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IZA DP No. 14648

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Flinders University and IZA

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ISSN: 2365-9793

IZA – Institute of Labor Economics

Schaumburg-Lippe-Straße 5–9
53113 Bonn, Germany

Phone: +49-228-3894-0
Email: publications@iza.org

www.iza.org

ABSTRACT

Retirement and Voluntary Work Provision: Evidence from the Australian Age Pension Reform*

This paper examines the empirical link between retirement and the supply of volunteer labor, using panel data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. To identify the causal impact, we exploit a major reform of the Australian Age Pension which has significantly changed the retirement incentives of older people. We find positive and significant effects of retirement status on the voluntary work provision of older men and women. Longer time spent in retirement increases the unpaid labor supply of women, while there is no such evidence for men. We further find evidence of intra-household retirement externalities: older people's retirement impacts positively on the volunteer behavior of their family members. Our findings suggest that the Australian Age Pension reform aiming at working life prolongation has led to an unintended shrinkage of the volunteer workforce.

JEL Classification: H55, J22, J26

Keywords: retirement status, retirement duration, voluntary work, pension reform

Corresponding author:
Rong Zhu
College of Business, Government and Law
Flinders University
Australia
E-mail: rong.zhu@flinders.edu.au

* Thanks go to the Editor, five anonymous referees, and Ilke Onur for very helpful comments. This paper uses the restricted unit record data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. The HILDA Project was initiated and is funded by the Australian Government Department of Social Services (DSS) and is managed by the Melbourne Institute of Applied Economic and Social Research (Melbourne Institute). The findings and views reported in this paper, however, are those of the author and should not be attributed to either DSS or the Melbourne Institute.

1 Introduction

Volunteering, as a widespread social activity, makes fundamental contributions to the active functioning of the society. Unpaid supply of labor offers essential and productive resources for many communities and not-for-profit organizations. In Australia, around 6 million people devote their time, energy, and expertise to voluntary activities each year. In the 2012–13 financial year, volunteers contributed around 521 million hours of unpaid work to the Australian society, with the value of their voluntary services estimated to be over AUD$17 billion (Australian Bureau of Statistics, 2015). Given the substantial benefits of volunteering for individuals, communities, and the country, the Australian Government developed the National Volunteering Strategy in 2011 with the aim to "ensure that volunteering is encouraged, supported and recognised by all Australians". Besides the benefits for recipients, volunteers are also beneficiaries of unpaid labor supply, in terms of expanded network of contacts (Wilson and Musick, 1997), enhanced self-esteem (Okun et al., 1998), improved health (Kumar et al., 2012), and increased subjective well-being (Magnani and Zhu, 2018; Appau and Awaworyi Churchill, 2019).

This paper considers voluntary work provided formally through an organization among the elderly population in Australia and examines its empirical link to retirement (defined as not in the labor force). This relation is important for several reasons. First, elderly people constitute a crucial component of the volunteer workforce. According to Volunteering Australia (2016), individuals aged 65 years and over contribute more time to unpaid work than any other age group in Australia. In many other countries such as England, Germany, Ireland, and the United States, older individuals are also significant contributors to volunteer services (Erlinghagen, 2010; Tang, 2016; Eibich et al., 2020). Second, volunteering has been recognized as one of the few formal roles that older people can take to stay active in their retirement life (Morrow-Howell, 2010). With the steady growth in life expectancy in recent decades, answers are being sought regarding how to encourage elderly individuals to be more engaged in voluntary activities. Last, the fiscal challenge due to population aging and rising life expectancy has led many countries to extend the statutory retirement age at which people can receive pension benefits. Pension reforms aiming at working life prolongation may be accompanied by socioeconomic effects at the individual and household levels. An increase in retirement age may produce unintended side effects concerning the voluntary work provision of older people (Eibich et al., 2020).

Theoretically, the relation between retirement and volunteering is ambiguous. Economic theory has focused on two main motivations for volunteer behavior (Carpenter and Myers, 2010; Sauer, 2015): (i) the consumption motive and (ii) the investment motive. The former refers to the case that individuals receive an internal reward as a direct consequence of their voluntary behavior (Andreoni, 1990). The price of volunteer work as a consumption good is the opportunity cost of time that could have been spent on paid work or leisure. We expect individuals with the consumption motive to increase volunteering after retirement as the cost of time reduces substantially after retirement. Alternatively, the investment motive suggests that people who take up volunteer work consider it as an investment and expect job-related benefits or payoffs in the future (Menchik and Weisbrod, 1987). Voluntary activities can help workers develop skills, expand networks, and enhance future earnings potential. If the investment motive dominates the consumption motive, volunteering will decline after retirement since job-related volunteering considerations are no longer relevant for retirees. For most people, volunteering is probably out of a combination of both intrinsic and extrinsic motivations. Unpaid labor supply may not only bring a feeling of personal satisfaction, but also an investment value that leads to improved job prospects. Hence, the overall direction of the relation between retirement and volunteering is theoretically unclear.

The influence of retirement on the provision of voluntary services is ultimately an empirical question. However, the identification of the causal relation is challenging. The decision to retire is known to be not exogenously determined. Unobserved confounders can be correlated with both retirement decision and voluntary behavior. Volunteering may also affect an individual's decision to retire. To the best of our knowledge, only two studies have analyzed the causal impact of retirement status on voluntary work provision.[1] Exploiting legal retirement ages in European countries as the

[1] A few studies have considered the correlations between retirement and voluntary activities. For example, Erlinghagen (2010) reports a modest positive association between work–retirement transition and the propensity to be a volunteer. Tang (2016) shows that entry into retirement has a positive association with the amount of time volunteered, but it has no correlation with the decision to take up voluntary work.

instrument, Laferrère (2016) finds positive effects of retirement on voluntary activities across 10 continental European countries. Eibich et al. (2020) use the qualifying ages for the old age pensions to address the endogeneity problem and find that retirement increases the provision of voluntary services in England, Ireland, and the United States.

In this paper, we empirically examine the link between retirement and the supply of volunteer labor, using longitudinal data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. To identify the causal impact, we exploit a recent reform of the publicly funded Age Pension in Australia, which has significantly changed the financial incentives for older people to retire. Specifically, we employ the fixed effects instrumental variable (FE–IV) approach and use the age eligibility for the Australian Age Pension as the instrument for retirement decision. Our FE–IV estimates measure the local average treatment effects (LATE) for compliers, a set of individuals whose age eligibility for the Age Pension determines their decision to retire.

Our empirical results show that retirement status, as a discrete change in lifestyle, leads to rising engagement in voluntary work among both older men and women. The intensity of their volunteer activities also increases upon retirement. We additionally consider retirement as a cumulative process of exposure to non-market activities. The duration of women's time spent in retirement is also found to increase volunteer labor supply along both the extensive and intensive margins, while there is no such evidence for men. This difference is likely to be attributable to gender-specific prosocial motivations. Last, we consider whether retirees affect the provision of voluntary services by their family members. Our findings suggest that such intra-household retirement externalities indeed exist. Older people's retirement impacts positively on the volunteer behavior of their family members. Therefore, pension institutions matter for volunteer labor supply indirectly through the retirement behavior of the elderly. While the Australian Age Pension reform helps prolong working lives, it leads to an undesirable shrinkage of the volunteer workforce.

This paper contributes to the literature in the following ways. First, we complement Laferrère (2016) and Eibich et al. (2020) by providing the Australian evidence to the understudied literature on the causal relation between retirement status and voluntary activities. The causal identification helps us test the competing consumption and investment motives of volunteering in economic theory. Exploiting the exogenous variation in retirement decisions induced by the Australian Age Pension reform, we identify a positive causal impact of retirement status on volunteering, which lends support to the theory that considers volunteering to be a consumption good. Second, we measure retirement by its duration as a cumulative process of being inactive in the labor market and provide evidence that retirement duration also causally increases the voluntary work provision of older women. Last, we contribute to the literature on intra-household retirement externalities on economic behaviors. Muller and Shaikh (2018) and Eibich and Siedler (2020) recently report causal spillovers of retirement on spousal health behavior and adult children's fertility decision, respectively. We advance the literature by showing novel evidence on the external effects of own retirement on voluntary services provided by other family members.

The remainder of the paper is organized as follows. Section 2 describes the Age Pension reform in Australia. Section 3 discusses the HILDA data and variables. Section 4 explains the identification strategy, and the estimation results appear in Section 5. Last, Section 6 concludes.

2 The Australian Age Pension reform

The retirement income system in Australia has three major pillars: (i) the publicly funded Age Pension; (ii) the employer-contributed superannuation for employees; and (iii) voluntary savings (Agnew, 2013; Atalay and Barrett, 2015). As retirement is not mandatory in Australia, the timing of older people's decision to retire depends on the financial incentives from public pension, private superannuation, and voluntary savings. Here we focus on the Australian Age Pension, as its recent reform offers the exogenous institutional variation in retirement incentives that can be exploited to identify the causal impact of retirement.

The Australian Age Pension is funded directly from government revenues. Since its introduction in 1908, it has been working as a safety net to ensure an acceptable standard of living in retirement among older Australians. The maximum amount of Age Pension payment is set at 25% of gross male average earnings.[2] Over 70% of elderly people in Australia are eligible recipients, and about two thirds of pension beneficiaries receive full benefits.

Age Pension entitlements have three qualifying conditions. First, pension applicants need to have been an Australian citizen or permanent resident for ten or more years in total. Second, the Age Pension is means tested with income and asset levels being important determinants of both pension eligibility and the amount of pension benefits.[3] Last, pension entitlements are subject to age requirements. When the Age Pension was introduced in 1908, the qualifying age threshold was 65 for both men and women. It was soon reduced to 60 for women in 1910. Since then, the eligibility ages for males (65) and females (60) remained constant until July 1995, when the age threshold for women started increasing progressively at a rate of six months every two years. The Age Pension eligibility age for women reached 65 in 2014 and became identical to that for men. There was a temporary pause in the increase of the age threshold in 2015 and 2016. From July 2017, the qualifying age for both genders has started rising again by six months every two years until reaching 67 years of age in July 2023.

The eligibility ages for the Age Pension by different birth cohorts are displayed in Table 1. Among the 5,466 women aged 50–75 in the HILDA data, only 11% (584 women who were born before 01/07/1935) have an eligibility age of 60. The qualifying age for the remaining 89% of older women (4,882 women who were born on or after 01/07/1935) have been affected by the pension reform, with their increased age threshold ranging from 60.5 to 67. Among the 5,038 older men in our HILDA sample, 51% (2,578 men who were born before 01/07/1952) have a qualifying age of 65, and 49% (2,460 men who were born on or after 01/07/1952) have an increased age threshold

[2] In 2021, the maximum rate per fortnight is AU$860.60 for singles and AU$1,297.40 for couples.

[3] In 2021, the relevant income test specifies that an individual (couple) can be entitled to full pension payment if his/her private income per fortnight does not exceed AU$178 (AU$316 for a couple). For those with incomes above these thresholds, pension benefits are reduced by AU$0.5 for each dollar above their income threshold. The relevant assets test depends on the status of home ownership. For homeowners, the level of assets disregarded (that is, the threshold value below which assets do not influence the benefit level) is AU$268,000 for singles and AU$401,500 for couples. For non-homeowners, the level of assets disregarded is AU$482,500 and AU$616,000 for singles and couples, respectively. For those with assets above these threshold values, pension benefits are reduced by AU$1.50 per fortnight for every AU$1,000 above their asset threshold. Detailed information about the means test of the Age Pension can be found at the website of Services Australia: https://www.servicesaustralia.gov.au/individuals/services/centrelink/age-pension.

Table 1: Eligibility age for the Australian Age Pension

Birth cohort	Eligibility age		Effective date	
	Female	Male	Female	Male
Before 01/07/1935	60.0	65.0	Before 01/07/1995	Before 01/07/2017
01/07/1935–31/12/1936	60.5	65.0	01/01/1996–01/07/1997	Before 01/07/2017
01/01/1937–30/06/1938	61.0	65.0	01/01/1998–01/07/1999	Before 01/07/2017
01/07/1938–31/12/1939	61.5	65.0	01/01/2000–01/07/2001	Before 01/07/2017
01/01/1940–30/06/1941	62.0	65.0	01/01/2002–01/07/2003	Before 01/07/2017
01/07/1941–31/12/1942	62.5	65.0	01/01/2004–01/07/2005	Before 01/07/2017
01/01/1943–30/06/1944	63.0	65.0	01/01/2006–01/07/2007	Before 01/07/2017
01/07/1944–31/12/1945	63.5	65.0	01/01/2008–01/07/2009	Before 01/07/2017
01/01/1946–30/06/1947	64.0	65.0	01/01/2010–01/07/2011	Before 01/07/2017
01/07/1947–31/12/1948	64.5	65.0	01/01/2012–01/07/2013	Before 01/07/2017
01/01/1949–30/06/1952	65.0	65.0	01/01/2014–01/07/2017	Before 01/07/2017
01/07/1952–31/12/1953	65.5	65.5	01/01/2018–01/07/2019	01/01/2018–01/07/2019
01/01/1954–30/06/1955	66.0	66.0	01/01/2020–01/07/2021	01/01/2020–01/07/2021
01/07/1955–31/12/1956	66.5	66.5	01/01/2022–01/07/2023	01/01/2022–01/07/2023
On or after 01/01/1957	67.0	67.0	On or after 01/07/2023	On or after 01/07/2023

being between 65.5 and 67.

The reform of the Australian Age Pension has introduced financial incentives for elderly people to retire at specific eligibility ages. Individuals close to these age thresholds may defer their retirement until they become qualified for pension entitlements. While pension eligibility thresholds clearly influence the decision to retire, they cannot influence the volunteer behavior of elderly people except indirectly through their retirement. We will exploit the legislative changes in the eligibility age for the Age Pension across birth cohorts to identify the causal effects of retirement on volunteer work provision.

3 Data, variables, and descriptive statistics

3.1 HILDA data

This paper draws on panel data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. Starting in 2001, HILDA is the only nationally representative household panel survey in Australia, which collects annual information on labor market dynamics, life events, health, and economic well-being. This study uses the 19 waves (2001–2019) of the restricted release of HILDA that has the information on both the exact date of birth and the exact date of survey in every wave for each individual respondent. These two pieces of date information will be used to calculate the exact age of each respondent in each wave. We can then precisely identify whether a HILDA respondent crossed the age threshold for the Age Pension at the time of survey.

Following Bonsang et al. (2012) and Zhu (2016), we focus on respondents aged 50–75 at the time of the HILDA Survey . As discussed in Section 2, to be eligible for the Age Pension, a person has to be an Australian resident for at least ten years. We exclude individuals who do not meet this requirement. We further exclude those with missing information on core variables used in the analysis. The final sample comprises 77,300 observations corresponding to 10,504 Australians during the 2001–2019 sampling period; these respondents are thus observed on average for 7–8 years.

3.2 Variables and descriptive statistics

In each wave of HILDA, respondents reported their current labor force status. Our definition of retirement follows Mastrobuoni (2009) and Zhu (2016). We consider an individual to be retired if he/she reported not to be in the labor force.

In HILDA, each respondent was asked a question on how much time he/she spent on formal volunteer or charity work in a typical week (for example, canteen work at the local school; unpaid work for a community club or organization). We focus on three binary indicators: (i) "whether participating in any voluntary work"; (ii) "whether volunteering for at least 2 hours per week"; and (iii) "whether volunteering for at least 5 hours per week". The first variable relates to the engagement or disengagement in volunteer work (i.e., the extensive margin), while the latter two measure the intensity of volunteering (i.e., the intensive margin). They will be used as the dependent variables in our estimations.[4]

The summary statistics of our analysis sample appear in Table 2. Approximately 47% of observations come from men and 53% from women. Around 25% of older Australians participate in volunteer work, and the participation rate is slightly higher among older women. There is little gender difference in the intensity of volunteer activities: about 16% spend at least 2 hours on volunteering per week, while 8% spend 5 hours or more per week. Among voluntary work providers, about two thirds volunteer for at least 2 hours per week, and one third work for at least 5 hours each week.

Table 2 also shows that the individuals in our sample are on average in their early 60's during the survey periods, with 53% of women and 41% of men being retired. About 37% of women have reached their qualifying age for the Age Pension, and the analogous figure for men is around one third. The average number of years of education is 12. With respect to the family, most observations

[4]We prefer not to use hours of volunteering as a dependent variable. As discussed in Thoits and Hewitt (2001) and Magnani and Zhu (2018), reported hours of voluntary work are prone to measurement errors, due to inaccurate recalls, unrealistic demand for precision in hours, and social desirability pressure to over-report. As will be elaborated in Section 4, our estimation approach will exploit within-person variation for identification. Small measurement errors in the hours of volunteering can become large after within-person transformation. Measurement errors in volunteering intensity are likely to be of a smaller concern when using binary indicators.

(73%) come from respondents who are married or in a de facto relationship. The average family size is slightly above 2. Lastly, around 58% of observations come from individuals who live in a major Australian city.

Table 2: Summary statistics

	All	Male	Female
Voluntary work provision:			
Participation in volunteering	0.25	0.23	0.27
Volunteering for at least 2 hours per week	0.16	0.15	0.17
Volunteering for at least 5 hours per week	0.08	0.08	0.09
Age	61.62	61.61	61.62
	(7.24)	(7.25)	(7.24)
Retired	0.48	0.41	0.53
Age eligible for Age Pension	0.35	0.34	0.37
Years of education	11.98	12.20	11.79
	(2.43)	(2.38)	(2.47)
Marital status:			
Married or in a de facto relationship	0.73	0.79	0.68
Separated	0.04	0.04	0.04
Divorced	0.11	0.09	0.13
Widowed	0.06	0.02	0.10
Never married	0.06	0.06	0.05
Family size	2.29	2.41	2.19
	(1.11)	(1.17)	(1.04)
Living in a major city	0.58	0.57	0.59
Observations	77,300	36,718	40,582
Individuals	10,504	5,038	5,466

Note: The standard deviations of the continuous variables appear in parentheses.

4 Identification strategy

We use the following model to examine the relation between retirement and volunteering:

$$Vol_{it} = RetStatus_{it}\beta + X'_{it}\gamma + u_i + \epsilon_{it}. \quad (1)$$

Here, Vol_{it} denotes the extensive or intensive margin of volunteer work of individual i at time t. $RetStatus_{it}$ is a retirement-status variable that is equal to one if an individual is retired and zero otherwise. The explanatory variables, denoted by X_{it}, include age, age squared, years of education, marital-status dummies, family size, whether living in a major city, state of residence dummies, and wave dummies.[5] u_i denotes individual fixed effects, and ϵ_{it} is the idiosyncratic error term.

The retirement-status variable ($RetStatus_{it}$) in Equation (1) can be endogenous due to its correlations with unobserved individual heterogeneity (u_i) and/or the error term (ϵ_{it}). If we assume that the correlation between $RetStatus_{it}$ and ϵ_{it} is zero, we can consistently estimate β, the parameter of key interest, by employing fixed effects (FE) panel estimation. The identification comes from the within-subject variation in Vol_{it} experienced by those whose retirement status has also changed during the sampling periods. However, this assumption may be violated for several reasons. Time-varying unobservables may affect both retirement decision and voluntary activities. Unpaid labor supply may also positively or negatively affect the decision to retire.

To resolve the concern about the endogeneity problem of $RetStatus_{it}$, we use the approach of fixed effects instrumental variable (FE–IV) estimation. Intuitively, the FE element of the FE–IV approach addresses the correlation between $RetStatus_{it}$ and u_i, while the IV component controls for the correlation between $RetStatus_{it}$ and ϵ_{it}. When a valid instrument for $RetStatus_{it}$ is available, the implementation of the FE–IV approach comprises two stages. Specifically, we estimate the following two equations with FE panel regression:

$$RetStatus_{it} = EliStatus_{it}\theta + X'_{it}\lambda + v_i + \varepsilon_{it} \tag{2}$$

$$Vol_{it} = \widehat{RetStatus}_{it}\beta + X'_{it}\gamma + u_i + \epsilon_{it}. \tag{3}$$

In Equation (2), Age Pension age eligibility ($EliStatus_{it}$) is the instrument for retirement status ($RetStatus_{it}$), and v_i is the individual fixed effects. In Equation (3), $\widehat{RetStatus}_{it}$ is the predicted retirement status derived from the first-stage FE estimation of Equation (2). Since $\widehat{RetStatus}_{it}$ is

[5] There are six states (New South Wales, Victoria, Queensland, South Australia, Western Australia, and Tasmania) and two territories (Northern Territory and Australian Capital Territory) in Australia.

predicted using $EliStatus_{it}$ and X_{it}, it is uncorrelated to any unobserved confounders absorbed in ϵ_{it}. Therefore, in the second stage, a FE panel estimation of Equation (3) can produce the estimate of β that uncovers the causal impact of retirement status on voluntary work provision. We adjust standard errors for clustering at the individual level to account for heteroskedasticity and arbitrary serial correlations across the waves of the HILDA Survey.

Our instrumental variable is defined as $EliStatus_{it} = I(Age_{it} \geq EliAge_{ct})$, where I is an indicator function taking the value of one when the condition in the parenthesis is true. Age_{it} denotes the age of individual i at time t, and $EliAge_{ct}$ is the Age Pension eligibility age specific to birth cohort c (displayed in Table 1). The instrument indicates whether the age of a person has crossed the corresponding threshold for the Age Pension. The validity of $EliStatus_{it}$ as a suitable instrument for $RetStatus_{it}$ is crucial for the success of the FE–IV method. It needs to satisfy both the relevance and the exclusion conditions. The former requires $EliStatus_{it}$ to be strongly correlated with $RetStatus_{it}$, and the latter requires $EliStatus_{it}$ to be orthogonal to ϵ_{it}. It has been shown in the literature that social security benefits affect retirement decisions (Anderson et al., 1999; Mastrobuoni, 2009; Atalay and Barrett, 2015; Kim, 2020). We can empirically test the relevance condition in the first stage of the FE–IV approach. The exclusion condition cannot be tested directly. However, conditional on a smooth age trend, the binary instrument indicating whether having reached certain specific age is unlikely to have an impact on people's voluntary work provision except through the channel of their retirement. Retirement induced by social security incentives is exogenous and has been used widely in the extant literature (Bonsang et al., 2012; Stancanelli and Van Soest, 2012; Eibich, 2015; Zhu and He, 2015; Kampfen and Maurer, 2016; Zhu, 2016; Atalay et al., 2019, 2020; Eibich et al., 2020; Fischer and Muller, 2020; Frimmel and Pruckner, 2020; Nguyen et al., 2020).

Overall, our causal identification is based on the exogenous variation in retirement induced by the birth-cohort differences in the reformed qualifying ages for the Age Pension. It is important to note that the FE–IV estimates should be interpreted as the local average treatment effects (LATE) for compliers whose treatment status is a deterministic function of the instrument (Imbens and

Angrist, 1994).[6] In this specific context, compliers are individuals who do not retire when they are below the qualifying age for the Age Pension, but who do retire once they reach the age threshold.

5 Results

5.1 Retirement status and voluntary work provision

Table 3 reports the results from the FE panel estimation of Equation (1). The FE estimates are very similar among older men and women. It is evident that retirees are more engaged in voluntary work provision than non-retirees. Entering retirement is associated with a 7–8 percentage point increase in taking up any volunteer work. The association between retirement status and the intensity of voluntary activities is also positive and statistically significant. Specifically, when compared with non-retirees, the probability of volunteering for at least 2 hours per week is about 8 percentage points higher among retirees. The analogous figure for 5 or more hours of volunteer work per week is around 5 percentage points. However, these estimates cannot be interpreted causally since the FE regressions deal with neither reverse causality nor the potential confounding influence of time-varying unobservables.

The causal impact of retirement status on volunteering can be identified using the two-stage FE–IV approach. The first-stage results, reported in Table 4, show that the binary instrument indicating Age Pension age eligibility is a highly significant predictor of older people's retirement decision. The F-statistics on the excluded instrument (168.35 for males and 113.71 for females) far exceed the Staiger and Stock (1997) rule-of-thumb threshold value of 10. Table 4 indicates that having reached the pension qualifying age increases the probability of older men to retire by around 15 percentage points. The analogous estimate for older women is around 12 percentage points. Delayed age eligibility to receive pension benefits thus induces postponed retirement among elderly people.

[6] A detailed description of the LATE framework can be found in Imbens and Angrist (1994) and Angrist and Pischke (2008). Within this framework, Equations (2)–(3) allow the treatment effects to be heterogeneous at the individual level. The FE–IV estimate of β is the expected value of β_i for all the individuals in the complier group.

Table 3: Retirement status and voluntary work provision (FE estimates)

	Participation	Intensity per week	
		≥2 hours	≥5 hours
Panel A: Male			
Retirement status	0.072***	0.079***	0.055***
	(0.009)	(0.008)	(0.007)
Observations	36,718	36,718	36,718
Individuals	5,038	5,038	5,038
Overall R-squared	0.004	0.007	0.000
Panel B: Female			
Retirement status	0.079***	0.077***	0.048***
	(0.010)	(0.009)	(0.007)
Observations	40,582	40,582	40,582
Individuals	5,466	5,466	5,466
Overall R-squared	0.006	0.008	0.000

Notes: The control variables include age, age squared, years of education, marital-status dummies, family size, a dummy for living in a major city, state of residence dummies, and wave dummies. Standard errors clustered at the individual level appear in parentheses. *** p<0.01; ** p<0.05; * p<0.10.

Table 4 also displays the second stage of the FE–IV regression results. Similar to Eibich et al. (2020), we find positive and significant causal effects of retirement status on volunteer activities. The results for males and females are very similar. For the three indicators of voluntary work provision, the FE–IV estimates are all considerably larger than those obtained from FE regressions. On average, the propensity to be a volunteer increases through retirement by 25 and 29 percentage points for men and women, respectively.[7] Moving into retirement also drives up the time dedicated to voluntary work. After becoming retired, older people are about 21–23 percentage points more likely to volunteer for at least 2 hours per week. Their propensity to volunteer for 5 or more hours per week is 9–13 percentage points higher when retired.

The positive causal relation between retirement and volunteering suggests that the consumption motive of volunteering dominates the investment motive. As such, paid employment and unpaid labor supply substitute rather than complement each other. When older people face an increase in

[7] Our estimated effects of retirement status on the propensity to participate in voluntary activities are larger than those reported in Eibich et al. (2020), which find that retirement leads to an increase in the probability of volunteering by 10–20 percentage points in England, Ireland, and the United States.

Table 4: The causal effects of retirement status on voluntary work provision (FE–IV estimates)

	First stage	Second stage		
	Retirement status	Participation	Intensity per week	
			≥2 hours	≥5 hours
Panel A: Male				
Retirement status		0.254***	0.226***	0.091*
		(0.065)	(0.059)	(0.050)
Age eligible for the Age Pension	0.154***			
	(0.012)			
F-statistic on the excluded instrument	168.35			
Observations	36,718	36,718	36,718	36,718
Individuals	5,038	5,038	5,038	5,038
Overall R-squared	0.319	0.004	0.006	0.000
Panel B: Female				
Retirement status		0.290***	0.209***	0.127**
		(0.088)	(0.080)	(0.062)
Age eligible for the Age Pension	0.119***			
	(0.011)			
F-statistic on the excluded instrument	113.71			
Observations	40,582	40,582	40,582	40,582
Individuals	5,466	5,466	5,466	5,466
Overall R-squared	0.289	0.006	0.007	0.001

Notes: The control variables include age, age squared, years of education, marital-status dummies, family size, a dummy for living in a major city, state of residence dummies, and wave dummies. Standard errors clustered at the individual level appear in parentheses. *** p<0.01; ** p<0.05; * p<0.10.

their pensionable age, they retire later and provide significantly less volunteer work than those with a lower age threshold for the Age Pension. As such, the Australian Age Pension reform aiming at working life prolongation has led to an undesirable reduction in the volunteer workforce.

5.2 Characterizing the composition of compliers

As noted in Section 4, the FE–IV approach identifies the local average treatment effects (LATE) for compliers whose treatment status is determined by the instrument. In our HILDA data, the complier group is composed of individuals whose age eligibility for the Age Pension determines their decision to retire. While compliers cannot be individually identified, we can measure the size of this group, which is given by the first stage of the FE–IV estimations. According to Table 4, around 15% of older men and 12% of older women in our analysis sample have their retirement status entirely dependent on the age eligibility for the Age Pension.

The distribution of complier characteristics can also be constructed. A general method for this purpose is the kappa-weighting scheme of Abadie (2003). Using D_{1i} to denote the treatment status of individual i when $Z_i = 1$ and D_{0i} to denote the treatment status when $Z_i = 0$, the mean of a covariate X_i for compliers with $D_{1i} > D_{0i}$ can be obtained by $E[X_i|D_{1i} > D_{0i}] = \frac{E[\kappa_i X_i]}{E[\kappa_i]}$, where the weighting function $\kappa_i = 1 - \frac{D_i(1-Z_i)}{1-P(Z_i=1|X_i)} - \frac{(1-D_i)Z_i}{P(Z_i=1|X_i)}$. If covariates are dummy variables, information on the characteristics of compliers can also be learned from variation in the first-stage estimates across covariate subgroups (Angrist and Pischke, 2008). Specifically, the relative likelihood that a complier has one characteristic (indicated by $x_{1i} = 1$) is given by $\frac{P[x_{1i}=1|D_{1i}>D_{0i}]}{P[x_{1i}=1]}$ $= \frac{E[D_i|Z_i=1,x_{1i}=1]-E[D_i|Z_i=0,x_{1i}=1]}{E[D_i|Z_i=1]-E[D_i|Z_i=0]}$, which is the ratio of the first-stage coefficient of the instrument for those with $x_{1i} = 1$ to that for the overall sample.

Here we examine the composition of the complier population, stratified by gender. This analysis provides suggestive evidence of which segments of the population are most strongly affected by the age threshold for receiving pension benefits in Australia. We focus on the same characteristics as in Eibich et al. (2020). We define subgroups using mutually exclusive binary indicators for education ("less than university education" and "university education"), marital status ("married or in a de facto relationship", "separated", "divorced", "widowed", and "never married"), and health ("having a long-term health condition, disability or impairment" and "having no long-term health condition, disability, or impairment").[8] To shed light on the distribution of complier characteristics, we follow the approach outlined in Angrist and Pischke (2008). We re-estimate Equation (2) with

[8]HILDA respondents were asked to report whether they have the following health problems: (1) sight problems not corrected by glasses or contact lenses; (2) hearing problems; (3) speech problems; (4) blackouts, fits or loss of consciousness; (5) difficulty learning or understanding things; (6) limited use of arms or fingers; (7) difficulty gripping things; (8) limited use of feet or legs; (9) a nervous or emotional condition which requires treatment; (10) any condition that restricts physical activity or physical work (e.g., back problems, migraines); (11) any disfigurement or deformity; (12) any mental illness which requires help or supervision; (13) shortness of breath or difficulty breathing; (14) chronic or recurring pain; (15) long-term effects as a result of a head injury, stroke or other brain damage; (16) long-term condition or ailment which is still restrictive even though it is being treated or medication is being taken for it; and (17) any other long-term condition such as arthritis, asthma, heart disease, Alzheimer's disease, dementia, etc.

FE panel regression for each subgroup, and then calculate the ratio of the estimated coefficient on the instrument for the subgroup relative to the coefficient on the instrument estimated using the overall sample. This gives us an estimate of the relative likelihood of individuals to belong to the subpopulation of compliers.

Table 5: Characterizing the composition of compliers

	Male	Female
Education:		
Less than university education	1.046	1.027
University education	0.779	0.839
Marital status:		
Married or in a de facto relationship	1.044	0.908
Separated	1.089	0.421
Divorced	0.859	1.421
Widowed	0.567	0.644
Never married	0.318	0.871
Health:		
Having a long-term health condition, disability, or impairment	0.727	0.572
Having no long-term health condition, disability, or impairment	1.155	1.196

Note: The numbers show the relative likelihood of individuals to belong to the subpopulation of compliers.

Table 5 shows the relative likelihood that an individual with a given characteristic is part of the compliers in the HILDA sample. As expected, lower educated men and women are over-represented among compliers. Pension qualifying ages are less relevant for better educated individuals as they are likely to rely less on the basic Age Pension entitlements for their old-age income (Eibich et al., 2020). We also find that older men who are married/in a de facto relationship or separated are more likely to comply with the age threshold, while men who have never married are least likely to retire at the eligibility age threshold. In contrast, divorced women have a significantly higher propensity to be in the complier group, when compared with older women with a different marital status. Finally, compliers are less likely to be those having a long-term health condition, disability, or impairment: these people generally retire before reaching their pensionable age.

5.3 Retirement duration and voluntary work provision

In Section 5.1, retirement was modelled as a discrete change in the lifestyle of elderly people. However, retirement has another dimension, which relates to a continual process of exposure to non-market activities (Bonsang et al., 2012; Mazzonna and Peracchi, 2012). It may take time for people to adapt to substantial changes and adjust to a new lifestyle. Individuals providing volunteer work may expand (reduce) their engagement and provide more (less) intensive volunteer services after staying in retirement for a longer time. Here, we incorporate retirement period into our modelling and investigate how the provision of voluntary work by the elderly can be affected by the cumulative amount of time since an individual entered retirement.

In HILDA, retirees reported the age at which they exited the labor market. We generate the measure of retirement duration as $RetDuration_{it}{=}Max\{Age_{it}{-}RetAge_{it}, 0\}$, which is the length of elapsed time between the retirement age ($RetAge_i$) and the current age (Age_{it}) at the time of survey. Those who are not retired have a retirement duration of zero.

We also construct a measure of the duration of being age eligible for the Age Pension, which is defined as $EliDuration_{it}{=}Max\{Age_{it}{-}EliAge_{ct}, 0\}$. It represents the time difference between the current age (Age_{it}) and the age at which an individual in birth cohort c first crossed the age threshold for the Age Pension ($EliAge_{ct}$). If an individual has not reached the pensionable age, $EliDuration_{it}$ is set to zero. Given the strong evidence of a positive linkage between pension eligibility and retirement decision in Section 5.1, we expect the eligibility-duration variable to be closely correlated with the time spent in retirement.

We model the relationship between retirement duration and unpaid labor supply as follows:

$$Log(RetDuration + 1)_{it} = Log(EliDuration + 1)_{it}\theta + X'_{it}\lambda + v_i + \varepsilon_{it}. \tag{4}$$

$$Vol_{it} = Log(RetDuration + 1)_{it}\beta + X'_{it}\gamma + u_i + \epsilon_{it}. \tag{5}$$

We estimate Equations (4) and (5) using the FE–IV approach, with $Log(EliDuration+1)_{it}$ being used as the instrument for $Log(RetDuration + 1)_{it}$. In Equation (5), the logarithmic retirement duration allows the changes in individual volunteer behavior to be nonlinearly affected by retirement duration. Compared with the linear form of duration variables, the specification using logarithmic transformations of duration variables is better supported by our data in terms of the goodness of fit and the levels of statistical significance of estimates.[9]

Table 6: Retirement duration and voluntary work provision (FE estimates)

	Participation	Intensity per week	
		$\geq$2 hours	$\geq$5 hours
Panel A: Male			
Log retirement duration	0.029***	0.032***	0.026***
	(0.007)	(0.006)	(0.005)
Observations	36,718	36,718	36,718
Individuals	5,038	5,038	5,038
Overall R-squared	0.005	0.007	0.000
Panel B: Female			
Log retirement duration	0.026***	0.022***	0.012***
	(0.006)	(0.005)	(0.004)
Observations	40,582	40,582	40,582
Individuals	5,466	5,466	5,466
Overall R-squared	0.006	0.009	0.000

Notes: The control variables include age, age squared, years of education, marital-status dummies, family size, a dummy for living in a major city, state of residence dummies, and wave dummies. Standard errors clustered at the individual level appear in parentheses. *** p<0.01; ** p<0.05; * p<0.10.

We first discuss the results from the FE estimations of Equation (5). Table 6 shows that the time spent in retirement is positively and significantly associated with the participation in voluntary activities, with minor gender differences in the FE estimates. Since the coefficient of logarithmic retirement duration can be interpreted as the semi-elasticity of volunteering with respect to retirement duration, a 10% increase in retirement duration is correlated with about 0.3 percentage point

[9]We have also considered alternative functional form specifications to model the nonlinear relation between retirement duration and volunteering. We first include the quadratic polynomial of retirement duration and use the quadratic polynomial of the duration of being age eligible for the Age Pension as their instruments. The F-statistics on the excluded instruments range from 2.31 to 6.00. The weak-instrument problem indicates that this specification is not supported by the HILDA data. Moreover, we combine Equations (2)–(5) to consider both the linear and logarithmic trend in the FE–IV estimations. The retirement-status variable is statistically significant, but logarithmic retirement duration is not. The statistical insignificance of the latter should not be over-interpreted: the variations in the two instruments for retirement status and logarithmic retirement duration come from the same source (the Age Pension reform).

increase in the provision of any unpaid work. We find similar positive associations when examining the intensity of volunteering.

We now turn to the FE–IV estimations of Equations (4) and (5). The first-stage results displayed in Table 7 show that the duration of being age eligible for the Age Pension is a strong determinant of retirement duration. The first-stage F-statistic on the instrumental variable is 121.02 for men and 82.41 for women, indicating that our instrument well satisfies the relevance condition. A 10% increase in the pension eligibility duration of elderly people is linked to about 2% increase in the amount of time spent in retirement.

Table 7: The causal effects of retirement duration on voluntary work provision (FE–IV estimates)

	First stage	Second stage		
	Log retirement duration	Participation	Intensity per week	
			≥2 hours	≥5 hours
Panel A: Male				
Log retirement duration		0.057	0.075*	0.010
		(0.047)	(0.045)	(0.037)
Log duration of being age eligible for the Age Pension	0.223***			
	(0.020)			
F-statistic on the excluded instrument	121.02			
Observations	36,718	36,718	36,718	36,718
Individuals	5,038	5,038	5,038	5,038
Overall R-squared	0.341	0.005	0.007	0.000
Panel B: Female				
Log retirement duration		0.120**	0.095**	0.066*
		(0.052)	(0.046)	(0.036)
Log duration of being age eligible for the Age Pension	0.199***			
	(0.022)			
F-statistic on the excluded instrument	82.41			
Observations	40,582	40,582	40,582	40,582
Individuals	5,466	5,466	5,466	5,466
Overall R-squared	0.406	0.007	0.009	0.001

Notes: The control variables include age, age squared, years of education, marital-status dummies, family size, a dummy for living in a major city, state of residence dummies, and wave dummies. Standard errors clustered at the individual level appear in parentheses. *** p<0.01; ** p<0.05; * p<0.10.

The second-stage results in Table 7 suggest that the FE estimates in Table 6 are far from being causal. The FE–IV results for older men are either statistically insignificant or marginally significant at the 10% level. In contrast, there is clear evidence that retirement duration increases the voluntary work provision of older women in a causal fashion. A 10% increase in women's time in retirement leads to about 1 percentage point increase in their propensity to participate in volunteering. Women also increase their intensity of unpaid work if their exposure to retirement becomes longer.[10]

It is natural to ask why the effects of retirement duration differ by gender. Many psychological studies have found that women score higher on measures of traits and motivations that predict prosocial behaviors such as volunteering (Clary and Snyder, 1991; Clary et al., 1998; Skoe et al., 2002; Einolf, 2011). Female retirees may learn how to overcome the constraints on their time dedicated to voluntary services. For example, after longer exposure to retirement, women may become more effective in managing their time and more efficient in fulfilling their household duties, which may allow them to provide more unpaid labor supply given their stronger prosocial motivations. Since elderly men are comparatively less internally motivated, they do not increase the provision of their unpaid work after spending longer time in retirement.

5.4 Intra-household spillovers of own retirement on the volunteering of family members

We have now shown clear evidence that retirement leads to strong and significant increases in one's own voluntary activities. The next question we ask is: does one's retirement induce voluntary services provided by his/her family members? The retirement of an individual may have interactive

[10] Some contributions have considered the choice between charitable donations of time and money (Duncan, 1999; Feldman, 2010). In HILDA Waves 6, 10, 14, and 18, respondents reported how often they gave money to charity if asked. The possible answers include (i) never, (ii) rarely, (iii) occasionally, (iv) sometimes, (v) often, and (vi) very often. We generate a binary indicator for any charitable donations that equals to one if the answers are (ii)–(vi) and zero otherwise. Similarly, we create another dummy variable measuring donation intensity that equals to one if the answers are (v)–(vi) and zero otherwise. Using them as dependent variables, we perform the FE–IV regressions using the same set of controls. The coefficient estimates of both retirement status and logarithmic retirement duration are very small in magnitude and highly statistically insignificant (the first-stage F-statistics on the excluded instruments are all considerably greater than 10). As such, for elderly people in our data, retirement only affects their voluntary contributions of time but not their charitable donations of money.

effects with other members of the household and thus affect the behaviors and/or outcomes of others (Atalay and Zhu, 2018; Muller and Shaikh, 2018; Eibich and Siedler, 2020). We speculate three possible reasons why such intra-household spillovers may exist. First, voluntary activities of family members may be positively correlated (Freeman, 1997; Rotolo and Wilson, 2006; Butrica et al., 2009).[11] Family members may develop the same attitudes toward volunteering over time and then volunteer together at retirement. Second, retirees may release the time constraints of their family members by sharing household duties such as home production (Stancanelli and Van Soest, 2012; Atalay et al., 2020) and informal care provision (Fischer and Muller, 2020). For example, Atalay et al. (2020) find that retirement induced by the Australian Age Pension reform increases the number of hours of home production by around 10.5 hours per week. Retirees' contribution to home production may help facilitate their family members to volunteer more. Last, many studies have found that older couples coordinate their retirement decisions: one's decision to retire impacts positively on his/her spouse's retirement (Hospido, 2015; Mavromaras and Zhu, 2015; Atalay et al., 2019; Michaud et al., 2020). Given our finding of a positive impact of retirement on own volunteering, spousal provision of voluntary services may increase accordingly. Among the three speculated reasons, the first two might matter for all other family members of a retiree, while the last one is relevant to his/her spouse only. Here, we empirically test whether the potential intra-household retirement externalities exist or not.

We restrict the sample to individuals from households with at least two members: this reduces the sample size from 77,294 observations for 10,504 individuals to 62,549 observations for 9,220 individuals.[12] We focus on three measures of the volunteer behavior of other family members of individual i in household h at time t (denoted by Vol_{-iht}): (i) "whether at least one family member of individual i participating in any voluntary work"; (ii) "whether at least one family member of individual i volunteering for 2 or more hours per week"; and (iii) "whether at least one family member of individual i volunteering for 5 or more hours per week". Using Vol_{-iht} as the dependent

[11] In the HIDLA data, the pairwise correlation coefficient between own volunteering and the volunteering of family members is 0.28, which is statistically significant at the 1% level.

[12] About 64% of the households in the reduced HILDA sample have two members and 36% have three or more.

variable and the same set of control variables as described in Section 4, we separately estimate the following two sets of equations using the FE–IV approach:

$$RetStatus_{iht} = EliStatus_{iht}\theta + X'_{iht}\lambda + v_{ih} + \varepsilon_{iht} \tag{6}$$

$$Vol_{-iht} = RetStatus_{iht}\beta + X'_{iht}\gamma + u_{ih} + \epsilon_{iht}; \tag{7}$$

and

$$Log(RetDuration + 1)_{iht} = Log(EliDuration + 1)_{iht}\theta + X'_{iht}\lambda + v_{ih} + \varepsilon_{iht} \tag{8}$$

$$Vol_{-iht} = Log(RetDuration + 1)_{iht}\beta + X'_{iht}\gamma + u_{ih} + \epsilon_{iht}. \tag{9}$$

For a causal interpretation of the FE–IV estimates from Equations (6)–(7) and (8)–(9), we need to assume that whether an older person reaches the qualifying age for the Age Pension does not have a direct effect on the voluntary work provision of his/her family members. While individual voluntary behavior might be related to the age of a family member, it seems unlikely that a discontinuous change in the propensity to volunteer happens at a specific pensionable age of another member in the family. As such, this assumption seems to hold (after conditioning on a smooth age trend).

Table 8 presents results from estimating the two sets of equations. Standard errors are clustered at the household level to adjust for arbitrary correlations in the error terms across family members. There is strong evidence of intra-household spillovers. An older individual's retirement status can lead to increased provision of volunteer work by his/her family members along both the extensive and intensive margins. Furthermore, we find that when an older man spends longer time in retirement, his family members are more likely to increase the supply of unpaid labor. In contrast, if older women are exposed to retirement for a longer time, their family members do not increase their voluntary work provision. Previous contributions have found that older people contribute more time to home production and informal care provision after retirement (Stancanelli

Table 8: Own retirement and volunteering of family members (FE–IV estimates)

	Male			Female		
	Participation	Intensity per week		Participation	Intensity per week	
		≥2 hours	≥5 hours		≥2 hours	≥5 hours
Retirement status	0.184***	0.142***	0.112***	0.152***	0.129*	0.034
	(0.050)	(0.045)	(0.035)	(0.072)	(0.067)	(0.054)
Log retirement duration	0.151***	0.126***	0.115***	0.018	0.026	0.015
	(0.038)	(0.035)	(0.027)	(0.035)	(0.033)	(0.027)
Observations	30,832	30,832	30,832	31,717	31,717	31,717
Individuals	4,474	4,474	4,474	4,746	4,746	4,746

Notes: The control variables include age, age squared, years of education, marital-status dummies, family size, a dummy for living in a major city, state of residence dummies, and wave dummies. Standard errors clustered at the household level appear in parentheses. *** $p<0.01$; ** $p<0.05$; * $p<0.10$.

and Van Soest, 2012; Atalay et al., 2020; Fischer and Muller, 2020), which allows their family members to have more free time allocated for other activities. Since females are generally more prosocial than males (Clary and Snyder, 1991; Clary et al., 1998; Skoe et al., 2002; Einolf, 2011), they are more willing to devote their time to volunteering. Consequently, the retirement of an older man has a more pronounced positive spillover on the voluntary services of his family members, who are more likely to be a female than the family members of an older woman.[13]

Overall, we present novel evidence of positive spillovers of individual retirement on the provision of volunteer work by his/her family members. The beneficial consequences of retirement for volunteering as a prosocial behavior in the society would be understated had such intra-household spillovers not been accounted for.

5.5 Robustness tests

5.5.1 Including household income and home ownership as additional controls

Here we check the sensitivity of our results by further controlling for the log of annual household income and home ownership in our FE–IV estimations. As explained in Section 2, the Australian Age Pension is means tested in the sense that household income and assets affect pension eligibility and the amount of pension entitlements. By controlling for income and assets, age eligibility for the Age Pension will be more closely related to actual pension eligibility. Also, variations in household income or assets may affect both the retirement decision and volunteer behavior of elderly people.

We first assess the influence of household income and home ownership separately and then control for both in the FE–IV estimations. Results are displayed in Panels A, B, and C in Appendix Table A1. The estimated results closely resemble the corresponding baseline estimates reported in Tables 4 and 7.[14]

[13] In the households with at least two members in the HILDA data, females account for 84% of the family members of older men, while the share is only 18% among those of older women.

[14] We have also considered the potential impact of health. Following the "use it or lose it" hypothesis (Cassel, 2002), volunteers might choose to provide unpaid work to preserve their health and cognitive functioning. In this sense, voluntary work can be considered a health investment and the investment motive of volunteering may also imply a positive effect of retirement on voluntary work provision. We further control for two measures of SF-36 physical and mental health in the FE–IV estimations. The inclusion of these two variables, which are arguably bad controls, has

5.5.2 Considering previous voluntary work provision

The literature has highlighted the importance of previous volunteering experiences as one of the most important predictors of voluntary activities (Erlinghagen, 2010; Eibich et al., 2020). Our earlier specifications have not accounted for the baseline levels of voluntary activities. In this sensitivity analysis, we consider the role of previous volunteer behavior. Specifically, we further include the lagged dependent variable as a control variable, in addition to the baseline set of explanatory variables. As the lagged dependent variable implies that the usual fixed effects estimator is inconsistent, we use the dynamic panel data model by Arellano and Bond (1991) while exploiting the Age Pension reform as an instrument for retirement. Results reported in Appendix Table A2 show similar results to those presented in Tables 4 and 7. We continue to find a positive causal impact of retirement on voluntary activities after controlling for previous voluntary work provision.

5.5.3 Excluding involuntary retirees

Our third robustness check is to exclude involuntary retirees from our estimation sample. In HILDA Waves 3, 7, 11, 15, and 19, retirees were asked whether their retirement was something that he/she felt forced or pressured to do. We drop the records of individuals who reported to have experienced involuntary/forced retirement. The estimation sample thus comprises mostly elderly people who are either non-retirees or voluntary retirees. Appendix Table A3 shows that our main results are robust to this sample restriction, with the FE–IV estimates being of similar magnitude to those in Tables 4 and 7.

5.5.4 Focusing on individuals with officially enforced pension eligibility age

The Australian Age Pension reform is still ongoing. As noted in Section 2, the qualifying age for both men and women is rising by six months every two years until reaching 67 years of age in July 2023. Accordingly, the eligibility age became 66.5 in July 2021 after reaching 66 in July

little influence on the estimated effects of retirement on voluntary activities.

2019. The data in the most recent wave of HILDA (Wave 19) were collected between July 2019 and February 2020. As such, the two eligibility ages of 66.5 and 67 had not been officially implemented when data in Wave 19 were collected.

In this section, we focus on individuals from those birth cohorts with qualifying ages that have already been officially enforced (60–66 for women and 65–66 for men). We drop those from the two youngest birth cohorts in Table 1 ("01/07/1955–31/12/1956" and "On or after 01/01/1957") since their eligibility ages are either 66.5 or 67. We then proceed to perform the same FE–IV estimations with the remaining observations. Results are presented in Appendix Table A4.

The FE–IV estimates using the reduced sample remain largely the same, which is unsurprising since our identification makes use of the within-person variation in the age eligibility for the Age Pension. Individuals in the two excluded birth cohorts have experienced no such variation in the instruments during the 2001–2019 sampling period.

5.5.5 Alternative definitions of retirement

We next perform two tests to assess whether our results are sensitive to alternative definitions of retirement. First, we define homemakers as not retired and exclude them from our estimation sample. Second, instead of using whether being in the labor force or not to define retirement, we use the self-reported retirement status as the core variable of interest. Appendix Tables A5 and A6 present the FE–IV estimates obtained from the two robustness checks, respectively. They are of very similar magnitude to those presented in Tables 4 and 7.

5.5.6 The range and specification of age

In this section, we assess whether our main results continue to hold when we focus on HILDA respondents of a smaller age range (55–75) as in Atalay et al. (2020) and Nguyen et al. (2020). Results shown in Appendix Table A7 indicate that this is the case. Retirement leads to significant increases in unpaid work provision among both older men and women.

Our next robustness check is related to the age trend. Our identification strategy is based on age-related instruments. While we have controlled for age and age squared in both stages of the FE–IV estimations, it is likely that this specification of age is not sufficiently rich to control for the age trend. To alleviate this concern, we test the robustness of our results by including the third order polynomials of age. The FE–IV results in Appendix Table A8 show that coefficients estimated using this age specification are similar to those in Tables 4 and 7, although the precision of the estimates is slightly reduced (as expected). The age cubed term, together with age and age squared, are not statistically significant in the FE–IV estimations. The results here suggest that the quadratic specification of age effects, as used in our baseline estimations, can sufficiently capture the smooth age trend (Zhu, 2016; Atalay et al., 2019, 2020; Nguyen et al., 2020).

5.5.7 Using whether receiving Age Pension benefits as the instrument

Our last sensitivity analysis is to use whether receiving Age Pension benefits as the instrument for retirement status.[15] Appendix Table A9 displays the results from the two-stage FE–IV regressions. A comparison of the first-stage estimates in Table 4 and Appendix Table A9 shows that whether receiving the Age Pension is a stronger predictor of retirement status than whether being age eligible for the Age Pension, in terms of both the sizes of the estimated coefficients and the F-statistics on the excluded instrument. It should be noted that this alternative instrument identifies the local average treatment effects (LATE) for a different complier group, i.e., those whose retirement status is determined by whether they receive Age Pension benefits. The first-stage FE–IV estimates indicate that the size of this complier group is larger than the one discussed in Section 5.2. Similar to our baseline estimates in Section 5.1, the second-stage results displayed in Appendix Table A9 also indicate a positive causal influence of retirement status on the voluntary activities of older men and women.

[15] Thanks to an anonymous referee for this suggestion.

6 Conclusion

This paper investigates the empirical link between retirement and the provision of volunteer work among elderly people, using panel data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. We address the endogeneity problem of retirement by exploiting the legislative variation in the eligibility age for the Australian Age Pension across birth cohorts. Our analysis has differentiated between retirement status as a discrete change in lifestyle and retirement duration as a cumulative process of being inactive in the labor market. Our fixed effects instrumental variable (FE–IV) estimations show that retirement has a positive and significant impact on voluntary work provision of both elderly men and women. The intensity of their volunteer activities also increases upon retirement. As such, the empirical results here indicate that the consumption motive of volunteering outweighs the investment motive. In addition, we show that longer time spent in retirement increases the unpaid labor supply of women, while there is no such impact for men. Finally, we present strong evidence of positive intra-household spillovers of older people's retirement on the volunteer behavior of their family members.

It is important to reflect on our findings in the context of global population aging, increased life expectancy, and the social security reforms currently happening in many countries. To relieve the financial burden of publicly funded pension schemes, many governments have extended the compulsory age thresholds for pension-related entitlements. However, policies aiming at prolonging working lives and increasing workforce participation are not without costs. Older people who are induced by the Age Pension reform to retire at a later age provide significantly less supply of volunteer labor to the society. Since older people's paid work and volunteer work are substitutes, policymakers should consider the trade-offs between the market and non-market labor supply of the elderly population.

To maintain the seniors in the voluntary workforce, more efforts can be directed at people who have just retired. Pensioners who have left working life have ample free time and many of them have high potential to be part of the volunteer workforce. Policymakers can provide them with information and decision support that accompany opportunities for volunteer work provision.

Informational campaigns via channels such as television and internet can be employed to advertise the intrinsic and extrinsic benefits of voluntary work. Economic incentives can also be provided to promote the provision of voluntary activities among the elderly population. Unpaid labor supply is in the interests of both the seniors themselves and the welfare of the wider society.

Declaration of Competing Interest:

None.

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Appendix

Table A1: Including household income and home ownership as additional controls (FE–IV estimates)

	Male			Female		
	Participation	Intensity per week		Participation	Intensity per week	
		≥2 hours	≥5 hours		≥2 hours	≥5 hours
Panel A: Controlling for household income						
Retirement status	0.254***	0.226***	0.091*	0.285***	0.207***	0.121***
	(0.064)	(0.059)	(0.050)	(0.082)	(0.075)	(0.058)
Log retirement duration	0.058	0.076*	0.011	0.125**	0.100**	0.065*
	(0.047)	(0.044)	(0.036)	(0.051)	(0.045)	(0.034)
Observations	36,718	36,718	36,718	40,582	40,582	40,582
Individuals	5,038	5,038	5,038	5,466	5,466	5,466
Panel B: Controlling for home ownership						
Retirement status	0.254***	0.226***	0.090*	0.291***	0.209***	0.127**
	(0.065)	(0.059)	(0.050)	(0.088)	(0.080)	(0.062)
Log retirement duration	0.057	0.075*	0.010	0.120**	0.095**	0.066*
	(0.047)	(0.045)	(0.037)	(0.052)	(0.046)	(0.036)
Observations	36,718	36,718	36,718	40,582	40,582	40,582
Individuals	5,038	5,038	5,038	5,466	5,466	5,466
Panel C: Controlling for both household income and home ownership						
Retirement status	0.254***	0.226***	0.090***	0.286***	0.207***	0.121**
	(0.064)	(0.059)	(0.050)	(0.082)	(0.075)	(0.058)
Log retirement duration	0.058	0.076*	0.011	0.125**	0.100**	0.066*
	(0.044)	(0.044)	(0.036)	(0.031)	(0.045)	(0.034)
Observations	36,718	36,718	36,718	40,582	40,582	40,582
Individuals	5,038	5,038	5,038	5,466	5,466	5,466

Notes: Other control variables include age, age squared, years of education, marital-status dummies, family size, a dummy for living in a major city, state of residence dummies, and wave dummies. Standard errors clustered at the individual level appear in parentheses. *** p<0.01; ** p<0.05; * p<0.10.

Table A2: Considering previous voluntary work provision (Arellano and Bond (1991) estimates)

	Male			Female		
	Participation	Intensity per week		Participation	Intensity per week	
		≥2 hours	≥5 hours		≥2 hours	≥5 hours
Retirement status	0.173**	0.187**	0.095	0.166***	0.322***	0.165**
	(0.083)	(0.074)	(0.063)	(0.058)	(0.109)	(0.083)
Log retirement duration	–0.006	0.055	0.015	0.130***	0.115***	0.070**
	(0.063)	(0.045)	(0.039)	(0.050)	(0.043)	(0.033)
Observations	29,023	29,023	29,023	32,156	32,156	32,156
Individuals	4,209	4,209	4,209	4,567	4,567	4,567

Notes: Other control variables include age, age squared, years of education, marital-status dummies, family size, a dummy for living in a major city, state of residence dummies, and wave dummies. Standard errors clustered at the individual level appear in parentheses. *** $p<0.01$; ** $p<0.05$; * $p<0.10$.

Table A3: Excluding involuntary retirees (FE–IV estimates)

	Male			Female		
	Participation	Intensity per week		Participation	Intensity per week	
		≥2 hours	≥5 hours		≥2 hours	≥5 hours
Retirement status	0.207***	0.191***	0.144***	0.318***	0.258***	0.161**
	(0.069)	(0.063)	(0.055)	(0.096)	(0.086)	(0.065)
Log retirement duration	0.036	0.084	0.051	0.155**	0.103*	0.083**
	(0.055)	(0.053)	(0.043)	(0.060)	(0.053)	(0.041)
Observations	27,188	27,188	27,188	30,935	30,935	30,935
Individuals	4,108	4,108	4,108	4,597	4,597	4,597

Notes: The control variables include age, age squared, years of education, marital-status dummies, family size, a dummy for living in a major city, state of residence dummies, and wave dummies. Standard errors clustered at the individual level appear in parentheses. *** $p<0.01$; ** $p<0.05$; * $p<0.10$.

Table A4: Excluding individuals with a qualifying age of 66.5 or 67 (FE–IV estimates)

	Male			Female		
	Participation	Intensity per week		Participation	Intensity per week	
		≥2 hours	≥5 hours		≥2 hours	≥5 hours
Retirement status	0.270***	0.227***	0.100*	0.281***	0.202**	0.142*
	(0.075)	(0.068)	(0.058)	(0.109)	(0.100)	(0.077)
Log retirement duration	0.090*	0.091**	0.014	0.123***	0.100**	0.070*
	(0.049)	(0.046)	(0.040)	(0.056)	(0.049)	(0.038)
Observations	25,737	25,737	25,737	28,333	28,333	28,333
Individuals	3,033	3,033	3,033	3,254	3,254	3,254

Notes: The control variables include age, age squared, years of education, marital-status dummies, family size, a dummy for living in a major city, state of residence dummies, and wave dummies. Standard errors clustered at the individual level appear in parentheses. *** $p<0.01$; ** $p<0.05$; * $p<0.10$.

Table A5: Excluding homemakers (FE–IV estimates)

	Male			Female		
	Participation	Intensity per week		Participation	Intensity per week	
		≥2 hours	≥5 hours		≥2 hours	≥5 hours
Retirement status	0.252***	0.223***	0.093*	0.285***	0.242***	0.143***
	(0.064)	(0.059)	(0.050)	(0.083)	(0.076)	(0.057)
Log retirement duration	0.059	0.076*	0.011	0.122**	0.115**	0.078**
	(0.048)	(0.045)	(0.037)	(0.051)	(0.046)	(0.035)
Observations	36,376	36,376	36,376	36,467	36,467	36,467
Individuals	5,025	5,025	5,025	5,281	5,281	5,281

Notes: The control variables include age, age squared, years of education, marital-status dummies, family size, a dummy for living in a major city, state of residence dummies, and wave dummies. Standard errors clustered at the individual level appear in parentheses. *** $p<0.01$; ** $p<0.05$; * $p<0.10$.

Table A6: Using self-reported retirement status (FE–IV estimates)

	Male			Female		
	Participation	Intensity per week		Participation	Intensity per week	
		≥2 hours	≥5 hours		≥2 hours	≥5 hours
Self-reported retirement status	0.230***	0.205***	0.082*	0.213***	0.153***	0.093**
	(0.058)	(0.053)	(0.046)	(0.065)	(0.059)	(0.045)
Observations	36,718	36,718	36,718	40,582	40,582	40,582
Individuals	5,038	5,038	5,038	5,466	5,466	5,466

Notes: The control variables include age, age squared, years of education, marital-status dummies, family size, a dummy for living in a major city, state of residence dummies, and wave dummies. Standard errors clustered at the individual level appear in parentheses. *** $p<0.01$; ** $p<0.05$; * $p<0.10$.

Table A7: Focusing on individuals of a smaller age range (FE–IV estimates)

	Male			Female		
	Participation	Intensity per week		Participation	Intensity per week	
		≥2 hours	≥5 hours		≥2 hours	≥5 hours
Retirement status	0.211***	0.191***	0.051	0.203*	0.162*	0.125
	(0.075)	(0.070)	(0.060)	(0.116)	(0.096)	(0.083)
Log retirement duration	0.069	0.083*	0.008	0.103**	0.091*	0.065
	(0.048)	(0.046)	(0.037)	(0.052)	(0.048)	(0.037)
Observations	27,676	27,676	27,676	30,709	30,709	30,709
Individuals	4,088	4,088	4,088	4,419	4,419	4,419

Notes: The control variables include age, age squared, years of education, marital-status dummies, family size, a dummy for living in a major city, state of residence dummies, and wave dummies. Standard errors clustered at the individual level appear in parentheses. *** p<0.01; ** p<0.05; * p<0.10.

Table A8: Controlling for third order polynomials of age (FE–IV estimates)

	Male			Female		
	Participation	Intensity per week		Participation	Intensity per week	
		≥2 hours	≥5 hours		≥2 hours	≥5 hours
Panel A: Retirement status						
Retirement status	0.262***	0.231***	0.102*	0.269***	0.219**	0.145*
	(0.072)	(0.065)	(0.056)	(0.100)	(0.091)	(0.089)
Age	–0.024	–0.022	0.061	–0.186	–0.013	0.070
	(0.103)	(0.111)	(0.088)	(0.129)	(0.111)	(0.082)
Age squared/100	–0.043	–0.034	–0.056	0.076	–0.036	–0.064
	(0.104)	(0.091)	(0.071)	(0.106)	(0.092)	(0.067)
Age cubed/10,000	0.018	0.012	0.026	–0.037	0.017	0.032
	(0.055)	(0.048)	(0.037)	(0.057)	(0.049)	(0.044)
Observations	36,718	36,718	36,718	40,582	40,582	40,582
Individuals	5,038	5,038	5,038	5,466	5,466	5,466
Panel B: Retirement duration						
Log retirement duration	0.051	0.070	0.010	0.104*	0.094*	0.071*
	(0.048)	(0.045)	(0.037)	(0.056)	(0.049)	(0.038)
Age	–0.187	–0.150	–0.009	–0.212	–0.022	0.074
	(0.118)	(0.104)	(0.081)	(0.132)	(0.113)	(0.085)
Age squared/100	0.101	0.080	0.005	0.103	–0.023	–0.064
	(0.095)	(0.083)	(0.064)	(0.107)	(0.092)	(0.069)
Age cubed/10,000	–0.061	–0.055	–0.006	–0.067	–0.003	0.023
	(0.049)	(0.043)	(0.033)	(0.054)	(0.047)	(0.035)
Observations	36,718	36,718	36,718	40,582	40,582	40,582
Individuals	5,038	5,038	5,038	5,466	5,466	5,466

Notes: Other control variables include years of education, marital-status dummies, family size, a dummy for living in a major city, state of residence dummies, and wave dummies. Standard errors clustered at the individual level appear in parentheses. *** $p<0.01$; ** $p<0.05$; * $p<0.10$.

Table A9: Using whether receiving Age Pension as the instrument (FE–IV estimates)

	First stage	Second stage		
	Retirement status	Participation	Intensity per week	
			≥2 hours	≥5 hours
Panel A: Male				
Retirement status		0.113**	0090*	0.062
		(0.052)	(0.050)	(0.042)
Currently receiving the Age Pension	0.213***			
	(0.014)			
F-statistic on the excluded instrument	219.58			
Observations	36,718	36,718	36,718	36,718
Individuals	5,038	5,038	5,038	5,038
Overall R-squared	0.321	0.004	0.007	0.000
Panel B: Female				
Retirement status		0.232***	0.198***	0.145**
		(0.077)	(0.071)	(0.055)
Currently receiving the Age Pension	0.146***			
	(0.013)			
F-statistic on the excluded instrument	129.91			
Observations	40,582	40,582	40,582	40,582
Individuals	5,466	5,466	5,466	5,466
Overall R-squared	0.294	0.006	0.007	0.001

Notes: The control variables include age, age squared, years of education, marital-status dummies, family size, a dummy for living in a major city, state of residence dummies, and wave dummies. Standard errors clustered at the individual level appear in parentheses. *** p<0.01; ** p<0.05; * p<0.10.