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The unintended consequences of a pension age increase. Evidence from Ireland.

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Abstract: We examine the labour market, welfare receipt and health effects of a reform to the Irish State Pension system which increased the age at which some workers could claim a State Pension. We use longitudinal data on ageing in Ireland and a causal identification strategy based on the random date of birth threshold around which workers with adequate contributions are differently affected by the reform. We find that the reform does not increase the employment probability of those affected. However, we find an increased probability of disability payment receipt for those affected by the reform (+12-13 pp). This effect is robust to extensive sensitivity analysis, multiple hypothesis testing and alternative identification methods. We also find an increase in the probability receiving unemployment benefit. We find little evidence of worsening mental health outcomes and no effect on subjective or objective physical health outcomes for those affected by the reform.

Keywords: pension age, labour supply, welfare, health

JEL Codes: I10, J14, J18, J26

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1 Introduction

Most OECD countries have increased or are due to increase the legal retirement or pension age in order to bridge the fiscal gap brought about by population ageing (OECD, 2023). The state pension age in Ireland is 66. Prior to 2014, workers with adequate social insurance contributions could claim a pension, named the State Pension (Transition), if they fully retired at age 65. In March 2010, it was announced that from January 2014, the State Pension (Transition) would be abolished, effectively increasing the pension age from 65 to 66 for individuals who had made enough social contributions to qualify for it. This paper examines the causal effects of this effective increase in the state pension age, the only such reform in Irish history, on those who were affected.

Ireland has a high reliance on the State Pension, and the abolishment of the State Pension (Transition) if the only reform that increased the effective pension age for some workers. At the time of the reform announcement, only 40% of workers had some form of private pension coverage (OECD, 2014). The international literature shows that postponing eligibility to a state pension can have consequences for employment, substitution into alternative welfare benefits and health outcomes. This effect is likely to be amplified in a setting where relatively few workers can expect another source of pension income.

Previous literature mostly finds that increasing the age at which workers can retire with a state pension leads to positive employment effects. There is also evidence that workers transition to alternative welfare payments to "wait" for pension eligibility and that a change in pension eligibility can affect health outcomes. However, the evidence on these latter two channels is more mixed. As noted by Barschkett et al. (2022), the empirical method, data source, pension systems and more can lead to different estimates that are not directly comparable across studies or countries. We contribute to the literature by examining the causal effects of a one-off pension age increase on all three sets of outcomes - employment, welfare receipt and objective and subjective health - using one data source.

We use a quasi-experimental design to identify the causal effect of the abolition of the

State Pension (Transition) in Ireland based on variation in outcomes for those born around the random threshold of January 1st, 1949, the date of birth of individuals who would first be affected by the reform. Comparing individuals with the same number of social insurance contributions born on either side of the date of birth threshold allows us to estimate the causal effect of the reform, assuming that individuals on either side of the cut-off are otherwise similar. We use The Irish Longitudinal Study on Ageing (TILDA), a nationally representative longitudinal study on ageing in Ireland, which contains rich information on working history, family characteristics and objective and subjective health outcomes. We follow the same individuals every two years from 2010, when the reform was announced, until 2016 (two years after the reform).

First, we estimate the number of social contributions individuals in our sample have made over their working life, allowing us to identify individuals who would have been eligible for the State Pension (Transition) at age 65. Second, we estimate the effect the abolition of the State Pension (Transition) on the probability of employment, unemployment, disability and health of this group in the three years after the reform using an event study design. We provide extensive sensitivity analysis of our main specification, test for multiple hypotheses and perform a placebo test. We also supplement this evidence with an analysis based on a Regression Discontinuity Design but acknowledge that the sample size is smaller than ideal for this type of exercise.

We find no statistically significant effect of the pension age increase on the employment or hours worked of those affected in the year of the reform. However, we find substantial substitution into alternative welfare payments: in the year of the reform, disability payment receipt among affected individuals increased by 12-13 percentage points. This effect is statistically significant and robust to all of our empirical specifications and robustness analyses. In addition, we find that affected individuals report higher receipt of unemployment benefit in the year of the reform, although this effect ranges from 5-13 percentage points, depending on the specification.

We find a small and statistically insignificant effect of the reform on physical health outcomes including self-reported overall health, high cholesterol, osteoporosis, stroke, number of medications taken or GP visits. We do not find any statistically significant effect on the objective health measure, grip strength. There is some indication that depression increased as a consequence of the reform, however the effects are not robust in all our specifications. Therefore, we are unable to definitively explain the increase in disability status with worsening health outcomes.

The rest of the paper is organised as follows: Section 2 discusses related literature, Section 3 describes the state pension and other welfare benefits in Ireland, and the 2014 reform. Section 4 describes the data, key variables and tests balancing of the sample. Section 5 outlines the empirical strategies in the paper. Section 6 shows main results, robustness and sensitivity analyses. Section 7 concludes.

2 Related literature

Two papers have previously investigated the effect of the abolishment of the State Pension (Transition) on labour market behaviour in Ireland. Barrett and Mosca (2013) examine the announcement of the reform in 2010. They find no effect of the announcement on the expected age of retirement of those who would be affected by the reform. Redmond et al. (2017) find no changes in retirement, employment or unemployment rates in the year of the reform. They suggest that this might be partly due to employee contracts which often state a fixed retirement age. They recommend, however, that detailed data on social security contributions, which is lacking from the Labour Force Survey used in their analysis, would be useful to confirm and further explore this result.

The international literature can be broadly split into strands which examine the effect of pension reforms on employment; welfare substitution and health. Pilipiec et al. (2021) provide a systematic literature review of this evidence up to 2019. The authors find mostly

positive employment effects of retirement age increases, but few and mixed results on health outcomes. Here, we provide a briefer targeted overview of the literature, concentrating on more recent evidence and evidence for more than one group of outcomes (for example, labour market and health).

The international literature predominantly finds positive employment effects of pension age increases in Germany, the U.K., Australia, Austria, Norway and Estonia (Geyer et al., 2020; Geyer and Welteke, 2021; Cribb et al., 2016, 2022; Atalay and Barrett, 2014a; Staubli and Zweimüller, 2013; Soosar et al., 2021). On the other hand, Morris (2021) examines the same pension reform as Atalay and Barrett (2014a) and finds no impact of increasing retirement age on any labour market outcomes in Australia.

An alternative pathway for labour market exit when the pension age is increased is through an increase in disability or unemployment benefit claims, as found by Cribb et al. (2022); Atalay and Barrett (2014a) and Vestad (2013). Oguzoglu et al. (2020) add extra nuance to the findings of Atalay and Barrett (2014a) for Australia, finding that 90% of the increase in welfare receipt can be attributed to individuals who were already welfare recipients who simply receive their welfare payment for longer.

Concerning health outcomes, Barschkett et al. (2022) find that raising the pension age increases the prevalence of both mood- and stress-related disorders, musculoskeletal diseases, diabetes and obesity in women. Atalay and Barrett (2014b) report an improvement in lifestyle related physical diseases for women, while Mazzonna and Peracchi (2017) report adverse effects on self-reported health and cognition, except for individuals who retire from physically strenuous occupations. The findings of Behncke (2012) indicate that retirement increases the risk of being diagnosed with a chronic condition, and Godard (2016) finds an increased likelihood of obesity following retirement.

The impact of retirement on healthcare consumption (for example, doctor visits, hospital stays, healthcare cost) is also ambiguous. While Zhang et al. (2018) report an increase in healthcare consumption in China, both Hagen (2018) for Sweden and Horner and Cullen

(2016) across Europe find no effect.

3 Institutional background

3.1 State Pensions in Ireland

The State Pension (Contributory) was introduced in Ireland in 1961, with a qualifying age of 70.[1] The State Pension (Transition) was also introduced to allow workers who retired at the age of 65 and who met the qualifying social insurance conditions to receive a pension.[2] The qualifying age for the State Pension (Contributory) was incrementally reduced during the 1970s until it reached 66, making the effective duration of the State Pension (Transition) just one year, after which recipients automatically transitioned to the State Pension (Contributory). In 2010 and 2014, both pensions' maximum rates were €230 per week.[3]

Figure 1 summarises the main eligibility conditions for both types of pension in 2010. Both the State Pension (Contributory) and State Pension (Transition) required the same minimum number of weekly contributions and annual contributions. However, to qualify for the minimum rate, a claimant of the State Pension (Transition) required 24 average annual contributions since 1953 while a claimant of the State Pension (Contributory) required just 10.[4] Additionally, to qualify for the State Pension (Transition) individuals must retire from insurable employment (but are allowed to work part-time if earning less than €38 per week or €3,174 per year if self-employed), which is not the condition for the State Pension (Contributory).

On 3 March 2010, the government announced that it would abolish the State Pension

[1]The old-age pension was introduced in 1908 for those over 70, and it was means-tested until 1961. See Ó Gráda (2000) for historical context.

[2]The requirement to fully retire did not apply for pension claims made at age 66 for either the State Pension (Contributory) or State Pension (Non-Contributory).

[3]A State Pension (Non-contributory) is available at age 66 to individuals without enough social insurance contributions. The age threshold hasn't changed since 2010.

[4]In April 2012, the number of minimum weekly contributions for the State Pension (Contributory) was increased from 260 (5 complete years) to 520 (10 complete years). This may have had employment and other effects on those affected but, in our sample of individuals who would have been eligible for the State Pension (Transition), it applies to just one individual.

(Transition) on 1 January 2014 – effectively increasing the state pension age from 65 to 66 for those with sufficient contributions to claim the State Pension (Transition) (see Table 1).[5]

Table 1: State pension comparison in Ireland – 2014 reform overview

	2010		2014	
	Transition	Contributory	Transition	Contributory
Age payable	65	66	–	66
Age of contributions start	55	56	–	56
Number of contributions for full rate:				
Min weekly contributions	260	260	–	520
Average annual contributions (from 1979)	48	48	–	48
Or, for minimum pension rate:				
Average annual contributions (from 1953)	24	10	–	10

3.2 Other welfare benefits in Ireland: unemployment, disability and illness benefits

There are a number of welfare payments in Ireland that those out of work can claim, subject to meeting certain criteria. The unemployed typically claim Jobseeker's Allowance or Jobseeker's Benefit. The former is a means-tested payment while the latter is a contributory benefit. To qualify for the maximum rate of Jobseeker's Benefit, claimants must have paid 260 social security contributions, similar to the requirement for the State Pension (Transition). The benefit is paid for up to 9 months.

There are two main disability and illness supports for adults in Ireland: Disability Allowance and Illness Benefit.[6] Illness Benefit is a non-means tested, contributory, payments,

[5]Further increases in the pension age, to 67 in 2021 and 68 in 2028, were also announced but later reversed.

[6]There is also an Invalidity Pension but claimants have typically spent two years in receipt of Illness

whereas Disability Allowance is means-tested and non-contributory.

Disability Allowance is a means-tested support for individuals aged 16 to 66, who have an injury, disease, or physical or mental disability that has continued or is expected to continue for at least one year.[7] To be eligible for the payment, apart from passing the means-test, the individual has to be substantially restricted from doing work because of the disability. This has to be confirmed by the General Practitioner (GP), who completes a report on the medical condition and submits it to the Department of Social Protection's medical assessors.[8] Medical assessors determine – based on this report – if the individual is eligible for Disability Allowance.

Illness Benefit is a weekly payment paid in case of sickness or illness that prevents work.[9] To be able to claim Illness Benefit, there should be at least 104 weeks of social insurance contributions paid since first started work and 39 weeks of contributions in the relevant tax year. Applicants should be under 66 (pension age) before they qualify, get medically certified as unfit for work from their GP and apply within 6 weeks from getting ill. If individuals turn 66 while in receipt of Illness benefit, they can defer their State Pension (Contributory) and continue receiving Illness benefit, but without credited contributions.

In 2010, the maximum rate for Jobseeker's Benefit, Illness Benefit and Disability Allowance supports was lower than the rate of the State Pension (Transition) at €196 per week and was decreased to €188 per week in 2014 as a result of austerity measures related to the financial crisis.[10]

Benefit before transferring to Invalidity Pension. This means that it is not a welfare payment which could immediately substitute for the State Pension.

[7]More details on Disability Allowance here: https://www.citizensinformation.ie/en/social-welfare/disability-and-illness/disability-allowance/ (accessed 27/11/2024)

[8]The Department of Social Protection is the government department responsible for paying out both Disability Allowance and Illness Benefit.

[9]More details on Illness Benefit here: https://www.citizensinformation.ie/en/social-welfare/disability-and-illness/illness-benefit/ (accessed 27/11/2024)

[10]In 2010, the Jobseeker's Benefit and Disability Allowance Schemes were the largest, with over 123 and 101 thousand recipients, respectively. There were approximately 80 thousand recipients of the shorter-term, contributory Illness Benefit. See O'Donoghue (2014) for detail of schemes and number of recipients.

4 Data

We use The Irish Longitudinal Study on Ageing (TILDA), a nationally representative longitudinal study on ageing in Ireland. This rich longitudinal data collects the information of individuals over the age of 50 living in private households.[11] The survey collects information on labour market status, work history, family environment and both objective and subjective measures of their health. The first wave of TILDA was collected in 2010 – around the time of the announcement of the pension reform – and every two years since.

Our sample consists of individuals who would be eligible for the State Pension (Transition) at the age of 65, based on the estimated number of social contributions in 2010 (wave 1). We estimate individual social insurance contributions by age 65 using information on the individual's years of work to date, the date when they first started working and time until they turn 65, during which time it is assumed that they continue their current employment status.We drop individuals who would not have enough social contributions to claim at least the minimum rate of State Pension (Transition). Figure C.2 shows the density of social security contributions in years and indicates that most of our sample has well over the 10 years of minimum required contributions for the State Pension (Transition). We exclude the self-employed, who did not have to pay social insurance before 1988 and, among whom, very few individuals qualified for the State Pension (Transition).[12]

Our main sample in wave 1 are individuals born in 1948 and 1949. This gives us a cohort of those who are affected by the pension reform (born in 1949) and a cohort who are not (born 1948). From wave 1 in 2010, we follow the same individuals in the next 3 waves: 2012, 2014 and 2016. We stop the analysis in 2016, as the treatment group are then all eligible for the State Pension (Contributory). We drop individuals who did not participate in all waves. We include those born in 1947 in the control group and those born in 1950 in the treatment group in a robustness check.

[11] i.e. excluding those in institutions such as nursing homes

[12] `https://www.citizensinformationboard.ie/downloads/relate/relate_2012_05.pdf`

Table 2 presents balance tests for the two samples and key outcome variables and covariates in pre-treatment waves.[13] Our sample is balanced in key outcome variables, although some differences stand out. As treatment is based on year of birth, the control group is by definition older than the treatment group. As a consequence, there are more employed people in the treatment group but fewer retired people. The treated are also more likely to contribute to an occupational pension. Table 3 indicates that pre-treatment differences in health outcomes are not statistically significant. We address potential effects on these imbalances in the empirical specification and test the parallel trends assumption required for the validity of our event study design both graphically and formally.

Outcome variables are employment on the extensive (employment status) and intensive margin (usual hours worked), disability status and disability payment receipt, labour market inactivity and unemployment benefit receipt. Health outcomes include overall mental and physical health, arthritis, heart attack, osteoporosis, number of medication and GP visits, anxiety and depression. As found by Spitzer and Weber (2019), depending on background characteristics of respondents, there could be considerable bias in reporting health outcomes. Therefore, we use measured grip strength as an objective indicator of good overall health and predictor of overall and cardiovascular mortality, stroke and early death (Leong et al., 2015; Wu et al., 2017; Vaishya et al., 2024). Further details on how we define and construct each outcome and control variable is in Tables A.0.1 - A.0.3, in Appendix A.

5 Empirical framework

5.1 Identification strategy

In (and after) 2014, those born on or after 1 January 1949 were no longer eligible to retire at the age of 65 with a State Pension, for the same number of social insurance contributions. The arbitrary date of birth threshold of 1st January 1949, around which employees are differently

[13] Descriptive statistics of the full sample in 4 waves is presented in Tables A.0.4 and A.0.5, Appendix A.

Table 2: Balance test general variables, pre-treatment waves 1-2

	Treat 1949-1950	Control 1947-1948	Difference	Treat 1949	Control 1948	Difference
Age	60.99	63.05	2.06	61.54	62.52	0.98
	(1.28)	(1.25)	(0.00)	(1.16)	(1.13)	(0.00)
Male	0.37	0.44	0.06	0.39	0.43	0.04
	(0.48)	(0.50)	(0.01)	(0.49)	(0.50)	(0.20)
Married	0.73	0.79	0.07	0.73	0.79	0.06
	(0.45)	(0.41)	(0.00)	(0.45)	(0.41)	(0.04)
Primary ed	0.26	0.27	0.00	0.27	0.28	0.01
	(0.44)	(0.44)	(0.85)	(0.44)	(0.45)	(0.68)
Secondary ed	0.42	0.41	-0.01	0.40	0.38	-0.02
	(0.49)	(0.49)	(0.68)	(0.49)	(0.49)	(0.53)
Tertiary ed	0.32	0.33	0.01	0.33	0.34	0.01
	(0.47)	(0.47)	(0.81)	(0.47)	(0.47)	(0.79)
Employed	0.42	0.26	-0.16	0.41	0.29	-0.12
	(0.49)	(0.44)	(0.00)	(0.49)	(0.45)	(0.00)
Unemployed	0.07	0.07	0.00	0.06	0.09	0.03
	(0.26)	(0.26)	(0.71)	(0.24)	(0.29)	(0.10)
Inactive	0.15	0.17	0.02	0.15	0.16	0.01
	(0.36)	(0.37)	(0.33)	(0.36)	(0.37)	(0.60)
Disabled	0.32	0.37	0.05	0.34	0.36	0.02
	(0.47)	(0.48)	(0.03)	(0.47)	(0.48)	(0.61)
Retired	0.26	0.41	0.14	0.29	0.38	0.09
	(0.44)	(0.49)	(0.00)	(0.45)	(0.49)	(0.01)
Usual hours worked	13.70	8.45	-5.25	13.35	9.13	-4.23
	(17.98)	(14.87)	(0.00)	(17.79)	(15.64)	(0.00)
Occupational pension	0.21	0.13	-0.08	0.22	0.15	-0.07
	(0.41)	(0.34)	(0.00)	(0.41)	(0.36)	(0.01)
Private pension	0.04	0.03	-0.01	0.05	0.02	-0.03
	(0.21)	(0.18)	(0.24)	(0.22)	(0.15)	(0.04)
Disability payment	0.13	0.13	-0.00	0.14	0.12	-0.02
	(0.33)	(0.33)	(0.85)	(0.35)	(0.33)	(0.42)
Unemployment payment	0.09	0.08	-0.00	0.07	0.11	0.04
	(0.28)	(0.28)	(0.72)	(0.26)	(0.31)	(0.05)
Homeowner	0.62	0.61	-0.00	0.60	0.62	0.02
	(0.49)	(0.49)	(0.84)	(0.49)	(0.49)	(0.53)
Mortgage	0.11	0.06	-0.06	0.12	0.05	-0.07
	(0.32)	(0.24)	(0.00)	(0.33)	(0.22)	(0.00)
Assets	0.38	0.38	-0.00	0.36	0.36	-0.00
	(0.49)	(0.48)	(0.92)	(0.48)	(0.48)	(0.90)
Second property	0.11	0.10	-0.01	0.12	0.08	-0.03
	(0.31)	(0.30)	(0.61)	(0.32)	(0.27)	(0.09)
N	857	870	1727	433	410	843

Notes: Table shows average values for variables by treatment status, pooled waves 1 and 2 In brackets we report standard deviation of the means and p-value of the difference between treatment and control groups. Values are in % except for age and hours worked. Further details on how we construct variables and the survey is in Table A.0.1 and A.0.2.

Table 3: Balance test health variables, pre-treatment waves 1-2

	Treat 1949-1950	Control 1947-1948	Difference	Treat 1949	Control 1948	Difference
Exercise	0.91	0.90	-0.01	0.90	0.90	-0.00
	(0.29)	(0.30)	(0.42)	(0.30)	(0.30)	(0.88)
Trouble sleeping	0.60	0.56	-0.04	0.61	0.59	-0.02
	(0.49)	(0.50)	(0.14)	(0.49)	(0.49)	(0.52)
Assisting family	0.07	0.07	-0.00	0.06	0.07	0.00
	(0.26)	(0.26)	(0.86)	(0.24)	(0.25)	(0.84)
Good physical health	0.80	0.81	0.01	0.81	0.83	0.03
	(0.40)	(0.40)	(0.65)	(0.39)	(0.37)	(0.33)
Good mental health	0.89	0.89	0.00	0.89	0.90	0.01
	(0.31)	(0.31)	(0.79)	(0.31)	(0.29)	(0.52)
No. of medication	2.38	2.83	0.45	2.51	2.65	0.15
	(2.55)	(2.67)	(0.00)	(2.58)	(2.44)	(0.40)
Depression	0.25	0.21	-0.03	0.21	0.23	0.02
	(0.43)	(0.41)	(0.14)	(0.41)	(0.42)	(0.50)
Smoker	0.12	0.09	-0.03	0.11	0.10	-0.01
	(0.32)	(0.28)	(0.05)	(0.31)	(0.30)	(0.77)
Anxiety	0.14	0.12	-0.02	0.14	0.12	-0.02
	(0.35)	(0.32)	(0.23)	(0.34)	(0.32)	(0.40)
Hypertension	0.34	0.38	0.04	0.33	0.36	0.04
	(0.47)	(0.49)	(0.07)	(0.47)	(0.48)	(0.25)
Heart attack	0.02	0.03	0.01	0.04	0.03	-0.01
	(0.15)	(0.18)	(0.17)	(0.19)	(0.17)	(0.53)
Diabetes	0.05	0.08	0.03	0.07	0.07	-0.00
	(0.22)	(0.27)	(0.03)	(0.26)	(0.25)	(0.85)
Stroke	0.01	0.01	-0.00	0.01	0.00	-0.01
	(0.11)	(0.09)	(0.45)	(0.12)	(0.00)	(0.02)
High cholesterol	0.38	0.40	0.02	0.39	0.39	-0.00
	(0.49)	(0.49)	(0.46)	(0.49)	(0.49)	(0.89)
Arthritis	0.29	0.31	0.02	0.30	0.34	0.04
	(0.45)	(0.46)	(0.32)	(0.46)	(0.47)	(0.26)
Osteoporosis	0.12	0.15	0.02	0.12	0.14	0.02
	(0.33)	(0.36)	(0.16)	(0.32)	(0.35)	(0.31)
GP visits	3.58	3.67	0.09	3.73	3.39	-0.34
	(4.04)	(5.95)	(0.70)	(4.12)	(4.64)	(0.26)
Hospital visits	1.28	2.01	0.73	1.39	1.59	0.20
	(3.16)	(9.28)	(0.03)	(3.17)	(4.21)	(0.43)
Good grip - dominant	0.92	0.92	-0.01	0.92	0.94	0.02
	(0.27)	(0.28)	(0.60)	(0.28)	(0.24)	(0.27)
Good grip - non-dominant	0.99	0.99	-0.00	0.99	1.00	0.01
	(0.11)	(0.12)	(0.55)	(0.12)	(0.07)	(0.18)
N	857	870	1727	433	410	843

Notes: Table shows average values for variables by treatment status, pooled waves 1 and 2. In brackets we report standard deviation of the means and p-value of the difference between treatment and control groups. Values are in % except for number of medication, GP and hospital visits. Further details on how we construct variables and the survey is in Table A.0.3.

affected by the abolition of the State Pension (Transition), allows us to causally estimate its impact.

The main identifying assumption underlying our analysis is that changes in outcomes (labour market status, health and disability) are exogenous to being born just before or just after January 1st 1949. We first estimate the effect of the 2014 reform, using an event study approach. Available data waves before the reform are 2010 and 2012, and after the reform are 2014 and 2016. We expect the main effect of the reform to affect the economic status in 2014, as the treatment groups are all eligible for the State Pension (Contributory) at this point; but potentially more permanent health effects in 2016.

In our main specification we compare individuals born in 1949 (treated) with those born in 1948 (control).[14]

To test the robustness of our main specification, we provide extensive sensitivity analysis including varying controls and individual fixed effects (Appendix B.2), a test for multiple hypotheses using Romano-Wolf correction developed by Clarke et al. (2020) (Appendix B.3) and a placebo test (Section 6.2.3).

We further supplement the main specification in two ways. First, to increase the sample size, we expand the sample around the date of birth threshold and compare those born in 1949 and 1950 (treated) with those born in 1947 and 1948 (control) over time, using the same event study approach. Second, we use a Regression Discontinuity Design (RDD) only for the sample observed in 2014. The running variable is month of birth and we limit the sample to those born close to the date of birth threshold.

The pension reform was announced in March 2010, the year when the first wave of data was collected and four years before its implementation. This means that, for the majority of the sample observed in 2010, news of the pension age reform was already public.[15] Although

[14]We circumvent a potential Age-Period-Cohort issue (de Ree and Alessie, 2011), by estimating pension age effects over time, rather than including individuals' age as a time variable, as done by Serrano-Alarcón et al. (2023).

[15]In our sample there are 100 individuals interviewed before the announcement in March 2010. This is 18% of our sample in wave 1 and this proportion is similar in both the treatment and control groups

Barrett and Mosca (2013) find no statistically significant announcement effect, if a fast reaction to the reform occurred after the announcement in 2010, then the effect we estimate in 2014 is a lower bound of the true effect.

5.2 Event study

We estimate an event study model as follows:

$$Y_{it} = \alpha_0 + \sum_{t \neq 2010} \beta_t \cdot Year_t \cdot Treat_{it} + \mu_1 \cdot Treat_{it} + \mu_2 \cdot Year_t + \alpha_i + \epsilon_{it} \tag{1}$$

Y_{it} are outcome variables (economic status, hours worked, unemployment payment, disability payment receipt, health outcomes) in year $t = 2010, 2012, 2014, 2016$ of individual i. $Treat_{it} = 1$ if the individual is born on or after January 1st 1949 and 0 otherwise. α_i are individual fixed effects, controlling for time-invariant unobservable heterogeneity. ϵ_{it} is the error term. Standard errors are clustered on the individual level.

The effect of the pension age reform is measured by the coefficients β_t. We interpret those coefficients compared to the time of the announcement of the reform– 2010. This means that β_{2012} measures the anticipation effect of the reform. β_{2014} and β_{2016} measure the effect of the reform on the outcomes of those affected. We expect to observe the effects on economic status in 2014 only, as the treatment groups are eligible for the State Pension (Contributory) by 2016. However, health effects may be observed beyond 2014. Estimates of β_t are likely to be unbiased if the outcome variables of the treatment and control group show parallel trends before 2014, which we verify in the next section.

Further sensitivity analysis includes: (i) a specification without individual fixed effects; (ii) controlling for individual characteristics: gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property and cohort fixed effects: year and month of birth dummies; (iii) and contributing to occupational and private pension plans.

5.3 Regression discontinuity design

We next use a Regression Discontinuity Design (RDD) to examine discontinuities in outcomes, around the random date of birth threshold of January 1st 1949, in the year of the reform. The identifying assumption is that individuals born just before and just after the threshold have otherwise similar characteristics in terms of labour market status and health outcomes. Any discontinuity can then be attributed to the reform. Figure C.1 shows no obvious discontinuity in the sample frequency around the date of birth threshold, suggesting that there is no manipulation occurring.

We estimate the following equation using data from wave 3, collected in 2014:

$$Y_{ia} = \alpha + \beta D_i + \gamma_0(1 - D_i)f(z_i - c) + \gamma_1 D_i f(z_i - c) + \epsilon_{ia} \tag{2}$$

Y_{ia} are outcome variables (economic status, hours worked, unemployment payment, disability status and payment receipt, health outcomes) for each individual i, and age in months a. We center age in months around January 1949, so that it ranges from -12 to 12 in the baseline specification. $D_i = 1$ if the individual was born on or after January 1949. Our baseline specification is a linear trend in the running variable: $f(z_i - c)$, where the cutoff c is January 1949 and z_i is month of birth. ϵ_{it} is the error term.

6 Results

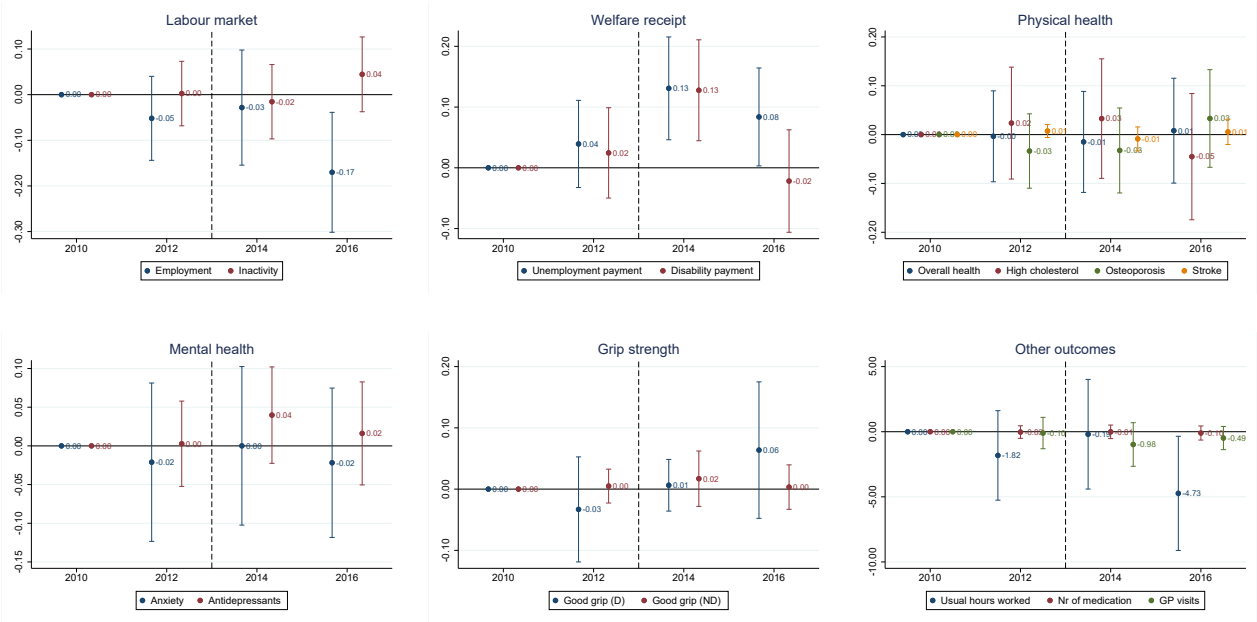
6.1 Event study

We first test that outcomes for the treatment and control group evolve similarly before 2014. We calculate average outcomes for each group over time. Figure B.1, in Appendix B.1 shows the pre-reform trends for labour market status and Figure B.2 shows the pre-reform trends for health outcomes. We find that most of our outcome variables display parallel trends for the treatment and control groups between 2010 and 2012. We find evidence of diverging trends

for self-reported disability status, heart attack, hospital visits, good mental health, depression and hypertension, although these differences are not statistically significant in pre-treatment waves. However, we concentrate the event study specification analysis from equation (1) on outcomes for which trends evolve similarly for both treated and control groups.

Figure 1 shows estimates of coefficients β_t from equation (1) from our main specification with individual fixed effects.

Figure 1: The effect of pension reform, individuals born 1948-1949



Notes: Sample consists of individuals estimated to be eligible for the State Pension (Transition) before 2014. Treated are born 1949, control in 1948. Outcome variables are defined in Appendix A. Coefficients shown are β_t from equation 1, with 95% confidence intervals and controlling for individual fixed effects. Standard errors in brackets, clustered on the individual level. Further sensitivity checks are shown in Appendix B.2

We find that the abolition of the State Pension (Transition) had no measurable impact on the employment or hours worked of those affected in 2014. We find a large negative effect on employment and hours of work in 2016, when the treated group became eligible for the State Pension (Contributory). Figure B.1, in Appendix B.1 shows that this corresponds to an alignment of the employment rates of the treated and control groups in 2016, when all are eligible for the State pension (Contributory). We find no effect of the reform on the

probability of labour market inactivity. Tables B.2.1, B.2.2 and B.2.3 in Appendix B.2 show that these results are robust to sensitivity analysis.

Looking next at welfare receipt, we find an increase in the probability of unemployment benefit receipt among the treated group of 13 percentage points in 2014. Similarly, we find that the pension age reform increases the receipt of disability payments by 13 percentage points in 2014 for the treated. Tables B.2.4 and B.2.5 in Appendix B.2 show that the effects are robust to our sensitivity analysis.

To explore the mechanisms behind the increase in disability payments, we next investigate physical and mental health outcomes. We find no statistically significant effect of the reform on overall health, number of medications, antidepressants, anxiety, cholesterol, GP visits, stroke or incidence of osteoporosis. We also find no effects of the pension age increase on objective health measures – grip strength of dominant or non-dominant hands. Most of the point estimates are small (0-3 percentage points) and all are non-significant, although some effects have narrower confidence intervals (incidence of stroke, grip strength, number of medication and GP visits) than others. Sensitivity analysis is in Tables B.2.6 - B.2.15 in Appendix B.2 confirm these findings.

6.2 Robustness analysis

We check if the main results from Section 6.1 are robust to expanding the sample of treated and control individuals to those born two years before and after the age threshold for treatment.

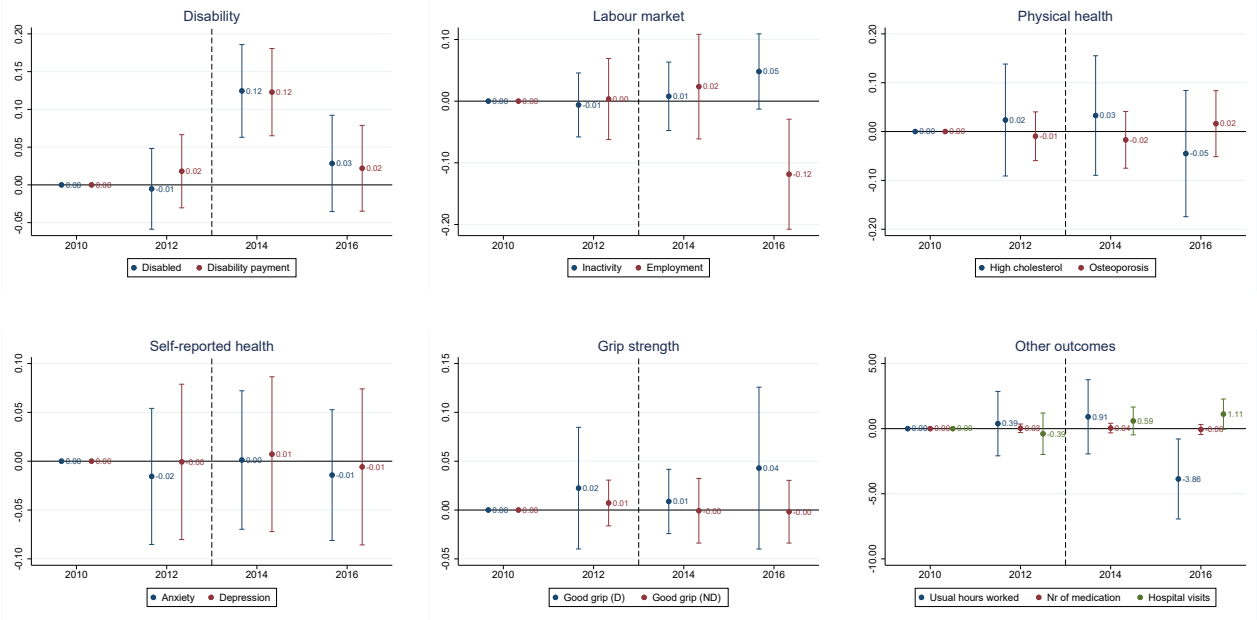
6.2.1 Event study: sample born 1947-1950

In this section, we estimate equation (1) on a bigger sample, born in 1947 and 1948 (control) and in 1949 and 1950 (treated). This roughly doubles our sample and therefore increases the power of our estimation.

The results are shown in Figure 2, where we show our main labour market, disability and

health outcomes, for which outcomes over time evolve similarly prior to 2014 (see B.4).[16] The specification controls for individual fixed effects, which is the specification with the highest adjusted R^2.

Figure 2: The effect of pension reform in 2014, individuals born 1947-1950



Notes: Sample consists of individuals estimated to be eligible for the State Pension (Transition) before 2014. Treated are born 1949 and 1950, control in 1947 and 1948. Outcome variables are defined in Appendix A. Coefficients shown are β_t from equation 1, with 95% confidence intervals and controlling for individual fixed effects. Standard errors in brackets, clustered on the individual level. Figure B.3 and B.4 in Appendix B.4 show parallel trends for this sample.

We confirm that there is no statistically significant effect of the reform on the employment or hours of work of those affected in 2014. We also find that the reform increased the probability of reporting a disabled status by 12 percentage points in 2014 and confirm that increase in disability benefit payment receipt is robust to our main specification, increasing by 12 percentage points in 2014.

We also find no statistically significant effect of the reform on health outcomes: anxiety, depression, cholesterol, osteoporosis, number of medication, hospital visits and grip strength.

[16] Using this larger sample, we find that the parallel trends assumption now holds for self-reported disability but doesn't hold for unemployment benefit receipt.

6.2.2 Regression discontinuity design

We next use an RD design and estimate equation (2) on the sample of individuals born in 1948 (control) and 1949 (treated) in wave 3 (2014), which greatly reduces the sample size. Figure 3 and Table C.0.1 in Appendix C show the results from a non-parametric estimation using a 12-month bandwidth. We show the linear specification for selected outcome variables, without controls.

Despite the relatively small sample size used for these estimates, we confirm that the pension reform increased the incidence of disability payment receipt among those affected by 12-13 percentage points in 2014. We do not find statistically significant effects on employment, self-reported disability or unemployment benefit receipt. Although the direction of these results is comparable to those reported in Section 6.1, the magnitude is smaller.

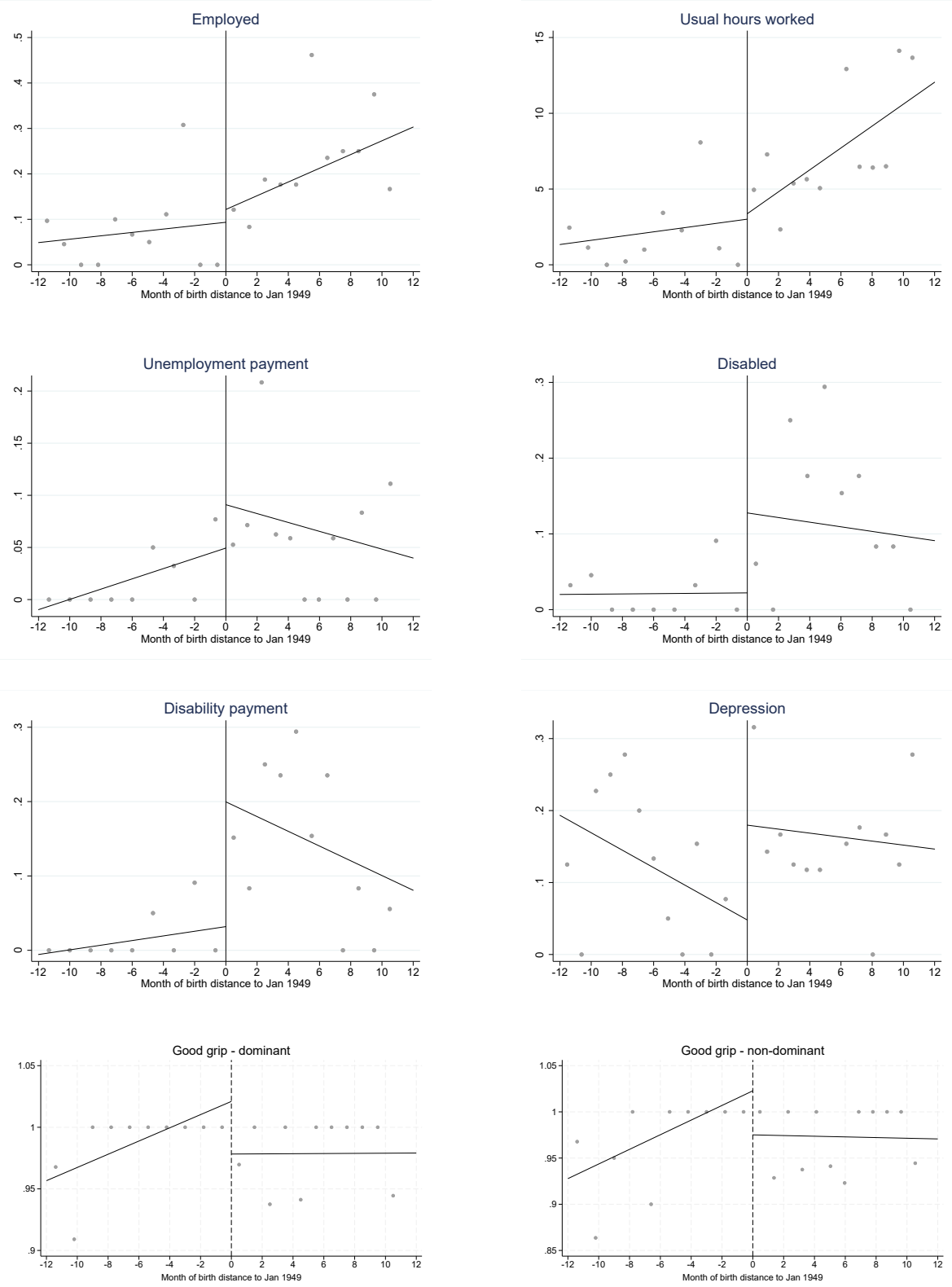
We find an increase in self-reported depression, by 20 percentage points, in 2014. This effect is robust to all 4 specifications of the RDD. Additionally, we find a decrease in grip strength by 3-4.5 percentage points, although this result is statistically significant only for the measurement of the non-dominant hand without controlling for background characteristics. We do not find this effect in other specifications.

6.2.3 Placebo analysis

As a final robustness check, we perform a placebo test of our event study specification to check for a false effect. We estimate equation 1 for two outcome variables that are unlikely to be affected by the pension reform – the probability of having tertiary education and the probability of living in Dublin. Both variables are likely to be determined much earlier in life, and not at the age of 65 as a result of the reform.

Table B.5.1 shows the placebo test for both samples. We find no effect of the reform on the probability of living in Dublin or obtaining tertiary education. Unlike our main specification, the R^2 is negative, indicating that the model used for the placebo test is wrongly specified. This indicates that our main findings are most likely the true effects of the pension age

Figure 3: Regression discontinuity, 2014



Notes: Sample consists of individuals estimated to be eligible for the State Pension (Transition) in 2014. Figures show regression discontinuity without controls, with linear smoothing function. Coefficients for this and specifications with controls are shown in Table C.0.1 in Appendix C.

increase, rather than time-varying unobservables.

7 Conclusion

In this paper we examine the effect of a State Pension reform in Ireland which effectively increased the age at which a certain cohort of workers could retire with a State Pension by one year. We investigate the effect of the reform on labour market, disability and health outcomes. In line with previous research examining this reform, we find no robust effect of the reform on the employment probability and hours of work of affected sixty-five years olds. However, we find a large and statistically significant substitution into alternative welfare programs. Disability payment receipt increased among those affected by 12-13 percentage points in the year of the reform and unemployment payment receipt increased by 5-13 percentage points. These effects are statistically significant and robust to a number of empirical specifications and robustness analyses.

We find no effect of the reform on various physical health outcomes: overall health, arthritis, heart attack, osteoporosis, or number of medication taken. There is some indication that the reform deteriorated the mental health of those affected, although the effects are not robust in all our specifications. Therefore, we are unable to explain the increase in disability payment receipt with available health outcomes.

To estimate the causal effect of the abolition of the State Pension (Transition), we have taken a short-term perspective and estimated only its impact in the years immediately following its abolition. It is possible that, as retirement norms and expectations adjusted after 2014, the reform resulted in fewer transitions to welfare and higher employment among 65 year olds. A very recent amendment to employment rights, which allows but does not compel workers to remain in employment until age 66, despite a potentially lower contractual retirement age, may help this evolution of norms.[17] However, the introduction of a Benefit Payment for 65 Year Olds in 2021, could also reinforce the expectation of "effective" retire-

[17] https://www.oireachtas.ie/en/bills/bill/2025/10/

ment at 65.[18] A longer-run effect is, however, not possible to estimate in a causal setting with these data. Future work using administrative data to examine unemployment and disability claims of those near retirement age could shed light on this.

One of the stated aims of the abolition of the State Pension (Transition) was to improve the sustainability of the pension system for future generations. We find that, in the short term at least, some of the exchequer savings which resulted from this reform are likely to have been paid out through additional disability and unemployment claims. Policymakers considering reforms to the pension age aimed and increasing the labour force participation of older workers should consider the possibility of these adverse effects in designing such reforms.

[18]This payment is available to people aged 65 who have ceased employment or self-employment and who satisfy the pay-related social insurance (PRSI) contribution conditions. It is paid at the same rate as Jobseeker's Benefit.

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A Information on variables and descriptive statistics

Table A.0.1: Variables definition: economic status and labour market

	Definition	Survey question
Age	Age in years	Calculated from month/year of birth and date of interview.
Married	= 1 if the respondent is married, =0 if not	Question on relationship status. = 1 if the answer was "married" and "living with a partner as if married"
Education	Primary, Secondary, Tertiary dummies	Primary: "Some primary", "Primary or equivalent"; Secondary: "Intermediate/junior/group certificate or equivalent", "Leaving certificate or equivalent" or "Diploma certificate"; Tertiary: "Primary degree" or "Postgraduate/higher degree"
Employed	= 1 if currently employed, = 0 otherwise	Question on current economic status. = 1 if the answer was "Employed" or "Self-employed".
Unemployed	= 1 if currently unemployed, = 0 otherwise	Question on current economic status. = 1 if the answer was "Unemployed".
Inactive	= 1 if currently inactive in the labour market, = 0 otherwise	Question on current economic status. = 1 if the answer was "Looking after home or family", "In education or training" or "Other".
Disabled	= 1 if currently inactive in the labour market due to disability, = 0 otherwise	Question on current economic status. = 1 if the answer was "Permanently sick or disabled" and if a response to question reason for not currently working is "Because of health problems".
Retired	= 1 if currently retired from the labour market, = 0 otherwise	Question on current economic status. = 1 if the answer was "Retired".
Usual hrs. worked	Number of hours worked in a usual week in primary employment	Question on usual hours worked in a week. Primary employment refers to the job with he highest salary, or where respondents work the largest number of hours.
Occupational pension	= 1 if currently contributing to a form of occupational pension, = 0 otherwise	Question on type of currently contributing to an occupational pension. = 1 if the answer was "Defined contribution scheme" or "Defined benefit scheme".
Private pension	= 1 if currently in contributing to a private pension, = 0 otherwise	Question do you currently contribute to one or more private pension plans = 1 if "Yes".
Disability payment	= 1 if a disability payment was received in the last 12 months.	Question on sources of income from social welfare. = 1 if the answer was "Illness Benefit" or "Disability Allowance".

Table A.0.2: Variables definition: assets

	Definition	Survey question
Homeowner	= 1 if the place of residence is owned by the respondent, = 0 otherwise	Question on ownership of residence. = 1 if the answer was "Owned by the respondent or his/her spouse/partner".
Mortgage	= 1 if the place of residence is owned with a mortgage, = 0 otherwise	Question on ownership type of residence. = 1 if the answer was "Owned with a mortgage".
Assets	= 1 if the respondent or/and their spouse/partner own any financial assets.	Coded from two questions. First question is on deposit and savings account, where = 1 if > €1,000. Second question is on other assets, such as bonds or shares. = 1 if > €0.
Second property	= 1 if the respondent or/and their spouse/partner own a second property	Coded from a question on ownership of other houses, flats or holiday homes. = 1 if the answer is "Yes".

Table A.0.3: Variables definition: health outcomes

	Definition	Survey question
Exercise	=1 getting regular exercise, 0 otherwise	Questions how many days have you vigorously, moderately exercised or walked in the last week. = 1 if >2.
Smoker	=1 if smoking, 0 otherwise	Question have you smoked daily in the last year. =1 if "Yes"
Trouble sleeping	=1 if having trouble sleeping, 0 otherwise	Questions how often do you have trouble falling asleep or waking up and falling asleep again. =1 if "Most of the time" or "Sometimes"
Assisting family	=1 if assists family, 0 otherwise	Questions on have you (financially or with basic personal activities) assisted family over the last 2 years. =1 if "Yes".
Overall physical health	=1 if good, 0 otherwise	Question on self-reported overall health. =1 if "Excellent", "Very good" or "Good".
Overall mental health	=1 if good, 0 otherwise	Question on self-reported overall mental health. =1 if "Excellent", "Very good" or "Good".
No. of medication	Number of medication	Number of reported medications daily.
Depression	=1 if depressive symptoms, 0 otherwise	If "Moderate" or "Severe".
Anxiety	=1 if HADS-A scale > 11, 0 otherwise	Based on a 14-item tool used to screen for anxiety (HADS-A)
Hypertension	=1 if high blood pressure	Self-reported high blood pressure.
Heart attack	=1 if had a heart attack	Have you ever had a heart attack.
Diabetes	=1 if has diabetes	Self-reported diabetes;. =1 if "Yes".
Stroke	=1 if had a stroke	Have you ever had a stroke. =1 if "Yes".
High cholesterol	=1 if high cholesterol	Self-reported high cholesterol.
Arthritis	=1 if has arthritis	Self-reported arthritis.
Osteoporosis	=1 if has osteoporosis	=1 if diagnosed osteoporosis.
GP visits	Number of GP visits in the last 12 months	
Hospital visits	Number of outpatient hospital visits in the last 12 months	
Grip strength (D/ND)	=1 if good grip strength by age and gender, 0 otherwise	Measured grip strength of dominant and non-dominant hand, average of two measurements per hand

Table A.0.4: Balance test general variables, waves 1-4

	Treat 1949-1950	Control 1947-1948	Difference	Treat 1949	Control 1948	Difference
Age	63.00	65.12	2.12	63.54	64.60	1.06
	(2.57)	(2.55)	(0.00)	(2.50)	(2.49)	(0.00)
Male	0.37	0.43	0.06	0.38	0.42	0.04
	(0.48)	(0.50)	(0.00)	(0.48)	(0.49)	(0.09)
Married	0.72	0.78	0.06	0.71	0.76	0.05
	(0.45)	(0.42)	(0.00)	(0.45)	(0.42)	(0.02)
Primary ed	0.25	0.26	0.00	0.26	0.29	0.02
	(0.44)	(0.44)	(0.88)	(0.44)	(0.45)	(0.32)
Secondary ed	0.41	0.41	0.00	0.40	0.38	-0.02
	(0.49)	(0.49)	(0.87)	(0.49)	(0.49)	(0.33)
Tertiary ed	0.33	0.33	0.00	0.33	0.34	0.00
	(0.47)	(0.47)	(0.97)	(0.47)	(0.47)	(0.94)
Employed	0.32	0.17	-0.14	0.29	0.19	-0.10
	(0.47)	(0.38)	(0.00)	(0.45)	(0.39)	(0.00)
Unemployed	0.05	0.04	0.00	0.04	0.05	0.01
	(0.21)	(0.20)	(0.54)	(0.19)	(0.22)	(0.24)
Inactive	0.14	0.15	0.01	0.13	0.15	0.02
	(0.35)	(0.35)	(0.49)	(0.34)	(0.36)	(0.35)
Disabled	0.32	0.34	0.02	0.35	0.32	-0.02
	(0.47)	(0.47)	(0.23)	(0.48)	(0.47)	(0.34)
Retired	0.41	0.58	0.17	0.45	0.56	0.11
	(0.49)	(0.49)	(0.00)	(0.50)	(0.50)	(0.00)
Usual hrs worked	10.37	5.59	-4.78	9.74	5.84	-3.90
	(16.41)	(12.48)	(0.00)	(16.16)	(12.82)	(0.00)
Occupational pen	0.15	0.08	-0.07	0.13	0.09	-0.05
	(0.35)	(0.27)	(0.00)	(0.34)	(0.28)	(0.00)
Private pen	0.03	0.02	-0.01	0.03	0.01	-0.02
	(0.17)	(0.14)	(0.09)	(0.17)	(0.11)	(0.03)
Unempl payment	0.07	0.05	-0.02	0.06	0.06	0.00
	(0.26)	(0.21)	(0.00)	(0.23)	(0.24)	(0.69)
Disability payment	0.11	0.07	-0.04	0.11	0.07	-0.05
	(0.31)	(0.26)	(0.00)	(0.32)	(0.25)	(0.00)
Homeowner	0.62	0.63	0.01	0.61	0.63	0.03
	(0.48)	(0.48)	(0.59)	(0.49)	(0.48)	(0.30)
Mortgage	0.09	0.05	-0.04	0.10	0.04	-0.06
	(0.28)	(0.22)	(0.00)	(0.29)	(0.20)	(0.00)
Assets	0.38	0.40	0.02	0.39	0.37	-0.01
	(0.49)	(0.49)	(0.36)	(0.49)	(0.48)	(0.60)
Second property	0.10	0.10	0.01	0.10	0.08	-0.02
	(0.30)	(0.30)	(0.57)	(0.30)	(0.27)	(0.16)
N	1558	1630	3188	786	773	1559

Notes: Table shows average values for variables by treatment status, pooled waves 1-4. In brackets we report standard deviation of the means and p-value of the difference between treatment and control groups. Values are in % except for age and hours worked. Further details on how we construct variables and the survey is in Table A.0.1 and A.0.2.

Table A.0.5: Balance test health variables, waves 1-4

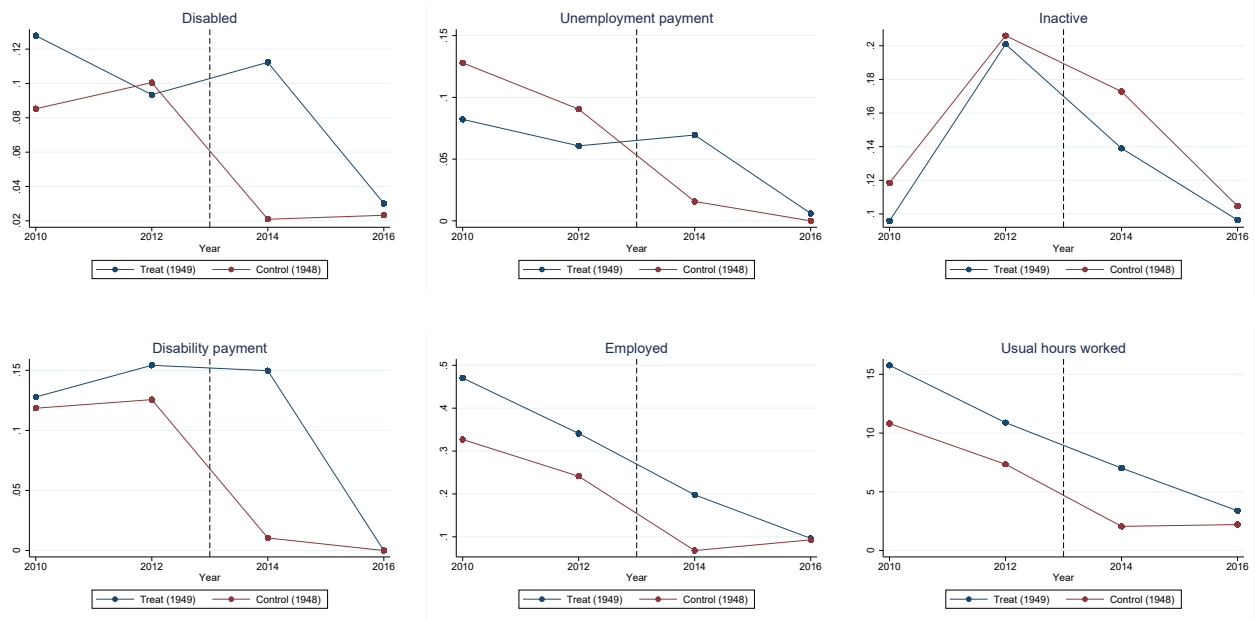
	Treat 1949-1950	Control 1947-1948	Difference	Treat 1949	Control 1948	Difference
Exercise	0.89	0.88	-0.01	0.89	0.89	-0.00
	(0.31)	(0.32)	(0.22)	(0.32)	(0.32)	(0.97)
Trouble sleeping	0.60	0.56	-0.04	0.62	0.60	-0.03
	(0.49)	(0.50)	(0.02)	(0.48)	(0.49)	(0.27)
Assisting family	0.06	0.05	-0.01	0.05	0.05	-0.00
	(0.23)	(0.22)	(0.44)	(0.22)	(0.21)	(0.69)
Good physical health	0.81	0.82	0.02	0.80	0.84	0.04
	(0.40)	(0.38)	(0.20)	(0.40)	(0.36)	(0.05)
Good mental health	0.89	0.90	0.02	0.88	0.92	0.03
	(0.32)	(0.30)	(0.10)	(0.32)	(0.28)	(0.03)
No. of medication	2.57	3.04	0.48	2.73	2.89	0.15
	(2.61)	(2.78)	(0.00)	(2.70)	(2.62)	(0.25)
Depression	0.20	0.17	-0.03	0.17	0.18	0.00
	(0.40)	(0.38)	(0.04)	(0.38)	(0.38)	(0.88)
Smoker	0.06	0.05	-0.02	0.06	0.05	-0.01
	(0.24)	(0.21)	(0.04)	(0.24)	(0.23)	(0.64)
Anxiety	0.09	0.08	-0.02	0.10	0.08	-0.02
	(0.29)	(0.27)	(0.07)	(0.30)	(0.26)	(0.09)
Hypertension	0.34	0.40	0.06	0.10	0.08	-0.02
	(0.47)	(0.49)	(0.00)	(0.29)	(0.26)	(0.15)
Heart attack	0.02	0.02	0.00	0.34	0.38	0.04
	(0.12)	(0.14)	(0.36)	(0.47)	(0.49)	(0.13)
Diabetes	0.06	0.09	0.03	0.02	0.02	-0.01
	(0.24)	(0.28)	(0.00)	(0.15)	(0.13)	(0.39)
Stroke	0.01	0.01	-0.00	0.09	0.08	-0.01
	(0.09)	(0.08)	(0.60)	(0.28)	(0.27)	(0.52)
High cholesterol	0.38	0.40	0.02	0.01	0.00	-0.01
	(0.49)	(0.49)	(0.28)	(0.11)	(0.04)	(0.01)
Arthritis	0.33	0.35	0.03	0.39	0.39	-0.00
	(0.47)	(0.48)	(0.13)	(0.49)	(0.49)	(0.96)
Osteoporosis	0.15	0.17	0.03	0.33	0.37	0.04
	(0.35)	(0.38)	(0.04)	(0.47)	(0.48)	(0.12)
GP visits	3.53	3.53	-0.00	0.15	0.17	0.02
	(6.79)	(5.67)	(1.00)	(0.36)	(0.37)	(0.37)
Hospital visits	1.33	1.59	0.26	3.47	3.32	-0.15
	(3.49)	(8.38)	(0.26)	(5.23)	(3.98)	(0.52)
Good grip - dominant	0.90	0.89	-0.01	1.37	1.23	-0.14
	(0.30)	(0.32)	(0.30)	(3.07)	(6.28)	(0.57)
Good grip - non-dominant	0.78	0.77	-0.01	0.90	0.90	-0.00
	(0.42)	(0.42)	(0.66)	(0.29)	(0.30)	(0.91)
N	1558	1630	3188	786	773	1559

Notes: Table shows average values for variables by treatment status, pooled waves 1-4. In brackets we report standard deviation of the means and p-value of the difference between treatment and control groups. Values are in % except for number of medication, GP and hospital visits. Further details on how we construct variables and the survey is in Table A.0.3.

B Additional information and robustness for the main specification

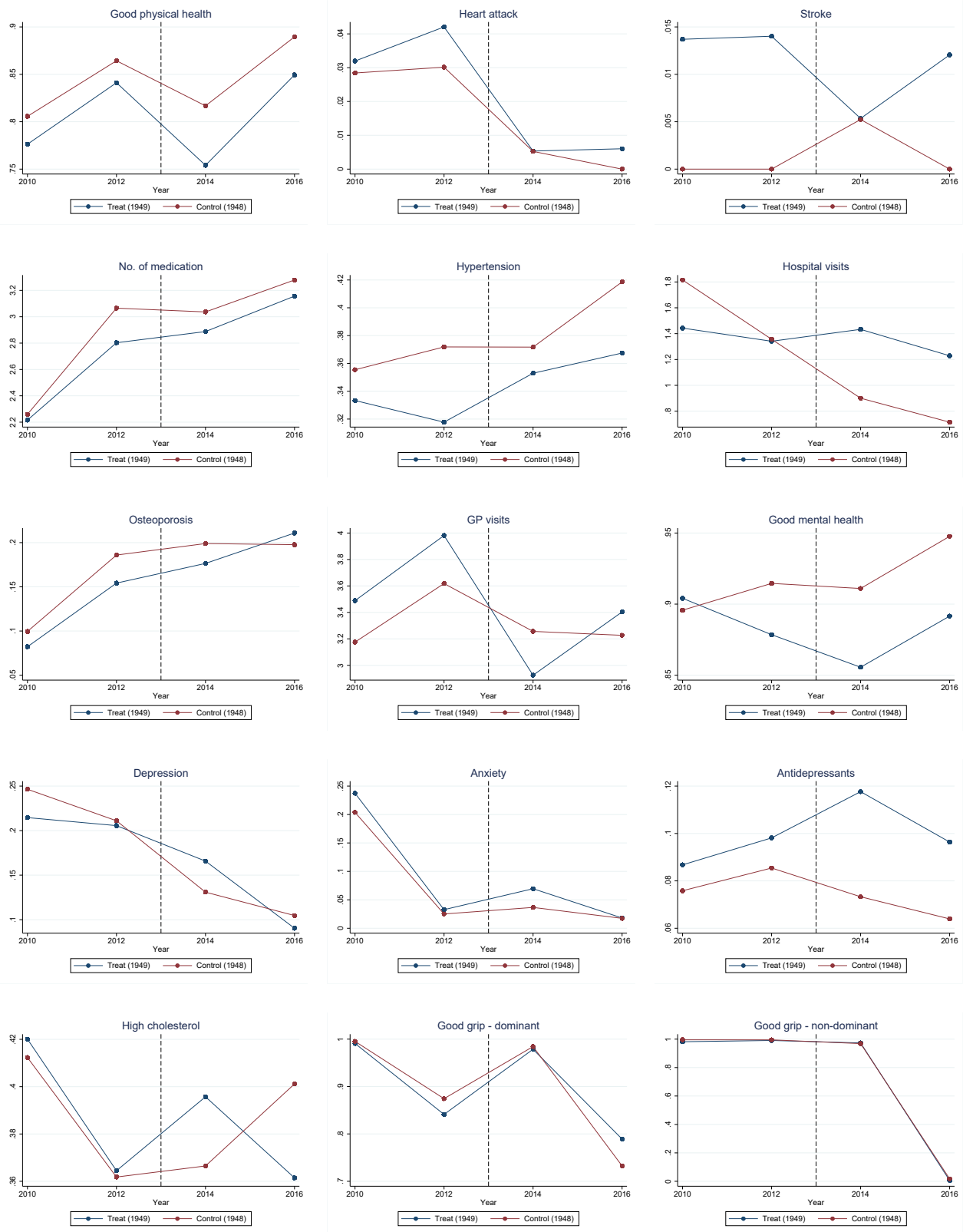
B.1 Parallel trends, sample 1948-1949

Figure B.1: Parallel trends for general outcome variables, individuals born 1948-1949



Notes: Sample consists of individuals estimated to be eligible for the State Pension (Transition) before 2014. Treated are born in 1949, control in 1948.

Figure B.2: Parallel trends for health outcome variables, individuals born 1948-1949



Notes: Sample consists of individuals estimated to be eligible for the State Pension (Transition) before 2014. Treated are born in 1949, control in 1947.

B.2 Sensitivity analysis, sample 1948-1949

Table B.2.1: Sensitivity analysis: pension age effects on employment status, sample born 1948-1949

	(1)	(2	(3)	(4)
2010*Treat	0	0	0	0
	(.)	(.)	(.)	(.)
2012*Treat	-0.0438	-0.0457	0.00606	-0.0519
	(0.0398)	(0.0399)	(0.0327)	(0.0468)
2014*Treat	-0.0142	-0.0117	0.0500	-0.0283
	(0.0510)	(0.0510)	(0.0408)	(0.0642)
2016*Treat	-0.146**	-0.143**	-0.0621	-0.170*
	(0.0519)	(0.0517)	(0.0402)	(0.0669)
Controls	Yes	Yes	Yes	No
Cohort FEs	No	Yes	Yes	No
Non-state pensions	No	No	Yes	No
Individual FEs	No	No	No	Yes
N	1559	1559	1559	1559
adj. R^2	0.122	0.123	0.436	0.471

Notes: Sample consists of individuals estimated to be eligible for the State Pension (Transition) before 2014. Treated are born 1949, control in 1948. Coefficients shown are β_t from equation (1. Controls include gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property. Cohort fixed effects are year and month of birth dummies. Standard errors in brackets, clustered on the individual level.

Table B.2.2: Sensitivity analysis: pension age effects on usual hours worked, sample born 1948-1949

	(1)	(2	(3)	(4)
2012*Treat	-1.269	-1.310	0.363	-1.821
	(1.518)	(1.524)	(1.296)	(1.748)
2014*Treat	0.0270	0.0760	2.230	-0.194
	(1.770)	(1.774)	(1.467)	(2.143)
2016*Treat	-3.988*	-3.878*	-1.040	-4.733*
	(1.735)	(1.731)	(1.388)	(2.231)
Controls	Yes	Yes	Yes	No
Cohort FEs	No	Yes	Yes	No
Non-state pensions	No	No	Yes	No
Individual FEs	No	No	No	Yes
N	1559	1559	1559	1559
adj. R^2	0.134	0.135	0.442	0.528

Notes: Sample consists of individuals estimated to be eligible for the State Pension (Transition) before 2014. Treated are born 1949, control in 1948. Coefficients shown are β_t from equation (1. Controls include gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property. Cohort fixed effects are year and month of birth dummies. Standard errors in brackets, clustered on the individual level.

Table B.2.3: Sensitivity analysis: pension age effects on inactivity, sample born 1948-1949

	(1)	(2	(3)	(4)
2010*Treat	0	0	0	0
	(.)	(.)	(.)	(.)
2012*Treat	0.00415	0.00312	-0.00613	0.00241
	(0.0345)	(0.0345)	(0.0347)	(0.0360)
2014*Treat	-0.0162	-0.0176	-0.0289	-0.0155
	(0.0381)	(0.0383)	(0.0389)	(0.0414)
2016*Treat	0.0105	0.00970	-0.00549	0.0445
	(0.0347)	(0.0347)	(0.0356)	(0.0417)
Controls	Yes	Yes	Yes	No
Cohort FEs	No	Yes	Yes	No
Non-state pensions	No	No	Yes	No
Individual FEs	No	No	No	Yes
N	1559	1559	1559	1559
adj. R^2	0.151	0.153	0.173	0.585

Notes: Sample consists of individuals estimated to be eligible for the State Pension (Transition) before 2014. Treated are born in 1949 and 1950, control in 1947 and 1948. Coefficients shown are β_t from equation (1. Controls include gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property. Cohort fixed effects are year and month of birth dummies. Standard errors in brackets, clustered on the individual level.

Table B.2.4: Sensitivity analysis: pension age effects on unemployment benefit, sample born 1948-1949

	(1)	(2	(3)	(4)
2010*Treat	0	0	0	0
	(.)	(.)	(.)	(.)
2012*Treat	0.0180	0.0183	0.0127	0.0393
	(0.0304)	(0.0306)	(0.0305)	(0.0365)
2014*Treat	0.0991**	0.0986**	0.0915**	0.131**
	(0.0343)	(0.0343)	(0.0340)	(0.0431)
2016*Treat	0.0542	0.0542	0.0449	0.0838*
	(0.0303)	(0.0304)	(0.0303)	(0.0410)
Controls	Yes	Yes	Yes	No
Cohort FEs	No	Yes	Yes	No
Non-state pensions	No	No	Yes	No
Individual FEs	No	No	No	Yes
N	1559	1559	1559	1559
adj. R^2	0.034	0.033	0.043	0.228

Notes: Sample consists of individuals estimated to be eligible for the State Pension (Transition) before 2014. Treated are born 1949, control in 1948. Coefficients shown are β_t from equation (1. Controls include gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property. Cohort fixed effects are year and month of birth dummies. Standard errors in brackets, clustered on the individual level.

Table B.2.5: Sensitivity analysis: pension age effects on disability payment receipt, sample born 1948-1949

	(1)	(2	(3)	(4)
2010*Treat	0	0	0	0
	(.)	(.)	(.)	(.)
2012*Treat	0.0246	0.0239	0.0197	0.0246
	(0.0317)	(0.0319)	(0.0318)	(0.0378)
2014*Treat	0.133***	0.135***	0.128***	0.128**
	(0.0349)	(0.0349)	(0.0346)	(0.0423)
2016*Treat	-0.00493	-0.00356	-0.0126	-0.0218
	(0.0324)	(0.0327)	(0.0325)	(0.0429)
Controls	Yes	Yes	Yes	No
Cohort FEs	No	Yes	Yes	No
Non-state pensions	No	No	Yes	No
Individual FEs	No	No	No	Yes
N	1559	1559	1559	1559
adj. R^2	0.083	0.080	0.093	0.373

Notes: Sample consists of individuals estimated to be eligible for transitional state pension before 2014. Treated are born in 1949 and 1950, control in 1947 and 1948. Coefficients shown are β_t from equation (1. Controls include gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property. Cohort fixed effects are year and month of birth dummies. Standard errors in brackets, clustered on the individual level.

Table B.2.6: Sensitivity analysis: pension age effects on antidepressant usage, sample born 1948-1949

	(1)	(2	(3)	(4)
2010*Treat	0	0	0	0
	(.)	(.)	(.)	(.)
2012*Treat	-0.000421	-0.00265	-0.00488	0.00277
	(0.0262)	(0.0261)	(0.0261)	(0.0281)
2014*Treat	0.0336	0.0314	0.0285	0.0398
	(0.0279)	(0.0279)	(0.0279)	(0.0317)
2016*Treat	0.0247	0.0249	0.0210	0.0161
	(0.0313)	(0.0314)	(0.0314)	(0.0339)
Controls	Yes	Yes	Yes	No
Cohort FEs	No	Yes	Yes	No
Non-state pensions	No	No	Yes	No
Individual FEs	No	No	No	Yes
N	1559	1559	1559	1559
adj. R^2	0.021	0.035	0.035	0.620

Notes: Sample consists of individuals estimated to be eligible for transitional state pension before 2014. Treated are born in 1949 and 1950, control in 1947 and 1948. Coefficients shown are β_t from equation (1. Controls include gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property. Cohort fixed effects are year and month of birth dummies. Standard errors in brackets, clustered on the individual level.

Table B.2.7: Sensitivity analysis: pension age effects on anxiety, sample born 1948-1949

	(1)	(2	(3)	(4)
2010*Treat	0	0	0	0
	(.)	(.)	(.)	(.)
2012*Treat	-0.0261	-0.0257	-0.0269	-0.0211
	(0.0416)	(0.0419)	(0.0419)	(0.0521)
2014*Treat	0.00134	0.00151	0.000121	0.0000473
	(0.0431)	(0.0432)	(0.0431)	(0.0521)
2016*Treat	-0.0299	-0.0296	-0.0311	-0.0218
	(0.0410)	(0.0408)	(0.0409)	(0.0491)
Controls	Yes	Yes	Yes	No
Cohort FEs	No	Yes	Yes	No
Non-state pensions	No	No	Yes	No
Individual FEs	No	No	No	Yes
N	1559	1559	1559	1559
adj. R^2	0.104	0.101	0.100	0.303

Notes: Sample consists of individuals estimated to be eligible for transitional state pension before 2014. Treated are born in 1949 and 1950, control in 1947 and 1948. Coefficients shown are β_t from equation (1. Controls include gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property. Cohort fixed effects are year and month of birth dummies. Standard errors in brackets, clustered on the individual level.

Table B.2.8: Sensitivity analysis: pension age effects on the number of GP visits, sample born 1948-1949

	(1)	(2	(3)	(4)
2010*Treat	0	0	0	0
	(.)	(.)	(.)	(.)
2012*Treat	0.0811	0.0756	0.000330	-0.103
	(0.501)	(0.499)	(0.503)	(0.614)
2014*Treat	-0.562	-0.566	-0.651	-0.982
	(0.660)	(0.665)	(0.659)	(0.853)
2016*Treat	-0.143	-0.160	-0.266	-0.487
	(0.415)	(0.416)	(0.414)	(0.453)
Controls	Yes	Yes	Yes	No
Cohort FEs	No	Yes	Yes	No
Non-state pensions	No	No	Yes	No
Individual FEs	No	No	No	Yes
N	1559	1559	1559	1559
adj. R^2	0.028	0.032	0.033	0.214

Notes: Sample consists of individuals estimated to be eligible for transitional state pension before 2014. Treated are born in 1949 and 1950, control in 1947 and 1948. Coefficients shown are β_t from equation (1. Controls include gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property. Cohort fixed effects are year and month of birth dummies. Standard errors in brackets, clustered on the individual level.

Table B.2.9: Sensitivity analysis: pension age effects on high choleterol, sample born 1948-1949

	(1)	(2	(3)	(4)
2010*Treat	0	0	0	0
	(.)	(.)	(.)	(.)
2012*Treat	-0.0126	-0.0123	-0.0103	0.0236
	(0.0497)	(0.0495)	(0.0497)	(0.0583)
2014*Treat	0.0147	0.0133	0.0129	0.0328
	(0.0526)	(0.0528)	(0.0529)	(0.0623)
2016*Treat	-0.0415	-0.0436	-0.0447	-0.0451
	(0.0547)	(0.0550)	(0.0553)	(0.0658)
Controls	Yes	Yes	Yes	No
Cohort FEs	No	Yes	Yes	No
Non-state pensions	No	No	Yes	No
Individual FEs	No	No	No	Yes
N	1559	1559	1559	1559
adj. R^2	0.031	0.033	0.032	0.556

Notes: Sample consists of individuals estimated to be eligible for transitional state pension before 2014. Treated are born in 1949 and 1950, control in 1947 and 1948. Coefficients shown are β_t from equation (1. Controls include gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property. Cohort fixed effects are year and month of birth dummies. Standard errors in brackets, clustered on the individual level.

Table B.2.10: Sensitivity analysis: pension age effects on overall health, sample born 1948-1949

	(1)	(2	(3)	(4)
2010*Treat	0	0	0	0
	(.)	(.)	(.)	(.)
2012*Treat	0.00617	0.00779	0.0143	-0.00350
	(0.0394)	(0.0395)	(0.0398)	(0.0474)
2014*Treat	-0.0380	-0.0376	-0.0298	-0.0150
	(0.0451)	(0.0448)	(0.0451)	(0.0526)
2016*Treat	-0.0105	-0.0114	-0.00169	0.00806
	(0.0463)	(0.0462)	(0.0466)	(0.0547)
Controls	Yes	Yes	Yes	No
Cohort FEs	No	Yes	Yes	No
Non-state pensions	No	No	Yes	No
Individual FEs	No	No	No	Yes
N	1559	1559	1559	1559
adj. R^2	0.062	0.069	0.071	0.479

Notes: Sample consists of individuals estimated to be eligible for transitional state pension before 2014. Treated are born in 1949 and 1950, control in 1947 and 1948. Coefficients shown are β_t from equation (1. Controls include gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property. Cohort fixed effects are year and month of birth dummies. Standard errors in brackets, clustered on the individual level.

Table B.2.11: Sensitivity analysis: pension age effects on the number of medication, sample born 1948-1949

	(1)	(2	(3)	(4)
2010*Treat	0	0	0	0
	(.)	(.)	(.)	(.)
2012*Treat	-0.233	-0.249	-0.274	-0.0281
	(0.229)	(0.228)	(0.230)	(0.246)
2014*Treat	-0.0776	-0.103	-0.145	-0.00875
	(0.254)	(0.255)	(0.255)	(0.265)
2016*Treat	-0.0826	-0.0939	-0.149	-0.100
	(0.270)	(0.274)	(0.275)	(0.275)
Controls	Yes	Yes	Yes	No
Cohort FEs	No	Yes	Yes	No
Non-state pensions	No	No	Yes	No
Individual FEs	No	No	No	Yes
N	1554	1554	1554	1554
adj. R^2	0.047	0.056	0.058	0.728

Notes: Sample consists of individuals estimated to be eligible for transitional state pension before 2014. Treated are born in 1949 and 1950, control in 1947 and 1948. Coefficients shown are β_t from equation (1. Controls include gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property. Cohort fixed effects are year and month of birth dummies. Standard errors in brackets, clustered on the individual level.

Table B.2.12: Sensitivity analysis: pension age effects on osteoporosis, sample born 1948-1949

	(1)	(2	(3)	(4)
2010*Treat	0	0	0	0
	(.)	(.)	(.)	(.)
2012*Treat	-0.0225	-0.0232	-0.0189	-0.0337
	(0.0335)	(0.0339)	(0.0343)	(0.0387)
2014*Treat	-0.0133	-0.0176	-0.0124	-0.0325
	(0.0380)	(0.0382)	(0.0382)	(0.0443)
2016*Treat	0.0230	0.0208	0.0284	0.0330
	(0.0428)	(0.0429)	(0.0433)	(0.0509)
Controls	Yes	Yes	Yes	No
Cohort FEs	No	Yes	Yes	No
Non-state pensions	No	No	Yes	No
Individual FEs	No	No	No	Yes
N	1559	1559	1559	1559
adj. R^2	0.079	0.087	0.094	0.659

Notes: Sample consists of individuals estimated to be eligible for transitional state pension before 2014. Treated are born in 1949 and 1950, control in 1947 and 1948. Coefficients shown are β_t from equation (1. Controls include gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property. Cohort fixed effects are year and month of birth dummies. Standard errors in brackets, clustered on the individual level.

Table B.2.13: Sensitivity analysis: pension age effects on stroke, sample born 1948-1949

	(1)	(2	(3)	(4)
2010*Treat	0	0	0	0
	(.)	(.)	(.)	(.)
2012*Treat	0.000973	0.000621	0.000700	0.00730
	(0.00909)	(0.00905)	(0.00917)	(0.00675)
2014*Treat	-0.0132	-0.0132	-0.0131	-0.00870
	(0.0110)	(0.0110)	(0.0111)	(0.0124)
2016*Treat	-0.000493	-0.000504	-0.000378	0.00568
	(0.0116)	(0.0115)	(0.0117)	(0.0132)
Controls	Yes	Yes	Yes	No
Cohort FEs	No	Yes	Yes	No
Non-state pensions	No	No	Yes	No
Individual FEs	No	No	No	Yes
N	1559	1559	1559	1559
adj. R^2	0.005	0.005	0.004	0.224

Notes: Sample consists of individuals estimated to be eligible for transitional state pension before 2014. Treated are born in 1949 and 1950, control in 1947 and 1948. Coefficients shown are β_t from equation (1. Controls include gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property. Cohort fixed effects are year and month of birth dummies. Standard errors in brackets, clustered on the individual level.

Table B.2.14: Sensitivity analysis: pension age effects on grip strength (dominant hand), sample born 1948-1949

	(1)	(2	(3)	(4)
2010*Treat	0	0	0	0
	(.)	(.)	(.)	(.)
2012*Treat	-0.0312	-0.0308	-0.0312	-0.0331
	(0.0349)	(0.0351)	(0.0355)	(0.0436)
2014*Treat	-0.00368	-0.00418	-0.00459	0.00627
	(0.0159)	(0.0164)	(0.0166)	(0.0215)
2016*Treat	0.0611	0.0619	0.0616	0.0637
	(0.0467)	(0.0470)	(0.0472)	(0.0567)
Controls	Yes	Yes	Yes	No
Cohort FEs	No	Yes	Yes	No
Non-state pensions	No	No	Yes	No
Individual FEs	No	No	No	Yes
N	1559	1559	1559	1559
adj. R^2	0.116	0.117	0.115	0.235

Notes: Sample consists of individuals estimated to be eligible for transitional state pension before 2014. Treated are born in 1949 and 1950, control in 1947 and 1948. Coefficients shown are β_t from equation (1. Controls include gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property. Cohort fixed effects are year and month of birth dummies. Standard errors in brackets, clustered on the individual level.

Table B.2.15: Sensitivity analysis: pension age effects on grip strength (non-dominant hand), sample born 1948-1949

	(1)	(2	(3)	(4)
2010*Treat	0	0	0	0
	(.)	(.)	(.)	(.)
2012*Treat	0.00971	0.00891	0.00898	0.00494
	(0.0130)	(0.0131)	(0.0132)	(0.0141)
2014*Treat	0.0171	0.0176	0.0177	0.0170
	(0.0200)	(0.0200)	(0.0202)	(0.0230)
2016*Treat	0.00310	0.00411	0.00427	0.00331
	(0.0156)	(0.0155)	(0.0156)	(0.0185)
Controls	Yes	Yes	Yes	No
Cohort FEs	No	Yes	Yes	No
Non-state pensions	No	No	Yes	No
Individual FEs	No	No	No	Yes
N	1559	1559	1559	1559
adj. R^2	0.919	0.919	0.918	0.927

Notes: Sample consists of individuals estimated to be eligible for transitional state pension before 2014. Treated are born in 1949 and 1950, control in 1947 and 1948. Coefficients shown are β_t from equation (1. Controls include gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property. Cohort fixed effects are year and month of birth dummies. Standard errors in brackets, clustered on the individual level.

B.3 Multiple hypothesis testing, sample 1948-1949

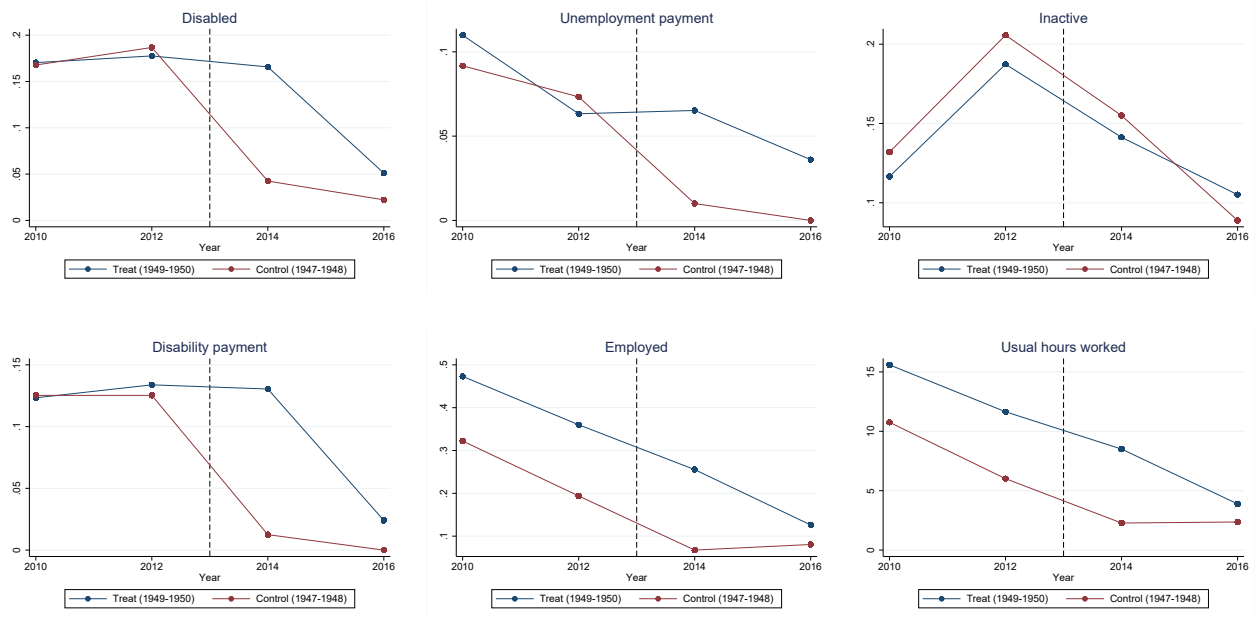
Table B.3.1: Robustness analysis, multiple hypothesis testing

	Treat*2012	Treat*2014	Treat*2016
Employment	-0.0519	-0.0283	-0.170*
	(0.268)	(0.659)	(0.0112)
	[0.512]	[0.714]	[0.0318]
Usual hrs	-1.821	-0.194	-4.733*
	(0.298)	(0.928)	(0.0344)
	[0.339]	[0.119]	[0.0905]
Unemployment benefit	0.0393	0.131**	0.0838*
	(0.282)	(0.00252)	(0.0416)
	[0.0738]	[6.56e-08]	[0.00809]
Disability payment	0.0246	0.128**	-0.0218
	(0.516)	(0.00267)	(0.612)
	[0.771]	[0.000118]	[0.0503]
Overall health	-0.00350	-0.0150	0.00806
	(0.941)	(0.776)	(0.883)
	[0.103]	[0.319]	[0.298]
Anxiety	-0.0211	0.0000473	-0.0218
	(0.686)	(0.999)	(0.658)
	[0.158]	[0.454]	[0.183]
Grip strength (D)	-0.0331	0.00627	0.0637
	(0.448)	(0.770)	(0.262)
	[0.0476]	[0.699]	[0.767]
Grip strength (ND)	0.00494	0.0170	0.00331
	(0.726)	(0.459)	(0.858)
	[0.600]	[0.00488]	[0.318]

Notes: Sample consists of individuals estimated to be eligible for the State Pension (Transition) before 2014. Treated are born in 1949, control in 1948. Coefficients shown are β_t from equation 1 and should be interpreted compared to 2010. The specification includes individual fixed effects. In parentheses we show corresponding p-values, and in square brackets Romano-Wolf-adjusted p-values.

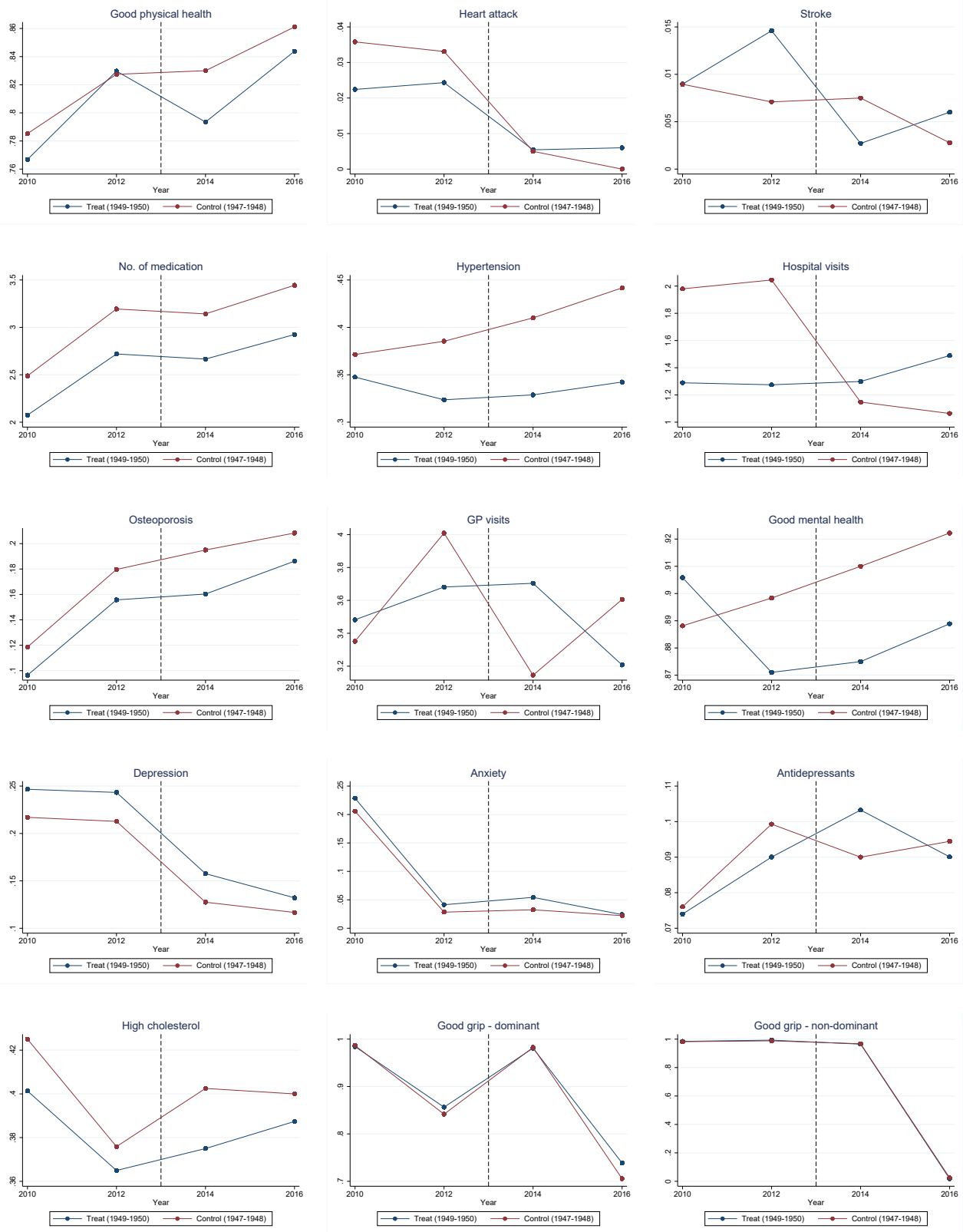
B.4 Parallel trends, sample 1947-1950

Figure B.3: Parallel trends for general outcome variables, individuals born 1947-1950



Notes: Sample consists of individuals estimated to be eligible for the State Pension (Transition) before 2014. Treated are born in 1949 and 1950, control in 1947 and 1948.

Figure B.4: Parallel trends for health outcome variables, individuals born 1947-1950



Notes: Sample consists of individuals estimated to be eligible for the State Pension (Transition) before 2014. Treated are born in 1949 and 1950, control in 1947 and 1948.

B.5 Placebo test

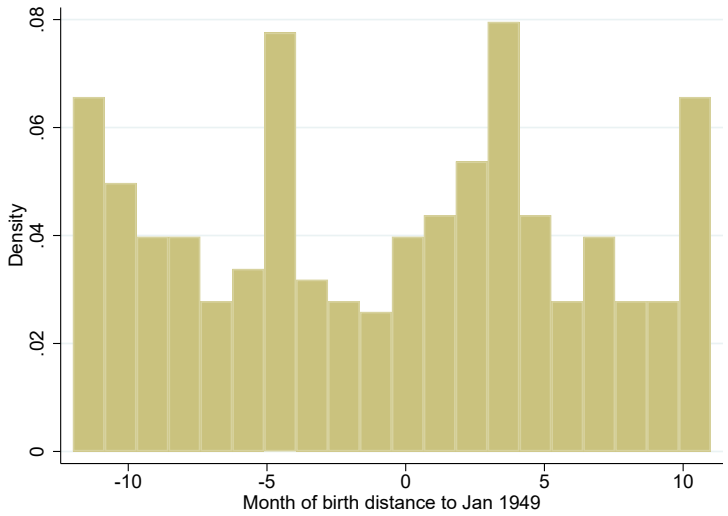
Table B.5.1: Placebo test, event study

	1948-1949		1947-1950	
	Education	Dublin	Education	Dublin
2010*Treat	0	0	0	0
	(.)	(.)	(.)	(.)
2012*Treat	0.00738	-0.00655	0.00559	0.0152
	(0.0254)	(0.0209)	(0.0172)	(0.0141)
2014*Treat	0.0300	0.0118	0.0208	0.0187
	(0.0289)	(0.0234)	(0.0202)	(0.0168)
2016*Treat	0.00641	0.0158	0.00635	0.0254
	(0.0272)	(0.0279)	(0.0192)	(0.0196)
N	1559	1559	3188	3188
adj. R^2	-0.004	-0.001	-0.002	-0.000

Notes: Coefficients shown are β_t from equation (1), without controls and individual fixed effects. Standard errors are in brackets, clustered on the individual level.

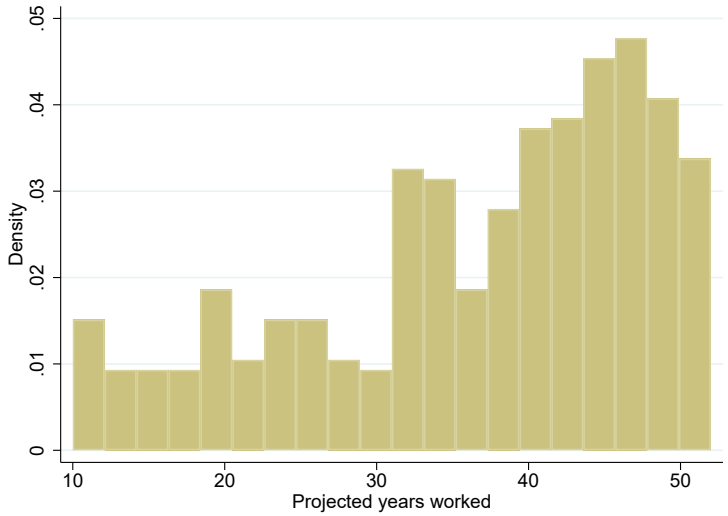
C Regression discontinuity

Figure C.1: Sample density around threshold January 1949, in 2014



Notes: Sample consists of individuals estimated to be eligible for the State Pension (Transition) in 2014.

Figure C.2: Distribution of social contributions in 2014



Notes: Sample consists of individuals estimated to be eligible for the State Pension (Transition) in 2014.

Table C.0.1: Pension age effects around date of birth January 1949, in 2014

	Linear		Quadratic	
	No controls	Controls	No controls	Controls
Employment	0.00792	0.0206	0.0667	0.0509
	(0.0592)	(0.0577)	(0.0674)	(0.0654)
Usual hours worked	1.113	1.707	5.088	4.950
	(2.221)	(2.082)	(2.868)	(2.742)
Unemployment payment	0.0493	0.0545	0.0410	0.0528
	(0.0552)	(0.0553)	(0.0907)	(0.0933)
Disabled	0.0407	0.0326	-0.0282	-0.0250
	(0.0488)	(0.0475)	(0.0646)	(0.0644)
Disability payment	0.134*	0.124*	0.0914	0.0814
	(0.0572)	(0.0571)	(0.0781)	(0.0794)
Depression	0.214**	0.200**	0.232*	0.246*
	(0.0763)	(0.0712)	(0.118)	(0.110)
Grip strength (D)	-0.0341	-0.0323	-0.00824	-0.00909
	(0.0201)	(0.0193)	(0.0220)	(0.0224)
Grip strength (ND)	-0.0457*	-0.0406	-0.00838	-0.00599
	(0.0213)	(0.0210)	(0.0254)	(0.0267)
N	378	378	378	378

Notes: Sample consists of individuals estimated to be eligible for the State Pension (Transition) before 2014. Treated are born in 1949, control in 1948. Coefficients are estimated from equation (2. Controls include gender, married, education, smoker, exercise, sleep quality, assists family, house owner, mortgage, second property and cohort fixed effects: year and month of birth dummies).