The Best is Yet to Come:

Retirement and Prosocial Behaviour

Sotirios Georganas[a], Ioannis Laliotis[a,*], Alina Velias[a]

[a] City, University of London

Department of Economics

Abstract

We examine the impact of retirement on prosocial behaviour using individual cross-sectional and longitudinal data covering 22 European countries, as well as experimental data. Currently, there is no formal evidence on how individuals behave regarding their volunteering activity after they exit from the labour market. Identification relies on exogenous variation in the early retirement age legislation across countries, time and gender. We find that retirement increases the probability of volunteering and providing care to household members, at least for a few hours per week. The effect is stronger for females, people who are better educated, people not limited by health conditions, those with past volunteering activity and those with volunteering partners. The experiment involving 255 participants of pre-retirement and retirement age making incentive-compatible choices confirms that the increased volunteering is explained by a broader increase in prosocial preferences, rather than by having more free time upon retirement. Given the ageing of the population and the increased life expectancy at retirement, these are policy-relevant findings, providing evidence on time and effort allocation decision of retirees, as well as their productive capacity regarding unpaid labour supply. Targeted policies could stimulate their interest and engagement in prosocial activities.

Keywords: Retirement; Prosocial behaviour; Volunteering

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[*] Corresponding author: City, University of London, Department of Economics, Northampton Square, London EC1V 0HB, UK. E-mail: ioannis.laliotis@city.ac.uk. We are thankful to participants at the EALE/SOLE/AASLE Conference, June 2020, for their useful feedback and suggestions. We thank Saqib Jafarey and Charitini Stavropoulou for their comments on earlier versions. We also thank Foteini Angelidou for conducting the interviews in the experimental part of our work. Ioannis Laliotis acknowledges financial support from City, University of London (Research Pump-Priming Fund 90648AL). Declarations of interest: none. The usual disclaimer applies.

1. Introduction

Retirees are often portrayed as carefree, kindly people in literature and film. Is there any substance to this portrayal - are retirees actually more prosocial? And if they are, does the increase in prosociality stem just from the wisdom that accompanies old age, or is there something special about retirement that makes people more altruistic? Is retiree altruism related to spending more time helping others (given they have more of it), or are they also more willing to sacrifice their income to support relatives and/or strangers?

In this paper we aim to answer these questions, using data from surveys that include questions on volunteering, in several European countries. We use volunteering as a proxy for altruism and indeed find that retirees volunteer more. In the next step, we use incentivised experiments on a relatively large sample of retirees in Greece to dig deeper into the nature of retiree altruism and the mechanisms through which retirement makes people more prosocial. We find that evidence that retirees are more likely to offer both in-kind and monetary donations, favouring an enhanced prosociality rather than an increased spare time mechanism.

The literature on human altruism is very large. We have clear evidence that individuals often engage in prosocial behaviour -those promoting others' well-being (Brief and Motowildo, 1986)- even when they are costly to themselves, e.g. volunteering, helping others, participating in political organisations, voting, donating to charities, etc. (Bénabou & Tirole, 2006). Age is a factor that partially explains variation in prosocial behaviour; price incentives, personality traits, social pressure, institutions, gender, and education are some others (e.g. Branas-Garza et al, 2018; Dohmen et al., 2008; Kettner and Waichman, 2016). The economics and psychology literature point to positive links between prosocial behaviour and age: motivational shifts to more emotional goals (Carstensen and Charles, 1998), empathy and prosocial behaviour (Sze et al., 2012), both probability and amount of charity donations ((Bellemare et al., 2008; Carpenter et al. 2008; List, 2004) as well as hours volunteered (Katz and Rosenberg, 2005).[1]

There is no evidence on how transition to retirement affects prosocial behaviour, with the economics literature currently focusing on labour market effects of volunteering using working-age samples.[2] Such transitions are major events that typically occur later in life and for age-related reasons, and they are associated with important changes in lifestyle, consumption, activity, health and wellbeing (Battistin et al., 2009; Coe and Zamarro, 2011; Fitzpatrick and Moore, 2018).

Withdrawing from the labour market and entering retirement is challenging. Individuals switch from a working-life structure to one in which they identify themselves as retirees (Van Solinge and Henken, 2008). Despite this transition being totally anticipated, individuals still face challenges to adjust regardless of their pre-retirement working conditions (Centre for Ageing Better, 2018). Mutchler et al. (2003) stretch out two competing theories on how prosocial behaviour might be

[1] Several indicators of prosocial behaviour are considered in the empirical analysis (volunteering, providing care, active citizenship). The terms volunteering and prosocial behaviour are being used interchangeably throughout the paper.

[2] Sauer (2015) used data for women aged 25-55 years old from the Panel Study of Income Dynamics (PSID) and estimated that an extra year of volunteering increases full-time and part-time wage offers by 2.6 percent and 8.5%, respectively, and lifetime earnings by 16.7%. Cozzi et al. (2017) demonstrated that volunteer experience is related with higher earnings for both genders. Through a field experiment, volunteering has also been shown to be associated with increased hiring chances (Baert and Vujic, 2017).

linked to transitions from paid work to retirement. The first theory predicts a negative relationship, arguing that work and volunteering are complements. Individuals will use some sort of prosocial behaviour as a signalling device in the labour market, and as a means to accumulate human capital and develop career-promoting networks (Menchik and Weisbrod, 1987). As individuals switch from paid employment to retirement, social networks shrink and productive opportunities decline, therefore their motivation to engage in prosocial activities diminishes (Mutchler et al., 2003).

The second theory argues for a substitution effect. It predicts a positive relationship that allows individuals to maintain their desired level of wellbeing. This substitution could be seen as a response to their increased time availability, the role or occupational loss, and the identity disruption caused by labour market disengagement. Using descriptive evidence, Sherman and Shavit (2012) argued that changes from employment to retirement positively affect the likelihood to involve in volunteering activities. The authors discussed how the standard life-cycle hypothesis can be modified to predict the positive impact on volunteering for people who retire. While working, total consumption is the sum of all material goods plus the immaterial product of work per se, i.e. the subjective gains associated with -paid or unpaid- work. Under this assumption, total consumption will fall if the supply of unpaid working hours is zero post-retirement. As individuals seek to smooth out total consumption over time, they are motivated to start engaging in some sort of prosocial behaviour, e.g. participate in voluntary activities, or increase their supply of unpaid labour relative to their pre-retirement level.[3] Mutchler et al. (2003) used data from Americans' Changing Lives (ACL) survey respondents aged 55-74 years old, to demonstrate increased volunteering activity for part-timers, those not working and those who stopped working between interviews, relative to full-time employees. They suggested that this positive effect operates through formal, rather than informal, volunteering. The insensitivity of informal volunteering to work status was attributed to its obligatory nature and reductions in requests for help or support due to shrinking social networks once retired.

On the other hand, generativity was shown to increase interest in volunteering among later adulthood individuals, whilst community service motivation was significantly associated with individuals' interest in volunteering among all life stages, and social networking motivation was unique among the early and middle adulthood groups (Yamashita et al., 2019). Therefore, it is still not quite clear whether a potentially positive relationship between retirement and volunteering is due to increased time availability or enhanced prosocial preferences.

Understanding the link between retirement and prosocial behaviour is important for two reasons. Firstly, for the accurate welfare analysis of retirement-related policies. Despite the fact that economists often attach an explicit zero wage to the supply of volunteer labour -or unpaid work in general-, the implications for the economy are considerable (Menchik and Weisbrod, 1987). Therefore, volunteering -even later in life- can have a substantial contribution to the economy. In the UK, for example, volunteer work represents about 3.7% of the total labour supply in the

[3] Using the German Socio-Economic Panel, Erlinghagen (2010) reported that the effect of retirement on volunteering is exaggerated and mostly determined by the decision to continue offering voluntary work that was already taken up before retirement. However, the study pooled data from two distant waves, i.e. 2001 and 2005, that did not allow for a direct test of this mechanism. Moreover, it did not evaluate the effect of retirement on voluntary activity, but rather reported regression coefficients -not conditional on time effects- of retirement status on binary variables indicating whether someone started or ceased volunteering between waves.

country.[4,5] Moreover, the 7% drop observed in dedicated volunteer time during 2012-2015 was associated with a loss greater than £1 million. They also estimated that one hour of volunteering per week is worth £750.4 per year, and that unpaid work for this type of activity has the second highest value after childcare, and ranks before other unpaid activities, e.g. housework, adult care, transport, laundry and cooking. As the figures sketched out above refer to volunteering alone, the total contribution coming from all types of prosocial behaviour in an economy is higher, although difficult to be precisely quantified. As the both the share of retirees and their life expectancy will keep growing, encouraging them to get involved in prosocial activities will enhance their role in reducing social costs and increasing welfare, let alone the positive effects that volunteering has been shown to have on own wellbeing. Apart from volunteering, the increased prosociality of retirees could mean higher transfers to their offspring and their children. This means that retirement policies have obvious distributional effects, but also possibly effects on consumption patterns.

Secondly, for the practical reasons of addressing a potentially excess demand for volunteering opportunities by retirees, and harnessing the associated welfare loss. In the 2015-16 Community Life Survey (CLS), 51% of the respondents in the 65-74 age group participated in voluntary activities at least once a month, compared to 42% and 30% for the 50-64 and 25-34 age groups, respectively. Moreover, according to the ONS analysis, those above 65 years old reported 13.4 minutes of formal volunteering per day, on average, while those aged 25-34 reported a daily average of only 6 minutes.

This paper is the first to provide empirical evidence of the impact of retirement on prosocial behaviour, as the latter is -mostly- captured by participation in volunteering activities. Our empirical analysis uses two strands of data. The first one are the survey data samples from the European Survey on Income and Living Conditions, and the Survey of Health, Ageing and Retirement in Europe. The identification strategy relies upon a fuzzy regression discontinuity design. Therefore, the endogenous decision to retire is modelled as a function of whether an individual's age has crossed the legislated early retirement age threshold that applies in their case. In this way, the discontinuous jump of the retirement probability at institutionally set age thresholds will allow the identification of the impact of retirement on prosocial behaviour indicators. Our first set of 2SLS and FE-2SLS results includes evidence of both survey samples that are quite comparable and indicate that there is a positive relationship between retirement and prosocial behaviour. The result is robust to sensitivity tests, past prosocial activity, partner's volunteering activity and partner's retirement. Retirement positively affects the probability of volunteering, by around 10%, and the relationship is marginally stronger when considering formal volunteering.

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[4] The UK is used as an example due to data availability. The ONS analysis used data from the UK Household Satellite Accounts. More information can be found here:
www.ons.gov.uk/employmentandlabourmarket/peopleinwork/earningsandworkinghours/articles/billionpoundlossinvolunteeringeffort/2017-03-16

[5] The Office for National Statistics (ONS) reported that 1.93 billion hours of volunteer work were supplied in the UK during 2015. According to the UK Labour Force Survey (LFS), the total number of actual weekly hours worked in 2015 was 1,004 million, or equivalently 52.2 billion worked hours over the year. Hence, volunteer work represented about 3.7% of the total labour supply in the country.
www.ons.gov.uk/employmentandlabourmarket/peopleinwork/employmentandemployeetypes/timeseries/ybus/lms

We build on this evidence by using an incentivised experiment to uncover the causal links in this behavioural change. The positive link between retirement and prosociality is also confirmed with the experimental data. Our second set of results demonstrates that retirees have higher prosociality in both in-kind and monetary donations. This points towards the mechanism of increased prosocial preference post-retirement, rather than a mechanism related to increased time availability or preference for same amount of labour. To our knowledge, this is the first study that measures volunteering activity in the subjects rather than relies on self-reported measures. Also, this is one of a few studies experimental studies with retirees, especially involving real effort, with several methodological innovations that had to be introduced.

Our findings improve our understanding of the behaviour, and time and effort allocation decisions of a growing part of the European population that exit the labour market in later life, i.e. retirees. Transitions to retirement become more frequent with population ageing. In Europe, working-age population is decreasing and the old-age dependency ratio, i.e. people over 65 years old relative to working-age ones, will rise from 29.6% in 2016 to 51.2% in 2070. Moreover, life expectancy at retirement will increase by over five years by 2070 (European Commission, 2018).[6] Hence, behaviour, time allocation decisions and productive capacity of retirees are central in policy-making (Centre for Ageing Better, 2018; Mutchler, 2003). Lastly, this study contributes towards the wider agenda of understanding what drives prosocial preferences in general, highlighting heterogeneity in prosocial motivations driven by age and employment status.

The remainder of the paper is structured as follows: Section 2 presents the data sources and the construction of the main variables used in the analysis. Section 3 outlines the adopted identification strategy, including the experimental design. Section 4 presents and discusses the results. Section 5 concludes.

2. Data

2.1 Data sources

One dataset used in this work is the European Union Statistics on Income and Living Conditions (EU-SILC), provided by the Eurostat. Since 2004, EU-SILC collects data on demographic characteristics, income, employment, living conditions and several activities. In the 2015 and 2016 waves, they provided information on prosocial activity, i.e. volunteering (formal and informal; 2015 sample), provision of care to others (inside and outside the household; 2016 sample) and active citizenship (2015 sample).

The analysis using EU-SILC data is coupled with information from the Survey of Health, Ageing and Retirement in Europe (SHARE). SHARE is a cross-national longitudinal survey collecting information on demographics, health, and socio-economic status for individuals aged over 50 years old. For the SHARE sample to be comparable to the EU-SILC one, waves 4, 5, 6 and 7 are used, covering 2011, 2013, 2015 and 2017, respectively. In those waves, individuals provided

[6] Consequently, labour force participation among those 20-64 years old in the EU will increase from 77.5% in 2016 to 80.7% in 2070 (European Commission, 2018). As a response, many countries encourage new forms of working in later life, e.g. partial-retirement, bridge jobs and un-retirement (Centre for Better Ageing, 2018). Wahrendorf et al. (2017) presented evidence about paid employment beyond age 65 becoming more common across Europe.

information regarding their voluntary activity, however, without distinguishing between formal and informal volunteering. However, SHARE data have two advantages. The first one is that surveyed individuals were around their retirement age. The second one is that SHARE follows individuals over time. This allows to control for unobserved heterogeneity and for dynamics in prosocial behaviour.

Our analysis also incorporates a field experiment, which involved a separate subject pool. In the experiment, subjects answered a questionnaire similar to the EU-SILC and SHARE ones, which included questions about volunteering. Subjects then took part in a lottery and effort experiment. We describe the experiment in detail in the mechanism section below. Individual interviews took place over the phone. Using social media announcements, word of mouth and local pharmacies we specified the target age to be 15 years around retirement, and randomised contacts between waves. The data collection took place over 3 waves, 4 days each: 30 April - 3 May, 14-17 May, and 24-27 September 2020 (i.e. during, straight after and a while after the COVID-19 lockdown in Greece). A total of 255 individuals aged 38-84 years old participated.[7]

2.2 Retirement and retirement eligibility

Using individual responses regarding own current activity status, a binary variable is constructed to indicate retirees, versus non-unemployed labour market active individuals, i.e. excluding those in military/community service, studying, disabled or performing domestic tasks. Information about the timing of the interview and the timing of birth is also available; i.e. quarter and month in the EU-SILC and the SHARE data, respectively. Hence, we calculate the respondent's age at the time of the interview. Age is crucial because it predict treatment status; the probability of retirement increases with age. Moreover, the calculated distance between an individual's age and the official early retirement age (ERA) in their country will be used as the forcing variable in the econometric design.

Retirement eligibility is at the heart of European welfare systems. Over time, countries have implemented a series of pension reforms, including ERA increases. Hence, ERA is an important institutional threshold determining who can exit from the labour market and start claiming pensions. Moreover, it is associated with major changes in behaviour, health and lifestyle (Fitzpatrick and Moore, 2018). Similar to other studies, e.g. Muller and Shaikh (2018), information on early retirement eligibility age was collected from the Social Security Programs Throughout The World Survey (SSPTWS) which is available from the U.S. Social Security Administration (2016), as well as from OECD Pensions At A Glance reports (e.g. OECD, 2017). In the sample of European countries considered here, ERA is more frequently set after 60 years old. However, there is variation over time, across countries and by gender. For example, ERA in Austria in 2015 was 64 years and 59 years for men and women, respectively while in 2016 both thresholds were increased by one year. In other countries, e.g. Denmark and Czech Republic, ERAs remained unchanged (see Appendix).

[7] Response rate was 63% in the first wave (150 contacted, 94 participated), 70% in the second wave (150 contacted, 105 participated), and 60% in the third wave (93 contacted, 56 participated).

2.3 Outcome variables

The International Labour Organisation (ILO) defines volunteering as "any unpaid, non-compulsory activity to produce goods or provide services for others; that is for economic units outside the volunteer's household or family". Within this, two types of volunteer work are identified: informal and formal. Our first prosocial behaviour indicator is about participation in formal voluntary work. Respondents reported if, during the last 12 months, they carried out any unpaid non-compulsory work for or through an organisation, a formal group, a club as well as for a charitable or religious organisation. Activities related to people, the environment, animals and the wider community, and attending meetings related to those activities were considered. Unpaid internships in profit-making companies were not considered. Respondents justified their non-participation in formal volunteering due to lack of interest, lack of time or other reasons. Their answers were grouped to construct a binary outcome indicating participation or not to formal volunteering.

Our second prosocial indicator records participation in informal voluntary activities. Respondents aged 16 and over in the 2015 EU-SILC wave were asked whether, during the last 12 months, they undertook any informal unpaid activities that were not arranged, organised or motivated by any organisation. These activities include helping other people including family members living outside their household (e.g. cooking for others, taking care of people in hospitals or at home, taking people for a walk, shopping etc.), taking care of homeless or wild animals, and participating in other informal voluntary activities (cleaning a beach, a forest etc.). Informal volunteering excludes any activity related to own household, work or undertaken within charitable organisations. Respondents (aged 16 years old and over) also report whether not being engaged in informal volunteering was due to lack of interest, time or other reasons. A binary variable indicating participation or not to informal volunteering was constructed. However, because informal volunteering can occur through any informal arrangement, it is difficult to be precisely captured.

General information on voluntary work, either formal or informal, is not provided in the EU-SILC. Therefore, individual responses on formal and informal volunteering questions were grouped to construct a general voluntary activity indicator. Information on volunteering is collected in the SHARE data, however, without distinguishing between different types. Individuals were asked whether they did any voluntary or charity work during the last year and this information was used to construct a volunteering work indicator and check whether the results from the two surveys are comparable. Non-volunteers were not asked for a reason of why they did not volunteer. In a later section we explain how we set up an experiment to measure participants' volunteering activity.

The 2015 EU-SILC wave also reports if individuals participated in political or local interest group activities, public consultation, peaceful protest, petition signing, participation in demonstration, writing letters to politicians or the media. Active participation using the internet and attending meetings related to these activities were also considered. Voting and participation in elections were not considered. Not participating in such activities was justified due to lack of time, interest or other reasons. An active citizenship indicator was constructed using those responses. Similarly, the 2016 EU-SILC wave collected information on providing care or assistance to others (excluding

childcare). Three outcome variables were constructed using those responses: (a) whether the respondent provided care or assistance to people from inside or outside their household relative to those who not engaging in such activities; (b) whether someone provided care or assistance only to household members relative to those who do not provide any care or assistance; and (c) whether someone provided care or assistance only to people from outside the household relative to those who do not engage in any caring activity.

Table 1 presents descriptive statistics, by retirement status, on those outcome variables using both surveys. Statistics are weighted by the respective survey weights. Samples have been restricted to include individuals within a 10-year window around their country, gender and year-specific ERAs. This is the time window used throughout the empirical analysis. Statistics on voluntary work are obtained from the SHARE sample. Based on this sample restriction there are 121,182 individuals in this sample, and 58.2% of them is retired. Overall, 19.6% of the total SHARE sample reported some voluntary work. Retirees seem to be more involved in voluntary work than non-retirees and the difference is statistically significant. For a more disaggregated information on prosocial behaviour, statistics on outcome variables from the EU-SILC sample are reported. After applying the same sample restriction, 87,768 individuals are left in the sample with 47.1% of them being retired.[8] In the EU-SILC sample, 27.3% and 23.8% of the individuals report offering informal and formal voluntary work, respectively. Although higher, these figures are comparable to voluntary incidence in the SHARE sample. Regarding informal voluntary work, EU-SILC retirees seem to be more involved in a statistically significant way. The incidence of formal volunteering and care provision to other people within the household is more balanced between retirees and non-retirees. Non-retirees are more likely to provide care to non-household members and be more active citizens. Regarding the experimental data, the sample seems balanced with respect to labour market status. Retirees are less likely to offer formal volunteering than non-retirees but the difference is not significant; the difference is negligible when considering informal volunteering.

[Table 1 here]

3. Estimation Strategy

The objective is to identify the causal link between retirement status and prosocial behaviour. Retirement is endogenous as individuals can opt to retire earlier or later in their lives depending on their health, wealth, time preferences, institutional that regulate the retirement eligibility criteria that apply to their case. A natural experiment randomly assigning individuals to groups of retirees and non-retirees would be ideal in providing a causal answer to this empirical question. However, such experiments are not feasible and simple regression methods are likely to result in biased and inconsistent estimates regarding the effect of retirement on prosocial behaviour. Instead, a fuzzy regression discontinuity (RD) design is adopted. Endogeneity concerns are addressed by exploiting

[8] To further check that individuals identified as retirees have actually withdrawn from the labour force, the variable recording whether someone worked at least one hour during the week before the interview. In the EU-SILC sample 93.7% of retirees reported no hours of work last week. In a similar question 85.9% of the SHARE retirees sample reported no hours of paid work during last 4 weeks. Excluding those retirees reporting (paid) hours of work from the estimation samples does not affect the results.

discontinuous jumps of the retirement probability at the year, country, and gender-specific ERA thresholds that apply to each individual in my samples.

3.1 Fuzzy Regression Discontinuity Design

The implementation of an RD design relies upon information of a policy rule that determines whether an individual is potentially treated. In this context, retirement status is partially determined by whether an individual's age, i.e. the forcing variable, crosses a known cutoff point *c*, which is the early retirement eligibility age that applies to each individual given their country, year and gender. The validity of the RD design relies on the fact that individuals cannot manipulate the forcing variable around *c*, and therefore they are considered to be randomly classified as treated and non-treated (Lee and Lemieux, 2010).

In the European context, crossing the institutional cutoff point does not imply compulsory retirement. Instead, there is imperfect compliance because the discontinuity in the retirement probability is lower than 1 as someone crosses ERA. This calls for a fuzzy RD design where the forcing variable (age) can only partially determine retirement status. Therefore, a 2-Stage Least Squares (2SLS) framework is applied in order to instrument individual retirement status using the predicted discontinuity in the probability of retirement after crossing the ERA. The following system of parametric equations is estimated:

$$y_{ic} = \beta_o + \beta_1 D_{ic} + \beta_2 \widetilde{age}_{ic} + \beta_3 \widetilde{age}_{ic} D_{ic} + X_{ic} + \mu_c + \varepsilon_{ic} \quad (1)$$

$$D_{ic} = b_o + b_1 \widetilde{age}_{ic} + b_2 I_{ic} + X_{ic} + \mu_c + v_{ic} \quad (2)$$

In this framework, y_{ic} is the reported prosocial behaviour of individual *i* in country *c* and *D* is an indicator variable of the retirement status. The forcing variable is centered at the country, year and gender-specific ERA, i.e. $\widetilde{age}_{ic} = (age_{ic} - c_c)$. Retirement is instrumented using binary indicators on whether the *i*-th individual's age has crossed the ERA threshold, i.e. $I_{ic} = 1[\widetilde{age}_{ic} \geq 0]$. All models include a set (X_{ic}) of pre-determined characteristics such as gender, education, and ethnicity. A set of country fixed effects, μ_c, is also included to account for time-invariant differences across countries, e.g. in the institutional framework or culture. Models also control for time fixed effects to adjust for common time trends.[9] Finally, ε_{ic} and v_{ic} are idiosyncratic disturbance terms. In the cases where Equation (1) is estimated using longitudinal rather than cross-sectional data, model specifications control for individual fixed effects and lagged variables.

Under Equation (1), the impact of retirement on prosocial behaviour is given by β_1. Equation (2) is the first-stage regression indicating how retirement probability changes at the cutoff, i.e. b_2. Linear interaction terms between the forcing variable and the instrument are also included as

[9] The EU-SILC data are cross-sectional, however, a set of quarter-of-survey fixed effects is included to control for seasonal patterns. Whenever the SHARE sample is used, a set of year fixed effects is included in the models.

additional instruments, i.e. $\widetilde{age}_{ic}I_{ic}$, in order to allow for different slopes at both sides of the cutoff point. In this case, additional first-stage regressions are estimated for the interaction terms. Models using higher-order polynomials of the forcing variable are also estimated, although their use is avoided in RD designs due to poor performance, especially when samples are not sufficiently large around the cutoff (Gelman and Imbens, 2018).

Given this framework, the estimated β_1 coefficient in Equation (1) is interpreted as the local average treatment effect (LATE) of retirement on prosocial behaviour indicators. In other words, it is the average treatment for the compliers, i.e. for those individuals who exit labour market and enter into retirement once they cross the ERA threshold.

3.2 Experiment set-up

3.2.1 Measurements

The first set of measurements we take are identical to those in EU-SILC and SHARE data, which enable to compare self-reported volunteering between surveyed individuals and our experiment participants. Specifically, we ask participants about self-reported volunteering (and reasons for not volunteering), time spent helping family, general social and cultural activity, health, and the standard socio-economic indicators such as age, gender, education, labour status and so on.

The second set of measurements are fully incentive-compatible. They involve participants' choices about real in-kind and and donations to be made to real charities. The first incentivised measurement constitutes a real effort task where participants could earn up to €5. Before they started the task, they had to choose the recipient of the earnings from their labour from the following options, that cover all possible consumption options (appendix Figure A3):

• Keep it for myself.

• Give it to a relative/friend.

• Donate it to the Church of Greece.

• Donate it to a charity (of your choice) for the environment

• Donate it to a charity (of your choice) for refugees.

• Donate it to a charity (of your choice) for cancer.

This measure is designed to gauge the preference for volunteering (as captured by surveys) in an incentive-compatible way. Conversely, we expect people who report having volunteered in the past year to be more willing to volunteer their labour towards a charity recipient in our experiment.

The first incentivised measurement constitutes a lottery draw, where participants had a 1/100 chance of winning €200. Before learning the outcome of the draw, participants were asked about proportions of the potential earnings they wanted to allocate to the list of options was identical to the real-effort task (appendix Figure A4). Participants could choose any combination of allocations and number of recipients, as long as it added up to €200. They could also indicate the details of

the friend, relative or the charity organisation they wished to donate to.[10] This measure is designed to gauge the broader pro-social inclinations that are not dependent on time availability. Conversely, if increase in volunteering was driven by greater time availability, we would expect the monetary donations for a given level of in-kind donations to remain the same after retirement. Formally, we use the experimental measurements to test the following hypotheses:

H1: The post-retirement increase in volunteering is observable in our sample and comparable to the survey-based evidence.

H2: Post-retirement increase in volunteering is driven by lower cost of time, while prosocial preferences remain stable. In this case, we would (i) observe retirees providing -on average- greater effort than non-retired participants, and (ii) for the same level of in-kind donation, a retired person would provide the same or lower monetary donation than a non-retired person.

H2Alt: Post-retirement increase in volunteering is driven by an increase in prosocial preference after retirement. In this case, we should see both real effort volunteering and monetary donations to charity to be higher among retirees.

In short, we (i) test if retirement predicts greater self-reported volunteering in the experimental sample and (ii), if retiree's in-kind donations (experiment's analogue of volunteering) predict greater monetary donations, which are our measurement of pro-sociality.

3.2.2 Design

We created a number of novel experiment design solutions to ensure the inclusivity of the sample, and credibility towards incentivised measures. Both are crucial for the external validity of the results. Specifically, we expected some retired participants to be less tech-savvy and less willing to travel, compared to the average subject pool of a study reliant on a real-effort task. Additionally, COVID-19 quarantine measures came into place, which eliminated the option of administering the study face-to-face, with the interviewer inputting answers into the tablet.

We selected the real effort task that satisfied the criteria we believe were important to ensure the sample's representativeness: (i) skill-independent; (ii) free of intrinsic value (to avoid unobserved heterogeneity in enjoyment, sense of purpose, etc.) (iii) suitable for elder people, (iv) possible to administer over the phone, rather than exclusively online or in the lab. Whilst most of the existing real effort tasks satisfy requirements (i) and (ii), requirements (iii) and (iv) were specific to both our research question and the data collection timing. We wanted to minimise the exclusion from our sample based on technology (for example, online participation requires certain level of internet proficiency) or willingness to travel (for lab participation). to address this challenge, We designed what we believe is a novel real-effort task, that was administered over the phone.

The real-effort task involved counting the number of vowels in common words of the local language, i.e. in Greek. Subjects could earn up to €5 by completing up to seven sets of tasks, four vowel counts in each. To ensure equal time and effort cost, we pre-recorded audio clips of the research assistant pronouncing the words, with gaps in-between for the subject to provide the answer. The participants first learned the nature of the task; they could then choose one recipient

[10] We were careful for the recipient details not to impose privacy concerns (friend or relative) or make the decision too tasking (remembering the exact name of the charity). The interviewers would tell the subjects that they could indicate the full details if they won, if they were struggling with the sub-question.

of the real-effort task's earnings. They then listened to the audio clips and reported the vowel counts (appendix Figure A5). Participants were free to stop the task at any stage and move on to the next section of the study.

Designing how to credibly administer the lottery over the phone was non-trivial. The interviewer would ask the participant to find any banknote in their wallet and read out the digits of the serial number, apart from the last two. The last two digits were the lottery number. The interviewer would then generate a random number and tell it to the participant. The participant knew that they would win the lottery if the last two digits of the serial number on their banknote (unknown to the interviewer at that point) were the same as the random number the interviewer had just told them (appendix Figure A6).

It is not surprising that experiments involving elder and, in particular, retired people are very rare. To our knowledge, there is only one controlled laboratory experiment involving retirees in their late sixties. Sutter and Kocher (2007) use a lab setting to study the relationship between age and trust. Their sample of 64 retirees was recruited from athletic courses for retired persons at the local Department of Sports and from an adult education institution, which organizes seminars on various topics and for various age groups. Similarly, Holm and Nystedt (2005) administered a mail-based semi-experimental trust game with participants of 20 and 70 years old, using public database in Sweden. Charness and Villeval (2009) explore cooperation and competition in a sample involving 39 elder (over 50 years old) employed people. Our experiment is the first that administered a controlled experiment administered to a sample of 123 retirees and 105 non-retirees of close-to-retirement age.

4. Results

4.1 First stage results and RD validity checks

Because retirement status is endogenous it is instrumented with the ERA indicator. This variable must be relevant and valid in order to be a suitable instrument. Throughout European countries, ERAs are exogenously set by the governments, hence validity cannot be formally tested. Therefore, ERAs are assumed to be linked to prosocial behaviour only through transitions to retirement. For the instrument to be relevant, a strong first-stage relationship between the endogenous variable and the instrument is required, i.e. the probability of being retired must be strongly predicted by the ERA indicator, I_{ic}.

Figure 1 scatters the share of retired individuals by their ERA-normalised age (specific to year, country and gender) using EU-SILC (waves 2015 and 2016) SHARE (waves 4-7) and our experiment data. SHARE means lie slightly above the EU-SILC ones, because SHARE surveys individuals older than 50 years old and closer to their retirement age. The experiment data also follow these patterns, although in a bit noisy way due to a considerably smaller sample size.[11] The graph confirms that there is no perfect treatment compliance as some individuals retire before they reach their ERA while others stay in the labour market even after having crossed it. However,

[11] The similarity between the experiment and the survey data lines is more evident if the EU-SILC and SHARE samples are restricted to individuals from Greece alone. Results available upon request.

the share of retirees increases disproportionately at the eligibility age cutoff, providing reassurance about the instrument strength.

[Figure 1 here]

Panel A in Table 2 displays first-stage results from Equation (2) using the EU-SILC sample to support this claim. The probability of retirement increases by 28% when a local constant age function is specified (column 1). Using a linear age function at both sides of the ERA cutoff (column 2) suggests that the discontinuity in retirement probability is 31% higher for those having crossed their ERA. Discontinuities are also significant when quadratic and cubic age functions are specified at both sides of the cutoff. In all cases, the instrument relevance condition is satisfied. The retirement eligibility indicator strongly predicts retirement status, it is always statistically significant at the 1% and the first-stage *F*-statistics of excluded instruments are sufficiently high. We get similar results using the SHARE sample, in Panels B and C.

[Table 2 here]

The identifying assumption in an RD design is that individuals cannot manipulate the forcing variable around the cutoff age. Therefore, all observable characteristics should be balanced around the cutoff and individuals below it should be a valid control group for those above it, i.e. the treatment is considered to be as good as random (Lee and Lemieux, 2010). Examination of the forcing variable density around the cutoff can validate that local assignment could be considered as random. Figure A1 in the Appendix displays a normalised age histogram within a time window of -/+ 10 years around ERA. The forcing variable is smooth around the cutoff age providing no evidence of forcing variable manipulation.[12]

4.2 Impact of retirement on prosocial behaviour

After establishing the existence of a strong first-stage relationship between retirement status and early retirement eligibility, the impact of retirement on prosocial behaviour indicators is examined. Panels A-C in Table 2 report our results. Models control for individual characteristics, time of survey, country fixed effects, and for individual fixed effects (Panel C). Regressions are weighted

[12] We also test if predetermined individual characteristics, i.e. gender, nationality and education, are locally balanced around the cutoff. Individuals around the cutoff should not be systematically different if the treatment is locally randomised. We obtained some 2SLS retirement estimates using predetermined covariates as outcomes, and focusing on a short time-window around the cutoff age. All parameters were not statistically significant indicating that treated and control individuals are balanced in terms of observables. Results are available upon request.

using the relevant survey weights and they are estimated over a 10-year time window around the cutoff age.[13]

Panel A presents 2SLS estimates regarding the impact of retirement on the incidence of voluntary work, formal voluntary work and informal voluntary work. The voluntary work indicator has been constructed using the formal and informal volunteering variables provided by the EU-SILC. The results suggest a positive and significant relationship. Retirement increases the probability of engaging into voluntary work by approximately 8% based on the local linear specification in column 2. The result remains positive when second order polynomials of the forcing variable are used, however it is less precisely estimated. Using higher-degree polynomials of the forcing variable returns much noisier estimates. Hence, models with local linear age functions will be used as the preferred specifications.

Distinguishing between informal and formal voluntary activity does not uncover any notable differentiation regarding the impact of retirement. Retirement increases the probability of informal voluntary work by 6%-8%, depending on how the forcing variable is specified. The incidence of formal voluntary work post-retirement increases by about 7%. Although not reported here, active citizenship is not affected by retirement status. The same holds when considering provision of care to other people inside and outside the household. Providing care to household members only, is associated with a positive although not significant coefficient.

The usefulness of the EU-SILC data relies on the availability of several prosocial behaviour indicators. From this perspective, the SHARE data are not so rich; in waves 4, 5, 6 and 7 only information about respondents' voluntary activity last year was collected.[14] However, SHARE collects information from a panel of individuals at least 50 years old, hence closer to their retirement. Therefore, Equation (1) is re-estimated conditional on the SHARE data in order to see whether the impact of retirement on voluntary activity is comparable between databases. (Panels B-C in Table 2). The SHARE sample is considerably larger than the EU-SILC one, and covers the period 2013-2017. The results of retirement on voluntary work are remarkably similar to those obtained using the EU-SILC sample.[15] Retirement increases the probability of voluntary work by about 9% (columns 1-3), depending on how the age function is specified. Moreover, because SHARE follows respondents over time, Panel C reports parameter estimates conditional on individual fixed effects. These should capture any unobserved time-invariant heterogeneity correlated to both volunteering activity and retirement status. The FE-2SLS results confirm the

[13] Individual survey weights have been adjusted based on the distance of each individual's age from the ERA threshold, so that individuals closer to it (from either side) are attached to a greater weight. However, results are robust to alternative weighting schemes.

[14] Unlike in the EU-SILC data, no distinction on the type of voluntary work is available. Recall that in EU-SILC, the voluntary activity indicator has been constructed using originally provided information on formal and informal volunteering.

[15] The lists of countries covered by the two surveys overlap to a great extent. The EU-SILC estimation sample covers 22 countries and the SHARE one covers 19 countries (observations for Norway, Ireland and The Netherlands are not available). When the EU-SILC sample is forced to cover the countries covered by the SHARE one, the estimation sample reduces from 85,695 observations to 79,331 observations but the results remain practically the same. The retirement coefficient is .087 and the standard error is .037 (compared to the result in Table 3, panel A, column 2). A full list of the countries included in both samples is provided in the Appendix.

positive relationship between retirement and voluntary work, suggesting that retirement increases the probability of voluntary work by 10%-13%, depending on the local age function specification.[16]

4.3 Robustness checks

The results so far have been estimated using a 10-year bandwidth around the ERA cutoff. To check their sensitivity to the bandwidth choice, baseline models using a local-linear age function are re-estimated using a range of alternative bandwidths. Figure A2 displays the results for formal and informal volunteering since no significant retirement effects on care provision and active citizenship were uncovered. 2SLS coefficients are plotted with their 95% confidence intervals. Horizontal dashed lines represent the baseline effects. For both formal and informal volunteering, the results are robust to the bandwidth choice although estimates become noisier as the time window gets narrower. Panel A reports the respective 2SLS-FE results for the impact of retirement on volunteering using alternative bandwidths on the SHARE sample. Regardless the bandwidth choice, the estimated parameters are in the neighbourhood of the baseline effect (horizontal line).

Another robustness test is to replace actual ERA for each individual by fake ones ranging a few years back. This will indicate whether prosocial behaviour is affected before crossing the official ERA, because individuals might choose to retire earlier or they start adjusting their behaviour as they approach retirement. Table 3 displays the results which are based on a local linear age function and control for the usual set of variables and fixed effects. Regarding informal volunteering, there are some statistically significant estimates up to four years before the actual ERA that disappear for earlier years. The results are in accordance with Mutchler et al. (2003) who reported that informal volunteering is not affected by working status, mainly due to its obligatory nature. Moreover, they argued that as people grow older and retire, they should be receiving less requests for informal help because their social networks shrink post-retirement. This could also be hidden behind the diminishing parameter estimates in column 1; recall that the actual baseline effect is .061, i.e. lower than the placebo one estimated for *t*-1.

However, there are no significant estimates when placebo ERAs are used when formal volunteering is considered as outcome (column 2). This indicates that people tend to change only their informal volunteering behaviour as they approach their ERA. This is not the case for formal volunteering as the latter is more likely to be more structured and scheduled, and hence less compatible with working and commuting patterns. 2SLS and 2SLS-FE estimates for volunteering using the SHARE sample are also positive and significant up to four years before the actual ERA but the effect disappears after that. This could be conflating retirement implications on informal volunteering, however, no further disaggregation into volunteering types is possible as in the EU-SILC data. Therefore, these results can provide some support to the claim that people tend to change their prosocial behaviour as they as they approach their ERA, at least regarding the incidence of their volunteering and charity activity.

[16] All the baseline estimates are robust to the exclusion of retirees reporting hours of work in the last week (EU-SILC sample) or the last month (SHARE sample). More specifically, using the same bandwidth and a local linear age function, the 2SLS retirement coefficient is .076 (standard error = .036) in the EU-SILC sample. In the SHARE sample, the respective FE-2SLS parameter is .122 (standard error = .041).

[Table 3 here]

4.5 Experiment-based mechanisms

The sample was fairly gender balanced (110 males, 119 females) and the average (median) age was 62.8 (63) years old. The majority (75%) completed the study over a phone interview, the rest opted into receiving a link over email and completing online.

4.5.1 Self-reported volunteering

First, we use the experiment data to replicate the survey-based evidence. About 28,9% (25.9%) reported having participated in formal (informal) volunteering in the past year. This is comparable with the EU-SILC sample, where 27.3% (23.8%) of the individuals report offering informal (formal) voluntary work. Estimating Equation (1) using the experiment data confirms the survey-based evidence, in Table 4. There is a strong first-stage relationship and we find that retirement increases the volunteering probability by about 40%. Moreover, this is due to engagement in formal volunteering, as retirees are no different compared to working individuals when it comes to informal volunteering.

[Table 4 here]

We also check whether the incentivised measures correlate with the self-reported formal volunteering in our sample. We find that, conditional on retirement status, individual characteristics and wave fixed effects, each additional unit of effort produced for the charity recipient (in-kind donation) predicts 1% higher chances of reporting participation in formal volunteering. Every extra euro donated to charity rather than left to self, on the contrary, predicts a 0.5% decrease in the likelihood of reporting formal volunteering.[17] This suggests that, on average, monetary and in-kind donations to charity are likely to be substitutes. Further in the analysis we show that this relationship is complementary specifically for the subsample of retirees.

4.5.2 Effort

Most of the 229 participants chose to produce effort (to earn, gift or donate money) whilst a minority (n=31) refused to take part. Over three quarters (76.3%) of those produced effort chose to donate earnings to charity, whilst some participants (23.7%) chose to keep the earnings for themselves or give it to a friend or relative (appendix Figure A7). Among the charities, the cancer research one attracted most in-kind donations overall and, also, highest intensity of effort.

The relationship between the intensity of effort and the recipient of the earnings was significant in the 2SLS analysis (appendix Table A2. Overall, intensity of effort was significantly lower among

[17] The 2SLS results of this test are available upon request.

retirees compared to the non-retirees. However, the intensity of effort increased with post-retirement age. People who did the study online (vs. by phone) provided significantly more effort. We verified that retirees were not more likely to complete the study by phone.

4.5.3 Money

Money donations were multimodal: majority of participants chose to keep, gift or donate sums of €0, €100, or €200 (a handful of people did not participate in the lottery). We are specifically interested in the difference between monetary donations to charity vs. the money a participant chose to keep for themselves. This captures the prosocial preference in the monetary domain. There were three dominant patterns in participants' choices: (i) a fully prosocial allocation (+€200), (ii) equal amounts allocated to charity and to self (€0), (iii) kept everything (-€200). In line with the pattern observed in the in-kind donations above, the cancer research charity attracted most monetary donations compared to other charities, as well as the highest shares of the total lottery pot (appendix Figure A8).

4.5.4 Money-effort elasticity

We interacted donation in-kind and retirement to test if it predicts the size of monetary donation. This would indicate that the trade-off between time and money is different between retirees and non-retirees. The 2SLS results (Table 5) confirm the hypothesis of increased prosociality driving the increased volunteering. Retirees who donate more in-kind also donate more in lottery earnings compared to how much they keep for themselves. Specifically, for each unit of voluntary work, a retiree donated extra €8 in lottery winnings. Given that completing all 28 available units of work earned €5 in charity donations, for each €1 of donation in-kind, retirees donated about €50 more in money winnings. This would not be the case if the increased volunteering was driven by merely more time.

[Table 5 here]

4.6 Survey-based mechanisms

To examine whether the impact of retirement varies with observable characteristics, we split the samples accordingly (Table 6). Regarding the SHARE sample, only FE-2SLS estimates are reported. Splitting by gender indicates that the baseline effect on volunteering is driven by females, especially in SHARE, and it is confirmed in the EU-SILC. However, the EU-SILC data suggest that retirement affects informal volunteering for females and formal volunteering for males. Moreover, volunteering after retirement is more likely for those who have completed tertiary education. Regarding the retirement impact on informal volunteering, the parameter estimate is higher, although significant at the 10%, in the case of those having completed only secondary education.

Splitting by subjective health-related indicators support the existence of a health gradient behind the baseline effects. Samples were split between individuals reporting bad or very bad health status

and those reporting fair, good or excellent health. The retirement effect is strong and positive only for those with a good self-reported health status, and it is not significant for individuals with poor health. This is confirmed when the samples are split using a variable indicating whether respondents are limited in their activities due to health issues. In both samples, the baseline effect is driven by those reporting that health issues do not limit their activities. In the case of formal volunteering the only significant estimate comes from those reporting not being severely limited in their activities due to health problems. For those severely limited due to health issues, the estimated parameters are either very low or negative, and always not significant.

[Table 6 here]

Individual behaviour is affected by how people in one's social network behave (Manski, 1993). Hence, peer influences from social and family networks can also affect volunteering behaviour. Friends and family members who volunteer could stimulate individual volunteering behaviour by the value of transmission, as it should be frequently encountered by their family members, friends and contacts (Goethem et al., 2014). Individual social networks cannot be identified in the data. Nevertheless, using the SHARE sample we examine whether a person's volunteering activity is affected by their partner's activity. Table 7 (Panel A) displays the FE-2SLS results using a local linear age function and a 10-year window around ERA. Column 1 confirms the positive retirement impact and demonstrates a sizeable positive effect for individuals whose partner is volunteering. In columns 2-3 the sample is split based on the partner's volunteering activity during the same year. Retirement has a positive effect regardless the partner's prosocial behaviour, however, its impact is considerably higher when partners have also volunteered during the same year. Furthermore, the longitudinal design of the SHARE data allows to calculate how intense is the partner's volunteering activity across the 4 waves of the survey. Column 5 suggests that retirement increases volunteering when partners of retirees tend to volunteer more often. The results hold when we use samples of individuals whose partners' retired more than 2 and more than 3 times in the period.

Retirement exerts intra-household externalities on expenditure, home production and health behaviour (Moreau and Stancanelli, 2015; Muller and Shaikh, 2018; Stancanelli and Van Soest, 2012). Therefore, transitions to retirement could cause spillover effects on prosocial behaviour within the household. To empirically test this hypothesis, we construct a binary indicator on whether an individual's partner is retired and instrument it the usual way, i.e. a dummy on having crossed the respective ERA. Panel B in Table 7 displays the results. There is a strong first-stage evidence for partners as well, however, own volunteering is not affected by partner's retirement (column 1). Controlling for both own and partner's retirement (column 2) confirms this result; the probability of volunteering is only affected by own retirement. Column 3 provides further evidence showing that own retirement does not have an impact of partner's volunteering. In columns 4-5 the sample is split based on partner's retirement status. Own retirement does not affect the volunteering probability for individuals whose partners are retirees (column 4). On the contrary, own retirement has a strong positive relationship with volunteering for those whose partners are still in the labour market. This could be an indication of a substitution effect for

couples of retirees towards more home-oriented activities, in line with the evidence presented by Stancanelli and Van Soest (2012).

[Table 7 here]

Another hypothesis could be that prosocial behaviour post-retirement is affected by previous experience and activity. This point has been raised by Erlinghagen (2010) who argued that the effect of retirement on volunteering is rather exaggerated and it is own previous experience that determines prosocial behaviour after leaving the labour market. The longitudinal design of the SHARE data allows to test this argument. Therefore, a dynamic version of Equation (1) is estimated by including a one-year lagged dependent variable alongside the rest regressors and fixed effects. Due to the fact that the sample consists of thousands of individuals followed for a relatively short period of time, i.e. 4 waves, the 2SLS and the 2SLS-FE estimators will be upwards and downwards biased, respectively (Nickell, 1981).[18] For situations with "small T, large N panels", fixed effects, serial correlation within individuals, endogenous regressors and, possibly, predetermined lagged explanatory variables, the system Generalised Method of Moments (GMM) estimator has been shown to be quite consistent; especially when $T \geq 3$ (Arellano and Bond, 1991; Blundell and Bond, 1998; Bond, 2002; Roodman, 2009).

Table 8 (Panel A) displays the results. Results for a static specification are also reported for reference. SHARE is not a balanced panel of individuals, hence results are reported using both the original panel, a more balanced version of it where individuals are observed at least in 3 waves, as well as a fully balanced panel of individuals only observed in all waves, i.e. T=4.[19] Regarding the static specifications, the results confirm a positive effect of retirement on volunteering activity. Although the GMM evidence suggests that the relationship is weaker relative to the 2SLS-FE estimates, the retirement status coefficient estimates are statistically significant at the 1%. Controlling for dynamics, columns 3-4, confirms that previous volunteering experience is a very strong predictor of current activity. However, including a lagged dependent variable leaves the retirement status coefficient unaffected, therefore indicating that there is an autonomous impact of retirement on the probability of offering volunteering work.[20]

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[18] In the 2SLS case, the lagged dependent variable would be correlated with the individual fixed effects included in the error term. Demeaning the data would eliminate the individual effect, however, the lagged dependent variable will remain correlated with the disturbance term. Even if the number of individuals is large, this sort of correlation induces a bias of order $1/T$, which is quite sizeable in small panels as in here where T=4 (Nickell, 1981).

[19] Results are robust when using samples with $T \geq 3$. Also, we obtained FE-2SLS estimates using subsamples of SHARE individuals observed in at least 3 and all 4 waves. All first-stage relationships are strong and the impact of retirement is higher as compared to the baseline results using the total -unbalanced- panel. In the case were T=4 the impact of retirement is statistically significant even when higher order local functions of age are used at both sides of the cutoff. All tests are available upon request.

[20] Moreover, past volunteering activity is a stronger predictor of today's behaviour in the case of non-retirees. After splitting the sample by retirement status (and using those within 10 years before or after their ERA), the coefficient of the lagged dependent variable is .224 (standard error = .039) for non-retirees and .198 (standard error = .026) for those retired.

[Table 8 here]

So far a positive connection between the probability of voluntary (or charity) work and retirement status has been established. A question that naturally arises is how retirement impacts on the intensity -or the frequency- of offering unpaid work. Although the actual number of volunteer hours is not available, SHARE respondents reported how often they provided voluntary or charity works within the last 12 months. Those who volunteered, were given the following options: (a) almost every day; (b) almost every week; (c) almost every month; and (d) less often. Based on these responses, four binary indicators are constructed with those who did not volunteer being the reference groups. Then, linear probability models using local linear age functions at both sides of the ERA cutoff are estimated. Apart from the usual set of individual characteristics and fixed effects, models also control for past volunteering activity -regardless the frequency-, treating it as predetermined. Panel B of Table 8 displays the system GMM estimates. From a descriptive point of view, the fraction of retirees among volunteers steadily increases with the frequency of volunteering activity. For example, 48% of the sample of those who volunteer less than once per month (column 1) are retirees. However, the fraction of retirees in the sample of those who report volunteering activity almost every day rises to 70%. This could be partially attributed to increased time availability post-retirement, although a distinction in the SHARE sample among volunteering types, i.e. formal, informal, household oriented or not, would be quite useful to look deeper in their activity patterns. The prevalence of volunteers in the sample of retirees follows a hump-shaped pattern as volunteering frequency increases. More specifically, 4% of retirees volunteer less often than every month, 8.3% of them volunteer every week, and 3.4% volunteer almost every day.

Using the sample of individuals observed in all 4 SHARE waves, reveals that the impact of retirement also follows a hump-shape profile as the frequency of volunteering activity increases. The effect is zero in columns 1-2 where only those volunteering every month or less often are used. However, retirement has a positive and significant impact on volunteering almost every week, relative to non-volunteers (column 3). There is also a lower, and less precisely estimated, positive impact of retirement on the probability of volunteering almost every day. Moreover, past volunteering activity is always a strong predictor of current volunteering frequency – especially for those volunteering almost every week.

Overall, this paper provided evidence that transition to retirement increases the likelihood of engaging in prosocial activities. Given that (a) these activities have been shown to be beneficial for both individual well-being and societal welfare, and (b) population ageing will intensify, policy interventions should aim at increasing participation in post-retirement unpaid work. The EU-SILC collected information on why respondents were not engaged in any kind of volunteer work, i.e. due to lack of interest, due to lack of time, or due to any other reason. Figure 2 graphs some trends by age. Among all non-volunteering individuals (retired or not), the fraction of those being time-constrained decreases with age. Regarding non-volunteering retirees, the share of those being constrained by time, is small but relatively stable around ERA and starts decreasing quite late. Similar patters hold for those not engaged in volunteering due to other reasons. To rule out any health-related reasons, their shares have also been calculated using only those not being limited in their activities by some health condition and the picture remains the same.

However, after crossing the ERA, there is a considerable increase in the fraction of those who do not volunteer, either formally or informally, due to lack of interest. The fraction of retirees not engaged in informal volunteering due to lack of interest decreases as the approach their ERA but to a much lesser extent after crossing it. Moreover, the fraction of retirees not offering formal voluntary work remains stable after crossing the ERA. Therefore, targeted interventions to raise awareness and support to volunteering could increase interest and engagement as approaching retirement and after leaving paid employment. Public or non-profit agencies that provide training and match individuals -based on their skills and interests- to prosocial activities, media campaigns and employer incentives especially oriented to those closer to retirement, e.g. paid volunteer leave or flexible working patterns, could be some of the actions that stimulate interest and participation towards the end of working life and after retirement.

[Figure 2 here]

5. Conclusions

As the population in Europe grows older and life expectancy at retirement is increasing, questions about the behaviour and well-being of retirees become central in the public agenda. Retirement is a major transition occurring later in life and the economics literature has provided empirical evidence on how it affects consumption patterns and health. However, there has been no evidence on how retirement affects prosocial behaviour, such as volunteering or providing care to others.

Despite the fact that economists often attach a zero wage to various prosocial activities, the implications for the economy are substantial. Survey evidence suggests that volunteering activities represent a considerable part of the overall labour supply and generate value. Although disengaged from paid employment, retirees can have significant contributions to the public good and reduce social costs through such activities, apart from the benefits on their own well-being.

It is not clear, however, how the transition from paid employment to retirement affects the engagement of retirees in prosocial activities, e.g. volunteering. The relationship could be negative if individuals behave prosocially before retirement to send labour market signals, and if productive opportunities and social networks shrinks after retirement. On the other hand, it could be positive if individuals seek to smooth their well-being and consumption levels over their life-cycle, and as a response to their increased time availability and identity disruption caused by labour market disengagement. Also, increased prosociality after retirement could be due to enhanced altruism, i.e. retirees become more willing to sacrifice own resources in order to support causes and people from inside and outside their households or social networks.

Two different datasets covering individuals from a large number of European countries are used to answer these questions, a cross-sectional (EU-SILC) and a longitudinal one (SHARE). As suggested by the retirement literature, variation in the Early Retirement Age legislation across countries, years and genders is used to identify the causal effect of retirement on various prosocial behaviour indicators. Using instrumental variables methods, the results obtained from all sources of data provide strong evidence to the claim that retirement increases the probability of

volunteering, either formally or informally. A series of robustness and sensitivity tests confirms the validity of this finding. The relationship is stronger for females, tertiary educated, people with good self-reported health status and those not limited in their activities by health-related issues. Also, the impact of retirement is higher for those who volunteered in the past and for people whose partners are also volunteers. Moreover, retirement increases the probability to provide assistance or care to other people within the household, at least once per week or a few hours per week. There is no evidence on retirement impacts on other types of prosocial behaviour such as assistance or care to people outside the household, or active citizenship.

The experimental part of our paper confirms the survey-based evidence and allows proper identification of the mechanisms underlying these reulsts. We find that increased volunteering after retirement is driven by an increase in prosocial preference. Interestingly, this increased prosociality does not seem to apply equally to all causes. Retirees donated much more to cancer research-related charities than to charities addressing the needs of refugees and of the environment (appendix Figure A10). Had prosocial preferences increased for any cause, we would expect retirees to donate fairly equally to all the charities. The fact that they instead prioritised donations to the cancer-related charities suggests that further research is needed into what retirees considered worthy recipients of their prosocial activity.

Although further examination of how retirement impacts the actual number of prosocial activities with the current data is not possible, these first findings can be policy-relevant given the ageing of the population. They provide evidence on time and effort allocation decision of retirees, as well as their productive capacity regarding unpaid labour supply. As the basic reason for not volunteering is the lack of interest rather than time constraints or other reasons, targeted public policies could be implemented in order to increase awareness and participation in prosocial action of people around their retirement age.

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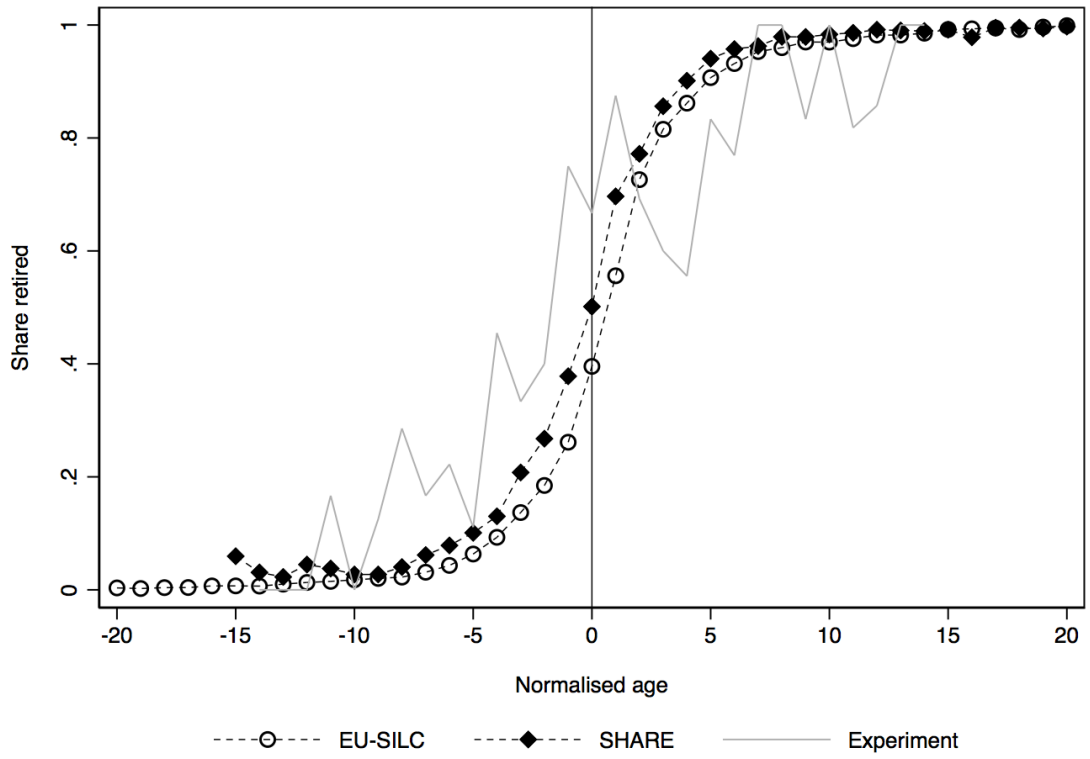
Figures & Tables

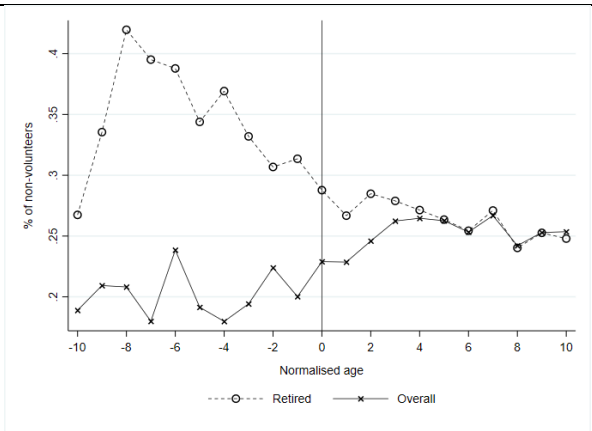
Figure 1. Share of retirees by age.



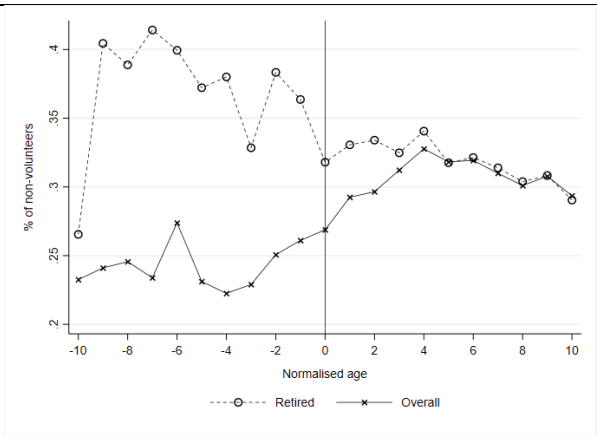
Source: EU-SILC; SHARE. Notes: EU-SILC waves: 2015, 2016; SHARE waves: 4, 5, 6, 7; Experiment waves: all. Means are weighted by the respective survey weights (EU-SILC and SHARE). Age is normalised by the gender, country and year-specific ERA of each individual.

Figure 2. Reasons for not volunteering.

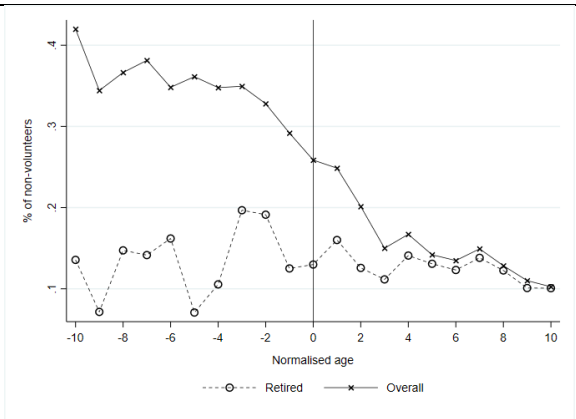
No informal volunteering due to lack of interest



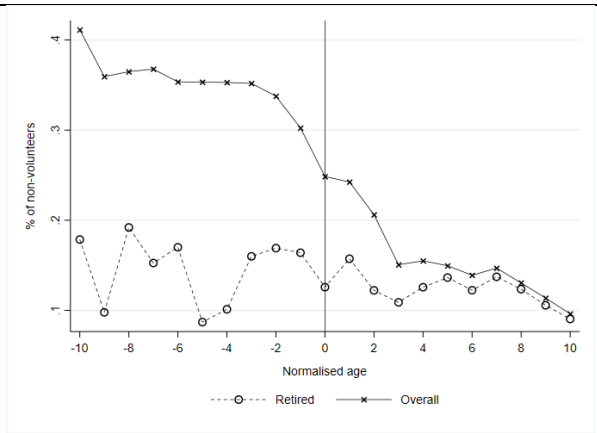
No formal volunteering due to lack of interest



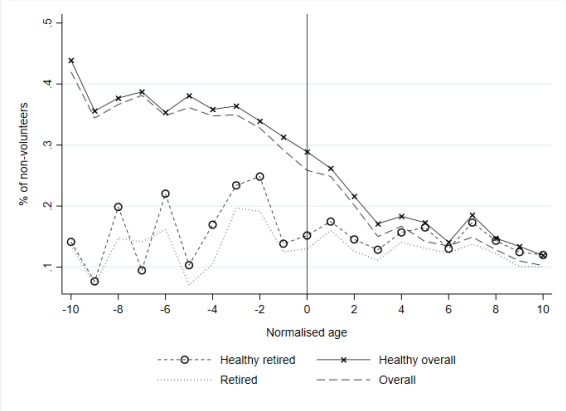
No informal volunteering due to lack of time



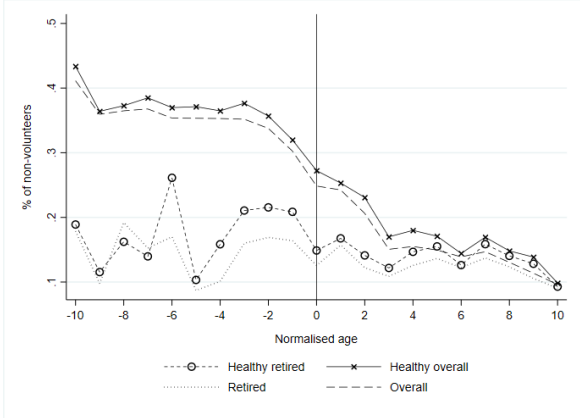
No formal volunteering due to lack of time



No informal volunteering due to other reasons



No formal volunteering due to other reasons



Source: EU-SILC. Notes: Means by normalised age are weighted using the survey weights. Overall refers to both retired and non-retired non-volunteers. Healthy refers to non-volunteers who report not being limited in their activities by any health-related conditions.

Table 1. Descriptive statistics.

	Retirees	Non-retirees	Difference	Observations
	[1]	[2]	[3]	[4]
Voluntary work (SHARE)	.207	.184	.023***	-
Observations	70,557 (58.2%)	50,625 (41.8%)	-	121,182
Informal voluntary work (EU-SILC)	.294	.256	.038***	-
Observations	41,291 (47.1%)	46,477 (52.9%)	-	87,768
Formal voluntary work (EU-SILC)	.242	.234	.008*	-
Observations	41,293 (47.1%)	46,475 (52.9%)	-	87,768
Provide care inside household (EU-SILC)	.068	.066	.001	-
Observations	42,207 (49.3%)	43,383 (50.7%)	-	85,590
Provide care outside household (EU-SILC)	.091	.100	-.010***	-
Observations	43,454 (48.4%)	46,264 (51.6%)	-	89,718
Active citizenship (EU-SILC)	.147	.167	-.020***	-
Observations	41,290 (47.1%)	46,462 (52.9%)	-	87,752
Formal voluntary work (experiment)	.263	.307	-.044	-
Observations	118 (53.9%)	101 (46.1%)	-	219
Informal voluntary work (experiment)	.263	.248	.015	
Observations	118 (53.9%)	101 (46.1%)	-	219

Source: EU-SILC; SHARE; experiment. Notes: EU-SILC waves: 2015, 2016; SHARE waves: 4, 5, 6, 7; Experiment waves: all. Means are weighted by the respective survey weights (EU-SILC and SHARE). Samples cover individuals 15 years around their country, year and gender-specific ERAs.

Table 2. Retirement and prosocial behaviour: Evidence from survey data.

	[1]	[2]	[3]	[4]
	Panel A: 2SLS estimates; EU-SILC sample			
Retired (outcome: voluntary work)	.097** (.039)	.079** (.035)	.081 (.092)	.322 (.409)
Retired (outcome: informal voluntary work)	.088** (.034)	.061** (.030)	.067 (.081)	.121 (.348)
Retired (outcome: formal voluntary work)	.073** (.035)	.071** (.031)	.079 (.081)	.251 (.346)
First-stage: Age>ERA	.281*** (.010)	.311*** (.009)	.167*** (.011)	.132*** (.013)
First stage: F-statistic	847.83	1547.04	1431.96	1154.28
Observations	85,695	85,695	85,695	85,695
Local age function	Constant	Linear	Quadratic	Cubic
Individual characteristics	Yes	Yes	Yes	Yes
Survey quarter fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
	Panel B: 2SLS estimates; SHARE sample			
Retired (outcome: voluntary activity)	.087*** (.023)	.086*** (.024)	.092* (.048)	.114 (.113)
First stage: Age>ERA	.349*** (.008)	.338*** (.009)	.253*** (.010)	.229*** (.011)
First stage: F-statistic	1,705.33	1,025.08	1,823.05	1,409.93
Observations	121,182	121,182	121,182	121,182
Local age function	Constant	Linear	Quadratic	Cubic
Individual characteristics	Yes	Yes	Yes	Yes
Individual fixed effects	No	No	No	No
Country fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
	Panel C: FE-2SLS estimates; SHARE sample			
Retired (outcome: voluntary activity)	.100*** (.035)	.105*** (.035)	.127** (.060)	.135 (.117)
First stage: Age>ERA	.225*** (.009)	.227*** (.009)	.182*** (.010)	.170*** (.010)
First stage: F-statistic	609.59	304.81	404.82	314.19
Local age function	Constant	Linear	Quadratic	Cubic
Observations	98,840	98,840	98,840	98,840
Individual characteristics	Yes	Yes	Yes	Yes
Individual fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes

Source: EU-SILC; SHARE. Notes: Results are weighted using survey weights. Robust standard errors in parentheses. Asterisks ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Table 3: Retirement and prosocial behaviour: Falsification tests.

	Informal volunteering (EU-SILC sample)		Formal volunteering (EU-SILC sample)		Volunteering (SHARE sample)			
	2SLS	Obs.	2SLS	Obs.	2SLS	Obs.	FE-2SLS	Obs.
Fake ERA set at:	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]
t-1	.068** (.033)	84,436	.065* (.033)	86,435	.084*** (.024)	116,691	.094*** (.036)	94,644
t-2	.088** (.037)	86,821	.058 (.037)	86,820	.082*** (.026)	111,370	.100*** (.038)	89,707
t-3	.118** (.047)	86,845	.063 (.047)	86,848	.088*** (.030)	105,541	.092** (.043)	84,335
t-4	.154** (.067)	86,831	.045 (.068)	86,829	.110*** (.041)	99,051	.106** (.052)	78,355
t-5	.202 (.123)	86,642	.094 (.125)	86,648	.117 (.075)	92,299	.124 (.081)	72,300
t-6	.415 (.440)	86,229	.111 (.447)	86,241	.356 (.302)	85,052	.330 (.200)	65,866

Source: EU-SILC; SHARE. Notes: Models are weighted using survey weights. Models use a local linear age function and control for the usual set of characteristics and fixed effects. Robust standard errors in parentheses. Asterisks ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Table 4. Retirement and prosocial behaviour: Evidence from experiment data.

	Total sample	Excluding early retired	Excluding early retired & -/+ 15 years around ERA
	[1]	[2]	[3]
Retired (outcome: voluntary work)	.403* (.231)	.389* (.214)	.406* (.233)
Retired (outcome: informal voluntary work)	.108 (.188)	.143 (.175)	.143 (.188)
Retired (outcome: formal voluntary work)	.458** (.226)	.498** (.214)	.534** (.236)
First-stage: Age>ERA	.453*** (.083)	.501*** (.086)	.481*** (.089)
First stage: F-statistic	32.18	36.74	36.70
Observations	229	198	189
Local age function	Linear	Linear	Linear
Individual characteristics	Yes	Yes	Yes
Interview wave fixed effects	Yes	Yes	Yes

Source: experiment. Notes: Robust standard errors in parentheses. Asterisks ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Table 5. Money-effort elasticity upon retirement: Evidence from experiment data.

	Total sample	Excluding early retired	Excluding early retired & -/+ 15 years around ERA
	[1]	[2]	[3]
Retired X In-kind donation for charity (outcome: difference between money to charity and money to self)	8.046*** (1.737)	7.391*** (1.783)	7.077*** (1.770)
Retired	-50.638 (53.348)	-53.525 (60.960)	-45.990 (63.882)
First-stage: Age>ERA	.582*** (.075)	.592*** (.080)	.583*** (.083)
First stage: F-statistic	36.27	31.81	30.43
Observations	226	196	187
Local age function	Linear	Linear	Linear
Individual characteristics	Yes	Yes	Yes
Interview wave fixed effects	Yes	Yes	Yes

Source: experiment. Notes: Robust standard errors in parentheses. Asterisks ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Table 6. Retirement and prosocial behaviour: Analysis by group.

	Voluntary work (SHARE sample)	Voluntary work (EU-SILC sample)	Informal voluntary work (EU-SILC sample)	Formal voluntary work (EU-SILC sample)
	FE-2SLS	2SLS	2SLS	2SLS
Sub-group:	[1]	[2]	[3]	[4]
Males	.055 (.053)	.071 (.049)	.038 (.040)	.081* (.044)
Females	.150*** (.047)	.087* (.051)	.081* (.046)	.062 (.044)
Primary or less education	.168 (.110)	-.104 (.092)	-.063 (.082)	-.007 (.069)
Secondary education	.026 (.042)	.079* (.042)	.065* (.036)	.043 (.036)
Tertiary education	.259*** (.076)	.191*** (.092)	.112 (.078)	.235*** (.088)
Fair/Good/Very Good health status	.093** (.037)	.091** (.037)	.063** (.032)	.087*** (.033)
Bad/Very Bad health status	.052 (.320)	-.038 (.131)	.063 (.103)	-.109 (.112)
Not limited in activities due to health	.099** (.048)	.079* (.042)	.060 (.036)	.058 (.038)
Not severely limited in activities due to health	.072 (.084)	.099 (.075)	.078 (.067)	.156** (.065)
Severely limited in activities due to health	.119 (.179)	-.039 (.125)	.006 (.107)	-.080 (.108)

Source: EU-SILC; SHARE. Notes: Results are weighted using survey weights. Models use a local linear age function, and control for the usual set of individual characteristics and fixed effects. Robust standard errors in parentheses. Asterisks ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Table 7: Retirement and prosocial behaviour: Couple complementarities.					
	[1]	[2]	[3]	[4]	[5]
	Panel A: The role of partner's volunteering activity				
	Total sample	Partner did not volunteer in same year	Partner volunteered in same year	Partner did not volunteer in period	Partner volunteered ≥1 time in period
Retired	.113** (.048)	.096* (.050)	.302* (.159)	.083** (.037)	.191** (.089)
Partner volunteering	.123*** (.013)	-	-	-	-
Observations	51,249	39,130	7,329	79,676	19,164
	Panel B: The role of partner's retirement				
	Own volunteering (total sample)	Own volunteering (total sample)	Partner's volunteering (total sample)	Own volunteering (partner retired)	Own volunteering (partner not retired)
Retired	-	.115** (.057)	.048 (.049)	.095 (.111)	.224*** (.080)
Partner retired	.035 (.052)	-.012 (.061)	-	-	-
First stage: Own age>ERA	-	.231*** (.013)	.241*** (.013)	.184*** (.020)	.193*** (.019)
First stage: F-statistic	-	97.88	183.03	82.54	96.50
First stage: Partner's age>ERA	.239*** (.013)	.232*** (.013)	-	-	-
First stage: F-statistic	171.99	93.97	-	-	-
Observations	52,212	52,212	52,093	19,271	29,570

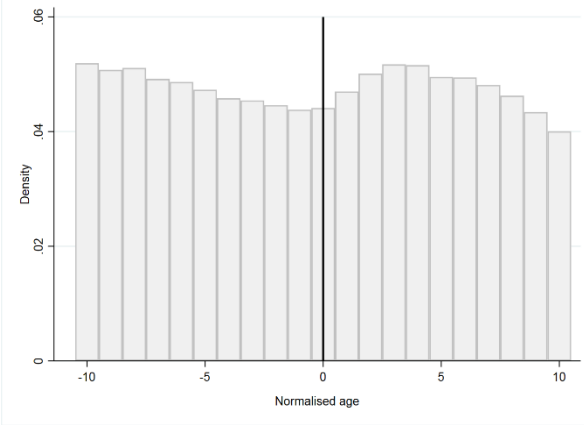
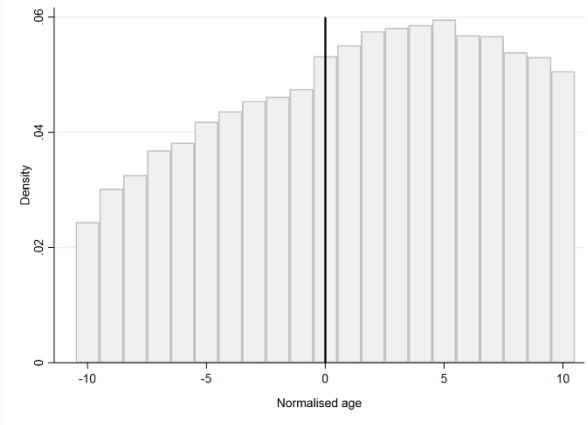
Source: SHARE. Notes: FE-2SLS estimates. Results are weighted using survey weights. Models use a local linear age function and control for the usual set of individual characteristics and fixed effects. Robust standard errors in parentheses. Asterisks ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Table 8: Retirement and prosocial behaviour: Past activity and volunteering frequency.				
	Panel A: The role of past volunteering activity			
	[1]	[2]	[3]	[4]
Retired	.024*** (.007)	.040*** (.012)	.028*** (.008)	.039*** (.012)
Volunteered last year	-	-	.212*** (.022)	.227*** (.026)
Panel time dimension	$T \geq 1$	$T = 4$	$T \geq 1$	$T = 4$
First stage: F-statistic	83.38	28.67	4.49	38.12
Instrument count	28	21	29	25
Hansen test	10.20	16.67	15.42	27.64
Observations	121,182	44,244	61,311	31,407
	Panel B: The role of volunteering frequency			
	Volunteer less than every month	Volunteer almost every month	Volunteer almost every week	Volunteer almost every day
% retired among those who:	48.20	55.12	67.24	70.51
% volunteer among retired:	4.07	5.66	8.29	3.39
Retired	-.005 (.007)	.001 (.008)	.047*** (.010)	.011* (.006)
Volunteered last year	.070*** (.020)	.074*** (.020)	.126*** (.024)	.037** (.016)
Panel time dimension	$T = 4$	$T = 4$	$T = 4$	$T = 4$
First stage: F-statistic	5.96	9.65	26.20	6.71
Instrument count	25	25	25	25
Hansen test	15.53	18.61	13.01	10.37
Observations	25,823	26,350	27,080	25,116

Source: SHARE. Notes: System Generalised Method of Moment (GMM) estimates. Results are weighted using survey weights. Models use a local linear age function and control for the usual set of individual characteristics and fixed effects. In dynamic specifications, lagged variables are instrumented using instruments dated *t*-2 and earlier. Samples include individuals within 10 years at both sides of the ERA cutoff. Windmeijer-corrected cluster-robust standard errors in parentheses. Asterisks ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.

Appendix

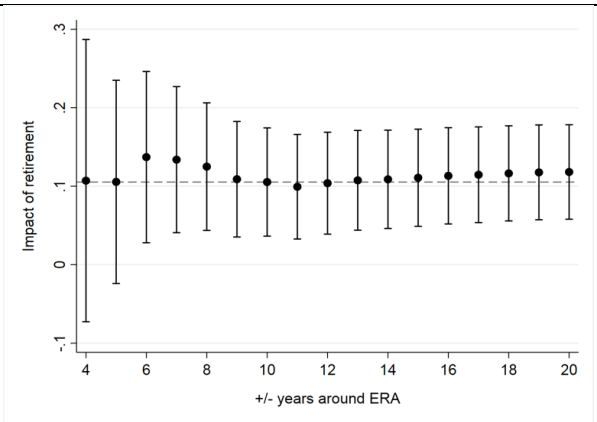
Figure A1. Density of the forcing variable around the cut-off.

EU-SILC sample	SHARE sample
	

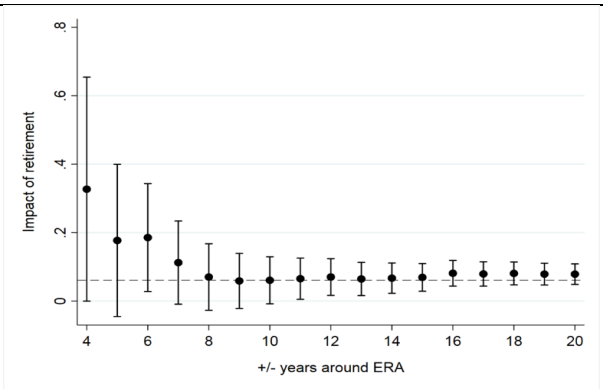
Source: EU-SILC; SHARE.

Figure A2. Retirement and volunteering using alternative bandwidths around ERA

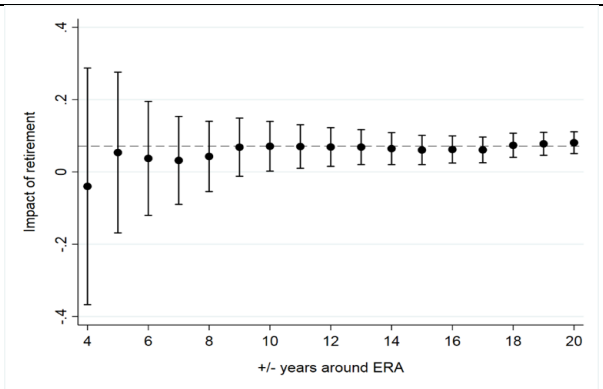
Panel A: Voluntary activity (SHARE)



Panel B: Informal voluntary work (EU-SILC)



Panel C: Formal voluntary work (EU-SILC)



Source: SHARE; EU-SILC. Notes: 2SLS (EU-SILC) and FE-2SLS (SHARE) estimates using a local linear age function. Horizontal dashed lines correspond to the baseline effects (Table 2). Vertical lines represent the 95% confidence intervals based on robust standard errors.

Figure A3. Choice of recipient of earnings in the real effort task (example screen)

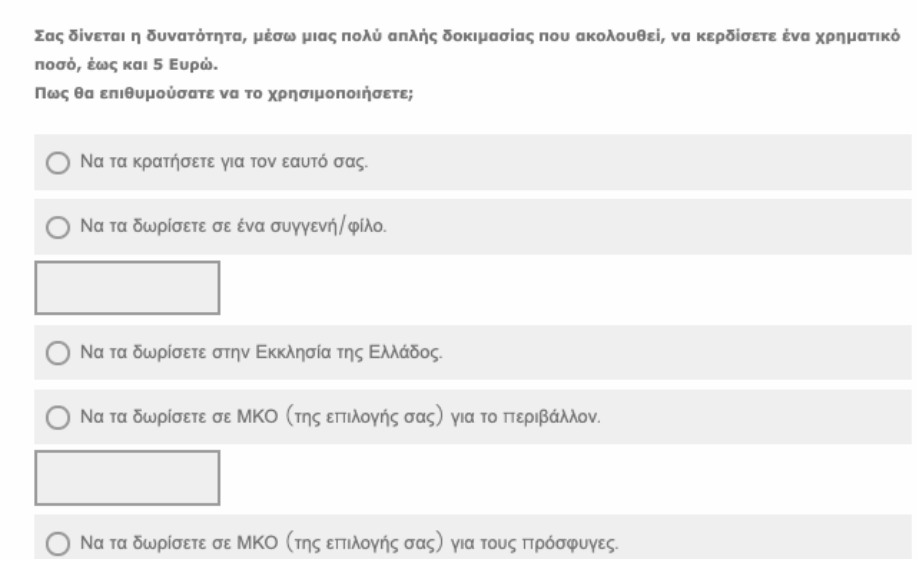


Figure A4. Choice of recipient of lottery winnings (example screen)

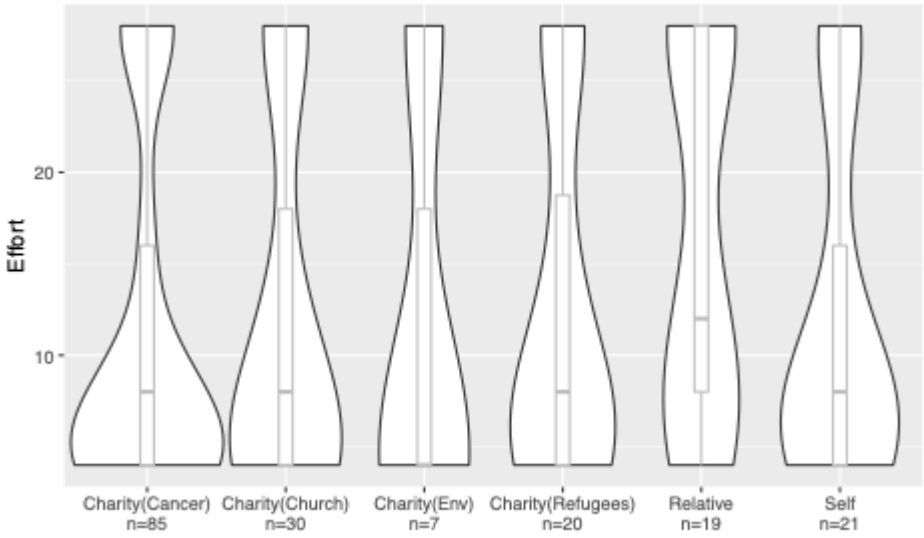
Figure A5. Real effort task: Vowel Counts (example screen)

Figure A6. Screen (translated) explaining the random draw procedure.

Now it's time to play the lottery. Please find any banknote in your wallet. Don't worry, we will only ask you to use its serial number to make sure that the lottery procedure is transparent and your lottery number is truly random.

So, Find a banknote, and type **the full serial number** in the field below. Then click next - and the computer will generate a random number between 00 and 99. If it's the same as the **last two digits** of your number - you won!

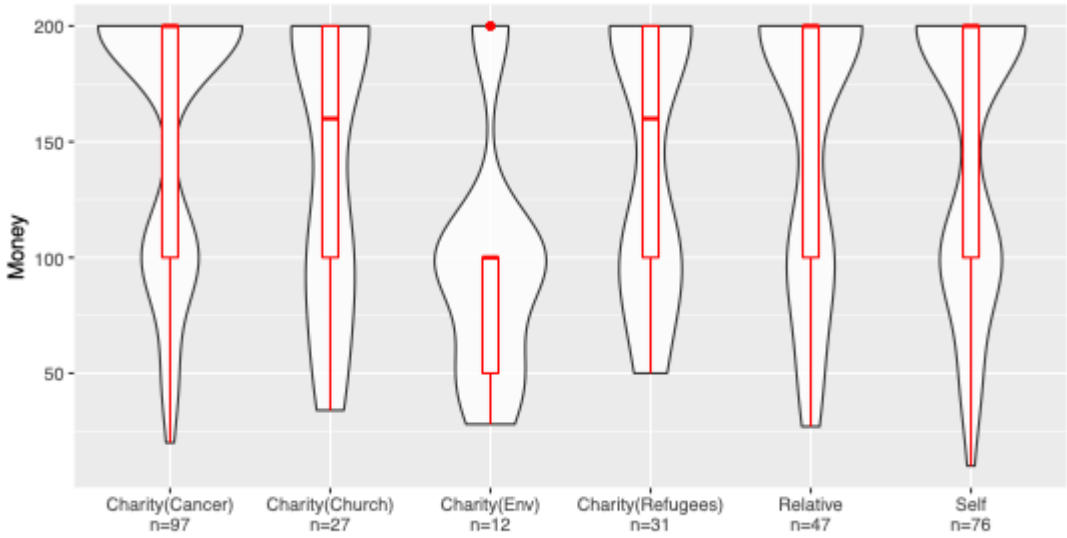
Figure A7. Effort intensity by recipient.



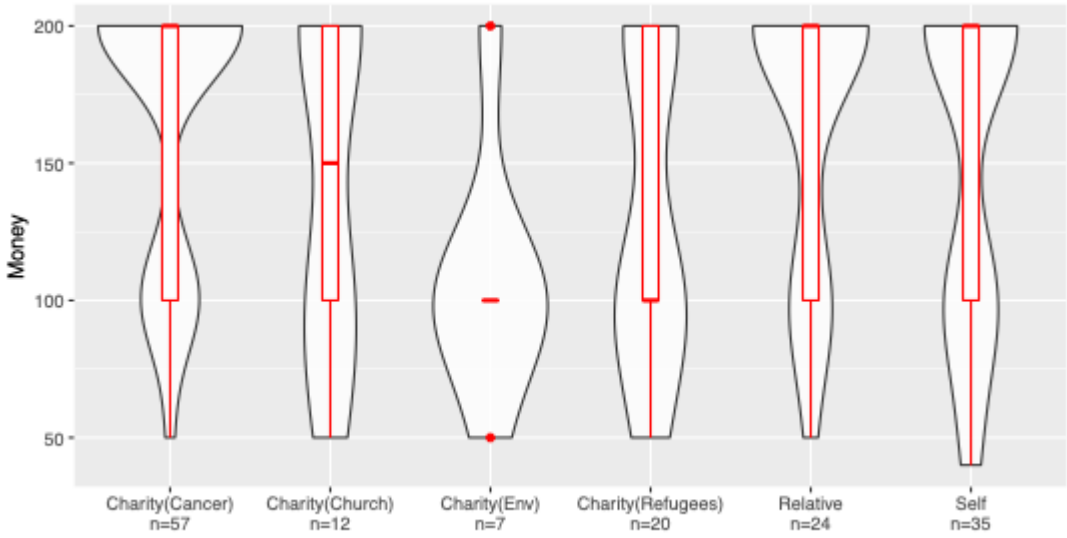
Notes: The vertical box indicates interquartile range, with thick horizontal market for the median and whiskers indicating most extreme data points. The outer shape illustrates density of the distribution of observations.

Figure A8. Money allocations by recipient type.

Panel A: Total sample



Panel B: Retirees sub-sample



Notes: Vertical axes measure in Euros. Vertical boxes indicate interquartile range, thick horizontal markers the median, and whiskers the most extreme data points. The outer shape illustrates density of the distribution of observations.

Table A1. Early retirement ages and sample sizes for countries in the EU-SILC and SHARE data.

Country	EU-SILC sample	SHARE sample	2011	2013	2015	2017
Austria	3,236	8,740	M: 62; F:58	M:64; F:59	M:64; F:59	M:65; F:60
Belgium	2,936	11,304	60	60	60	62
Switzerland	3,700	7,080	M:63; F:62	M:63; F:62	M:63; F:62	M:63; F:62
Cyprus	2,323	576	63	63	63	63
Czech Republic	5,122	11,984	60	60	60	60
Germany	7,483	9,151	63	63	63	65
Denmark	2,259	8,045	65	65	65	65
Estonia	3,408	11,484	60	60	60	60
Greece	6,781	3,380	M:60; F:55	M:60; F:57	62	62
Spain	5,713	7,689	61	61	61	61
Finland	3,464	1,301	63	63	63	63
France	6,523	9,543	60	60	61	61
Ireland	1,498	-	66	66	66	66
Italy	5,452	6,290	M:62; F:61	M:63; F:62	M:63; F:62	M:63; F:62
Luxemburg	1,834	2,093	57	57	57	60
Netherlands	3,114	-	65	65	65	65
Norway	1,752	-	67	67	67	67
Poland	5,813	4,579	M:65; F:60	M:65; F:60	M:65; F:60	M:66; F:61
Portugal	4,686	1,933	55	55	65	65
Sweden	1,749	7,616	61	61	61	61
Slovenia	2,821	6,846	M:58; F:57	M:58; F:57	M:59; F:58	M:60; F:59
Slovakia	4,028	1,548	60	60	60	60
Total	85,695	121,182	-	-	-	-

Source: Social Security Programs Throughout The World; OECD Pensions At A Glance.
Notes: M is for Males and F for Females. Ireland, Norway and the Netherlands are not included in the SHARE estimation samples. Sample sizes correspond to the baseline estimation samples in Tables 3 and 4. For the EU-SILC sample, figures refer only to 2015.

Table A2. Real effort and recipients.

	Effort intensity (0-28 units)	Completed study over email (vs phone)
	[1]	[2]
Retired	-8.483* (3.658)	-0.173 (0.174)
Recipient: charity	8.394*** (1.193)	
Recipient: Relative	11.29***(2.733)	
Completed study over email (vs phone)	10.15***(1.915)	
First-stage: Age>ERA	.450*** (.083)	.452*** (.083)
First stage: F-statistic	29.92	32.95
Observations	229	229
Local age function	Linear	Linear
Individual characteristics	Yes	Yes
Interview wave fixed effects	Yes	Yes

Source: experiment. Notes: Robust standard errors in parentheses. Asterisks ***, ** and * denote statistical significance at the 1%, 5% and 10% level, respectively.