinghagen, 2010; Mutchler et al., 2003). We examine the role of previous voluntary work engagement by estimating separate effects for individuals who volunteered in the previous wave, and those who did not volunteer in the previous wave. This analysis also allows us to disentangle the effects at the external and the internal margin. The estimated effects on "any volunteering" capture changes at the external margins – positive effects on any volunteering among those who did not volunteer previously would represent entries into volunteering, whereas negative effects on any volunteering among those who did volunteer previously represent exits out of volunteering. Changes at the internal margin are captured by the effects on frequent volunteering among those who volunteered previously.

It should be noted that even when we restrict the sample to individuals who volunteered in the previous wave, it is still possible to identify positive effects on *any volunteering*. Our models include an age trend, and thus participation among individuals who previously volunteered might decline with age. Thus, a positive effect of retirement on *any volunteering* would imply that retirement (partially) offsets the decline in voluntary work engagement for individuals who volunteered previously. Put differently, retirement would reduce the rate of age-related exits out of volunteering.

The results in Tables 4–6 suggest that in England, Ireland and the Nordic countries changes at the internal margin dominate, i.e., effects tend to be significant only when looking at individuals who did volunteer in the previous wave. In Central and Southern Europe, we find significant changes primarily at the external margin, i.e., volunteering increases among individuals who did not previously engage in voluntary work. However, we note that the effect sizes are considerably smaller for these countries. Finally, in the U.S. there does not seem to be a clear pattern, with some results indicating changes at the intensive margin and others suggesting changes at the extensive margin.

7.3. Retirement duration and spillover effects

Next, we examine whether the effect of retirement changes over time. For this analysis, we construct three alternative treatment indicators for individuals that have been retired *(i)* for less than two years, *(ii)*

Table 4
Heterogeneity by previous voluntary work provision - any voluntary work.

	ELSA	TILDA	HRS	SHARE		
				NORDIC	CENTRAL	SOUTHERN
A. Did not volunteer in previous wave, Men						
Retired	0.046	0.120	0.085	0.029	0.064*	0.033
	(0.066)	(0.130)	(0.085)	(0.042)	(0.030)	(0.046)
B. Volunteered in previous wave, Men						
Retired	0.139	−0.132	0.207	0.119	0.112	−0.301
	(0.152)	(0.095)	(0.138)	(0.140)	(0.099)	(0.644)
C. Did not volunteer in previous wave, Women						
Retired	0.102	−0.089	−0.033	0.0220	0.0426†	0.074†
	(0.069)	(0.150)	(0.085)	(0.036)	(0.024)	(0.043)
D. Volunteered in previous wave, Women						
Retired	0.144	−0.007	0.091	0.215†	0.019	0.215
	(0.104)	(0.110)	(0.080)	(0.120)	(0.067)	(0.224)

Source: ELSA Waves 5–8, TILDA Waves 1–4, HRS Waves 10–13, SHARE Waves 4–7. Estimates come from a 2SLS regression model controlling for quadratic age and survey wave. SHARE regressions also include country fixed effects. ELSA and TILDA results use state pension ages as instruments. HRS results use age thresholds at 62 and 65 as instruments. SHARE results use early and ordinary retirement age thresholds as instruments. Clustered standard errors on the individual-level in parentheses. Significance: † $p<0.1$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Table 5
Heterogeneity by previous voluntary work provision - monthly (ELSA, TILDA, SHARE)/50± (HRS) hours of volunteering.

	ELSA	TILDA	HRS	SHARE		
				NORDIC	CENTRAL	SOUTHERN
A. Did not volunteer in previous wave, Men						
Retired	0.003	−0.009	0.087	0.030	0.060*	0.020
	(0.052)	(0.077)	(0.062)	(0.033)	(0.026)	(0.026)
B. Volunteered in previous wave, Men						
Retired	0.319†	0.169	0.358†	0.180	0.080	0.170
	(0.175)	(0.150)	(0.208)	(0.151)	(0.102)	(0.568)
C. Did not volunteer in previous wave, Women						
Retired	0.057	0.119	0.115*	−0.018	0.050*	0.036
	(0.054)	(0.093)	(0.056)	(0.032)	(0.020)	(0.028)
D. Volunteered in previous wave, Women						
Retired	0.307*	−0.069	−0.041	0.306*	−0.026	0.261
	(0.128)	(0.160)	(0.112)	(0.131)	(0.071)	(0.222)

Source: ELSA Waves 5–8, TILDA Waves 1–4, HRS Waves 10–13, SHARE Waves 4–7. Estimates come from a 2SLS regression model controlling for quadratic age and survey wave. SHARE regressions also include country fixed effects. ELSA and TILDA results use state pension ages as instruments. HRS results use age thresholds at 62 and 65 as instruments. SHARE results use early and ordinary retirement age thresholds as instruments. Clustered standard errors on the individual-level in parentheses. Significance: † $p<0.1$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Table 6
Heterogeneity by Previous Voluntary Work Provision - Weekly (ELSA, TILDA, SHARE)/100± (HRS) Hours of Volunteering.

	ELSA	TILDA	HRS	SHARE		
				NORDIC	CENTRAL	SOUTHERN
A. Did not volunteer in previous wave, Men						
Retired	0.035	0.023	0.159**	0.014	0.034†	0.020
	(0.035)	(0.061)	(0.050)	(0.023)	(0.019)	(0.038)
B. Volunteered in previous wave, Men						
Retired	0.421*	0.291*	0.223	0.245†	−0.023	−0.174
	(0.176)	(0.140)	(0.282)	(0.145)	(0.104)	(0.616)
C. Did not volunteer in previous wave, Women						
Retired	0.024	0.066	0.069	−0.028	0.030*	0.065†
	(0.042)	(0.073)	(0.043)	(0.023)	(0.015)	(0.037)
D. Volunteered in previous wave, Women						
Retired	0.329*	0.020	−0.166	0.280*	0.050	0.201
	(0.128)	(0.150)	(0.143)	(0.135)	(0.071)	(0.221)

Source: ELSA Waves 5–8, TILDA Waves 1–4, HRS Waves 10–13, SHARE Waves 4–7. Estimates come from a 2SLS regression model controlling for quadratic age and survey wave. SHARE regressions also include country fixed effects. ELSA and TILDA results use state pension ages as instruments. HRS results use age thresholds at 62 and 65 as instruments. SHARE results use early and ordinary retirement age thresholds as instruments. Clustered standard errors on the individual-level in parentheses. Significance: † $p<0.1$, * $p<0.05$, ** $p<0.01$, *** $p<0.001$.

Table 7
Complier Characteristics – ELSA, TILDA and HRS.

	ELSA		TILDA		HRS			
					62		65	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
Not in a partnership	0.973	1.172	1.172	1.108	0.862	0.889	0.413	0.661
In a partnership	0.993	0.955	0.958	0.925	1.079	1.291	0.804	0.873
Less than secondary education	1.243	1.300	1.373	1.224	1.587	1.185	0.942	0.566
Secondary education	1.103	0.982	0.932	1.093	1.042	1.153	0.672	0.704
Tertiary education	0.627	0.700	0.679	0.541	0.698	0.995	0.630	1.069
Poor health	0.983	1.110	0.948	0.410	0.746	0.921	0.476	0.471
Good health	0.938	0.950	0.997	1.063	0.476	0.471	0.799	0.926

Source: ELSA Waves 5–8, TILDA Waves 1–4, HRS Waves 10–13. The numbers show the relative likelihood that an individual with a given characteristic is part of the complier population in the working sample.

for two or more years, and *(iii)* for three or more years. We construct additional instruments analogously as being two or more years above the ERA/ORA as well as being three or more years above the ERA/ORA. The results of Figs. A.16-A.21 in section 12 of the online appendix suggest that for English and Irish men the effects are rather stable over time, whereas the effects for Central European men and for women in general only seem to emerge for individuals that have been retired for three or more years. However, we also note that the confidence intervals tend to be large and the results should therefore be interpreted with caution.

We also consider *(i)* spillover effects within couples, and *(ii)* joint retirement behaviour. First, we estimate our preferred IV specification using partner's voluntary work provision as the outcome. We then estimate models that include retirement behaviour of both partners as well as an interaction term for couples where both partners are retired. The results (Tables A.20-A.23 in section 13 of the online appendix) suggest the presence of partnership dynamics in some but not all countries. Specifically, we find significant spillover effects of retirement on the partner's voluntary work provision in continental Europe. In the Nordic countries and Southern Europe, retirement increases voluntary work provision of the partner (in Southern Europe only for women's retirement). In Central European countries, our estimates suggest that retirement reduces partner's voluntary work provision. Considering joint retirement, we find significant estimates for the U.S. as well as Northern and Central Europe. In all countries, the estimates suggest that both own and partner's retirement alone reduce voluntary work provision, but there is a strong and significant increase in voluntary work provision when both partners are retired.

7.4. Composition of the complier population

Our preferred IV specification estimates a local average treatment effect, which is only identified by the complier, i.e., individuals who only retire once they have reached the relevant state pension age threshold. Without further assumptions we cannot generalize our findings to other groups. Therefore, it is important to understand who these complier are. Moreover, the generosity of the pension systems considered in this study differs considerably, and it is therefore likely that the composition of the complier population will also differ between countries. We examine the composition of the complier population, stratified by sex, following an approach outlined by Angrist and Pischke (2009, p. 172). Although it is not possible to determine which observations are complier, we can draw conclusions on the characteristics of the complier population by comparing the estimated coefficient on the instrument for a specific subgroup to the estimated coefficient on the instrument in the overall sample.

Tables 7 and 8 show the relative likelihood of individuals to belong to the complier population. We examine partnership status, education as well as self-reported health. In line with expectation, we find that in England and Ireland lower educated men and women are overrepresented in the complier population, i.e., the likelihood to be a complier decreases across education categories. The same pattern holds for U.S. men and for early retirement of U.S. women. In continental Europe, we find that lower educated individuals are overrepresented among the complier population for the early retirement age threshold, whereas they are underrepresented among the complier for the ordinary retirement age threshold. This is likely because better educated individuals rely less on the basic state pension for their old-age income, and therefore the eligibility age thresholds are less relevant to these groups. Moreover, they are often in better health and are less likely to work in physically demanding occupations, and thus may be more able to postpone their retirement until they reach the ordinary retirement age threshold.

There is no clear pattern emerging with regard to partnership status. Interestingly, there is also no clear pattern for health status. In England and for early retirement in the U.S., the pattern is as expected, i.e., individuals in poor health are more likely to comply with the state pension age. However, in Ireland and in continental Europe individuals in good health are more heavily represented among the complier population. One potential explanation might be that individuals in poor health use alternative routes to exit the labour market in these countries, e.g., disability insurance.

8. Robustness checks

Tables A.24-A.29 in section 14 of the online appendix show the results from a number of robustness checks conducted to assess the sensitivity of the IV estimates. First, we explore an alternative treatment definition, which includes homemakers as retired and unemployed as well as permanently sick or disabled individuals as not retired. Then, we limit the age range for included observations from 50 to 79 to 55–74 to improve the fit of the quadratic age trend in our model and reduce potential bias due to nonlinearities in the true age trend. Following a similar logic, we also explore cubic and quartic polynomials for age.

The results show that using different definitions of retirement does not affect our conclusions. Reducing the age range or modelling age with a cubic or quartic polynomial reduces the precision of our estimates (as expected). For England, the point estimates for women are considerably reduced, while the point estimates for men remain stable. For Ireland, the point estimates for both men and women are reduced, although the decrease is larger for women. For the U.S., the point estimates for both men and women remain relatively stable. For continental Europe, point estimates for men are smaller and lose significance, while point estimates for women are more stable and, in some cases, even larger in these robustness checks. All in all, we conclude that our conclusions are robust to changes in these assumptions.

9. Discussion

This paper examines the causal effect of retirement on voluntary work provision in Europe and the U.S. We use an instrumental variable approach to address potential bias due to selection into retirement. We

Table 8
Complier characteristics - SHARE.

	NORDIC				CENTRAL				SOUTHERN			
	ERA		ORA		ERA		ORA		ERA		ORA	
	Men	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*	*Men*	*Women*
Not in a partnership	0.783	0.781	1.054	0.998	1.059	0.917	0.931	1.024	0.854	0.963	0.766	0.923
In a partnership	1.029	1.045	0.989	1.002	0.992	1.028	1.013	0.992	1.013	1.005	1.025	1.019
Less than secondary education	0.790	0.684	0.955	0.846	0.963	1.056	0.753	0.791	0.905	0.863	0.895	0.915
Secondary education	1.147	0.859	1.075	0.998	0.980	1.06	1.006	1.089	1.313	1.157	0.992	1.043
Tertiary education	0.776	1.019	0.886	1.006	0.994	0.78	1.122	0.984	0.766	1.037	1.234	1.173
Poor health	1.004	0.74	0.805	0.827	0.921	1.019	0.722	0.736	0.911	0.918	0.556	0.772
Good health	0.956	1.019	1.004	1.025	1.014	0.984	1.081	1.076	1.016	1.012	1.167	1.087

Source: SHARE Waves 4–7. The numbers show the relative likelihood that an individual with a given characteristic is part of the complier population in the working sample.

exploit age thresholds in the eligibility criteria for state pension or Social Security benefits as instruments for retirement. We find remarkable consistency in the relationship between retirement and voluntary work: retirement increases voluntary work provision in all countries considered here by between 4 and 20 percentage points. While we find significant effects for both men and women, the effects are stronger and more precisely estimated for men than for women. We conduct a number of diagnostic tests and robustness checks, which overall confirm the robustness of our empirical findings. However, the test of instrument validity suggests that the estimates for English women should be considered with caution. These findings support the hypothesis of *activity substitution* between employment and voluntary work at older ages, and are consistent with theoretical explanations based on opportunity costs of time investments or role stability.

We also observe some differences across countries. For example, the estimated effects are stronger and more precisely estimated for the three English-speaking countries than for continental Europe. In particular, for Southern Europe we only find significant increases in voluntary work provision among women. These differences are in line with overall participation rates in voluntary work, and might further reflect differences in the roles of volunteer and charity organisations relative to the welfare state and family for the provision of social services (Bambra, 2007). This may also explain why the increases in voluntary work provision in England, Ireland, and the U.S. seem to predominantly occur at the intensive margin, whereas in continental Europe retirement seems to affect voluntary work provision primarily at the extensive margin.

We also find further differences, e.g., regarding the role of partnership status, or the composition of the complier population. While these findings raise important questions about differences between the countries studied here, e.g., with respect to the structure of their labour markets as well as their volunteering and non-profit sectors, identifying the factors driving these differences is beyond the scope of this paper. Despite the large sample size of our study, some of our results (in particular for subgroups) are imprecisely estimated, and for some of the models larger samples are needed to determine whether results across countries are statistically different. Moreover, detailed information on the type of voluntary work provided might explain some of the observed differences between countries. Unfortunately, this type of information is only available for ELSA, and we could thus not draw on it for our harmonized analysis.

Another limitation of our analysis is that the measures of voluntary work provision are self-reported in the datasets we are using and might be subject to recall bias. Moreover, the frequency of volunteering is only reported in broad categories. Unfortunately, comparable prospective data (e.g., from time use diaries) are to our knowledge not available. Although our measures of volunteering are broadly comparable, there are some differences in the questions used across included surveys, which might affect our results. More generally, while our harmonised analysis provides important insights for a range of institutional settings, it also limits the depth of our analysis. For example, it is likely that the role of the state pension differs across institutional contexts. This particularly affects our analysis of SHARE – due to the limited sample size for each participating country we decided to aggregate 10 countries into three groups. This aggregation might mask important heterogeneity within these groups. Therefore, we conclude that our results show a consistently strong increase in voluntary work provision upon retirement in all countries, but we recommend that future studies should examine the potential differences more in-depth.

There is also considerable attrition within our working samples. While we argue that this attrition should not affect our identification strategy, we cannot rule out that it might influence our results. Our identification strategy crucially relies on the assumption that state pension ages are valid instruments for retirement. While the IV validity test fails to reject this assumption, we cannot rule out the presence of unobservable characteristics that might violate, e.g., the exclusion restriction. Moreover, IV methods only estimate a local average treatment effect and it is plausible that this may not generalise to the entire population. Finally, we pool several survey waves to obtain a sufficient sample size for the IV estimation. While we argue that it is unlikely that the relationship between retirement and voluntary work provision would have meaningfully changed over the eight years considered in our study, we cannot entirely rule out heterogeneity over time.

Our findings provide further evidence that older workers face important trade-offs in their time investment decisions (Eibich and Siedler, 2020; Fischer and Müller, 2020). Retirement relaxes these constraints and allows retirees to engage in other activities that are both beneficial to the individual (e.g., health investments) and to the wider society, such as provision of voluntary work. Thus, retirement can be an important part of an “active ageing” process by allowing older individuals to shift their priorities from employment to other commitments.

Yet, labour market policies in many developing countries aim to increase labour market participation at older ages, e.g., by raising the retirement age. Our results imply that such policies can have unintended consequences for the provision of voluntary work, at least in the short-term, as older workers will spend more of their time in employment rather than volunteering. Moreover, depending on the health effects of prolonged working lives, postponing retirement might further reduce voluntary work provision if retirees at older ages have fewer capacities to volunteer due to health limitations.

Data availability

ELSA data is available free-of-charge from the UK Data Service (https://ukdataservice.ac.uk/). TILDA data can be downloaded free-of-charge from the Irish Social Science Data Archive (www.ucd.ie/issda/), Gateway to Global ageing (www.g2aging.org/) and Interuniversity Consortium for Political and Social Research (www.icpsr.umich.edu/icpsrweb). Researchers will also need to apply

to the TILDA Statistics and Data Management Team, based at Trinity College Dublin (email: tilda@tcd.ie), for access to variables not included in these publicly-available files. HRS data is publicly available at the study website (https://hrs.isr.umich.edu/data-products).

This paper uses data from SHARE Waves 4, 5, 6, and 7 (DOIs: 10.6103/SHARE.w5.710, 10.6103/SHARE.w6.710, 10.6103/SHARE.w7.711), see Börsch-Supan et al. (2013) for methodological details.

The SHARE data collection has been funded by the European Commission, DG RTD through FP5 (QLK6-CT-2001–00,360), FP6 (SHARE-I3: RII-CT-2006–062,193, COMPARE: CIT5-CT-2005–028,857, SHARE-LIFE: CIT4-CT-2006–028,812), FP7 (SHARE-PREP: GA N°211,909, SHARE-LEAP: GA N°227,822, SHARE M4: GA N°261,982, DASISH: GA N°283,646) and Horizon 2020 (SHARE-DEV3: GA N°676,536, SHARE-COHESION: GA N°870,628, SERISS: GA N°654,221, SSHOC: GA N°823,782) and by DG Employment, Social Affairs & Inclusion through VS 2015/0195, VS 2016/0135, VS 2018/0285, VS 2019/0332, and VS 2020/0313. Additional funding from the German Ministry of Education and Research, the Max Planck Society for the Advancement of Science, the U.S. National Institute on ageing (U01_AG09740–13S2, P01_AG005842, P01_AG08291, P30_AG12815, R21_AG025169, Y1-AG-4553–01, IAG_BSR06–11, OGHA_04–064, HHSN271201300071C, RAG052527A) and from various national funding sources is gratefully acknowledged (see www.share-project.org).

Data preparation for SHARE use "The Harmonized SHARE version E.3": Gateway to Global ageing Data, Produced by the Program on Global ageing, Health & Policy, University of Southern California with funding from the National Institute on ageing (R01 AG030153)

The statistical code for the analyses performed in this study can be obtained upon request from the corresponding author.

Acknowledgments

We would like to thank Bruno Arpino, Eric Bonsang, Jo Mhairi Hale, Donal O'Neill, Miquel Pellicer, Olive Sweetman and Robert Wright for their helpful comments and suggestions. We would also like to thank seminar participants at the University of Torino, University of Southampton, and participants of the "Ageing of the Baby Boomer" workshop at the Federal Institute for Population Research for their helpful comments and suggestions.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.labeco.2022.102185.

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