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ABSTRACT

Taking Back Control? Quasi-Experimental Evidence on the Impact of Retirement on Locus of Control*

We use nationally representative panel data from Australia to consider the impact of retirement on individual locus of control, a socio-emotional skill that has substantial explanatory power for a broad range of life outcomes. We establish causality via cohort-specific eligibility age for the Australian Age Pension. We show that retirement leads to increased internal locus of control. This greater sense of internal control can explain around one-third and one-fifth of the positive effects of retirement on health and subjective well-being, respectively. The impact of retirement on control beliefs varies along the distribution of locus of control, with the positive influence being most pronounced for men with a relatively high sense of internal control and for women with a relatively high sense of external control. Last, we provide evidence that locus of control is much more malleable at retirement than the other socio-emotional skills of the Big-Five personality traits, risk and time preferences, and trust.

JEL Classification: H55, J24, J26

Keywords: retirement, locus of control, socio-emotional skills, public pension

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1 Introduction

The role of socio-emotional skills in human behaviour has received increasing attention in economics (Borghans et al., 2008; Almlund et al., 2011; Heckman and Kautz, 2012; Heckman et al., 2021). In Almlund et al. (2011), these soft skills are included in a standard framework of production, choice and information, and are interpreted as resulting from an economic model of preferences, expectations and constraints. A growing body of empirical research has explored the role that socio-emotional skills such as the Big-Five personality traits, risk and time preferences, and locus of control play in determining economic outcomes.

As socio-emotional skills matter for many outcomes, it is important to understand how they come about (Ertac, 2020). One view of personality is that it is fixed, hence the use of the term "personality traits". This view has been at least partly superseded by models of the formation of personality and other socio-emotional skills over the life course. A well-known theoretical model of the technology of skill formation is provided by Cunha and Heckman (2007), in which the relationship between inputs and the output of skills over the life course is modelled via a multistage production function.[1] These skills, which are multidimensional in nature, are time scripted and are a function of both the initial skill stock (determined by genetics and the in-utero environment) and experience-related inputs (skill investments, the environment, and so on). In this model, skills can evolve over time via experience-related inputs to different degrees and at different stages of the life cycle.

A recent body of empirical research has produced evidence that soft skills do not seem to be set in stone, and can change as a result of life experiences. For example, Ananyev and Guriev (2019) find that the decline in income during the 2009 Russian economic crisis produced a drop in social trust in Russia that was not reversed during the subsequent economic recovery. In Hanaoka et al. (2018), the 2011 Great East Japan Earthquake led to a persistent rise in risk tolerance among men but not women, and in Akesaka (2019) the same earthquake had a long-lasting effect on individual

[1] Cunha and Heckman (2007) focus mainly on the technology of skill formation of children; Borghans et al. (2008), Cunha et al. (2010), and Almlund et al. (2011, Chap. 8.4) discuss that this theoretical framework can be extended to that of adults.

time preferences. Jetter et al. (2020) find greater risk aversion and impatience for men (but not women) following the higher regional unemployment rates during the 2008 global financial crisis. In Brown et al. (2019), violent crime during the Mexican war on drugs also produced increased risk aversion. At the individual level, Meier (2022) shows that risk tolerance is significantly positively correlated with emotions such as happiness and anger, while the correlation with fear is negative.

Our paper contributes to this area of research, by providing evidence of the causal effect of retirement, an individual-level life event that almost everyone will experience, on individual locus of control (as well as on other socio-emotional skills). Locus of control is a psychological trait capturing individuals' perceptions of the causal link between their own behaviour and subsequent life outcomes (Rotter, 1966; Lefcourt, 1976). The distinction is made between external control, where individual outcomes are attributed to external factors like fate and luck, and internal control where what happens to an individual in life is considered to be due to their own choices and actions. This control-orientation has been shown to have substantial explanatory power for individual behaviour in a broad range of domains. People with a more internal locus of control live healthier lifestyles (Cobb-Clark et al., 2014), have better health outcomes (Awaworyi Churchill et al., 2020; Kesavayuth et al., 2020; Botha and Dahmann, 2022), are more likely to take out supplementary private health insurance (Bonsang and Costa-Font, 2022), show more compliance with COVID-19 hygiene recommendations (Clark et al., 2022), have higher marital satisfaction (Lee and McKinnish, 2019), and are more resilient to negative life shocks (Buddelmeyer and Powdthavee, 2016; Schurer, 2017). In the labour market, individuals with more internal control sort into jobs with performance appraisals (Heywood et al., 2017), exert greater job-search effort when unemployed (Caliendo et al., 2015), take up more work-related general training (Caliendo et al., 2022), and achieve more career success (Cobb-Clark, 2015; Schnitzlein and Stephani, 2016). They also invest more in their own human capital (Coleman and DeLeire, 2003; Piatek and Pinger, 2016) and in their children's cognitive development (Lekfuangfu et al., 2018). Last, those with greater internal control engage more in prosocial behaviour (Andor et al., 2022), save more (Cobb-Clark et al., 2016), invest more in risky assets (Salamanca et al., 2020), and are less susceptible to problem gambling (Gong and

Zhu, 2019), energy poverty (Awaworyi Churchill and Smyth, 2021) and homelessness (Budria et al., 2023).

It is thus important to know whether locus of control is fixed. Cobb-Clark and Schurer (2013) use panel data to calculate the intra-individual variation in the locus of control of working-age individuals: they find this to be relatively small over a four-year period, with any movements seeming to reflect random noise rather than any systematic response to life events.[2] While the empirical analyses of Cobb-Clark and Schurer (2013) are correlational in nature, much of the subsequent literature (as summarised above) has considered locus of control as a stable psychological trait and as such exogenous when explaining economic behaviour. However, if locus of control does change systematically following individual life experiences, then analyses that treat it as stable will yield biased empirical results.[3] There is currently only little causal evidence on the role of life events in shaping control beliefs.[4] Gottschalk (2005) uses data from the Canadian Self-Sufficiency Project, a randomised control trial in which welfare recipients randomly received earnings subsidies to work. Subsidy-induced rises in hours of work improved recipients' internal control perceptions 36 months later. In Preuss and Hennecke (2018), using data from the German Socio-Economic Panel (SOEP), job loss due to plant closures led to reduced internal locus of control while unemployed; once re-employed, the sense of control returned to its pre-job loss level. As such, involuntary job loss did not have a permanent impact on control beliefs.

We here focus on older individuals and the causal impact of a very common event, retirement, on their locus of control. Retirement generally involves significant lifestyle changes in the physical, emotional and social dimensions, and thus may affect the individual's feeling of being in charge of his/her life. This analysis is particularly important in the context of population ageing and greater life expectancy (Maestas and Zissimopoulos, 2010; Harper, 2014), as many governments have

[2] Elkins et al. (2017) consider adolescents and young adults over an eight-year window, also finding that most do not change their control beliefs and that any changes seem to be not predicted by common life events occurring at this age.

[3] As Cobb-Clark and Schurer (2013, p. F363) note, "It is not clear, however, whether adults' locus of control responds to the economic, social and demographic events that they experience or whether the reverse is true. The potential simultaneity between locus of control and labour market outcomes poses enormous econometric challenges and renders much of the applied literature in this area rather unconvincing".

[4] Some contributions in economics have focussed on the role of parental engagement during childhood in the development of socio-emotional skills, including locus of control (Elkins and Schurer, 2020; Zumbuehl et al., 2021).

extended the statutory pensionable age to prolong working life and reduce the financial burden on pension schemes. If retirement increases internal locus of control, which latter has been found to produce a broad range of positive outcomes in the recent literature, then policies to delay retirement may come with a number of adverse consequences for older workers.

We do not *a priori* know how the lifestyle changes following retirement will affect locus of control. Retirement may alleviate the stress and time constraints of working, and increase the enjoyment of meaningful activities: as such, internal control may rise. On the contrary, retirees may also experience a reduced sense of the identity and purpose that employment brings, as well as weaker social networks: these may reduce the sense of control over their lives. Most older individuals probably experience some combination of these changes, so that the relationship between retirement and control beliefs is ambiguous and thus ultimately an empirical question.

We estimate the causal effect of retirement on individual locus of control in a local average treatment effect (LATE) framework, using nationally representative panel data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey. Exploiting the exogenous variation in retirement induced by the cohort-specific eligibility age for the Australian Age Pension, our fixed effects instrumental variable (FE–IV) analysis shows that retirement leads to a large rise in internal locus of control of 0.57 standard deviations. This greater internal control is then shown to explain around one-third of the positive impact of retirement on health, and one-fifth of that on subjective well-being. In the context of policy reforms pushing for later retirement, this implies that interventions reinforcing the agency of older workers regarding their life outcomes will have substantial health and well-being benefits. Due to the LATE nature of our estimates, the positive effects of retirement on internal control are specific to compliers whose retirement decision is solely based on their pensionable age. The complier group accounts for around 15% of the elderly people in our data: members of this group are more likely to be less educated, married, immigrants, live in major cities, come from lower socioeconomic backgrounds, and have no long-term health conditions. The impact of retirement is not homogeneous, being more pronounced for women with a relatively high sense of external control and for men with a relatively high sense of internal control. Retirement therefore exacerbates the inequality in locus of control for men, but reduces that for women. We last show that locus of control responds more strongly to retirement than do other soft skills such as the Big-Five personality traits, risk and time preferences, and trust.

We make three contributions to existing work. The first is to the empirical evidence on the evolution and malleability of locus of control (Cobb-Clark and Schurer, 2013; Elkins et al., 2017). Although much of the literature considers this as a stable psychological trait, our causal analysis demonstrates that retirement increases the internal locus of control. As such, control-orientation is not stable, at least around the age of retirement, and should not be treated as such in empirical analyses. Second, pension reform may produce unintended costs. Increasing the statutory age for pension receipt prolongs the working career and leads to later retirement (Behaghel and Blau, 2012; Atalay and Barrett, 2015; Lalive et al., 2023; Carta and De Philippis, 2024), and so alleviates fiscal pressures. But the increase in employment of older individuals has come with unintended negative consequences for health and well-being, in part due to a lower sense of internal control. Last, we contribute to the broader literature on the stability and malleability of personality traits and economic preferences (Cobb-Clark and Schurer, 2012; Meier and Sprenger, 2015; Schildberg-Hörisch, 2018; Ertac, 2020). While locus of control responds strongly to retirement, we find little evidence that other soft skills (the Big-Five personality traits, risk and time preferences, and trust) do so. While these skills do seem to be affected by other life experiences (see, for example, Kassenboehmer et al., 2018; Akesaka, 2019; Ananyev and Guriev, 2019; Meier, 2022), they are largely stable at the time of retirement.

The remainder of the paper is organised as follows. Section 2 describes the Australian Age Pension system, and Section 3 presents the data and summary statistics. Section 4 then discusses the identification strategy, and the estimation results appear in Section 5. Last, Section 6 concludes.

2 The Australian Age Pension system

Australian retirees have three main sources of income (Atalay and Barrett, 2015; Oguzoglu et al., 2020): (i) a government-funded Age Pension; (ii) a mandatory employer-contributed superannuation;

and (iii) voluntary private savings. As retirement is not compulsory in Australia, the financial incentives provided by these three income sources play a major role in determining the age at which individuals retire.[5] We here focus on publicly funded Australian Age Pension that has produced exogenous financial incentives for retirement.

Since its inception in 1908, the Australian Age Pension has aimed to provide older adults with an acceptable quality of life during retirement. Approximately 70% of the elderly in Australia fulfil the eligibility conditions to receive the State pension, two-thirds of whom receive a full pension. The maximum fortnightly State pension in the financial year 2022–2023 was AU$936.80 for a single person and AU$1,412.40 for couples.[6]

There are three eligibility criteria for the Age Pension. First, applicants must have lived in Australia for a minimum of ten years as an Australian citizen or permanent resident. Second, pension payments are not contingent on employment history, but are means-tested: both pension eligibility and amount depend on income and assets. In the 2022–2023 financial year, full pensions were paid only to single people (couples) with private incomes no higher than AU$190 (AU$336) per fortnight. The pension clawback is AU$0.50 for each dollar above this threshold. The assets test takes into account home ownership. Assets do not affect pension payments to homeowners if asset value is below AU$280,000 for a single person and AU$419,000 for a couple; the analogous values for non-homeowners are AU$505,400 and AU$643,500, respectively. The pension amount is reduced by AU$3 per fortnight for every AU$1,000 of assets above the threshold figure.

There is last an age requirement. When the Age Pension was introduced in 1908, both genders were eligible at the age of 65. This figure was quickly lowered to 60 for women in 1910. The eligibility age subsequently remained unchanged for eight decades until that for women began rising at a rate of six months every two years starting in July 1995. In 2013, the eligibility age reached 65 for women, the same as that for men. The thresholds for both sexes remained at this

[5] Australians depend primarily on the publicly funded Age Pension for income during retirement. Even though there are eligibility conditions (see the text), about 70% of Australian retirees receive either a partial or a full Age Pension (Oguzoglu et al., 2020). This public pension take-up rate is the second highest in all OECD countries (Raloston and Feng, 2017).

[6] More details regarding the Australian Age Pension can be found on the Services Australia website: https://www.servicesaustralia.gov.au/age-pension.

Table 1: The age of eligibility for the Age Pension

Birth cohort	Male		Female	
	Eligibility age	Date of change	Eligibility age	Date of change
Before 01/07/1935	65.0	10/06/1908	60.0	18/11/1910
01/07/1935–31/12/1936	65.0	10/06/1908	60.5	01/07/1995
01/01/1937–30/06/1938	65.0	10/06/1908	61.0	01/07/1997
01/07/1938–31/12/1939	65.0	10/06/1908	61.5	01/07/1999
01/01/1940–30/06/1941	65.0	10/06/1908	62.0	01/07/2001
01/07/1941–31/12/1942	65.0	10/06/1908	62.5	01/07/2003
01/01/1943–30/06/1944	65.0	10/06/1908	63.0	01/07/2005
01/07/1944–31/12/1945	65.0	10/06/1908	63.5	01/07/2007
01/01/1946–30/06/1947	65.0	10/06/1908	64.0	01/07/2009
01/07/1947–31/12/1948	65.0	10/06/1908	64.5	01/07/2011
01/01/1949–30/06/1952	65.0	10/06/1908	65.0	01/07/2013
01/07/1952–31/12/1953	65.5	01/07/2017	65.5	01/07/2017
01/01/1954–30/06/1955	66.0	01/07/2019	66.0	01/07/2019
01/07/1955–31/12/1956	66.5	01/07/2021	66.5	01/07/2021
01/01/1957 onwards	67.0	01/07/2023	67.0	01/07/2023

age for four years. Starting in July 2017, the eligibility age then rose by six months every two years for both men and women. This reform continued until July 2023, when the eligibility age for both sexes reached 67. Table 1 lists the eligibility ages by gender and birth cohort. As the pension amount, once eligible, does not depend on the age at which the individual starts to claim, potential pension beneficiaries have a financial incentive to retire at around the eligibility age. We will below use the cohort-specific eligibility age for the Age Pension to identify the causal effect of retirement on individual locus of control.

3 Data

3.1 HILDA data

Our nationally representative panel data comes from the Household, Income and Labour Dynamics in Australia (HILDA) Survey, which started in 2001 and follows more than 17,000 Australians in over 7,500 households every year. The survey data covers individual well-being, labour-market dynamics, and family life. We use the "Restricted Release 21" of HILDA incorporating data collected annually from 2001 through 2021 (Summerfield et al., 2021; Department of Social Services and Melbourne Institute of Applied Economic and Social Research, 2022), which contains information on both birth dates and interview dates. These two allow us to calculate each respondent's exact age at interview, and thus their eligibility for receipt of the Age Pension.

We analyse data from the HILDA waves that include information on locus of control: 2003, 2004, 2007, 2011, 2015, and 2019. We apply three additional sample restrictions. First, following previous analyses of retirement (Heller-Sahlgren, 2017; Apouey et al., 2019), we focus on respondents aged 50–75. Second, individuals who have not been living in Australia for at least ten years are excluded, as this is one of the eligibility requirements for Age-Pension receipt. Last, respondents with missing information on key variables are excluded. Our final analysis sample comprises 4,381 men and 4,777 women, with 12,218 and 13,501 person–year observations respectively.

3.2 Variables and summary statistics

Locus of control in HILDA is measured by respondents' answers to the following seven statements, all on a scale of 1 ("Strongly disagree") to 7 ("Strongly agree"): (i) "I have little control over the things that happen to me"; (ii) "There is really no way I can solve some of the problems I have"; (iii) "There is little I can do to change many of the important things in my life"; (iv) "I often feel helpless in dealing with the problems of life"; (v) "Sometimes I feel that I'm being pushed around in life"; (vi) "What happens to me in the future mostly depends on me"; and (vii) "I can do just about anything I really set my mind to do". The first five (i–v) of these are couched in terms of external control and the last two (vi–vii) refer to internal control. We construct a summary score of locus of control following Cobb-Clark and Schurer (2013) and Buddelmeyer and Powdthavee (2016) as the sum of the five external scores minus the two internal scores, plus a constant of 16: this produces a value between 7 and 49. The scale is then inverted so that the measure still ranges from 7 to 49, but with higher values now reflecting a greater sense of control over life outcomes and lower values a greater belief that external factors determine life outcomes. Higher scores thus correspond to internal control, and lower scores external control.

Labour-force status is reported in each wave. We define retirement as in Rohwedder and Willis (2010), Zhu (2021) and Eibich et al. (2022): individuals who are not in the labour force are considered to be retired.[7]

The summary statistics by gender and retirement status are presented in Table 2. The sample is almost balanced by gender. About 40% of the observations in the male sample are from retirees, and 50% of those in the female sample. Non-retirees have higher internal-control scores, with the difference being statistically significant at the 1% level. A two-sample Kolmogorov–Smirnov test also strongly rejects, for the overall, male, and female samples, the null hypothesis that retirees and non-retirees have the same locus-of-control distribution.

The other variables in Table 2 will appear as controls in the empirical analysis. Retirees are naturally older than non-retirees. Around 63% of male retirees and 59% of female retirees are

[7]We will consider an alternative definition of retirement in Section 5.6.2 below.

Table 2: Summary statistics

	All		Male		Female	
	Retired	Not retired	Retired	Not retired	Retired	Not retired
Locus of control (range: 7–49)	36.19	38.42	36.41	38.67	36.04	38.13
	(8.77)	(7.66)	(8.72)	(7.44)	(8.81)	(7.89)
Age	65.05	57.10	65.82	57.42	64.51	56.74
	(6.62)	(5.50)	(6.33)	(5.67)	(6.76)	(5.29)
Age-Pension age eligibility	0.61	0.12	0.63	0.12	0.59	0.11
Years of education	11.29	12.53	11.60	12.53	11.07	12.52
	(2.32)	(2.37)	(2.34)	(2.30)	(2.28)	(2.43)
Marital status:						
Married or in a *de facto* relationship	0.70	0.76	0.74	0.82	0.66	0.69
Separated	0.03	0.04	0.04	0.03	0.03	0.05
Divorced	0.11	0.11	0.10	0.08	0.12	0.15
Widowed	0.10	0.03	0.04	0.01	0.15	0.05
Never married	0.05	0.06	0.08	0.05	0.04	0.06
Household size	2.05	2.49	2.09	2.62	2.02	2.36
	(0.97)	(1.18)	(1.00)	(1.23)	(0.95)	(1.10)
Living in a major city	0.55	0.61	0.53	0.60	0.56	0.62
Observations	11,792	13,927	4,879	7,339	6,913	6,588

Notes: Data from HILDA waves 2003, 2004, 2007, 2011, 2015, and 2019. Standard deviations appear in parentheses.

age-eligible for the Age Pension; these figures are significantly lower among non-retirees. Respondents have on average between 11 and 13 years of education, and most observations come from respondents who are married or in a *de facto* relationship. The average household consists of two to three members, with non-retirees having slightly larger families. Last, over half of observations come from individuals living in major Australian cities.

4 Identification strategy

We first consider the relationship between retirement and locus of control via the following fixed effects (FE) panel regression:

$$LOC_{it} = RetST_{it}\beta + X_{it}'\gamma + \mu_i + \epsilon_{it}. \tag{1}$$

where LOC_{it} is the internal locus of control of individual i at time t and $RetST_{it}$ is a dummy variable for being retired at that time. The control variables, X_{it}, are age and age squared, years of education, household size, and dummies for marital status, living in a major city, State of residence, and wave.[8] The μ_i are the individual fixed effects, and ϵ_{it} is the error term. The introduction of μ_i resolves any problems resulting from a correlation between retirement status ($RetST_{it}$) and unobserved individual heterogeneity. However, the FE approach does not address the potential correlation between $RetST_{it}$ and ϵ_{it} from time-varying unobservables or reverse causality.[9]

We address these concerns with fixed effects instrumental variable (FE–IV) regressions, as below:

$$RetST_{it} = EliST_{it}\theta + X_{it}'\lambda + \upsilon_i + \varepsilon_{it}. \tag{2}$$

$$LOC_{it} = \widehat{RetST}_{it}\beta + X_{it}'\gamma + \mu_i + \epsilon_{it}. \tag{3}$$

[8]The eight States and Territories in Australia are New South Wales, Victoria, Queensland, South Australia, Western Australia, Tasmania, Northern Territory, and Australian Capital Territory.

[9]Individuals with higher internal-control scores are more likely to stay in the labour force and thus not to retire (Caliendo et al., 2015; Schurer, 2017; Hennecke, 2023). Cobb-Clark (2015) provides a review of the literature on the role of locus of control in the labour market.

In the first-stage FE estimation of Equation (2), $EliST_{it}$ is the instrument for retirement status $RetST_{it}$; in the second stage, $RetST_{it}$ from Equation (3) is replaced by the $\widehat{RetST}_{it}$ predicted from the first stage. As $\widehat{RetST}_{it}$ is predicted using $EliST_{it}$ and X_{it}, it is not correlated with the unobservables in ϵ_{it}, and the estimated β in Equation (3) reveals the causal impact of retirement on locus of control. We cluster the standard errors at the individual level to account for serial correlation in individual locus of control across HILDA waves.

The instrument ($EliST_{it}$) is a dummy for the individual having reached the age eligibility threshold for the Age Pension: $EliST_{it}=I(Age_{it} \geq EliAge_{ct})$, where Age_{it} is the age of individual i at time t, $EliAge_{ct}$ the pensionable age for individuals in birth cohort c (see Table 1), and I an indicator function.[10] The FE–IV estimate of β in Equation (3) is the local average treatment effect (LATE) for compliers whose retirement status is entirely determined by pension-age eligibility, if the instrument $EliST_{it}$ satisfies the four conditions of (i) relevance, (ii) exclusion, (iii) independence, and (iv) monotonicity (Imbens and Angrist, 1994). Relevance requires that $EliST_{it}$ be strongly correlated with $RetST_{it}$, which can be directly tested in the first stage of the FE–IV approach. The exclusion condition is that $EliST_{it}$ has no effect on LOC_{it} other than via $RetST_{it}$. Holding the effects of ageing constant, it is unlikely that retirement decisions triggered by the particular pensionable ages in Table 1 systematically occur at the same time as other life events that could affect locus of control. By controlling for the smooth age trend, $RetST_{it}$ is likely the only channel via which $EliST_{it}$ produces within-person changes in control beliefs. The third condition refers to independence between $EliST_{it}$ and the potential outcomes, which seems reasonable given that $EliST_{it}$ is based on the respondent's birth date and the date of interview in each HILDA wave. Last, monotonicity assumes that $EliST_{it}$ affects $RetST_{it}$ in the same direction for all individuals; there are no defiers who retire before reaching the pensionable age but then return to work once that age is reached. Although this kind of defiance does not seem *a priori* reasonable, it cannot be ruled out. There is no independent test of the monotonicity assumption, but the approach of

[10] Of the 4,381 men in the final sample, 2,104 (48.0%) were born before 01/07/1952 and so (from Table 1) were not affected by the rise in the pension eligibility age. The remaining 2,277 men (52.0%) were born later and have higher age thresholds of 65.5 to 67. Analogously, 420 (8.8%) of the 4,777 women in the sample were born before 01/07/1935 and were not subject to eligibility-age changes; the remaining 4,357 women (91.2%) born on or after 01/07/1935 have higher retirement age thresholds of 60.5 to 67.

Mourifie and Wan (2017), which we will apply in Section 5.6.4 below, does allow the joint validity of the exclusion, independence, and monotonicity assumptions to be tested.

If the four conditions above are all satisfied, the estimate of β is the local average treatment effect (LATE) for compliers, the sub-population of individuals who remain in the labour force when below the pensionable age but retire once they reach that age. As HILDA is a panel dataset, most compliers are observed multiple times at different retirement durations.[11] The estimate of β is then a weighted average of the effects of retirement on locus of control across the compliers with these different retirement durations, rather than revealing the instantaneous impact of retirement.

5 Results

5.1 Retirement status and locus of control

The results from the uninstrumented FE estimation of Equation (1) appear in Table 3. To simplify interpretation, internal locus of control is standardised to have zero mean and unit standard deviation. All of the estimated retirement coefficients here are small and statistically insignificant. However, as discussed above, these FE estimates are not causal and may well be biased by confounding time-varying unobservables or reverse causality.

Table 3: Retirement and locus of control (FE estimates)

	All	Male	Female
Retired	–0.018	–0.023	–0.014
	(0.019)	(0.026)	(0.028)
Observations	25,719	12,218	13,501
Individuals	9,158	4,381	4,777

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

The FE–IV estimates in Table 4 reveal, on the contrary, the causal effect of retirement on

[11] We will address this explicitly in Section 5.3.

locus of control.[12] In the first-stage results, the pensionable-age instrument significantly predicts retirement, with an effect size of 15 percentage points for the whole sample. The analogous estimate is 16 and 12 percentage points for men and women, respectively. The Kleibergen–Paap F-statistics of 205 for the whole sample, 110 for men, and 77 for women are far above the Staiger and Stock (1997) rule-of-thumb threshold value of 10. This postponement of retirement as the pension-eligibility age rises is consistent with the previous literature on the labour-supply effects of social-security rules (Behaghel and Blau, 2012; Atalay and Barrett, 2015; Lalive et al., 2023; Carta and De Philippis, 2024).

The instrumented effect of retirement on internal locus of control in columns 2, 4, and 6 of Table 4 is positive and statistically significant at the 1% level. The effect is large in size, at half of a standard deviation for men and two-thirds of a standard deviation for women.[13] Locus of control is therefore not a fixed trait and changes with retirement behaviour.[14] In terms of the ambiguous *a priori* effect of retirement in Section 1, the greater choice in time use then seems to outweigh any loss of identity and purpose so that retirement increases the feeling of being in charge of one's life. It should be noted that the results here apply to compliers only, a subgroup of the elderly whose retirement follows their reaching the eligibility age for the Age Pension. Given that involuntary retirees are unlikely to base their retirement decisions on pension-age eligibility, the positive effect on internal locus of control in Table 4 is that from voluntary retirement.[15]

[12] The full results of Table 4 appear in Appendix Table A1.

[13] These figures will be under-estimated if there are anticipation effects pre-retirement. However, the estimated coefficients are similar when dropping observations on individuals who are within one year before their eligibility age for the Age Pension.

[14] As noted in Borghans et al. (2008, pp. 1017–1018), "Personality change in adulthood may be precipitated by major shifts in social roles (for example, getting a job for the first time, becoming a parent)". The findings of Preuss and Hennecke (2018), discussed in Section 1, of the temporary reduction in sense of control due to involuntary job loss (and thus loss of employment), may then reflect the temporary nature of the change in employment status. Retirement, as considered here, is a much more permanent change.

[15] Involuntary retirees are those whose retirement decisions are driven by factors such as ill health, redundancy, inability to find work, and caring responsibilities (Australian Centre for Financial Studies, 2014). HILDA included a question that allows us to identify involuntary retirees in waves 2003, 2007, 2011, 2015, and 2019: "Thinking back to the time you retired, was that something you wanted to do or something you felt you were forced or pressured to do?". Around 31% of Australian retirees report that their retirement was "forced or pressured". This rate of involuntary retirement is higher than the figures in Finland (20%) and France (24%), close to those in the UK (30%) and Denmark (32%), but below those in Spain (38%) and Germany (42%) (Ebbinghaus and Radl, 2015). It is difficult to use this HILDA information in our setting, as some of these causes of involuntary retirement are endogenous and we do not know for which specific reason each individual felt they were forced or pressured to retire.

Table 4: The causal effects of retirement on locus of control (FE–IV estimates)

	All		Male		Female	
	First stage	Second stage	First stage	Second stage	First stage	Second stage
Retired		0.572***		0.520***		0.681***
		(0.145)		(0.190)		(0.249)
Age-Pension age eligibility	0.149***		0.164***		0.123***	
	(0.010)		(0.016)		(0.014)	
F-statistic on the instrument	204.59		110.45		77.11	
Observations	25,719	25,719	12,218	12,218	13,501	13,501
Individuals	9,158	9,158	4,381	4,381	4,777	4,777

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

There is a sharp difference between the FE and FE–IV estimates in Tables 3 and 4: the former are small, negative, and statistically insignificant, as in Cobb-Clark and Schurer (2013) in which retirement is one of the life events analysed. However, taking the endogeneity of retirement into account produces large, positive, and highly significant FE–IV estimates in Table 4. This is consistent with reverse causality, where those who feel in control of their lives are more likely to remain in the labour force (Caliendo et al., 2015; Schurer, 2017; Hennecke, 2023). Controlling for this endogeneity, retirement causes greater internal locus of control.

This finding has important potential implications for economic outcomes among the elderly. To shed light on this, we (i) examine whether within-individual variation in locus of control affects the health and well-being of older adults, and (ii) estimate the causal effects of retirement on health and well-being, and then establish the extent to which individual locus of control mediates these causal relationships.

Our health measures come from the 36-item Short Form Health Survey (SF-36), a widely used and validated tool for health measurement (Jenkinson, 1998; Zhu, 2016). Of the 36 items, 22 refer to four dimensions of physical health (physical functioning, role-physical, bodily pain, and general health), and the other 14 to four mental-health dimensions (social functioning, role-emotional, vitality, and mental health). Data on these eight dimensions are provided in a standardised form in each wave of HILDA ranging from 0 to 100, with higher scores indicating better health. We reduce these to two summary measures of physical and mental health, by calculating the average of the first and last four dimensions respectively. Our main measure of individual subjective well-being is life satisfaction (Clark et al., 2008; Zhu and He, 2015; Kaiser and Oswald, 2022). This comes from the question: "All things considered, how satisfied are you with your life?", with answers on a scale of 0 to 10 where 0 refers to "Totally dissatisfied" and 10 to "Totally satisfied". We will also consider a measure of satisfaction with health, with answers on the same scale.

We standardise these four measures of health and well-being (SF-36 physical, SF-36 mental, life satisfaction, and health satisfaction) to have zero mean and unit standard deviation.[16] We then carry out fixed effects (FE) panel regressions of each of these on the standardised measure of

[16]The summary statistics for the unstandardised health and well-being measures appear in Appendix Table A2.

internal locus of control, with the same set of covariates and the same sample as in Table 4.[17] The results in Table 5 show a clear positive relationship between within-person changes in locus of control and older people's health and well-being, with the magnitude being between 0.15 and 0.28. These figures are of similar sizes and statistical significance for men and women. Overall, greater internal locus of control confers substantial health and well-being benefits for older people.

Table 5: Locus of control, health, and well-being (FE estimates)

	SF-36		Satisfaction with	
	Physical	Mental	Life	Health
Panel A: All				
Locus of control	0.151***	0.283***	0.212***	0.147***
	(0.008)	(0.010)	(0.011)	(0.009)
Observations	24,770	24,770	24,770	24,770
Individuals	9,034	9,034	9,034	9,034
Panel B: Male				
Locus of control	0.178***	0.282***	0.188***	0.156***
	(0.012)	(0.013)	(0.015)	(0.014)
Observations	11,794	11,794	11,794	11,794
Individuals	4,325	4,325	4,325	4,325
Panel C: Female				
Locus of control	0.129***	0.284***	0.230***	0.139***
	(0.011)	(0.014)	(0.015)	(0.012)
Observations	12,976	12,976	12,976	12,976
Individuals	4,709	4,709	4,709	4,709

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

Tables 4 and 5 taken together imply indirectly that locus of control may then mediate the relationships between retirement and health/well-being. To investigate formally, we carry out a direct mediation analysis. We first estimate the causal effects of retirement on health and well-being for the same sample in Table 5, with Age-Pension age eligibility as the instrument. In the left half of Panel A of Table 6, retirement has a positive causal effect on all four health and well-being

[17]Missing values for the health and well-being measures account for 3.7% of observations, and the sample size drops from 25,719 to 24,770.

measures, with large effect sizes of 0.23, 0.44, 0.59, and 0.63 standard deviations. The mediating role of control beliefs is investigated in the right-hand side of panel A, where locus of control is added as a control. The comparison of these left- and right-hand estimated retirement coefficients reveals that changes in locus of control explain around one third of the rise in physical and mental health (from the SF-36) post-retirement. These figures are lower for life and health satisfaction (at 19% and 13%).[18] Panels B and C of Table 6 carry out the same analysis by gender. Retirement has a large positive effect on women's physical and mental health; however, the effects for men are imprecisely estimated (although positive).[19] On the contrary, retirement causally increases life and health satisfaction for both genders. The comparison of the left- and right-hand panels suggests a greater mediating effect of locus of control for men than women.

The overall message from Tables 4, 5, and 6 is that a rise in the age for pension eligibility (producing later retirement) has negatively impacted the health and subjective well-being of older individuals, in part due to their reduced sense of internal control that attributes life outcomes to own choices and actions.

5.2 Characterising compliers

Our empirical analysis in Section 5.1 identified the local average treatment effect (LATE) for the compliers whose retirement decision follows on from their age eligibility for the Age Pension, and is thus not necessarily representative of all older adults. An obvious question is then who these compliers are. We cannot identify compliers individually, but can nevertheless say how many there are from the first-stage estimates in Table 4: 15% of older individuals (16% of men and 12% of women) in our sample are compliers in the sense of retiring once they reach the age at which they qualify for the State pension.

To have an idea of the characteristics of these compliers, we apply the technique in Angrist

[18]This mediation may well apply to other subjective well-being measures. For example, Yemiscigil et al. (2021) find a sizable increase in purpose in life (a measure of eudaimonic well-being) following retirement in data from the Health and Retirement Study (HRS). Unfortunately, purpose in life is not measured in HILDA.

[19]This mediation analysis only uses the HILDA data that contain information on locus of control: the 2003, 2004, 2007, 2011, 2015, and 2019 waves. In all 21 HILDA waves currently available, the effects of retirement on physical and mental health are positive and highly significant for both men and women (see Appendix Table A3).

Table 6: The mediating role of locus of control in the relationships between retirement and health/well-being (FE–IV estimates)

	Excluding locus of control				Including locus of control			
	SF-36		Satisfaction with		SF-36		Satisfaction with	
	Physical	Mental	Life	Health	Physical	Mental	Life	Health
Panel A: All								
Retired	0.225*	0.439***	0.589***	0.633***	0.147	0.293**	0.479***	0.556***
	(0.121)	(0.131)	(0.147)	(0.144)	(0.118)	(0.123)	(0.142)	(0.140)
Locus of control					0.152***	0.284***	0.213***	0.148***
					(0.008)	(0.010)	(0.011)	(0.010)
Observations	24,770	24,770	24,770	24,770	24,770	24,770	24,770	24,770
Individuals	9,034	9,034	9,034	9,034	9,034	9,034	9,034	9,034
Panel B: Male								
Retired	0.056	0.151	0.328*	0.482***	–0.032	0.011	0.234	0.403**
	(0.155)	(0.165)	(0.180)	(0.185)	(0.149)	(0.155)	(0.174)	(0.179)
Locus of control					0.177***	0.282***	0.189***	0.158***
					(0.012)	(0.014)	(0.015)	(0.014)
Observations	11,794	11,794	11,794	11,794	11,794	11,794	11,794	11,794
Individuals	4,325	4,325	4,325	4,325	4,325	4,325	4,325	4,325
Panel C: Female								
Retired	0.411**	0.798***	0.952***	0.929***	0.334	0.630***	0.815***	0.847***
	(0.209)	(0.236)	(0.268)	(0.256)	(0.205)	(0.220)	(0.256)	(0.250)
Locus of control					0.130***	0.285***	0.232***	0.140***
					(0.011)	(0.014)	(0.016)	(0.014)
Observations	12,976	12,976	12,976	12,976	12,976	12,976	12,976	12,976
Individuals	4,709	4,709	4,709	4,709	4,709	4,709	4,709	4,709

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

and Pischke (2009, Chap. 4.4.4) based on the different first-stage estimates by binary categories of covariates. Defining $RetST_{1i}$ as the retirement status of individual i when the instrument $EliST_i$=1 and $RetST_{0i}$ as that when $EliST_i$=0, the relative likelihood that compliers have a given characteristic (indicated by x_{1i}=1) is $\frac{P[x_{1i}=1|RetST_{1i}>RetST_{0i}]}{P[x_{1i}=1]}=\frac{P[RetST_{1i}>RetST_{0i}|x_{1i}=1]}{P[RetST_{1i}>RetST_{0i}]}$, which is equal to

$$\frac{E[RetST_i|EliST_i = 1, x_{1i} = 1] - E[RetST_i|EliST_i = 0, x_{1i} = 1]}{E[RetST_i|EliST_i = 1] - E[RetST_i|EliST_i = 0]}. \quad (4)$$

This is the ratio of the first-stage coefficient of the binary instrument $EliST_i$ for individuals with x_{1i}=1 to that in the overall sample.

We analyse the following six binary individual characteristics: (i) education ("Less than university education" vs. "University education"); (ii) marital status ("Married" vs. "Not married"); (iii) migrant status ("Immigrants" vs. "Natives"); (iv) area of residence ("A major city" vs. "Regional or remote Australia"); (v) income-support payments from the Australian Government ("Ever received" vs. "Never received"); and (vi) health ("No long-term health conditions" vs. "Long-term health condition").[20] The estimated coefficients on the instrument ($EliST_i$) from Equation (2) for each of the above characteristics appear in Panel A of Table 7. Following Angrist and Pischke (2009, Chap. 4.4.4), we then calculate the ratio of these estimated instrument coefficients to that in the whole sample, producing the corresponding relative likelihood of being a complier in Panel B. A figure over one here indicates groups that are more likely to comply with the pension-age threshold, when compared to the average adult in our data. These groups are thus more likely to experience lower internal locus of control following the pension reform.

Table 7 first reveals that the lower-educated are more likely to be compliers, as those with

[20] HILDA respondents were asked to report long-term health conditions which have lasted (or are likely to last) 6 months or longer, limit daily activities, and cannot be corrected by medication or medical aids. These 17 conditions include: (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.

Table 7: Sub-sample first-stage estimates and the relative likelihood of being a complier

	Panel A: First-stage estimates			Panel B: Complier likelihood		
	All	Male	Female	All	Male	Female
(i) Education:						
Less than university education	0.156***	0.178***	0.124***	1.051	1.086	1.011
University education	0.105***	0.105***	0.098***	0.708	0.637	0.799
(ii) Marital status:						
Married	0.159***	0.173***	0.125***	1.071	1.052	1.020
Not married	0.126***	0.149***	0.114***	0.851	0.911	0.924
(iii) Migrant status:						
Immigrants	0.181***	0.200***	0.150***	1.219	1.222	1.221
Natives	0.137***	0.149***	0.114***	0.922	0.906	0.928
(iv) Area of residence:						
A major city	0.161***	0.171***	0.138***	1.086	1.042	1.122
Regional or remote Australia	0.125***	0.143***	0.098***	0.843	0.873	0.802
(v) Income-support payments from Australian Government:						
Ever received	0.160***	0.185***	0.129***	1.079	1.129	1.050
Never received	0.059***	0.054*	0.058**	0.396	0.331	0.474
(vi) Health:						
No long-term health conditions	0.171***	0.192***	0.140***	1.149	1.171	1.143
Long-term health condition	0.098***	0.125***	0.067***	0.657	0.760	0.549

Notes: For the sub-sample first-stage estimates reported in Panel A, the control variables are age, age squared, years of education, household size, and dummies for marital status, living in a major city, State of residence, and wave. *** p<0.01; ** p<0.05; * p<0.10.

degrees may rely less on the basic pension for old-age income support. In addition, compliers are more likely to be married, immigrants, living in major cities, and recipients of income-support payments from the Australian Government. Income-support beneficiaries are mostly lower-income earners from relatively disadvantaged backgrounds.[21] Given the means-tested nature of the Age Pension, they are entitled to more generous pension payments and thus have greater incentives to comply with the age threshold. Last, those with long-term health conditions comply less, presumably as they often leave the labour force before reaching the eligible pension age.

5.3 Retirement duration and locus of control

The results above compared all the retired to all the non-retired. We can also consider retirement as more of a process that requires time for physical, emotional, and social adjustment. We here thus examine the role of retirement duration. In HILDA, retirees report the age at which they became retired ($RetAge_{it}$), and retirement duration is the elapsed time from this age to their current age: $RetDR_{it}{=}Max\{Age_{it}{-}RetAge_{it}, 0\}$. The non-retired thus have a retirement duration of zero. Analogously, the duration of Age-Pension age eligibility is $EliDR_{it}{=}Max\{Age_{it}{-}EliAge_{ct}, 0\}$, where $EliAge_{ct}$ is the eligibility age for the individual's birth cohort c.

We carry out a FE–IV estimation of the link between retirement duration and internal locus of control as follows:

$$Log(RetDR_{it} + 1) = Log(EliDR_{it} + 1)\theta + X_{it}'\lambda + v_i + \varepsilon_{it}. \quad (5)$$

$$LOC_{it} = \widehat{Log(RetDR_{it} + 1)}\beta + X_{it}'\gamma + \mu_i + \epsilon_{it}. \quad (6)$$

$Log(EliDR_{it}{+}1)$ is the instrument for $Log(RetDR_{it}{+}1)$ here, and given the strong relationship between pension eligibility and retirement decision in Table 4, we expect these to be positively correlated. The logarithmic specification in Equation (6) allows locus of control to change non-linearly

[21] Income-support payments by the Australian Government (such as Carer Payment/Allowance, Disability Support Pension, and Rent Assistance) are regular payments that assist with day-to-day living costs. They are means tested in the sense that the payment rate falls towards zero as income and assets rise. Income-support receipt thus generally indicates lower socioeconomic status (Tseng and Wilkins, 2003).

with retirement duration, with a decreasing marginal effect.

Table 8: Retirement duration and locus of control (FE estimates)

	All	Male	Female
Log retirement duration	–0.024*	–0.006	–0.037**
	(0.012)	(0.018)	(0.016)
Observations	25,719	12,218	13,501
Individuals	9,158	4,381	4,777

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

Table 8 shows the uninstrumented FE estimation results from Equation (6). The estimated coefficients for the whole sample and women are significant, but of negligible size (a 10% rise in women's retirement duration corresponding to a 0.004 standard-deviation fall in internal locus of control).

The FE–IV estimation results for Equations (5) and (6) appear in Table 9. In the first stage, the instrument has significant explanatory power and 10% longer pension eligibility is estimated to produce 2% longer time spent in retirement. Retirement duration increases internal locus of control in the second-stage FE–IV results, with little gender difference: a 10% longer retirement duration produces a 0.03 to 0.04 standard-deviation rise in internal locus of control. The log transformation we use does of course impose a concave relationship. We have re-estimated Equations (5) and (6) using both linear and convex (the reciprocal of 1+years of retirement) forms for the retirement variable. We find that the concave log transformation in Table 9 provides the best fit to the data: the longer is retirement, the more older adults believe that their life outcomes are under their own control.

5.4 The distributional effects of retirement on locus of control

The Kolmogorov–Smirnov tests in Section 3.2 indicated a difference in the locus-of-control distributions of retirees and non-retirees. The analysis above referred to retirement and locus of control at the mean; we therefore now ask whether this effect varies along the control-orientation

Table 9: The causal effects of retirement duration on locus of control (FE–IV estimates)

	All		Male		Female	
	First stage	Second stage	First stage	Second stage	First stage	Second stage
Log retirement duration		0.341***		0.331**		0.373**
		(0.102)		(0.154)		(0.148)
Log duration of being age eligible for the Age Pension	0.208***		0.207***		0.194***	
	(0.017)		(0.024)		(0.025)	
F-statistic on the instrument	142.52		75.51		61.06	
Observations	25,719	25,719	12,218	12,218	13,501	13,501
Individuals	9,158	9,158	4,381	4,381	4,777	4,777

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

distribution. We do so via the distribution regressions first proposed by Foresi and Peracchi (1995) that are increasingly being used as an alternative to quantile regressions (Rothe, 2012; Chernozhukov et al., 2013; Dube, 2019; Kolodziej and Garcia-Gomez, 2019; Morris, 2022).

These regressions involve a series of FE–IV estimations of Equations (2) and (3) above, but with the dependent variables being successively dummies for the internal locus of control being above a given threshold: $I(LOC_{it}>\widehat{q}_{\tau})$. We take this latter threshold $\widehat{q}_{\tau}$ as the τ^{th} percentile of the unconditional distribution of (unstandardised) LOC_{it}.

Table 10: The distributional effects of retirement on locus of control (FE–IV estimates)

	$I(LOC_{it}>\widehat{q}_{\tau})$				
	τ=10	τ=25	τ=50	τ=75	τ=90
Panel A: All					
Retired	0.088*	0.143**	0.276***	0.164**	–0.007
	(0.053)	(0.071)	(0.082)	(0.069)	(0.047)
Observations	25,719	25,719	25,719	25,719	25,719
Individuals	9,158	9,158	9,158	9,158	9,158
Panel B: Male					
Retired	0.065	0.072	0.394***	0.307***	0.028
	(0.072)	(0.091)	(0.114)	(0.098)	(0.061)
Observations	12,218	12,218	12,218	12,218	12,218
Individuals	4,381	4,381	4,381	4,381	4,381
Panel C: Female					
Retired	0.183**	0.286**	0.197	0.014	–0.054
	(0.087)	(0.117)	(0.132)	(0.110)	(0.082)
Observations	13,501	13,501	13,501	13,501	13,501
Individuals	4,777	4,777	4,777	4,777	4,777

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

The second-stage FE–IV results in Table 10 refer to values of τ of 10, 25, 50, 75, and 90.[22] While there was little gender difference in the average effects of retirement status in Table 4, these are more pronounced in the distributional estimates in Table 10.[23] The positive effects of retirement

[22] The first-stage estimates are the same as those in Table 4.

[23] In Appendix Table A4, the distributional estimates for retirement duration show the same pattern.

for men in Panel B are concentrated at the 50^{th}–75^{th} percentiles of the unconditional distribution of internal locus of control. When τ=50, the threshold ($\widehat{q}_\tau$) for men is 39, which is considerably above the mid-point (28) of the locus-of-control range (7–49): retirement then increases internal control of men who already believed they were in charge of their life outcomes, but not those who believed their fate was out of their control. As such, retirement increases the inequality in locus of control for men, with repercussions on the behaviour that it predicts. Conversely, it is women with external control who gain in internal locus of control: retirement makes women's locus of control more homogenous.[24] Last, both men and women at the top of the distribution (90^{th}) are unaffected by retirement; those who already had substantial internal locus of control do not gain any more.

5.5 Retirement and other socio-emotional skills

We above concluded that retirement causally increases internal locus of control: Does it then also affect other socio-emotional skills? We apply the analytical approach set out in Section 3.1 to (i) the Big-Five personality traits, (ii) risk preferences, (iii) time preferences, and (iv) trust.[25] Here we discuss the FE–IV estimates for retirement status: the results for retirement duration in Appendix Tables A6 and A7 are similar.

5.5.1 The Big-Five personality traits

HILDA waves 2005, 2009, 2013, 2017, and 2021 contain a 36-item personality inventory based on the trait descriptive adjectives of Saucier (1994) to measure the Big-Five personality traits of (i)

[24] This pattern may be (partially) explained by gender biological differences. One of these is testosterone, a hormone that regulates the reproductive system, muscle mass, and red blood cell production. Testosterone in both sexes is also involved in health, well-being, memory, reasoning, moods, and behaviour. Although men and women produce the same type of testosterone, men produce significantly more of it than women at any given age. Research in Psychology and Biology suggests that testosterone increases aggression (Archer, 2006), difficulty seeing flaws in one's own reasoning (Nave et al., 2017), and the belief that one's own opinions are correct (Wright et al., 2012). We find on average that retirement increases internal control. Older men with an external control-orientation may not change their control beliefs in this new situation (as they are convinced that their opinions are correct), whereas those with internal locus of control are reinforced in what they already believe. The testosterone levels of women are substantially lower than those of men; on average, women are therefore more likely to re-evaluate their opinions. As they feel more in control of their lives, female retirees who initially attributed life outcomes to external factors exhibit greater malleability in their locus of control.

[25] The summary statistics for these socio-emotional skills appear in Appendix Table A5.

agreeableness, (ii) conscientiousness, (iii) emotional stability, (iv) extroversion, and (v) openness to experience. Respondents reported their identification, from 1 ("Not at all") to 7 ("Very well"), with 36 adjectives. These answers are then combined into five indicators in HILDA (ranging from 1 to 7), each representing a personality dimension. We standardise these indicator scores for the empirical analysis. In Table 11, while the instrument for retirement status is very strong in the first stage, the second stage is insignificant for agreeableness, conscientiousness, and emotional stability.[26] We find weak evidence at the 10% level that older men become more extroverted following retirement, while there is no significant effect for women. Last, the causal impact of retirement on openness to experience is positive for men but negative for women, with effect sizes that are smaller than those for locus of control.[27]

5.5.2 Risk preferences

The HILDA risk-preferences question is "Which of the following statements comes closest to describing the amount of financial risk that you are willing to take with your spare cash? That is cash used for savings and investment", with possible answers of (1) "I take substantial financial risks expecting to earn substantial returns", (2) "I take above average financial risks expecting to earn above average returns", (3) "I take average financial risks expecting to earn average returns", and (4) "I am not willing to take any financial risks".[28] This risk-attitude question has been widely used due to its construct validity and reliability (Shai, 2022; Bernhofer et al., 2023), and appears in almost all HILDA waves (missing only in 2005, 2007, and 2009): as such, the sample size for the

[26] Abadie (2020) argues that, in a large sample, there is little reason to assume a point null hypothesis with substantial prior beliefs. Insignificant results from the analysis of large datasets can thus be informative in terms of updating beliefs. Here we follow the recommendation in Abadie (2020, p. 206) for the "visible reporting and discussion of nonsignificant results in empirical practice". As most of the FE–IV estimates in Sections 5.5.1–5.5.4 are not statistically significant, we also follow Abadie (2020) and Imbens (2021) and report point estimates together with their associated confidence intervals, which indicate the degree of uncertainty around the estimates. In Appendix Tables A8 and A9, the 95% confidence intervals are wide and almost always include zero (except those for openness to experience in the male and female samples).

[27] This gender difference in retirement's impact on openness to experience may reflect time use in retirement. Female retirees in Australia spend more time on housework and house errands per week than male retirees (Atalay et al., 2020), and are also more likely to be the primary caregiver providing informal assistance to those with long-term health conditions, old age, or disability (Zhu and Onur, 2023). Female retirees may thus have less time for exploring new ideas and experiences.

[28] We drop observations on individuals who answered "I never have any spare cash".

Table 11: The causal effects of retirement on Big-Five personality traits (FE–IV estimates)

	First stage	Second stage				
	Retirement	Agreeableness	Conscientiousness	Emotional stability	Extroversion	Openness to experience
Panel A: All						
Retired		0.156	–0.076	0.084	0.141	–0.042
		(0.136)	(0.119)	(0.128)	(0.112)	(0.116)
Age-Pension age eligibility	0.146***					
	(0.011)					
F-statistic on the instrument	183.62					
Observations	23,495	23,495	23,495	23,495	23,495	23,495
Individuals	9,179	9,179	9,179	9,179	9,179	9,179
Panel B: Male						
Retired		0.240	–0.066	0.079	0.240*	0.273**
		(0.168)	(0.143)	(0.152)	(0.128)	(0.136)
Age-Pension age eligibility	0.181***					
	(0.016)					
F-statistic on the instrument	124.80					
Observations	11,043	11,043	11,043	11,043	11,043	11,043
Individuals	4,351	4,351	4,351	4,351	4,351	4,351
Panel C: Female						
Retired		0.013	–0.119	0.106	0.029	–0.493**
		(0.241)	(0.219)	(0.234)	(0.212)	(0.227)
Age-Pension age eligibility	0.109***					
	(0.014)					
F-statistic on the instrument	56.81					
Observations	12,452	12,452	12,452	12,452	12,452	12,452
Individuals	4,828	4,828	4,828	4,828	4,828	4,828

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

analysis of risk preferences is well over twice as large as that in Table 4. The FE–IV results in Panel A of Table 12 refer to the standardised measure of risk preferences. The first stage is strong, but the second-stage estimates are small and insignificant: there is no statistical evidence that retirement changes risk attitudes.

5.5.3 Time preferences

Preferences for the present over the future (Akesaka, 2019; Jetter et al., 2020) come from a question about financial-planning horizons, appearing in HILDA waves 2001, 2002, 2003 and then every subsequent even wave (2004, 2006, ..., 2020): "In planning your saving and spending, which of the following time periods is most important to you?" The six options response categories are: (1) "The next week", (2) "The next few months", (3) "The next year", (4) "The next 2 to 4 years", (5) "The next 5 to 10 years", and (6) "More than 10 years ahead". We follow Jetter et al. (2020) and reverse the coding so that higher values refer to greater impatience; this variable is standardised in the FE–IV regressions. The estimated coefficients on retirement for time preferences in Panel B of Table 12 are insignificant and much smaller in size than the (significant) coefficients for locus of control in Table 4 (which latter are based on a sample that is only half as large as that for time preferences).

5.5.4 Trust

Our final dependent variable is trust, which indicates a person's willingness to be vulnerable to opportunistic individuals. It is measured by the agreement with the following statement – "Generally speaking, most people can be trusted" on a scale of 1 to 7, where 1 refers to "Strongly disagree" and 7 to "Strongly agree" (appearing in HILDA waves 2005, 2006, 2008, 2010, 2011, 2014, and 2018). This trust measure is common in the literature (Dohmen et al., 2011; Ananyev and Guriev, 2019). The FE–IV results for standardised trust in Panel C of Table 12 are statistically insignificant and much smaller than those for locus of control in Table 4.

Table 12: The causal effects of retirement on risk and time preferences and trust (FE–IV estimates)

	All		Male		Female	
	First stage	Second stage	First stage	Second stage	First stage	Second stage
Panel A: Risk preferences						
Retired		0.086		0.147		–0.038
		(0.085)		(0.108)		(0.147)
Age-Pension age eligibility	0.147***		0.169***		0.118***	
	(0.008)		(0.012)		(0.011)	
F-statistic on the instrument	319.05		195.49		109.70	
Observations	71,331	71,331	34,453	34,453	36,878	36,878
Individuals	10,245	10,245	4,948	4,948	5,297	5,297
Panel B: Time preferences						
Retired		–0.032		–0.120		0.070
		(0.108)		(0.139)		(0.180)
Age-Pension age eligibility	0.141***		0.153***		0.121***	
	(0.008)		(0.012)		(0.011)	
F-statistic on the instrument	300.04		162.76		116.61	
Observations	51,295	51,295	24,346	24,346	26,949	26,949
Individuals	10,310	10,310	4,943	4,943	5,367	5,367
Panel C: Trust						
Retired		0.088		–0.020		0.233
		(0.176)		(0.224)		(0.302)
Age-Pension age eligibility	0.123***		0.133***		0.105***	
	(0.010)		(0.015)		(0.014)	
F-statistic on the instrument	145.18		76.98		57.77	
Observations	30,147	30,147	14,285	14,285	15,862	15,862
Individuals	8,589	8,559	4,099	4,099	4,490	4,490

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

5.5.5 Summarising the results for other socio-emotional skills

Overall, we found little significant evidence that retirement affects the personality traits and economic preferences considered in Sections 5.5.1–5.5.4. One natural question is whether the insignificant estimates reflect Type-II errors (*i.e.*, there are actually non-zero retirement effects, but we fail to detect them empirically). In just-identified IV models (as is our case), recent econometric advances have found the test of Anderson and Rubin (1949) to be the most powerful and robust among the various unbiased approaches for the testing of a point null hypothesis, which minimises the Type-II error (Moreira and Moreira, 2019; Lee et al., 2022; Keane and Neal, 2023). We here apply this Anderson–Rubin approach. Specifically, we estimate reduced-form FE regressions of socio-emotional skills on the IV ($EliST_{it}$) and the control variables (X_{it}) and then test the statistical significance of the IV. The results in Appendix Table A10 show that, for most of the soft-skills variables we analyse, the $EliST_{it}$ coefficients are not statistically significant at the 5% level (except those for locus of control and openness to experience), which is consistent with the $RetST_{it}$ coefficients in Tables 4, 11, and 12. As noted in Angrist and Kolesar (2023, p. 8), "It is hard to imagine a convincing case for statistical significance of a just-ID IV estimate when the associated reduced form is statistically indistinguishable from zero". The Anderson–Rubin test thus helps confirm that the insignificant estimates in Tables 11 and 12 do not reflect Type-II errors, and that retirement mostly does not causally affect the Big-Five personality traits (except openness to experience), risk and time preferences, and trust at the 5% level of significance.

5.6 Robustness checks

5.6.1 Alternative measures of locus of control

Our first sensitivity analysis concerns the measure of locus of control. In Section 3.2, all seven individual items were assumed to contribute equally to the overall index: we here instead analyse the first predicted (latent) factor, as in Cobb-Clark and Schurer (2013). The FE–IV results in Appendix Table A11 continue to show that retirement increases internal locus of control.

We have also followed the approach in Fitzenberger et al. (2022) and created separate indices for external and internal control (the mean scores for the answers to questions (i–v) and (vi–vii), respectively). In Appendix Table A12, retirement affects both measures, reducing external control and increasing internal control.

5.6.2 An alternative measure of retirement

We next consider the definition of retirement. In Section 3.2, an individual was defined as retired if he/she was not in the labour force. Alternatively, we can follow Godard (2016) and use self-reported retirement status (although the appropriate question was only asked in HILDA waves 2003, 2007, 2011, 2015, and 2019). The FE–IV estimates in Appendix Table A13 confirm that instrumented (self-reported) retirement continues to increase internal locus of control, with effect sizes that are similar to those in Table 4.

5.6.3 Narrowing the age range

Our main results cover individuals who are aged 50–75. Other research on Australian retirement (Atalay et al., 2020; Kettlewell and Lam, 2022) has looked at those aged 55–75: the findings for this age group in Appendix Table A14 are not different from those discussed in the main text.[29]

5.6.4 Testing the LATE assumptions

We here address the assumptions that are required for the identification of the local average treatment effect (LATE). The joint validity of the exclusion, independence, and monotonicity assumptions for a binary instrument and a binary treatment (here, $EliST_{it}$ and $RetST_{it}$) can be

[29] Our identification strategy makes use of age-related instruments. If the quadratic specification of age in Equation (3) does not adequately reflect the smooth age trend, then the identification is flawed as the exclusion assumption may not be met. To alleviate this concern, we have used third-order age polynomials to model the age trend more flexibly. In the FE–IV estimations, all retirement coefficients continue to be positive, but less precisely estimated. In Equation (3), both age and age squared become statistically insignificant after the inclusion of the age cubed term; the latter is itself not statistically significant either. As such, the quadratic age term seems to be sufficiently rich to capture the smooth profile between age and locus of control. This is consistent with the Mourifie and Wan (2017) test result to be discussed in Section 5.6.4 that the exclusion condition is not violated in our baseline specification controlling for the quadratic in age.

tested (Kitagawa, 2015; Mourifie and Wan, 2017). The implications of the LATE assumptions, originally discussed in Balke and Pearl (1997) and Heckman and Vytlacil (2005), have been reformulated by Mourifie and Wan (2017) as two conditional-moment inequalities, which can be tested in the intersection bounds framework of Chernozhukov et al. (2013, 2015). The approach of Mourifie and Wan (2017) can incorporate multiple continuous covariates. This is critical in our case, as the validity of our age-related instrument depends on controlling for a smooth trend in age. At conventional significance levels, the Mourifie–Wan test does not reject the null hypothesis of the joint validity of the LATE assumptions in the overall, male, or female samples. As the relevance condition is satisfied via the first-stage FE–IV estimation results, we conclude that pension-age eligibility is a good instrument for retirement.

5.6.5 Adjusting the second-stage standard errors

Sections 5.1 and 5.3 appealed to the first-stage F-statistic on the excluded instrument and used the rule-of-thumb threshold of 10 to test for instrument weakness. Lee et al. (2022) have recently shown that this t-ratio-based inference tends to result in the over-statement of (i) instrument strength in the first stage and (ii) the precision of the estimates in the second stage. They introduce the tF critical value function that adjusts the standard errors of the second-stage estimates as a smooth function of the first-stage F-statistic on the excluded instrument.[30] At the 5% level, adjustment is required if the F-statistic is below 104.67 (see Table 3A in Lee et al., 2022). Our first-stage F-statistics in Table 4 are 204.59 for the whole sample, 110.45 for men, and 77.11 for women. Those in Table 9 are 142.52, 75.51, and 61.06, respectively. After applying the tF procedure, the standard errors of the six second-stage estimates in Tables 4 and 9 are 0%, 0%, 3.4%, 0%, 3.7%, and 6.4% larger. Nevertheless, all of the estimated retirement coefficients continue to be statistically significant at the 5% level.

[30]The tF adjustment assumes worst-case endogeneity (Lee et al., 2022; Angrist and Kolesar, 2023).

5.6.6 Exploiting the discontinuity in the retirement rate at the pensionable age

As discussed in Section 2, we have precise knowledge about the age requirements for Age-Pension eligibility (see Table 1). Reaching the eligibility age produces an exogenous variation in the financial incentives for retirement. However, as retirement is not mandatory in Australia, the discontinuity in the probability of entry into retirement is not 100% at the age threshold. We below exploit this setting via a fuzzy regression discontinuity (RD) design.

Using the same notation as in Section 4, we take the approach in Imbens and Lemieux (2008) with a baseline RD specification of:

$$RetST_{it} = EliST_{it}\theta + (Age_{it} - EliAge_{ct})EliST_{it}\delta + (Age_{it} - EliAge_{ct})\eta + X'_{it}\lambda + v_i + \varepsilon_{it}. \quad (7)$$

$$LOC_{it} = \widehat{RetST}_{it}\beta + (Age_{it} - EliAge_{ct})EliST_{it}\rho + (Age_{it} - EliAge_{ct})\sigma + X'_{it}\gamma + \mu_i + \epsilon_{it}. \quad (8)$$

The treatment variable is retirement status ($RetST_{it}$), and the running variable is normalised age centred at the cohort-specific pension-eligibility age (Age_{it}–$EliAge_{ct}$) with the cutoff point being zero. In Equation (7), the inclusion of (Age_{it}–$EliAge_{ct}$)$EliST_{it}$ allows the relationship between $RetST_{it}$ and (Age_{it}–$EliAge_{ct}$) to differ on either side of the age threshold. In Equation (8), we allow for a trend of LOC_{it} with respect to (Age_{it}–$EliAge_{ct}$) as well as a break in this trend at the cutoff point. The covariates (X_{it}) in both equations are years of education, household size, and dummies for marital status, living in a major city, State of residence, and wave. The estimated β is the local average treatment effect (LATE) of retirement on locus of control for compliers whose age is locally around their pensionable age.

One crucial RD parameter is the bandwidth, determining which observations are used around the cutoff point: larger (smaller) windows produce more (fewer) observations, and therefore smaller (bigger) variance, but greater (smaller) bias in the estimate. We apply the data-driven mean squared error bandwidth-selection procedure of Calonico et al. (2014, 2017), which yields a figure of 6.7 years (we check the sensitivity of the estimates by also considering alternative values of 4, 5, 6, 7, and 8 years).[31] Equations (7) and (8) are then estimated via FE–IV with standard errors clustered at the individual level. This approach is essentially a local linear regression model (based on a rectangular kernel), as suggested in Hahn et al. (2001), Imbens and Lemieux (2008), and Lee and Lemieux (2010).

The validity of the RD strategy relies on three assumptions. The first is that there is a discontinuity in the probability of retirement at the cutoff point. Appendix Figure A1 shows the retirement rate by the normalised age (Age_{it}–$EliAge_{ct}$). There is clear graphical evidence of a discontinuous jump in the rate of retirement at the pension-eligibility age. Second, the outcome variable is assumed to evolve continuously with the running variable around the cutoff point. In the absence of retirement, the smooth profile between locus of control and age seems reasonable, given that the ageing process is gradual. Accordingly, any change in locus of control at the pension-eligibility age should be triggered by retirement behaviour rather than by age itself. Last, individuals cannot precisely manipulate the running variable of age. We calculate the age of each individual based on the exact birth and interview dates, and there is little reason to suspect that individuals systematically misreport their birth date in HILDA. Lee and Lemieux (2010) point out that if the no-manipulation assumption holds, the RD estimates will not be affected by the inclusion of the baseline covariates (X_{it}) that should be locally balanced around the cutoff point. We check whether this is the case by estimating regressions with and without X_{it}.

The fuzzy RD estimates appear in Panel A of Appendix Table A15. With the optimal bandwidth of 6.7 years, retirement produces greater internal locus of control of 0.43 standard deviations.[32] This figure remains broadly stable in the other columns with alternative bandwidths. In addition, the inclusion or exclusion of the X_{it} has barely any effect on the estimated coefficients, providing empirical support for the no-manipulation assumption.[33]

[31] We have multiple cutoff points for different birth cohorts (see Table 1), as in Eibich (2015). The RD estimation sample covers individuals whose ages fall within the bandwidth years before the first discontinuity (at age 60 for women and 65 for men) and those after the last discontinuity (at age 67 for both genders).

[32] The RD design is data intensive, as it uses observations around the cutoff point for estimation. Since the estimates are of similar magnitude for men and women at the mean (as also revealed in Table 4), we focus on the pooled sample of men and women here to produce greater statistical power and a lower probability of Type-II errors.

[33] When exploiting the discontinuity in age, as Lee and Lemieux (2010, p. 345) note, “if one follows a single cohort over time, all characteristics determined prior to reaching the relevant age threshold are by construction identical just

We also apply the alternative RD specification suggested in Angrist and Pischke (2009, Chap. 6.2):

$$LOC_{it} = RetST_{it}\beta + (Age_{it} - EliAge_{ct})RetST_{it}\rho + (Age_{it} - EliAge_{ct})\sigma + X_{it}'\gamma + \mu_i + \epsilon_{it}. \quad (9)$$

Here, the slope of the relationship between LOC_{it} and $RetST_{it}$ is allowed to differ on either side of the age threshold. As $RetST_{it}$ and $(Age_{it}–EliAge_{ct})RetST_{it}$ are both endogenous, we instrument them with $EliST_{it}$ and $(Age_{it}–EliAge_{ct})EliST_{it}$. Panel B presents the results from this alternative specification. The positive RD estimates of β in Panels A and B of Appendix Table A15 are remarkably similar, and are both consistent with the estimated coefficient for the whole sample in Table 4.

6 Conclusion

We have here used nationally representative Australian panel data to show that retirement increases individuals' sense that they are in control of their lives (their internal locus of control). Causality is based on the exogenous variation in retirement induced by the cohort-specific eligibility age for the Australian Age Pension. This malleability of locus of control may well extend to other life events at different ages, so that it should not be treated as a fixed trait in empirical analyses. The findings here apply to compliers who account for 15% of the elderly population: these individuals retire at their pension-eligibility age, and are more likely to be less educated, married, immigrants, living in major cities, from lower socioeconomic backgrounds, and have no long-term health conditions. The distributional analysis reveals differential retirement effects along the distribution of locus of control, being particularly pronounced for men with a relatively high sense of internal control and for women with a relatively high sense of external control. Retirement then exacerbates locus of control inequality for men, but reduces that for women. Last, locus of control is considerably more responsive to retirement than are the other socio-emotional skills of the Big-Five personality traits, risk and time preferences, and trust, which are largely unaffected.

before and after the cutoff".

Growing longevity and greater financial pressure on pension schemes have led many governments to try to prolong individuals' working lives. Our findings show that individuals who delay retirement for pension-eligibility reasons have as a result a more external locus of control, attributing their life outcomes more to fate and luck than to their own choices and actions. As internal locus of control comes with a number of benefits (including improved health and well-being), the Australian pension reform may have increased employment among older individuals whose retirement follows their pension-age eligibility, but at the cost of unintended negative consequences in terms of their health and well-being.

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Appendix

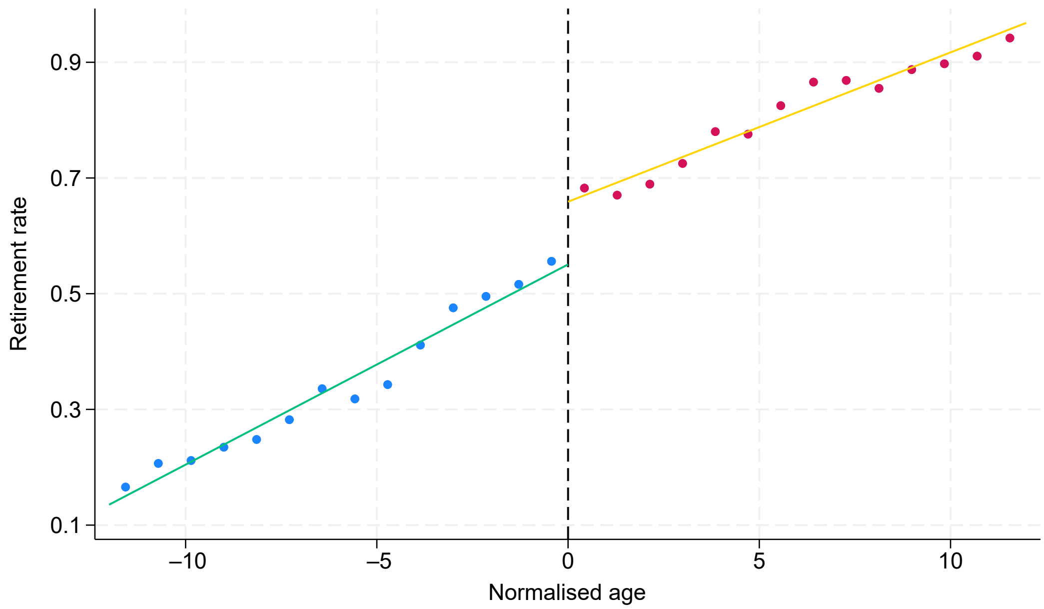

Figure A1: Retirement rate by normalised age (centred at pension-eligibility age)

Table A1: Full results of Table 4 (FE–IV estimates)

	All		Male		Female	
	First stage	Second stage	First stage	Second stage	First stage	Second stage
Retired		0.572***		0.520***		0.681***
		(0.145)		(0.190)		(0.249)
Age-Pension age eligibility	0.149***		0.164***		0.123***	
	(0.010)		(0.016)		(0.014)	
Age	0.080**	–0.011	0.086	0.055	0.074	–0.078
	(0.041)	(0.086)	(0.059)	(0.117)	(0.056)	(0.127)
Age squared/100	0.010*	–0.045***	0.039***	–0.065***	–0.017**	–0.023
	(0.006)	(0.014)	(0.009)	(0.023)	(0.008)	(0.018)
Years of education	–0.006	0.018	–0.025	0.029	0.001	0.013
	(0.012)	(0.024)	(0.020)	(0.029)	(0.015)	(0.033)
Marital status (reference: Never married):						
Married or in a *de facto* relationship	0.042	0.032	0.052	–0.013	0.021	0.082
	(0.058)	(0.122)	(0.078)	(0.150)	(0.088)	(0.203)
Separated	0.044	–0.094	0.100	–0.164	–0.022	–0.009
	(0.063)	(0.134)	(0.085)	(0.169)	(0.094)	(0.220)
Divorced	0.011	0.078	0.055	0.042	–0.033	0.130
	(0.062)	(0.131)	(0.084)	(0.163)	(0.094)	(0.215)
Widowed	–0.014	0.099	0.041	0.025	–0.035	0.145
	(0.062)	(0.133)	(0.090)	(0.182)	(0.092)	(0.212)
Household size	–0.000	–0.030***	–0.006	–0.010	0.008	–0.056***
	(0.005)	(0.010)	(0.007)	(0.014)	(0.007)	(0.015)
Living in a major city	–0.088***	0.026	–0.091***	0.032	–0.085***	0.017
	(0.019)	(0.037)	(0.026)	(0.049)	(0.027)	(0.056)
State of residence dummies	Yes	Yes	Yes	Yes	Yes	Yes
Wave dummies	Yes	Yes	Yes	Yes	Yes	Yes
F-statistic on the instrument	204.59		110.45		77.11	
Observations	25,719	25,719	12,218	12,218	13,501	13,501
Individuals	9,158	9,158	4,381	4,381	4,777	4,777

Notes: Standard errors clustered at the individual level are in parentheses. *** p<0.01; ** p<0.05; * p<0.10.

Table A2: Summary statistics of health and well-being

	All		Male		Female	
	Retired	Not retired	Retired	Not retired	Retired	Not retired
SF-36 physical health (range: 0–100)	61.11	77.20	60.29	78.07	61.70	76.23
	(26.20)	(18.57)	(26.19)	(17.76)	(26.19)	(19.39)
SF-36 mental health (range: 0–100)	70.30	78.64	70.44	79.93	70.20	77.21
	(23.24)	(17.04)	(23.35)	(16.18)	(23.16)	(17.85)
Satisfaction with life (range: 0–10)	8.10	7.99	8.05	7.99	8.13	8.00
	(1.65)	(1.32)	(1.64)	(1.28)	(1.66)	(1.36)
Satisfaction with health (range: 0–10)	6.60	7.40	6.44	7.41	6.71	7.39
	(2.29)	(1.64)	(2.31)	(1.60)	(2.26)	(1.68)
Observations	11,199	13,571	4,632	7,162	6,567	6,409

Notes: Data from HILDA waves 2003, 2004, 2007, 2011, 2015, and 2019. Standard deviations appear in parentheses.

Table A3: The causal effects of retirement on health and well-being using HILDA waves 2001–2021 (FE–IV estimates)

	First stage	Second stage			
	Retired	SF-36		Satisfaction with	
		Physical	Mental	Life	Health
Panel A: All					
Retired		0.439***	0.486***	0.541***	0.526***
		(0.080)	(0.083)	(0.088)	(0.087)
Age-Pension age eligibility	0.145***				
	(0.008)				
F-statistic on the instrument	364.03				
Observations	91,514	91,514	91,514	91,514	91,514
Individuals	10,749	10,749	10,749	10,749	10,749
Panel B: Male					
Retired		0.332***	0.340***	0.494***	0.439***
		(0.103)	(0.101)	(0.107)	(0.107)
Age-Pension age eligibility	0.163***				
	(0.011)				
F-statistic on the instrument	213.54				
Observations	43,265	43,265	43,265	43,265	43,265
Individuals	5,143	5,143	5,143	5,143	5,143
Panel C: Female					
Retired		0.569***	0.698***	0.644***	0.693***
		(0.134)	(0.147)	(0.157)	(0.152)
Age-Pension age eligibility	0.120***				
	(0.010)				
F-statistic on the instrument	134.40				
Observations	48,249	48,249	48,249	48,249	48,249
Individuals	5,606	5,606	5,606	5,606	5,606

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

Table A4: The distributional effects of retirement duration on locus of control (FE–IV estimates)

	$I(LOC_{it}>\widehat{q}_{\tau})$				
	τ=10	τ=25	τ=50	τ=75	τ=90
Panel A: All					
Log retirement duration	0.017	0.031	0.169***	0.152***	0.023
	(0.037)	(0.049)	(0.058)	(0.050)	(0.035)
Observations	25,719	25,719	25,719	25,719	25,719
Individuals	9,158	9,158	9,158	9,158	9,158
Panel B: Male					
Log retirement duration	0.003	0.004	0.224**	0.236***	0.001
	(0.058)	(0.075)	(0.095)	(0.085)	(0.052)
Observations	12,218	12,218	12,218	12,218	12,218
Individuals	4,381	4,381	4,381	4,381	4,381
Panel C: Female					
Log retirement duration	0.065	0.117*	0.129	0.106	0.042
	(0.052)	(0.069)	(0.079)	(0.067)	(0.051)
Observations	13,501	13,501	13,501	13,501	13,501
Individuals	4,777	4,777	4,777	4,777	4,777

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

Table A5: Summary statistics of the Big-Five personality traits, risk and time preferences, and trust

	All		Male		Female	
	Retired	Not retired	Retired	Not retired	Retired	Not retired
Big-Five personality traits:						
Agreeableness (range: 1–7)	4.31	4.41	4.18	4.30	4.40	4.54
	(1.06)	(1.07)	(1.00)	(1.03)	(1.10)	(1.11)
Conscientiousness (range: 1–7)	5.48	5.48	5.20	5.24	5.66	5.75
	(0.97)	(0.89)	(0.96)	(0.89)	(0.92)	(0.81)
Emotional stability (range: 1–7)	5.49	5.42	5.36	5.34	5.57	5.50
	(1.07)	(1.03)	(1.09)	(1.03)	(1.05)	(1.02)
Extroversion (range: 1–7)	5.24	5.27	5.14	5.17	5.31	5.39
	(1.03)	(0.98)	(1.01)	(0.97)	(1.04)	(0.99)
Openness to experience (range: 1–7)	4.07	4.24	4.14	4.27	4.01	4.21
	(1.11)	(1.06)	(1.09)	(1.00)	(1.12)	(1.11)
Risk preferences (range: 1–4)	3.51	3.29	3.40	3.17	3.58	3.42
	(0.62)	(0.68)	(0.65)	(0.70)	(0.58)	(0.63)
Time preferences (range: 1–6)	4.04	3.64	4.10	3.68	4.01	3.61
	(1.59)	(1.57)	(1.57)	(1.56)	(1.60)	(1.59)
Trust (range: 1–7)	5.06	5.04	5.03	5.01	5.08	5.08
	(1.37)	(1.24)	(1.35)	(1.23)	(1.38)	(1.25)

Notes: Data: The Big-Five personality traits appear in HILDA waves 2005, 2009, 2013, 2017, and 2021; risk preferences in waves 2001–2021 except 2005, 2007, and 2009; time preferences in waves 2001, 2002, 2003 and every subsequent even wave (2004, 2006, ..., 2020); and trust in waves 2005, 2006, 2008, 2010, 2011, 2014, and 2018. Standard deviations appear in parentheses.

Table A6: The causal effects of retirement duration on the Big-Five personality traits (FE–IV estimates)

	First stage	Second stage				
	Retirement	Agreeableness	Conscientiousness	Emotional stability	Extroversion	Openness to experience
Panel A: All						
Log retirement duration		0.136 (0.085)	0.076 (0.074)	0.043 (0.080)	0.063 (0.067)	–0.077 (0.072)
Log duration of being age eligible for the Age Pension	0.235*** (0.018)					
F-statistic on the instrument	172.68					
Observations	23,495	23,495	23,495	23,495	23,495	23,495
Individuals	9,179	9,179	9,179	9,179	9,179	9,179
Panel B: Male						
Log retirement duration		0.119 (0.111)	0.130 (0.095)	0.083 (0.102)	0.146* (0.085)	0.125 (0.092)
Log duration of being age eligible for the Age Pension	0.273*** (0.026)					
F-statistic on the instrument	113.91					
Observations	11,043	11,043	11,043	11,043	11,043	11,043
Individuals	4,351	4,351	4,351	4,351	4,351	4,351
Panel C: Female						
Log retirement duration		0.152 (0.131)	0.013 (0.116)	0.004 (0.125)	–0.011 (0.107)	–0.273** (0.118)
Log duration of being age eligible for the Age Pension	0.202*** (0.025)					
F-statistic on the instrument	65.12					
Observations	12,452	12,452	12,452	12,452	12,452	12,452
Individuals	4,828	4,828	4,828	4,828	4,828	4,828

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

Table A7: The causal effects of retirement duration on risk and time preferences and trust (FE–IV estimates)

	All		Male		Female	
	First stage	Second stage	First stage	Second stage	First stage	Second stage
Panel A: Risk preferences						
Log retirement duration		0.012		0.062		–0.044
		(0.053)		(0.081)		(0.075)
Log duration of being age eligible for the Age Pension	0.228***		0.235***		0.213***	
	(0.015)		(0.020)		(0.021)	
F-statistic on the instrument	236.14		131.99		103.66	
Observations	70,331	70,331	34,453	34,453	36,878	36,878
Individuals	10,245	10,245	4,948	4,948	5,297	5,297
Panel B: Time preferences						
Log retirement duration		–0.021		–0.011		–0.007
		(0.066)		(0.101)		(0.092)
Log duration of being age eligible for the Age Pension	0.225***		0.223***		0.214***	
	(0.015)		(0.020)		(0.021)	
F-statistic on the instrument	228.58		119.11		104.05	
Observations	51,295	51,295	24,346	24,346	26,949	26,949
Individuals	10,310	10,310	4,943	4,943	5,367	5,367
Panel C: Trust						
Log retirement duration		0.119		–0.097		0.300*
		(0.106)		(0.154)		(0.161)
Log duration of being age eligible for the Age Pension	0.193***		0.199***		0.178***	
	(0.018)		(0.025)		(0.026)	
F-statistic on the instrument	109.56		62.39		46.02	
Observations	30,147	30,147	14,285	14,285	15,862	15,862
Individuals	8,589	8,559	4,099	4,099	4,490	4,490

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

Table A8: 95% confidence intervals for the estimated effects of retirement on the Big-Five personality traits (FE–IV estimates)

	Agreeableness	Conscientiousness	Emotional stability	Extroversion	Openness to experience
Panel A: All					
Second-stage point estimate	0.156	–0.076	0.084	0.141	–0.042
95% confidence interval	[–0.111, 0.423]	[–0.310, 0.158]	[–0.166, 0.334]	[–0.078, 0.361]	[–0.270, 0.186]
Observations	23,495	23,495	23,495	23,495	23,495
Individuals	9,179	9,179	9,179	9,179	9,179
Panel B: Male					
Second-stage point estimate	0.240	–0.066	0.079	0.240	0.273
95% confidence interval	[–0.090, 0.569]	[–0.346, 0.214]	[–0.218, 0.376]	[–0.011, 0.491]	[0.006, 0.540]
Observations	11,043	11,043	11,043	11,043	11,043
Individuals	4,351	4,351	4,351	4,351	4,351
Panel C: Female					
Second-stage point estimate	0.013	–0.119	0.106	0.029	–0.493
95% confidence interval	[–0.459, 0.484]	[–0.547, 0.310]	[–0.352, 0.564]	[–0.387, 0.444]	[–0.937, –0.048]
Observations	12,452	12,452	12,452	12,452	12,452
Individuals	4,828	4,828	4,828	4,828	4,828

Notes: The control variables are age, age squared, years of education, household size, and dummies for marital status, living in a major city, State of residence, and wave. 95% confidence intervals are in square brackets.

Table A9: 95% confidence intervals for the estimated effects of retirement on risk and time preferences and trust (FE–IV estimates)

	All	Male	Female
Panel A: Risk preferences			
Second-stage point estimate	0.086	0.147	–0.038
95% confidence interval	[–0.081, 0.253]	[–0.065, 0.358]	[–0.326, 0.249]
Observations	71,331	34,453	36,878
Individuals	10,245	4,948	5,297
Panel B: Time preferences			
Second-stage point estimate	–0.032	–0.120	0.070
95% confidence interval	[–0.243, 0.179]	[–0.393, 0.153]	[–0.284, 0.423]
Observations	51,295	24,346	26,949
Individuals	10,310	4,943	5,367
Panel C: Trust			
Second-stage point estimate	0.088	–0.020	0.233
95% confidence interval	[–0.256, 0.433]	[–0.459, 0.419]	[–0.359, 0.825]
Observations	30,147	14,285	15,862
Individuals	8,589	4,099	4,490

Notes: The control variables are age, age squared, years of education, household size, and dummies for marital status, living in a major city, State of residence, and wave. 95% confidence intervals are in square brackets.

Table A10: Reduced-form estimates: Anderson–Rubin test results (FE estimates)

	All	Male	Female
Locus of control	0.085***	0.085***	0.084***
	(0.021)	(0.030)	(0.029)
Big-Five personality traits:			
Agreeableness	0.023	0.043	0.001
	(0.020)	(0.030)	(0.026)
Conscientiousness	–0.011	–0.012	–0.013
	(0.017)	(0.026)	(0.024)
Emotional stability	0.012	0.014	0.012
	(0.019)	(0.027)	(0.025)
Extroversion	0.021	0.044*	0.003
	(0.016)	(0.023)	(0.023)
Openness to experience	–0.006	0.050**	–0.054**
	(0.017)	(0.024)	(0.024)
Risk preferences	0.013	0.025	–0.005
	(0.013)	(0.018)	(0.017)
Time preferences	–0.005	–0.018	0.008
	(0.015)	(0.021)	(0.022)
Trust	0.011	–0.003	0.024
	(0.022)	(0.030)	(0.031)

Notes: This table lists the estimated coefficients from FE regressions of socio-emotional skills on Age-Pension age eligibility (the instrumental variable used in the main analysis). The control variables are age, age squared, years of education, household size, and dummies for marital status, living in a major city, State of residence, and wave. Standard errors clustered at the individual level are in parentheses. *** p<0.01; ** p<0.05; * p<0.10.

Table A11: An alternative latent-factor measure of locus of control (FE–IV estimates)

	All		Male		Female	
	First stage	Second stage	First stage	Second stage	First stage	Second stage
Panel A:						
Retired		0.522***		0.449**		0.653***
		(0.143)		(0.188)		(0.247)
Age-Pension age eligibility	0.149***		0.164***		0.123***	
	(0.010)		(0.016)		(0.014)	
F-statistic on the instrument	204.59		110.45		77.11	
Observations	25,719	25,719	12,218	12,218	13,501	13,501
Individuals	9,158	9,158	4,381	4,381	4,777	4,777
Panel B:						
Log retirement duration		0.311***		0.269*		0.364**
		(0.100)		(0.151)		(0.147)
Log duration of being age eligible for the Age Pension	0.208***		0.207***		0.194***	
	(0.017)		(0.024)		(0.025)	
F-statistic on the instrument	142.52		75.51		61.06	
Observations	25,719	25,719	12,218	12,218	13,501	13,501
Individuals	9,158	9,158	4,381	4,381	4,777	4,777

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

Table A12: Separate measures of external and internal control (FE–IV estimates)

	All		Male		Female	
	External	Internal	External	Internal	External	Internal
Panel A:						
Retired	–0.458***	0.539***	–0.370*	0.600**	–0.593**	0.528*
	(0.146)	(0.180)	(0.190)	(0.242)	(0.252)	(0.298)
Observations	25,719	25,719	12,218	12,218	13,501	13,501
Individuals	9,158	9,158	4,381	4,381	4,777	4,777
Panel B:						
Log retirement duration	–0.276***	0.316**	–0.194	0.482**	–0.352**	0.226
	(0.102)	(0.130)	(0.152)	(0.206)	(0.150)	(0.180)
Observations	25,719	25,719	12,218	12,218	13,501	13,501
Individuals	9,158	9,158	4,381	4,381	4,777	4,777

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

Table A13: Results with self-reported retirement (FE–IV estimates)

	All		Male		Female	
	First stage	Second stage	First stage	Second stage	First stage	Second stage
Retired (self-reported)		0.511***		0.457***		0.614**
		(0.137)		(0.173)		(0.240)
Age-Pension age eligibility	0.166***		0.188***		0.134***	
	(0.011)		(0.016)		(0.015)	
F-statistic on the instrument	228.24		141.34		76.91	
Observations	21,953	21,953	10,394	10,394	11,559	11,559
Individuals	8,974	8,974	4,287	4,287	4,687	4,687

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

Table A14: Only individuals aged 55–75 (FE–IV estimates)

	All		Male		Female	
	First stage	Second stage	First stage	Second stage	First stage	Second stage
Panel A:						
Retired		0.688***		0.596**		0.936**
		(0.191)		(0.236)		(0.384)
Age-Pension age eligibility	0.122***		0.139***		0.089***	
	(0.011)		(0.016)		(0.015)	
F-statistic on the instrument	125.13		75.05		35.95	
Observations	19,593	19,593	9,314	9,314	10,279	10,279
Individuals	7,483	7,483	3,582	3,582	3,901	3,901
Panel B:						
Log retirement duration		0.359***		0.393**		0.356**
		(0.103)		(0.162)		(0.148)
Log duration of being age eligible for the Age Pension	0.209***		0.205***		0.195***	
	(0.017)		(0.024)		(0.024)	
F-statistic on the instrument	147.37		70.69		64.51	
Observations	19,593	19,593	9,314	9,314	10,279	10,279
Individuals	7,483	7,483	3,582	3,582	3,901	3,901

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

Table A15: Regression discontinuity estimates of the impact of retirement on locus of control (FE–IV estimates)

		Bandwidth (years)					
		6.7	4	5	6	7	8
Panel A: Baseline specification							
Including X_{it}	Retired	0.433**	0.617	0.509*	0.521**	0.391*	0.570***
		(0.219)	(0.377)	(0.287)	(0.243)	(0.206)	(0.182)
	Observations	17,265	12,223	14,105	16,001	17,810	19,723
	Individuals	6,896	5,611	6,089	6,564	7,026	7,509
Excluding X_{it}	Retired	0.427**	0.582	0.503*	0.511**	0.377*	0.535***
		(0.214)	(0.367)	(0.282)	(0.240)	(0.202)	(0.177)
	Observations	17,265	12,223	14,105	16,001	17,810	19,723
	Individuals	6,896	5,611	6,089	6,564	7,026	7,509
Panel B: Alternative specification							
Including X_{it}	Retired	0.432**	0.637*	0.516*	0.529**	0.393*	0.581***
		(0.217)	(0.381)	(0.289)	(0.243)	(0.205)	(0.181)
	Observations	17,265	12,223	14,105	16,001	17,810	19,723
	Individuals	6,896	5,611	6,089	6,564	7,026	7,509
Excluding X_{it}	Retired	0.425**	0.585	0.504*	0.516**	0.380*	0.546***
		(0.211)	(0.363)	(0.281)	(0.238)	(0.199)	(0.175)
	Observations	17,265	12,223	14,105	16,001	17,810	19,723
	Individuals	6,896	5,611	6,089	6,564	7,026	7,509

Notes: The regressions in Panel A control for $(Age_{it}–EliAge_{ct})$ and $(Age_{it}–EliAge_{ct})EliST_{it}$; those in Panel B control for $(Age_{it}–EliAge_{ct})$ and $(Age_{it}–EliAge_{ct})RetST_{it}$. The baseline covariates (X_{it}) are years of education, household size, and dummies for marital status, living in a major city, State of residence, and wave. Standard errors clustered at the individual level are in parentheses. *** p<0.01; ** p<0.05; * p<0.10.