Discussion Paper Series – CRC TR 224

Discussion Paper No. 514
Project C 01

Live Longer and Healthier: Impact of Pension Income for Low-Income Retirees

Chiara Malavasi[1]
Han Ye[2]

March 2024

[1] University of Mannheim, ZEW – Leibniz Centre for European Economic Research,
Email: chiara.malavasi@uni-mannheim.de
[2] University of Mannheim, Email: han.ye@uni-mannheim.de

Support by the Deutsche Forschungsgemeinschaft (DFG, German Research Foundation) through CRC TR 224 is gratefully acknowledged.

Collaborative Research Center Transregio 224 - www.crctr224.de
Rheinische Friedrich-Wilhelms-Universität Bonn - Universität Mannheim

Live Longer and Healthier: Impact of Pension Income for Low-Income Retirees

Chiara Malavasi
University of Mannheim, ZEW

Han Ye
University of Mannheim, IZA, ZEW

December 2023

Click here for the latest version

Abstract

We estimate the effect of additional pension income on mortality outcomes by exploring the eligibility criteria of a German program subsidizing the pensions of low-wage workers. Using novel administrative data, we find that eligibility leads to a 2-month delay in age at death (censored at 75). Survey evidence suggests that additional pension income improves both mental and physical health. In addition, individuals feel less financially constrained and are more optimistic about their future. Heterogeneity analysis indicates that the results are mainly driven by men.

JEL Codes: I10, I12, J14, J26
Keywords: Mortality, Health, Income, Pension subsidy, Retirement

*We are grateful to Matilde Cappelletti, Thibault Cézanne, Antonio Ciccone, Andrea Ichino, Eckhard Janeba, Fabrizio Mazzonna, Todd Morris, Lucie Schmidt, Hitoshi Shigeoka, Nicolas Ziebarth and participants at seminars in University of Mannheim, ZEW, EALE 2022, SAEe 2022, UCL ENTER Seminar Spring 2023, SOLE 2023, ICEEE 2023, ESPE 2023, EEA 2023 for their helpful insights and suggestions. The views expressed here are solely those of the authors. The authors acknowledge funding from the German Research Foundation (DFG) through CRC TR 224 (Project C01). All errors are our own.
Corresponding authors: Chiara Malavasi: chiara.malavasi@uni-mannheim.de, Han Ye: han.ye@uni-mannheim.de

1 Introduction

Old-age poverty has become an important policy concern in light of diminishing public pension generosity and increased longevity (Sarfati, 2017; Börsch-Supan and Coile, 2018). In particular, the trend of transitioning from a defined benefit to a defined contribution pension system has left a growing number of lower-income workers vulnerable to old-age poverty (ILO, 2014). Many governments have provided safety nets for pensioners with low benefits, however, relatively little is known about how pension income affects mortality and health[1], although this is an important indicator of the social value of old-age income support programs. Moreover, whether people live longer and healthier lives due to additional pension income can also help understand the persistent and widening socioeconomic disparities in old-age mortality in many developed countries (Currie and Schwandt, 2016; Wenau et al., 2019; Haan et al., 2020), although mortality has improved for the population as a whole. Therefore, the answer to this question can have considerable policy relevance, as old-age poverty is a growing and pervasive problem around the world.

This question remains understudied, in part due to the difficulty of isolating exogenous variations in the parameters of the public pension system, such as benefit levels, pension eligibility age, penalties for claiming pensions early, etc. Existing papers on the mortality response to pension reforms mostly focus on reforms that raised or lowered the pension eligibility age (see, e.g., Hernaes et al. (2013); Shai (2018); Belles et al. (2022)) or reforms that bundle changes in parameters (see, e.g., Saporta-Eksten et al. (2021); Bozio et al. (2021)).

In this paper, we investigate how a permanent increase in pension income affects the mortality and health outcomes of low-income pensioners by examining a German pension subsidy program. Several features of this program make it an ideal natural experiment to study the effects of additional pension income. First, the subsidy is determined on the basis of contributions made before the announcement of the program. Second, individuals are eligible for the subsidy only if they fulfill two conditions: at least 35 contribution years and average monthly earnings points from full-value contribution years below a certain threshold. These eligibility criteria allow us to estimate the causal impact of additional pension income. Third, the additional benefits from this subsidy program occur without any changes to other pension system parameters, such as the statutory retirement age. This enables us to isolate the causal impact of additional pension income from other characteristics of pension systems. Also, as Germany has universal health care, the implications of pension income is not tied to access to (subsidized) health care, as in the U.S. for example (Ayyagari, 2019). This feature allows us to decouple the effect of additional income on mortality

[1] There is a small but growing literature studies the labor supply responses to the generosity of public pension (e.g., Stock and Wise (1990); Krueger and Pischke (1992); Snyder and Evans (2006); Gelber et al. (2017); Ye (2022)).

from the effect of losing access to health care. Fourth, enrolment is automatic, as the subsidy is added directly to the pension of eligible individuals without any application process. This ensures that the subsidy reaches those who might not have enrolled due to incomplete information or transaction costs (Bertrand et al., 2004; Finkelstein and Notowidigdo, 2019), which are often the people most in need of support.

Our analysis is based on novel administrative data covering the universe of German pensioners who died between 1994 and 2018. The baseline sample consists of West German old-age pensioners who were born between 1932 and 1942. Using a difference-in-differences (DID) method, we find that eligibility for the pension subsidy increases pension income by 64.6€/month (around an 8% increase).[2] After establishing a sizable impact on pension income, we turn to the impact on mortality. We find that eligibility for the pension subsidy improves age at death (censored at age 75) by 2 months (around a 0.2% increase). Specifically, eligibility reduces the probability of dying before age 65, 70, and 75 by 0.9 percentage points (17.6%), 1.4 percentage points (5.4%), and 0.8 percentage points (1.5%), respectively. We, therefore, estimate intent-to-treat pension income-mortality elasticities of -2.2, -0.63, and -0.19. We find no significant effects on the retirement age. Despite the fact that men receive a smaller subsidy on average, the heterogeneity analysis suggest that the mortality responses are mainly driven by men. The estimates are robust to several robustness tests that vary the sample restrictions and the set of controls. Moreover, we verify that there are no mortality effects when using placebo eligibility conditions in ineligible samples. To better quantify and scale the effects, and investigate the importance of pension income on mortality and health, we also employ a instrumental variable method. In particular, we use the two eligibility criteria as instruments for the pension income. We quantify that a permanent increase in monthly pension income of 100€ (about a 13% increase) increases the age at death (censored at age 75) by around 2.4 months.

To better understand the mechanisms, we examine the responses in health outcomes using the SHARE-RV dataset, which links information from the *Survey on Health and Retirement in Europe* with active pension records from the *German Pension Register*. The survey sample contains a similar population of pensioners to the administrative sample. However, the questions were asked when they were alive. We find that increases in pension income improve both mental and physical health. For example, we find that additional pension income leads to reductions in depression, the number of chronic diseases, the incidence of chronic lung disease and high blood pressure, and difficulties with activities of daily living. In addition, feeling less financially constrained and feeling more optimistic about the future appear to be relevant drivers of improved health. We also

[2] All monetary values are CPI adjusted and expressed in 2015 euros.

find a reduction in both alcohol and cigarette consumption among men, which may be related to a reduction in stress. Again, we find stronger effects for men than for women.

The policy implication of our findings is that the pension subsidy for low-income workers in Germany have beneficial effects on life expectancy and health. In particular, male recipients live longer and healthier lives. We show that a stable increase in cash flow during retirement, despite being a relatively small amount, can have substantial improvement on health and life expectancy for poor retirees in a developed country with a universal healthcare system. Additional pension income can make individuals feel less stressed, less financially constrained and reduce their alcohol and cigarette consumption, which improve quality of life and ultimately decrease mortality. The cost-benefit analysis suggests that this program is a cost-effective policy to increase the life expectancy of pensioners. The monetary benefits of the life expectancy gain of 100€ additional pension income per month is around 102,395€ for male recipients. Finally, a simple back-of-the-envelope calculation suggests that a subsidy, targeted at people with low pension entitlements, would help to flatten the income-mortality gradient and reduce the gap in life expectancy at age 65 between the top and bottom income deciles in Germany by 3%.

We contribute to the relatively small literature on the causal impact of pension income on mortality. Most of the evidence is for developing countries (Case, 2004; Jensen and Richter, 2004; Barham and Rowberry, 2013; Huang and Zhang, 2021; Miglino et al., 2023) by exploring either non-contributory pension programs or conditional cash transfer programs. For example, Miglino et al. (2023) study the effect of income on mortality by exploring the eligibility condition for the non-contributory pension program in Chile. They find the basic pension increases income by 72% and reduces four-year mortality by 28%. Huang and Zhang (2021) examine the implementation of China's New Rural Pension Scheme, which targeted at vulnerable elderly in rural areas. They find that the pension scheme increased the household income by 18% and result in a reduction in one-year mortality by 2.2 percentage points. Consistent with our findings, they find that addition pension income saves lives.

However, the implication of additional pension income in developed countries might not necessary apply to developed countries. To the best of our knowledge, there are only two papers studying the impact of pension income on mortality and health in the context of developed countries (Snyder and Evans, 2006; Johnsen and Willén, 2022). While Johnsen and Willén (2022) show that negative shocks to pension income had no impact on both employment and health care utilisation of pensioners in Sweden, Snyder and Evans (2006) find that lower pension income leads to reduced mortality by examining a cut in social security wealth for the U.S. "notch" cohort. However, the effects of higher and lower pension income on mortality are not necessarily symmetric. These estimates may not be generalizable to policies aimed at ensuring income support for older people at risk of poverty. In fact, in contrast to their findings, we show that higher pension income leads to lower mortality. Another important distinction is the indirect employment response. Pension income differs from other types of income in that it affects mortality directly by improving physical and mental health and indirectly by influencing retirement choices. While higher income typically improves life expectancy, it can also induce earlier retirement, thereby increasing mortality (e.g., Fitzpatrick and Moore, 2018; Kuhn et al., 2020) or decreasing mortality (e.g., Hernaes et al., 2013; Hagen, 2018; Belles et al., 2022), depending on the sub-population affected. The employment effect may offset or amplify the wealth effect on mortality. For example, the reduced mortality due to lower pension income in Snyder and Evans (2006) is explained by the beneficial effects of employment. Our paper studies a pension subsidy program that has a relatively small effect on retirement age (Ye, 2022), which helps to pinpoint a pure wealth effect of additional pension income on mortality.

Moreover, our paper links to the broader literature examining the impact of income on mortality and health outcomes for older people by examining other social insurance programs (e.g., Eli, 2015; Bailey and Goodman-Bacon, 2015; Black et al., 2017; Gelber et al., 2023).[3] In particular, Gelber et al. (2023) study the impact of more generous Disability Insurance benefits on mortality for low-income DI beneficiaries, who are vulnerable population similar as in our setting. They show that $1,000 more in annual disability insurance payment in the U.S. reduces mortality of low-income beneficiaries by 0.18 to 0.35 percentage points.

Previous studies have also investigated the pure wealth effect on mortality and health by exploring financial shocks, such as lotteries (e.g., Lindahl, 2005; Cesarini et al., 2016; Lindqvist et al., 2020) and stock market fluctuations (e.g., McInerney et al., 2013; Schwandt, 2018). Our paper differs from these studies in two important respects: the population studied and the income variation. We focus on low-income pensioners, the population most affected by recent pension reforms. In addition, we examine a permanent increase in pension benefits, which provides a steady higher income stream, as opposed to a one-off windfall or transitory income fluctuations.

The rest of the paper proceeds as follows. Section 2 explains the main elements of the German Pension System and of the subsidy program. Section 3 describes the data and Section 4 delineates the empirical strategies. Section 5 reports the DID results, IV estimates and also provides some evidence on the mechanisms driving our results. Finally, Section 6 discusses and Section 7 concludes.

[3] A large literature examine the health and mortality effects of income by examining transfer program and social insurance such as cash transfers(e.g., Aizer et al., 2016, 2020), the Earned Income Tax Credit (e.g., Evans and Garthwaite, 2014; Dow et al., 2020), health insurance (e.g., Bitler et al., 2005; Ziebarth, 2018).

2 Institutional Setting

German Public Pension System The German Public Pension System is an earnings-related points system financed on a pay-as-you-go basis.[4] Participation is mandatory, except for civil servants and the self-employed. On average, the public pension replaces around 50% of pre-retirement wage, net of income, and payroll tax. As of the end of 2021, the average monthly pension benefit of the insured was around 1,163 euros for men and 860 euros for women.

The statutory retirement age for a regular old-age pension remained 65 years old for the cohorts in our baseline sample; the only prerequisite being at least five years of contributions. Several alternate pathways make retiring before 65 years of age possible.[5] For example, eligible workers born before 1946 can claim their pension at the earliest via the old-age pension due to unemployment, at age 60. Women have another option to claim the pension as early as age 60 via the old-age pension for women. Almost all female recipients of the subsidy program born before 1952 are eligible for this pathway.[6]

In Germany, pension benefit levels are closely tied to lifetime wages. The main determinant of pension benefits is the sum of the individually accumulated earnings points (Entgeltpunkte, (EP)). Essentially, for each year of contributions, a worker accumulates some earnings points, which are determined by the individual wage in that year relative to the average wage of all the insured. For example, a worker whose wage is half of the average wage will accumulate 0.5 points in that year.[7] Aside from a few exceptions, workers with few contribution years or low relative wages are more likely to face old-age poverty. This is one of the reasons that the majority of the subsidy recipients are women, as they have short employment periods and a lower wage over their life cycle. Pensioners can work while claiming their pensions, however, they face a stringent earnings test.

Pension Subsidies for Low-wage Workers The pension subsidy program studied in this paper

[4]The pension system is mainly financed via mandatory contribution payments, which are normally shared equally by employers and employees. In 2021, the total mandatory contribution rate was 18.6%.

[5]Starting from 2012, the statutory retirement age for cohorts born after 1947 began increasing from 65, and this will reach age 67 for cohorts born after 1964. There are four main early retirement pathways: old-age pensions for long-term insured, old-age pensions for women, old-age pensions due to unemployment (and, later, part-time work); and old-age pensions for severely disabled persons Börsch-Supan et al. (2004).

[6]The eligibility requirements for the unemployed pathway were: 1) at least 15 years of contributions, at least 8 of which must have occurred in the past 10 years, and 2) being unemployed for at least 1 year after the age of 58 and six months. The generosity of unemployment insurance benefits, combined with lenient job search requirements for older workers, made old-age pensions due to unemployment attractive. The early retirement age is 60 for cohorts younger than 1946 and starts to gradually increase in monthly increments between 60 and 63 from 1946 to 1948 and remains at age 63 until it is abolished for cohorts born after 1951.

[7]See Appendix B.1 for more details on the pension benefit calculation.

was introduced during the German pension reform in 1992.[8] The primary policy consideration of this subsidy program is to ensure adequate old-age income, which credits additional earnings points to eligible individuals. The target recipients are workers with low lifetime pension contributions.[9]

This subsidy program ensures an adequate pension for people with two characteristics: individuals with a long pension contribution history and workers with low wages. Specifically, individuals need to fulfill two criteria to become eligible for this subsidy program. First, a worker should have at least 35 contribution years. Second, the average monthly EPs from full-value contribution years at the time of retirement are below 0.75. This criterion means that only individuals in the bottom 37.5 percentile of the income distribution at the time of retirement are eligible. It guarantees that workers are not only poor before 1992 but also at the time of retirement.[10] According to the statistics from the Research Data Center of the German Pension Insurance, in December 2015, 14% of old-age pensioners — 4% of all male pensioners and 26% of all female pensioners — were recipients of this subsidy program.

Eligible pensioners do not need to apply for this subsidy. The amount is computed by applying a built-in formula and is added directly to the recipients' pension account by the pension office. The subsidy size is predetermined. The determinants of subsidy size are total contributions made before 1992 and the average relative wage (average earning points) prior to 1992 (aep^{92}). The subsidy size has a kinked relationship with pre-1992 average earning points. [11] Recipients receive, on average, around 85 euro per month in our baseline sample, which corresponds to an increase in pension income of 11%. In 2015, the total payments for this subsidy program were approximately 3 billion euros.

---

[8]See Appendix B.2 for a summary of other reforms implemented in 1992.

[9]The German name of this subsidy program is "Mindestentgeltpunkte bei geringem Arbeitsentgelt". See German Social Law, vol. 6 clause 262 (SGB VI § 262) for the exact definition.

[10]Full value contribution periods are typically periods with gainful employment. See Online Appendix B.4 for more details of the composition of creditable years, contribution periods and consideration periods.

[11]In particular, subsidy size is determined as:

$$Subsidy_i = min\left(0.5 \times \sum_{\tau<92} EP_{i\tau}, 0.75 \times T_i^{92} - \sum_{\tau<92} EP_{i\tau}\right) \quad where\ EP_{i\tau} = \frac{\omega_{i\tau}}{\overline{\omega}_\tau} \tag{1}$$

where, for each individual i and each year of contribution τ, $EP_{i\tau}$ indicates accumulated earnings points, T_i^{92} indicates years contributed before 1992, $\omega_{i\tau}$ indicates earned wage τ and $\overline{\omega}_\tau$ indicates (West or East) German average wage in τ. The formula implies the subsidy size has a kinked relationship with pre-1992 average earning points, and Figure A.1 depicts this relationship in the case of an individual who contributed 19 years to the pension system prior to 1992. Once subsidy size in terms of EPs is determined, this is added to the accumulated lifetime EPs of individual i, which are then used to compute pension income. See Ye (2022) for more details and Appendix B.3 for examples illustrating the calculation of the subsidy amounts.

3 Data

3.1 Main data and sample

The analysis is based on a novel administrative dataset covering the universe of retirees who left the German public pension system between 1994 and 2018, provided by the German State Pension Fund (FDZ-RV). The dataset is a non-public version of the Discontinued Pension Records (RTWF, Rentenwegfälle), which contains the universe of individuals who were active in the German public pension system at some point in their lives (workers and pensioners) and who left the pension system (mostly due to death) at the time of data collection. The main dataset is assembled from 24 years of cross-sectional waves (1994 to 2018). The dataset includes time-invariant information (such as accumulative pension points, gender, birth month, number of children, and age at claiming pension), at the time when they fall out of the pension system. We refer to this sample as the RTWF sample throughout the paper.

Several important advantages of the data are worth noting. First, this data contains accurate information on average pension points from full-value contribution and contribution years, which are necessary for us to determine the treatment status. Moreover, the data provides an accurate measure of the amount of pension subsidy and pension income, which are crucial for testing the relevance of the instruments. Third, we observe the exact dates of their birth and death and the universe of the German inactive pension accounts, which help us measure the mortality responses accurately. Lastly, our data includes information on an individual's marital status, which was specially provided by the German pension data center. Unfortunately, other potentially useful information is lacking due to the cross-sectional nature of the data set; for example, biographical information such as pension points accumulated before 1992. In addition, occupation is not accurately measured and therefore cannot be used.

For our baseline sample, we restrict the analysis to those individuals who left the pension system due to death. We further restrict to German nationals residing in West Germany. By doing so, we abstract from migration patterns and German reunification effects. Moreover, East Germans face different pension rules that are not comparable to those who worked in West Germany. We keep retirees who claimed old-age pension because the pension subsidy is a part of the old-age pension benefit. We restrict the sample to cohorts born between 1932 and 1942.[12] Finally, we keep those who contributed within the bandwidth of 5 years around the 35-year contribution eligibility, and

[12] The lower bound (1932) is chosen to include individuals who could potentially retire after 1992 (age 60 in 1992) after the introduction of the reform. The upper bound (1942) is chosen to include people who are at least 75 years old in 2018 to have an uncensored measure of probability of dying.

those with aep between 0.45 and 1.05 (approx. between 600 and 1500 euro of monthly pension benefits).[13] The final sample contains 401,932 individuals, of whom 62% are women, and 32.4% satisfy both conditions with aep below 0.75 and more than 35 contribution years.[14]

Table A.1 reports the summary statistics for West Germans who claimed an old-age pension between 1994 and 2018 (*West German pensioners*), for those born between 1932 and 1942 in the *West German pensioners* sample (*1932-1942 sample*), and finally for our *baseline sample*, i.e. with the 30-40 contribution years and 0.45-1.05 aep restrictions. In the baseline sample, age at death (censored at age 75) is around 72.2.[15] Their average probability of dying before age 65, 70, and 75 are 5%, 26%, and 52% , respectively. They have a pension income of 753€/month, and become a subsidy recipient with a 29% likelihood. Conditional on being a recipient, they receive a subsidy of about 85€/month. Of the baseline sample, 38% are male, and 59% are married. Female pensioners have on average 2.2 children. On average, these pensioners claim their current pension at age 63. The baseline sample is comparable to the West German Pensioners and 1932-1942 samples, except for the share of women. The baseline sample is 62% female, while the *West German Pensioners* and *1932-1942* samples have 42% and 39% women, respectively. This is likely due to women having lower wages, thus lower aep, and women are more likely to have contribution years between 30 and 40 as they are granted a generous amount of contribution years devoted to childcare.[16]

[13] We verify that being in the sample is not affected by eligibility conditions. Table A.6 shows that the impact of eligibility conditions on being included in the baseline sample (column 1) and on each restriction that we impose (columns 2 and 3). We find no significant effect on being a West German pensioner and no significant effect on being born between 1932 and 1942. We find a small negative effect (0.1 percent) on selection into our baseline sample due to the contribution years and aep restrictions at a 10 percent significance level. Given the large sample size and small magnitude of the coefficient and significance level, we are not too concerned about this small effect. In Table A.10, we further show robustness by varying the cohort restrictions and varying the aep bandwidth choice.

[14] The majority of the subsidy recipients are female workers. Out of all treated individuals in our baseline sample, 80% are women. The higher share of women can be explained by two characteristics of women: lower wages and more child-raising periods. On the one hand women, on average, have lower wages than men; therefore, their aep is more likely to be below 0.75. On the other hand, because child-raising periods count as contribution years, it is relatively easier for women to reach the 35 contribution years cutoff. In particular, the time of raising a child up to age 10 counts in the consideration period. The package is 10 years for one child, 15 years for two children and 20 years for more than two children.

[15] As we only observe deaths that occurred between 1994 and 2018, our baseline cohorts were at least 75 years old in 2018. For this reason, we examine the impact on the probability of dying before age 75 and age at death censored at 75 throughout the paper. In Table A.7, we further show that the probability of dying before 60 and the probability of dying after 75 are not affected by the eligibility conditions for the pension subsidy by using younger and older cohorts. See Appendix C for further discussion.

[16] Table A.2 shows the characteristics of pensioners in our sample by gender. Overall, men are more likely to die before the age of 70, with a probability of 32 % compared to 22% for women. Age at death (censored at age 75) is around 72.2. Men receive almost 900€/month of pension income, while women receive 668€/month. Women are also less likely overall to have more than 35 years of contributions, while they are more likely to have aep below 0.75.

3.2 Survey data on health outcomes

To provide suggestive evidence on the impact of additional pension income on health and to better understand the mechanisms behind the reduction in mortality, we examine an auxiliary dataset: SHARE-RV. This dataset links the German subsample of the Survey on Health Ageing and Retirement in Europe (SHARE) with administrative pension records provided by FDZ-RV.[17] SHARE collects data on a representative sample of individuals aged 50 and over. We take the following waves: wave 1 (interview years 2004 and 2005), wave 2 (2006 and 2007), wave 4 (2011 and 2012), wave 5 (2013), wave 6 (2015), and wave 7 (2017).[18]

Our SHARE-RV sample contains West German old-age pensioners who were born after 1931.[19] To ensure a reasonable sample size for the analysis, we take a larger bandwidth around the 35-year contribution eligibility and the 0.75 aep cutoff than the RTWF sample. The SHARE-RV sample contains people who contributed between 15 and 55 years and had an aep between 0.25 and 1.25. We end up with 2,328 observations, of which 44% are women and 37% are eligible for the subsidy.

The SHARE-RV sample allows us to gain insights into how health conditions, financial constraints, and psychological feelings are affected by additional pension income. In particular, we consider the following overall health measures: an indicator of overall well-being (*CASP*), a self-reported indicator of health, the number of diagnosed chronic diseases, and a measure of depression symptoms. Moreover, we use a set of variables measuring physiological feelings. We use "how often the individual felt money stopped them from participating in generally defined activities" as an indicator for perceived financial constraints. We also exploit self-reported measures of optimism, particularly measuring how often the individuals feel their life is full of opportunities and how often they feel that their future looks good. Table A.3 gives an overview of how these variables are constructed and their scale.

Table A.4 shows that the baseline SHARE-RV sample is generally comparable to the West German Pensioners sample, except for the amount of pension income without subsidy, being slightly unhealthier and having fewer pension income.[20] Table A.5 further shows the characteristics of

[17] Specifically, SHARE-RV links SHARE with *Versichertenkostenstichtprobe* (VSKT) and *Versichertenrentenbestand* (RTBN). VSKT is a longitudinal dataset and contains monthly information on respondents' employment histories. RTBN is a cross-sectional dataset that summarizes respondents' benefits accumulated during retirement and information on the amount of paid pensions. SHARE-RV is based on direct linkage, meaning that the records of the same SHARE respondents were linked using the respondents' social security number as a unique identifier. See SHARE-RV website and Börsch-Supan et al. (2020) for more information on SHARE-RV.

[18] See SHARE website for further information on SHARE. We do not use wave 3 because it is a retrospective survey and has a different structure from the other waves.

[19] We do not set an upper bound (1942) as we did in the mortality data sample, because health variables are not subject to censor biases and include more cohorts increase the sample size.

[20] We also compare the baseline sample with a restricted sample if we impose the same restrictions as in the mortality

pensioners in the baseline survey sample by gender. The pattern is similar as to the administrative data set. Women are overall healthier, except for the depression index. Women's pension income is on average a smaller share of the household income.

It is worth noting that we can only observe the survey responses of surviving individuals. Since we find a reduction in mortality due to higher income using the administrative dataset, older pensioners who survive to participate in the survey without the subsidy may be healthier than those with the subsidy. Therefore, the survey sample in the treatment group may be less healthy compared to the control group. In this case, our health estimates likely provide a lower bound on the health impact of additional pension income.

4 Empirical Strategy

Estimating the causal effects of income on mortality is challenging because of the endogeneity of income. Unobserved factors might affect both pension income and mortality. This paper exploits the eligibility conditions for an exogenous pension subsidy program to estimate the causal effect of pension income on mortality. First, we study the intent-to-treat effect of the pension subsidy program on mortality using a Difference-in-Differences (DID) method. Second, we use an instrumental variable (IV) approach to report the causal effect of pension income on mortality and health outcomes.

4.1 Difference-in-Differences Method

We use the two eligibility criteria of the subsidy program to obtain a DID estimate. The first difference is having aep at retirement below 0.75, and the second is having more than 35 years of contributions. We measure the change in the differences between treatment and control group before and after 35 contribution years. The treatment group consists of individuals with aep at retirement below 0.75. The control group consists of individuals with aep at retirement above 0.75. Table A.2 reports the summary statistics for the treatment and control groups for men and women, respectively. The two groups present similar characteristics except for the control groups have higher pension benefits without subsidy. The average amount of pension benefits without subsidy differ by approximately 236€ per month for women and 318€ per month for men between the two groups.

data sample. Note that the sample size drops to 205 when we make this restriction. They are generally comparable too.

Theoretically, individuals with aep below 0.75 and more than 35 contribution years could still receive no subsidy if their wages were high before 1992 (aep_{92} being higher than 0.75 renders the amount of subsidy zero). Because the RTWF data does not provide information on average earning points before 1992, our DID estimator measures an Intent-To-Treat (ITT) effect. In practice, most individuals who fulfill the two conditions receive a positive subsidy for two reasons. First, eligible individuals do not need to apply for the subsidy. The pension office automatically adds the amount to their pension account. Second, 81% of pensioners fulfill the eligible conditions received a positive amount of subsidy (Table A.14).

The estimation equation for the DID design is the following:

$$Y_i = \alpha + \theta D_i \times Above35_i + \delta_1 D_i + \beta X_i + \tau + \lambda + \epsilon_i \tag{2}$$

Y_i represents the outcome variable of individual i with aep. The treatment indicator D_i is defined as $D = \mathbb{1}(aep_i < 0.75)$. τ indicates contribution years fixed effects. $Above35_i$ is a dummy that takes the value one for individuals with 35 or more contribution years, and zero for those with less than 35 contribution years. θ measures the reduced-form effect of being eligible for pension subsidy on mortality, which is also the first-stage estimate for the IV regression.

X_i contains the demographic characteristics, such as a male indicator, being married, not having any health insurance, having children[21], pension pathway, (indicators for claiming early retirement via unemployment or women's pension pathway and claiming disability pension benefits), and pension benefits without subsidy. λ is the birth cohort fixed effect. τ is the contribution year fixed effect. The standard errors are clustered at the birth year level [22] and we report the bootstrap p-values in brackets in all tables.

Manipulation into treatment If the existence of the subsidy and the knowledge of its eligibility conditions were to induce individuals to manipulate either one of the parameters determining eligibility, our estimates would be biased. In the following, we show that such manipulation is rather unlikely and not supported by empirical evidence.

First of all, because the subsidy amount is computed from aep^{92}, which in turn is fully determined by full-value contribution periods and wages prior to 1992, the subsidy size is as good as

[21] This variable is based on whether the individual has claimed child benefit. As it is usually the women who do this, this variable is a poor measure of the number of children for men. Instead, for men this variable is a proxy for being a man who is more involved in caring for children at home.

[22] It is crucial to include cohort fixed effects because there has been a series of pension reforms in Germany during the sample periods. The cohort fixed effects account for the incentive changes caused by raising the statutory retirement age, which was implemented gradually by cohorts.

exogenous. To receive a positive subsidy amount, one must in practice fulfill three conditions: (1) have more than 35 years of contributions, (2) have $aep < 0.75$, and (3) have $aep^{92} < 0.75$ (otherwise the amount of subsidy is zero). Since aep^{92} cannot be manipulated, selective behaviour could only come from manipulating aep or changing labor supply decisions.

Second, we discuss the possibility of selection into the aep condition. After 1992, those with aep^{92} below 0.75 might closely monitor their aep to ensure they do not lose the subsidy entitlement. In practice, aep is highly correlated with aep^{92} (Ye, 2022). The higher the number of contribution periods before 1992, the closer will aep^{92} be to aep, i.e. average earning points at retirement. Consequently, the only plausible instance in which manipulation might be profitable is for somebody with aep^{92} below but close to 0.75 and aep above but close to 0.75. Only a small share of pensioners fall into this group.[23] Moreover, the kinked subsidy schedule suggests that such an individual would receive a relatively low monthly subsidy, approximately lower than 20€/month. That is, the monthly subsidy would be less than 4% of their pension income and less than 2% of their pre-retirement wage. This makes it unlikely to be profitable for people to lower their wages to manipulate subsidy eligibility. It is also worth noting that for manipulation to be possible, people would need to know about the subsidy well in advance and fully understand the complicated formula by which the subsidy is allocated and calculated, which is likely to be a strong requirement. Finally, if individuals were to accept lower wages at the end of their careers in order to qualify for the subsidy, we should observe bunching of individuals with more than 35 years of contributions around the 0.75 aep cutoff. Figure A.6 shows the density of aep distinguishing between those with more (red bars) and less (blue bars) than 35 years of contributions in the baseline sample (panel (a)) and the differences between these two densities (panel (b), above minus below 35 group). Overall we observe a rather smooth density around the cutoff for both groups and, if anything, a higher concentration of individuals with less than 35 years of contributions at $aep = 0.75$. Therefore, we rule out the possibility of strategic behaviour around the 0.75 cutoff.

Finally, we discuss the possibility of selection into the 35 years of contributions condition. Individuals with aep^{92} and aep below 0.75 might be tempted to postpone retirement and reach 35 years of contributions in order to receive the subsidy. If this were the case, we would observe bunching at 35 contribution years in the density of individuals with $aep < 0.75$ in our baseline sample. Figure A.7 plots the distribution of contribution periods by aep group for the baseline sample (panel (a)) and the difference in densities between the two groups (panel (b), below 0.75 minus above 0.75). Although we observe bunching at 35 years of contributions, this sharp bunching exists for both

[23] Using the VSKT sample, we find that only 6% of pensioners with aep at retirement higher than 0.75 have aep^{92} lower than 0.75.

groups. One possible explanation is that 35 years of contributions is also the eligibility requirement for the old-age pension for the long-term insured. The long-term insured path allows people to retire at 63 instead of waiting until the statutory retirement age.

Figure A.7 (b) shows that the $aep < 0.75$ group bunch more than the $aep \geq 0.75$ group. This could be problematic. However, when we further examine the distribution of contribution years, we can see that compared with the $aep \geq 0.75$ group, the excess mass for the $aep < 0.75$ group seems to primarily come from people at the top of the distribution. Figure A.7 (b) shows that while the $aep \leq 0.75$ group has a large degree of bunching, this group also has a smaller mass between 37 and 40 years of contributions, compared with the $aep < 0.75$ group. This suggests that relatively poorer individuals are retiring earlier (reducing the years of contributions) than they would have otherwise. This is most likely driven by the incentives to retire via the long-term pension once they reach 35 years of contributions threshold. This seems reasonable in light of the intuition that poorer people are more likely to be blue-collar workers with a more physically demanding job, which may give them a greater incentive to retire as early as possible.

Moreover, for those with more than 35 years of contributions, gaining eligibility for a subsidy is unlikely to be the reason for working fewer years. This is because they are already eligible for the long-term insured pension. Finally, Table 1 shows that the eligibility conditions do not seem to impact retirement choices. Even if people in our sample choose to retire earlier, the overall composition of our treatment group would not be affected. We also show the robustness of our estimates when dropping the individuals who bunch exactly at the 35 years of contributions cutoff (Table A.10).

4.2 Instrumental Variables Strategy

The purpose of the instrumental variable approach is twofold. First, it helps us to investigate the broader question: what is the effect of pension income on mortality? Second, it facilitates the investigation of health outcomes. Because of the sample size limitations of the SHARE-RV data, we need to rely on the IV analysis to explore the health consequences of having more pension income. We use the interaction between the two subsidy eligibility conditions as an instrument for pension income (PB_i). The first-stage and second-stage equations are as follows:

$$PB_i = \gamma_0 + \gamma_1(D_i \times Above35_i) + \gamma_2 Above35_i + \gamma_3 D_i + \beta X_i + \lambda + \tau + \mu_i \tag{3}$$

$$Y_i = \pi_0 + \pi_1 \widehat{PB}_i + \pi_2 Above35_i + \pi_3 D_i + \theta X_i + \lambda + \tau + \epsilon_i \tag{4}$$

PB_i indicates the amount of total pension income received by individual i. γ_1 measures the average treatment effect of the eligibility conditions on pension income. If the RTWF sample is used, X contains the demographic characteristics, including gender, being married, having children, not having health insurance, pension income without subsidy, receiving an unemployment pension, receiving a women's pension, receiving disability pension. When using the SHARE-RV sample, X contains gender, being married, having children, being in contact with at least one of their children at least once a week, an indicator for their children being employed, pension income without subsidy, receiving unemployment pension benefits, receiving women's pension benefits, receiving disability pension benefits, years of schooling, and socioeconomic status before retirement[24]. We also control for age at claiming pension, the contribution years fixed effect τ and birth cohort fixed effect λ. Using the predicted value of pension income ($\widehat{PB_i}$), we obtain the causal effect of pension income on mortality or health outcomes (π_1).

There are three conditions necessary to interpret the two-stage least squares IV estimates. First, the interaction of these two eligibility conditions is independent of unobserved characteristics that affect pension income and mortality. Further, pension income must be strongly associated with the two eligibility conditions. The DID results in Section 5.1 confirm the exogeneity and relevance of the instruments.

Second, the exclusion restriction requires that the interaction of the two eligibility conditions affect mortality outcomes only through changes in pension income. One concern would be the indirect impact of pension subsidy program on age at claiming pension. We have shown that eligibility for the subsidy does not affect retirement choices. Nonetheless, by controlling for age at claiming pension in our regressions, we address this concern on second-order effects of the subsidy program. Throughout the paper, we always show the IV estimates with and without controlling for age at claiming pension. The results are similar.

Third, the monotonicity condition requires that satisfying both eligibility conditions will not cause a reduction in pension income. This condition is readily satisfied because of the nature of the subsidy program which aims to increase pension income.

5 Results

In this section, we first present graphical evidence and estimation results under the DID framework. We show both the pension income and mortality responses to eligibility for the subsidy program.

[24] SES before retirement is measured using the following variables: no information, unpaid care or incapacity to work or illness, unemployed or marginally employed, gainfully employed and obligated to pay social insurance, other as supplementary period, pension provision from own insurance.

We further estimate heterogeneous results and robustness and placebo tests. Then, we show the impact of additional pension income on mortality using the IV method. Finally, we explore the impact on health outcomes, financial constraints, psychological feelings, and risky behaviours to better understand the mechanisms.

5.1 Effects on Pension Income and Retirement

First, we examine graphically the impact on the probability of receiving the subsidy and the amount of the subsidy received. Figure A.3(a) plots average subsidy size against years of contributions for the control ($aep \geq 0.75$) and treatment ($aep < 0.75$) groups. We observe a sharp increase in the subsidy received after 35 years of contributions for the treatment group. In contrast, no change is observed for the control group. The empirical pattern is similar to the policy schedule depicted in Figure A.2. The similar pattern is observed when we look at the probability of receiving subsidies (Figure A.3(b)).

Furthermore, Figure A.4 shows pension benefits without and including subsidies by number of contribution years, for the treated and control groups. Figures A.4(a) and (c) depict the mean values by treatment, while Figures A.4(b) and (d) show the difference between the means of the two groups (treatment minus control). The absence of the subsidy, pension benefits increase approximately linearly with the number of contribution years. The difference in pension benefits without the subsidy between the treatment and control group increases with the number of contribution years. However, we do not see a change around the 35 years cutoff. In contrast, Figures A.4(c) and (d) show that the subsidy entails a permanent upward shift of the trajectory, decreasing the difference in pension benefits between the two groups.

Panel A of Table 1 shows the first-stage DID estimates, i.e., the impact on the probability of receiving a subsidy, subsidy amount, and total pension income. We progressively control for contribution years fixed effects (column 1), birth cohort fixed effects (column 2), demographic, pension-related variables (column 3), and finally pension income without subsidy (column 4). We find that eligibility for the subsidy increases the probability of receiving a subsidy by 73%, increases the size of the subsidy received by 65€/month, and increases pension income by the same amount. While the estimates on the probability of being a recipient and subsidy amount are not sensitive to varying controls, these matter for the estimated effect on pension income. This is not surprising as the two groups differ in their lifetime income. Therefore it is crucial to add pension income without subsidy as a control variable. Figure 1 and panel A of Table A.8 show the event-study figure and results. We observe non-significant or precisely zero estimates before the 35 contribution years cutoff and a sharp increase in subsidy amount, pension income and probability of being a recipient afterwards.

Panel C of Table 1 reports the impact on age when the pension is claimed. We do not find any significant effects. Panel C of Table A.8 reports event study coefficients and confirms the pattern.

5.2 Effects on Mortality

We now examine the effect of subsidy eligibility on mortality outcomes. The graphical evidence and regression analysis show that additional pension income reduces mortality. Figure A.5 plots the mean mortality outcomes for for the control ($aep \geq 0.75$) and treatment ($aep < 0.75$) groups(left column) and the difference in means between the two groups (treatment minus control) by number of contribution years. We see that the probability of dying before 65 increases sharply at 35 years of contributions for both groups, but the gap between these two groups widens after the cutoff. Similarly, for the probability of dying before 70 and dying before 75, we observe a similar evolution before the 35 year cutoff and a change in the trajectory in favour of the poorer group. Notably, without controlling for birth cohorts nor pension pathway, the mortality rates of the poorer group are lower than those of the richer group.

Panel B of Table 1 shows the estimated effects of being eligible for additional pension on mortality. We find significant decreases in the probability of dying before 65, 70, and 75 by 0.9, 1.4, and 0.8 percentage points, respectively. These correspond to relative decreases of 17.6%, 5.4%, and 1.5% with respect to the sample average. The estimates are not sensitive to varying controls. The event study results are depicted in Figure 2 and reported in Panel B of Table A.8. For each outcome, we find non-significant and close to zero point estimates before the 35 year cutoff, supporting the parallel trends assumption.[25] We show the 95 percent CI (shaded line) and the 90 percent CI (solid line) in Figure 2. For the probability of dying before 75, the estimates are relatively nosier.

When we use alternative measures of mortality, the results are similar. Table A.9 show the impacts on the probability of dying between age 62 and 69, the probability of dying between 70 and 75, and the probability of dying within 4 years of claiming an old-age pension (hence also 4 years after receiving the subsidies). Eligibility for the subsidy decreases the probability of dying between 62 and 69 and the probability of dying within 4 years by 1.1 and 0.4 percentage points, respectively, corresponding to relative decreases of 5.5% and 2.6%. Figure A.9 further plots the impact on the probability of dying at each year after retirement (left column), which is also the time when the subsidies are disbursed, and the impact on the cumulative probability of dying by each year (right column). We can see that the additional income yield improvement effects starting from

[25] The results are robust when using contribution semesters instead of years as the time variable, as depicted in Figure A.8.

the second year for men. Moreover, the improvement in life expectancy is driven by the responses in the first 5 years after the subsidies are received.

Several exercises further establish the robustness of the estimates as we vary sample selection (Table A.10). First, we present the results are robust to the exclusion of individuals who retired after exactly 420 months (35 years). Second, the estimates are similar in magnitude when we narrow the bandwidth of aep be closer to the cutoff. Third, our estimates are also robust to the inclusion of individuals born 1943 to 1948 and when restricting the analysis to cohorts born between 1932 and 1937, i.e. the cohorts born before the Second World War. For more detailed discussion, see Appendix D.

We also perform several placebo tests in Table A.11, including the use of a sample of older cohorts who retired before the announcement of the subsidy (Figure A.10), and using other placebo cutoffs (Figure A.11). These tests rule out the possibility that other confounding factors are driving our reduced-form estimates. For more details, see Appendix D.

5.3 Heterogeneous Effects on Mortality

Table 2 reports the DID estimates by gender, marital status, and type of health insurance. Table A.13 shows the p-values testing the hypothesis that the coefficients by subgroup are equal.

Columns (2) and (3) of Table 2 show the DID estimates by gender. Unsurprisingly, women in our sample receive more than twice the amount of subsidy than men. This is because, on average, women have a lower lifetime earnings profile than men and are therefore more likely to be entitled to a higher level of subsidy.[26] However, despite a larger first-stage impact on pension income, we find stronger effects on mortality for men than women. Men's probability of dying before 70 and 75 decreases by 2.1 and 1.4 percentage points, respectively, while the effects for women are close to zero and insignificant. Age at death (censored at 75) increases by 0.17 years (about 2 months) for men, while there is no effect for women.

One possible explanation for the lack of impact on women could be related to the actual standard of living of the treated women. It is possible that the program subsidises women in relatively well-off households, since the subsidy is a function of individual rather than household income. However, their actual standard of living may be determined not only by their own income but also by the income of their husbands or children. Moreover, because of the possibility of accumulating contribution years from years spent caring for children, low-income women with shorter careers can also be eligible for the subsidy. Therefore, the additional income from the subsidy may have

[26] Women's aep^{92} are distributed centering 0.5, which grants the highest amount of pension subsidy, all else equal.

a limited impact on their longevity. To explore this possibility, we perform some heterogeneity analyses on women by their marital status and whether they have children.

We would expect single women to benefit more from the subsidy, as they are the sole earners in the household. However, Table A.12 shows that married women seem to experience stronger mortality effects than unmarried ones (columns (2) and (3)), despite similar first-stage estimates. Table A.13 shows the p-values testing the hypothesis that the coefficients by subgroups within the female sample are equal.[27] We also expect eligible women without children to benefit more from the subsidy as they need to have worked more years to reach the 35 contributions years threshold compared to women with children. Yet again, we do not find significantly different effects by parental status (columns (4) and (5)). However, the impact on pension income is slightly higher for mothers. Marital status and children do not seem to help explain why women's mortality outcomes are less responsive. Section 6.2 provides additional discussion of the gender differences.

Columns (4) and (5) of Table 2 show heterogeneous effects by marital status for the full sample. The effects on subsidy size and mortality outcomes are similar between the married and single groups.

Finally, we also investigate the heterogeneous effects by health insurance status. In Germany, the majority of people have public health insurance. Only people with a higher labor income (or who are a dependent of a private health insurance policy holders) or the self-employed can enrol in private health insurance.[28] Given we expect those with private health insurance to have higher household incomes and better healthcare coverage, even if they are eligible for the pension subsidy, the additional pension income has little impact on their well-being. We find that the first-stage estimates are smaller for those with private health insurance. Despite subsidy eligibility, people with private health insurance received a smaller subsidy, on average, mainly because they are more likely to be men. The reduced-form effect on mortality is larger for those with public health insurance. The age at death is postponed by 1.7 months (significant at the 5 percent level),

[27] Marital status is recorded at the time of pension claim application. The singles include widower, divorcees and the ones who have never married. There are around 9% with missing marital status, which we do not include in this analysis. We suspect that those ones who with missing status are widows.

[28] Although the majority of the German population is covered by generous statutory health insurance, out-of-pocket payment for healthcare services remain and account for 13% of total healthcare expenditure in Germany (WHO, 2023). Bock et al. (2014) shows that the top three highest amount of out-of-pocket payment for elderly German public health insurance beneficiaries are medical supplies, dental prostheses and payments for pharmaceuticals (co-payments for prescribed drugs, and non-prescribed drugs). This is mainly driven by the fact that costs for glasses, medical devices that went beyond pure medical necessity, such as electrical wheelchair, dental prostheses, and non-prescribed drugs are not covered by health insurance. See here for a detailed description of the co-payment regulations of the statutory health insurance in Germany. Privately insured individuals could have better coverage and incur less out-of-pocket payment. Unfortunately, we can't test the impact on out-of-pocket payments due to sample size limitations.

while it increases by 1 month for those with private health insurance and the effect is insignificant. However, taking into account the different magnitudes of the first-stage estimates, the results for mortality are similar, with the exception of the probability of dying before age 75.

In most instances, we don't find a significant effect on labor supply choices. The only exception are men, for whom we estimate a significant small decrease in age when the pension is claimed. Eligible men claim pension 0.4 months earlier.

5.4 Effect of Pension Income on Mortality

To quantify the impact of an additional 100€of pension income on mortality and health outcomes, we estimate the impacts in an IV framework. Table 3 reports the effect of having more pension income on mortality and the age at which the pension is claimed. We show the estimates for the overall sample (columns (1) and (2)) and by gender (columns (3)-(6)). Odd columns do not control for age at claiming pension, while even columns do. One concern of the exclusion restriction is that eligibility for the subsidy also affects retirement choices. Our preferred specification is to control for age at claiming pension (including pension pathways) to abstract from possible labor supply effects.

Panel A shows the first-stage estimates. Eligibility for a pension subsidy increases pension income by around 65€/month (71€/month for women, and 33€/month for men, on average). F-statistics are above the rule-of-thumb threshold of 10 in all specifications.

The IV estimates in Panel B of Table 3 indicate that more pension income has a statistically significant positive effect on age at death and a significant negative effect on the probability of dying before 65, 70, and 75. These estimates are in line with DID results. We find that 100€ per month of additional pension income causes a decrease of 1.2, 2.1, and 1.3 percentage points in the probability of dying before 65, 70, and 75, respectively, in the full sample. This corresponds to an increase in age at death by about 2.4 months. Similar to the DID estimates, results on mortality are predominantly driven by men, who experience substantially larger improvements in mortality outcomes than women. An additional 100€/ month pension income reduces the probability of dying before 65, 70, and 75 by 1.2, 6 and 3.9 percentage points for men, respectively. Moreover, the inclusion of a control for the age at which a pension was claimed does not affect the magnitude of the estimates.[29]

[29] We observe a slight increase in the magnitude of mortality results for men, but the estimates with and without age at claiming control are not statistically different. We also examine the heterogeneous effects of the IV estimates for the same subgroups as in section 5.3. The results are similar. The results are available on request.

To interpret the IV results, it is important to understand who the compliers are. In our setting, the compliers are those individuals whose pension income increases when they fulfill the two eligibility conditions. Because the pension subsidy amount is computed by applying a built-in formula and is credited directly to the recipient's pension account by the pension office, almost all eligible individuals are compliers. The only exception is people with a zero subsidy amount because their aep^{92} is above 0.75, therefore according to the subsidy formula, they receive a zero subsidy amount even though they fulfill both eligibility conditions. In practice, there are very few never-takers. These are people with higher average wages before 1992 but lower average wages when they retire. Table A.14 compares the characteristics of individuals in the baseline sample with those of the eligible individuals, the compliers (subsidy recipients in the eligible group, 82% of all eligible individuals) and the never-takers (individuals who received no subsidy despite of general subsidy eligibility, 18% of all eligible individuals). Compared to the never-takers, the compliers are less likely to be male, married and more likely to be covered by public health insurance. They also have children at an earlier age and have fewer years of schooling. Compliers are poorer overall — they have lower pension incomes without the subsidy and are less likely to own a home.

5.5 Mechanisms: Effects of Pension Income on Health Outcomes

To better understand the mechanisms behind the reduction in mortality, we explore the changes in health outcomes by exploiting the SHARE-RV data. First, we show the impact on health measures, including measurements of overall health, self-perceived health, number of chronic diseases, and depression index.[30] We then unpack overall response of better physical health by looking at specific types of chronic diseases. Moreover, to probe deeper into the connection between income and mental health, we look at a measure of optimism and measures of perceived financial constraints. We also look at changes in risky behaviours. We present the IV estimates in this section.

Overall Health Table 4 shows the effect of additional pension income on overall health. Columns (1) and (2) show results for the baseline sample, (3) and (4) for women, and (5) and (6) for men. For health outcomes in this table, estimated coefficients are reported in terms of standard deviations from the mean. Even columns control for age at claiming pension. Generally, adding the age control does not substantially affect the estimates. In the following, we focus on the results when controlling for age at claiming pension. Panel A shows that all estimated first-stage coefficients are positive and highly significant and F-statistics are above 10. Different to the RTWF sample,

[30] See Section 3.2 and Table A.3 for descriptions of these outcome variables.

eligibility for the subsidy program increases the pension income by 44€/month for women, and 59€/month for men in the SHARE-RV sample.[31]

Table 4 Panel B reports the IV estimates. For the full sample, we find a positive impact on overall well-being, as measured by CASP (an indicator of overall well-being), and a reduction in the number of diagnosed chronic diseases. An additional 100€ monthly pension income increases the CASP by 55 percent of a standard deviation (significant at the 5 percent level) and the number of chronic diseases decreases by 46 percent of a standard deviation (significant at the 10 percent level). When distinguishing between genders , we find the improvements in health measures are driven by men, which is consistent with the finding that men drive the improvement in mortality outcomes in Table 3. We also see a significant improvement in the self-perceived health and depression index. An additional 100€ monthly pension income improves men's overall well-being (CASP) by 1.3 standard deviations, self-perceived health by 1.7 standard deviations and reduces the depression index by 0.6 standard deviations and number of diagnosed chronic diseases by 1.9 standard deviations. The results are consistent with existing evidence, which has shown that the number of chronic diseases and depression symptoms are strongly correlated with a worse quality of life and excess mortality (Adamson et al., 2005; Kahneman and Krueger, 2006). For women, we find non-significant effects of additional pension income.

Long-term Care Dependency We also examine the impact of two health measures which are linked to long-term care dependency: difficulties with Activities of Daily Living (ADLs, including dressing, bathing, going to bed, eating, walking across a room), difficulties with Instrumental Activities of Daily Living (IADLs, including shopping, preparing meals, taking medication, managing money, using the telephone). These two measures are also good indicators of cognitive decline, which can have a negative impact on financial decision-making (Mazzonna and Peracchi, 2020), in addition to the need for long-term care services (Li et al., 2023). We find an additional 100€/month of pension income reduces men's difficulties with ADLs by about 1 standard deviation at the 5 percent significant level. For difficulties with IADLs, we find an overall decline of 0.4 standard deviations, again driven by men. These findings suggest that additional pension income may reduce pensioners' long-term care dependency, which can alleviate considerable financial burdens on the healthcare system. For women, surprisingly, we find an increase in difficulties with ADLs by 0.6 standard deviations at a 10 percent significance level.

[31] This is because the treated men are poorer than treated women in the SHARE-RV sample because we include a wider range of aep and contribution years in the survey sample. The treated men in the SHARE-RV sample have a pension income of around 715€/month without subsidy, while treated women have 760€/month of pension income without subsidy.

Chronic Diseases Table 5 investigates the effects on specific types of chronic disease, including whether the individual has had a stroke, has chronic lung disease, has cataracts, and has high blood pressure. We again observe substantially stronger effects for men than for women. Women experience marginal reductions in the probability of chronic lung disease and cataracts (non-significant effects). On the other hand, men experience sizable reductions in the probability of being currently diagnosed with a chronic lung disease, cataracts, or high blood pressure.

Table A.15 examines the impact on diseases for which the incidence is less likely to be affected by changes in income, such as cancer, Parkinson's disease, and fractures of the hip. Indeed, we find no effect of additional pension income on the probability of these occurring. We also study the incidence of diabetes[32], which typically takes many years to develop. Diabetes is caused by genetic predisposition and obesity. Potentially, higher pension incomes may allow pensioners to afford healthier diets. In addition, less stress about money could also reduce the likelihood of obesity. However, these factors may take many years to influence the onset of diabetes, and indeed we find no significant effect of additional pension income on the likelihood of having diabetes.

Future Outlook In addition, we explore the impacts on perceived financial constraints and optimism in Table 5. Both measures can be underlying causes of stress, depression, and poor mental health, consequently affecting mortality (Mendes de Leon et al., 1994; Gardner and Oswald, 2004; Ridley et al., 2020). All coefficients are expressed in standard deviations from the mean. For the full sample, we find significant improvements in "feel full of opportunities" and "future looks good". Again, men drive the results. We also see a significant reduction in feeling a "lack of money stops them from participating in activities" for men. These factors could contribute to the estimated decrease in depression and improvement in self-perceived health for men.

Risky Behaviours Finally, we examine risky behaviours, such as smoking and alcohol consumption, which are important risks that can lead to poorer health. Table 5 shows that an additional 100€ of monthly pension income reduces the days of alcohol consumption in the last 6 months by 88% of a standard deviation for men.[33] The overall probability of smoking at the time of the interview is reduced by about 3 percentage points for both men and women. We don't find any effect on the probability of ever having smoked on a daily basis. The reduction in drinking and smoking could be related to the lower stress levels resulting from the extra income.

[32] Unfortunately, we cannot distinguish between type I and type II diagnosis.

[33] These variables are unfortunately only available for some respondents in the SHARE-RV baseline sample. Therefore, we report the minimum number of observations and value of first-stage F-statistics.

All in all, these findings suggest that the reduction in mortality is driven by an improvement in overall health. In particular, more pension income leads to a reduction in the incidence of chronic diseases, including cataracts and high blood pressure, and an improvement in the ability to perform daily activities. We also show that better health outcomes may also partly be due to a better mental health status, as indicated by a reduction in the depression index, reduced stress about money, a more optimistic view of the future and a reduction in frequent alcohol consumption.

6 Discussion

6.1 Comparisons with existing literature

In Table 1, we show that eligibility for the pension subsidy increases pension income by 8% (64/750) and reduces the probability of dying before age 65, 70, and 75 by 17.6% (0.009/0.051), 5% (0.014/0.257), and 1.5% (0.008/0.519), respectively. Therefore, we estimate ITT pension income-mortality elasticities of -2.2, -0.63 and -0.19, which represent the percentage change in the probability of dying before age 65, 70, and 75 due to a 1% increase in pension income.[34]

To understand the estimated mortality and health responses, we compare our results with the existing literature. The effect of an increase in pension income on mortality is not necessarily symmetric with the effect of a decrease in pension income, therefore, we make separate comparisons between studies which focus on studying increases or decreases in pension income.

First, we compare our estimates with evidence on mortality responses to an increase in pension income (Case, 2004; Barham and Rowberry, 2013; Huang and Zhang, 2021; Miglino et al., 2023), the majority of which explore the non-contributory pension in developing countries. Our pension income-mortality elasticity of -0.63 (probability of dying before age 70) is at the higher end compared to these studies. For example, Barham and Rowberry (2013) study the phasing-in of the Mexican conditional cash transfer program, Progresa, between 1997 and 2000, which led to an increase in average beneficiary income levels of 22% in rural areas. They find a 4% decline in average municipality-level mortality for people aged 65 and above. This translates to an income-mortality elasticity of -0.18. Miglino et al. (2023) study the effect of income on mortality by exploring the eligibility condition for the non-contributory pension program in Chile. They find the basic pension increases income by 72% and reduces four-year mortality by 28%, leading to

[34]The IV estimates in Table 3 show monthly pension income increase by 100 euro (around 12 percent increase) leads to a decrease in the probability of dying before age 65, 70, and 75 of 23.5% (0.012/0.051), 8% (0.021/0.257), and 2% (0.013/0.519), respectively. The pension income-mortality elasticities calculated using the IV estimates are similar: -1.9, -0.67, -0.17.

an income–mortality elasticity of -0.386. In comparison, our estimated pension income-mortality elasticity is similar to the findings of Huang and Zhang (2021), which find an income-mortality elasticity of -0.67, similar to our estimate. Huang and Zhang (2021) examine the implementation of China's New Rural Pension Scheme, which increased the household income by 18%. They find that the pension scheme reduced one-year mortality by 2.2 percentage points (12%) among the treated group.

Second, we compare our estimates with evidence on mortality responses to decreases in pension income (Jensen and Richter, 2004; Snyder and Evans, 2006; Johnsen and Willén, 2022). While Jensen and Richter (2004) find lower income leads to higher mortality by exploring a crisis in Russia in 1996, during which many pensioners were not paid for an extended period, Snyder and Evans (2006) show lower pension income leads to reduced mortality by examining a variation in social security wealth for the U.S. "notch" cohort. In addition, Johnsen and Willén (2022) shows negative income shocks had no impact on both employment and health care utilisation of pensioners in Sweden. Specifically, Jensen and Richter (2004) finds an income-mortality elasticity of -0.20. They find that the crisis decreased household income by 24% for these pensioners and they were 5% more likely to die in the two years following the crisis. Snyder and Evans (2006) find an income-mortality elasticity of 0.5, and that lower pension income leads to reduced mortality, which they attribute to beneficial effects of employment. They find a 4% drop in income leads to a reduction in five-year mortality by 2%.

The relatively large income-mortality elasticities suggested by our findings are likely due to the fact we study the impact on low-income retirees, who are likely the most vulnerable among the population with limited resources. For example, Gelber et al. (2023) study the impact of more generous Disability Insurance (DI) benefits on mortality and find a large impact on low-income DI beneficiaries. They show $1,000 more in annual disability insurance payment in the U.S. reduces mortality of low-income beneficiaries by 0.18 to 0.35 percentage points, implying an elasticity of mortality with respect to DI income of around -0.6 to -1.0. The magnitude of their elasticity is similar to ours.

Lastly, comparing our findings to studies in the medical literature, our results are unsurprising. Compared with studies on patients cutting back high-value drugs (e.g., statins, antihypertensives for cardiovascular and steroids, inhalers for respiratory) (Brot-Goldberg et al., 2017; Chandra et al., 2021), our estimates show a similar size of the impacts on mortality. For example, Chandra et al. (2021) find that an exogenous 100$/month decrease in Medicare's drug coverage, a 24.4% change) causes mortality to increase by 0.0164 percentage points per month (13.9%). Combined with our suggestive evidence of increased out-of-pocket payments, our results could be due to some drugs having large protective effects in the very short term for patients with acute conditions, such as heart attack and stroke (Chandra et al., 2021). Moreover, when compared with studies on correlation between different causes of mortality risk and the switch from a sedentary to a moderately active lifestyle, our estimated effects on mortality rates imply similar benefits to regularly engaging in moderately intensity physical activity.[35]

6.2 Gender Differences

We find stark difference in mortality and health responses to additional pension income by gender. Men benefit from having additional pension income, while women are not affected. The analysis in Section 5.3 suggests that marital status and number of children do not explain the different gender responses. One explanation is that the composition of eligible women is more heterogeneous than that of men, even after controlling for marital status and number of children. Women with more than 35 contribution years and low average earnings can include, on the one hand, mothers with low attachment to the labor market but who are rewarded more pension contribution years due to childcare needs and, on the other hand, women who have worked for many years in low-paid jobs. Moreover, since men are the primary earners in most West German family, women with a low pension entitlement can either come from low-income families or from well-off families because the household income is high.

We use two measures to proxy for truly low-income families: a higher share of pension income in household income and the household having no assets.[36] Table A.16 shows the heterogeneous effects by the share of pension income in household income. We compare the results for people with a share of pension income above and below 50% of total household income.[37] Although suggestive, we find that women whose pension income makes up a higher proportion of overall

[35] Different studies based on survey data from around the world show a correlation between different causes of mortality risk and the switch from a sedentary to a moderately active lifestyle. For example, Richardson et al. (2004) use data on U.S. adults aged between 51 and 61 in 1992. They estimate that regular physical activity can reduce overall mortality by 38% compared with sedentary individuals. Baade et al. (2011) follow colorectal cancer patients in Australia from 2003. Patients engaging in some level of physical activity after the diagnosis had a 25% to 28% lower risk of all-cause mortality within five years of diagnosis than sedentary participants. Kikuchi et al. (2018) look at community-dwelling Japanese between between 2000 and 2012. They find that engaging in vigorous-intensity physical activity was correlated with a reduction in all-cause mortality risk between 20 and 30%, depending on the level of activity, which can improve quality of life and ultimately reduce mortality.

[36] The correlations between these two measures and marital status are not very high, suggesting that marital status does not capture these characteristics. The correlation between the share of pension income in total household income and being married is -0.26. And the correlation between owning assets and being married is -0.09. These two measures also capture different families, as the correlation between owning assets and the share of pension income is -0.23.

[37] Note that the sample size is almost halved as we only observe household income for some of the respondents. If we further divide it by income share and by gender, the sample size becomes even smaller, with the result that the F-statistic for men is below 10.

household income are more likely to respond to the following health measures: feeling life is full of opportunities and future looks good.

Table A.17 shows the heterogeneous effects on the list of health outcomes by home ownership status, which is an indicator of household wealth. Home ownership is defined by whether any household member owns at least one house/apartment. We find that men who do not own home respond more strongly to additional pension income on many dimensions of health. We do not find that women who are not homeowners benefit more from additional pension income, except for feeling better about the future. This suggests that while reliance on pension income may partly explain men's health responses to additional income, it can't explain the different gender responses.

One alternative explanation for the gender difference in responses may stem from different working conditions across the lifespan, leading to varying pre-existing health conditions in men and women. Table A.18 compares the mortality and health outcomes in the absence of the subsidy by gender. We proxy the outcomes in the absence of the subsides by looking at the pensioners who have more than 35 years of contributions but with aep higher than 0.75. Indeed, we find that potentially treated men are overall less healthy than women.

To further test the differences in health between eligible men and women, we utilise the scientific use file of the Insurance Account Sample (VSKT, administrative data from the German Pension insurance) 2002, 2003-2006 waves, which contains biographical information on a random sample of individuals with an active public pension insurance account in Germany in 2002, 2003 to 2006. We make the same sample restrictions as our baseline sample. We examine whether those eligible individuals are healthier or unhealthier before claiming the subsidy and whether the difference varies by gender. Table A.19 shows the effect of eligibility on the duration of sickness and the probability of experiencing any sickness before age 50 (and age 55). The estimates are positive and significant. On average, individuals eligible for the subsidy claim sickness leave benefits for one month more and they are 0.07% more likely to experience any sickness leave before age 50. When we divide the sample by gender, we can see that men drive the results. Eligible men claim 5 months more sickness leave before age 50, while eligible women claim a half-month more sickness leave before age 50. The results on sickness before age 55 are similar. This finding implies that eligible individuals are less healthy, which is not surprising given that the subsidy program is targeted at poorer retirees. Moreover, eligible men are in much worse health than eligible women. This could be the reason why we see a large mortality reduction in our context, because the subsidy program targets predominantly low-income and poor health beneficiaries, similar to the disability insurance recipients in the U.S. (Gelber et al., 2023) and low-income pensioners in rural China (Cheng et al., 2018; Huang and Zhang, 2021).

6.3 Policy implications

Over the past few decades, there is a large and widening gap in life expectancy across income groups in many countries, including Germany (Tarkiainen et al., 2012; Wenau et al., 2019; Haan et al., 2020). The improvement in mortality is the largest in the high-income group and the smallest in the low income group. Haan et al. (2020) shows that for West German men born in 1932-1934, the gap in life expectancy at age 65 between the top and bottom of the earnings decile is 4 years; while for cohorts born in 1941-1943, this gap increased to close to 7 years [38]. At the same time, younger cohorts receive less subsidy as this subsidy program is gradually being phased out.[39] From a policy perspective, it would be interesting to know how this life expectancy gap would change if the subsidy level remain at a high level. Our IV estimates imply that if men born between 1941-1943 had received the equivalent subsidy as those born between 1932-1934, their life expectancy at age 65 would have increased by one month. This adjustment would consequently narrow the gap by one month, constituting approximately 3% of the overall disparity. This simple exercise suggests that providing additional pension income to low-income pensioners would help to flatten the income-mortality gradient.

We also perform a simple cost-benefit analysis by computing the associated increase in the value of a statistical life when receiving an additional 100€ pension benefits per month. Using the value of a statistical life year at age 60 implied by Aldy and Viscusi (2007) and life tables for the average German (Destatis, 2023), we show that for each 100€ subsidy, the mortality improvements for men are worth 102,395€.[40] The fiscal cost of providing the subsidy for men is about 26,751.6€ per male subsidy recipient. Compared with the fiscal cost of providing the subsidy, we show that the pension subsidy program was cost-effective in increasing the life expectancy of male recipients.[41] See Appendix E for more details.

[38] Figure 2 of Haan et al. (2020)

[39] This is because low-income workers who never contributed to the pension system before 1992 will not benefit from this subsidy program. Eligible West German men born in 1932-1934 received, on average 90€/month, of pension subsidy, while this number is reduced to 43€/month for younger cohorts.

[40] Our calculation of improvement in life expectancy at age 60 is a lower bound because the gain in life expectancy is benchmarked to the life tables for an average German, rather than the poorest German pensioners, who likely experience higher-than-average mortality rates.

[41] We also perform a similar cost-benefit analysis for women. We take a pension income without subsidy of 614€/month (average value for eligible women) and a life-expectancy improvement of 1.3 months (based on non-significant 0.7 percentage point decrease in the probability of dying before 70). Life expectancy at age 60 is 25.41 years (305 months) for women. Thus, the net cost of providing a retired woman with an additional 100€/month would be 31,420€. This implies a net monetary cost of about 2,210€ . However, given the effects on women are not statistically significant, one should be cautious when concluding that such a policy would not be cost-effective for women.

7 Conclusion

This paper estimates the impact of pension income on the mortality and health for low-income pensioners by exploiting a German pension subsidy program. The specific feature of the program allows us to identify the effect of additional pension benefits on mortality in an environment where the statutory pension eligibility ages remain unchanged and also the retirement timing responses are limited.

By utilising a novel administrative data covering the universe of retirees who died between 1994 and 2018, we find that eligibility leads to a permanent increase in monthly pension income of 8.6% (about 65€) and a 2-month delay in age at death (censored at 75). The IV analysis shows that a 100€ increase in monthly pension income (about 13% increase) reduces the probability of dying before age 65, 70, and 75 by 23.5%, 8%, and 2%, respectively. The heterogeneity analysis suggests that the mortality responses are driven by men. The analysis using survey data suggests that additional pension income also leads people to live healthier lives. Again, we find that men's health improves while women's health does not. We find significant improvements in both mental and physical health for men. Feeling less financially constrained, feeling more optimistic about the future and life chances, and reducing alcohol and cigarette consumption are possible drivers of improved health.

The external validity of the results could be questioned given that the subsidy recipients consist of pensioners with lower-than-average earnings in Germany. However, the recent trend of lowered public pension generosity to incentivize later retirement has left a growing number of lower-income workers vulnerable to old-age poverty risk in many developed countries (see e.g., Engelhardt and Gruber (2004); Cribb and Emmerson (2019); Morris (2022)). People with lower incomes have greater health risks and are the ones most in need of income support. Our findings can be used to consider the beneficial effects of providing safety nets for low-income pensioners in countries with similar contexts.

The main policy implication is that additional pension income improves life expectancy and leads to better physical and mental health for low-income pensioners. The findings further support income support programs for the elderly, as the social value is greater than the fiscal costs. Moreover, additional pension income for low-income retirees could flatten the income-mortality gradient and narrow the socioeconomic disparities in old-age mortality.

An interesting extension to this paper will be to further unpack the gender differences in responses to additional pension income. A caveat of this paper is that we cannot link household members and further explore the differential gender responses in mortality and health, which may be a fruitful avenue for future research.

References

Adamson, Joy A, Gill M Price, Elizabeth Breeze, Christopher J Bulpitt, and Astrid E Fletcher, "Are older people dying of depression? Findings from the Medical Research Council trial of the assessment and management of older people in the community," *Journal of the American Geriatrics Society*, 2005, *53* (7), 1128–1132.

Ahammer, Alexander, G Thomas Horvath, and Rudolf Winter-Ebmer, "The effect of income on mortality—new evidence for the absence of a causal link," *Journal of the Royal Statistical Society Series A: Statistics in Society*, 2017, *180* (3), 793–816.

Aizer, Anna, Shari Eli, and Adriana Lleras-Muney, "The incentive effects of cash transfers to the poor," Technical Report, National Bureau of Economic Research 2020.

_ , _ , Joseph Ferrie, and Adriana Lleras-Muney, "The long-run impact of cash transfers to poor families," *American Economic Review*, 2016, *106* (4), 935–971.

Aldy, Joseph E and W Kip Viscusi, "Age differences in the value of statistical life: revealed preference evidence," *Review of Environmental Economics and Policy*, 2007.

Ayyagari, Padmaja, "Health insurance and early retirement plans: Evidence from the affordable care act," *American Journal of Health Economics*, 2019, *5* (4), 533–560.

_ and David Frisvold, "The impact of social security income on cognitive function at older ages," *American Journal of Health Economics*, 2016, *2* (4), 463–488.

Baade, Peter D, Xingqiong Meng, Philippa H Youl, Joanne F Aitken, Jeff Dunn, and Suzanne K Chambers, "The impact of body mass index and physical activity on mortality among patients with colorectal cancer in Queensland, Australia," *Cancer epidemiology, biomarkers & prevention*, 2011, *20* (7), 1410–1420.

Bailey, Martha J and Andrew Goodman-Bacon, "The War on Poverty's experiment in public medicine: Community health centers and the mortality of older Americans," *American Economic Review*, 2015, *105* (3), 1067–1104.

Barham, Tania and Jacob Rowberry, "Living longer: The effect of the Mexican conditional cash transfer program on elderly mortality," *Journal of Development Economics*, 2013, *105*, 226–236.

Belles, Cristina, Sergi Jiménez, and Han Ye, "The Effect of Removing Early Retirement on Mortality," *Documento de Trabajo*, 2022, p. 06.

Berkel, Barbara and Axel Börsch-Supan, "Pension reform in Germany: The impact on retirement decisions," *FinanzArchiv/Public Finance Analysis*, 2004, pp. 393–421.

Bertrand, Marianne, Sendhil Mullainathan, and Eldar Shafir, "A behavioral-economics view of poverty," *American Economic Review*, 2004, *94* (2), 419–423.

Bitler, Marianne P, Jonah B Gelbach, and Hilary W Hoynes, "Welfare reform and health," *Journal of Human Resources*, 2005, *40* (2), 309–334.

Black, Bernard, Eric French, Jeremy McCauley, and Jae Song, "The effect of disability insurance receipt on mortality," Technical Report, mimeo, University College London 2017.

Bloemen, Hans, Stefan Hochguertel, and Jochem Zweerink, "The causal effect of retirement on mortality: Evidence from targeted incentives to retire early," *Health economics*, 2017, *26* (12), e204–e218.

Bock, Jens-Oliver, Herbert Matschinger, Hermann Brenner, Beate Wild, Walter E Haefeli,

Renate Quinzler, Kai-Uwe Saum, Dirk Heider, and Hans-Helmut König, "Inequalities in out-of-pocket payments for health care services among elderly Germans–results of a population-based cross-sectional study," *International journal for equity in health*, 2014, *13* (1), 1–11.

Börsch-Supan, Axel, Christin Czaplicki, Sabine Friedel, Imke Herold, Julie Korbmacher, and Tatjana Mika, "SHARE-RV: linked data to study aging in Germany," *Jahrbücher für Nationalökonomie und Statistik*, 2020, *240* (1), 121–132.

Börsch-Supan, Axel H and Courtney Coile, "Social security programs and retirement around the world: reforms and retirement incentives–introduction and summary," Technical Report, National Bureau of Economic Research 2018.

_ **, Christina B Wilke et al.**, *Reforming the German public pension system*, Citeseer, 2004.

Börsch-Supan, Axel, Tabea Bucher-Koenen, Michela Coppola, and Bettina Lamla, "Savings in times of demographic change: Lessons from the German experience," *Journal of Economic Surveys*, 2015, *29* (4), 807–829.

Bozio, Antoine, Clémentine Garrouste, and Elsa Perdrix, "Impact of later retirement on mortality: Evidence from France," *Health economics*, 2021, *30* (5), 1178–1199.

Brot-Goldberg, Zarek C, Amitabh Chandra, Benjamin R Handel, and Jonathan T Kolstad, "What does a deductible do? The impact of cost-sharing on health care prices, quantities, and spending dynamics," *The Quarterly Journal of Economics*, 2017, *132* (3), 1261–1318.

Case, Anne, "Does money protect health status? Evidence from South African pensions," in "Perspectives on the Economics of Aging," University of Chicago Press, 2004, pp. 287–312.

_ **and Francis Wilson**, "Health and wellbeing in South Africa: Evidence from the Langeberg survey," *Research Program in Development Studies, Princeton, NJ (December). Processed*, 2000.

_ **, Ingrid Le Roux, and Alicia Menendez**, "Medical compliance and income-health gradients," *American Economic Review*, 2004, *94* (2), 331–335.

Celidoni, Martina and Vincenzo Rebba, "Healthier lifestyles after retirement in Europe? Evidence from SHARE," *The European Journal of Health Economics*, 2017, *18* (7), 805–830.

_ **, Chiara Dal Bianco, and Guglielmo Weber**, "Retirement and cognitive decline. A longitudinal analysis using SHARE data," *Journal of Health Economics*, 2017, *56*, 113–125.

Cesarini, David, Erik Lindqvist, Robert Östling, and Björn Wallace, "Wealth, health, and child development: Evidence from administrative data on Swedish lottery players," *The Quarterly Journal of Economics*, 2016, *131* (2), 687–738.

Chandra, Amitabh, Evan Flack, and Ziad Obermeyer, "The health costs of cost-sharing," Technical Report, National Bureau of Economic Research 2021.

Cheng, Lingguo, Hong Liu, Ye Zhang, and Zhong Zhao, "The health implications of social pensions: Evidence from China's new rural pension scheme," *Journal of Comparative Economics*, 2018, *46* (1), 53–77.

Chetty, Raj, Michael Stepner, Sarah Abraham, Shelby Lin, Benjamin Scuderi, Nicholas Turner, Augustin Bergeron, and David Cutler, "The association between income and life expectancy in the United States, 2001-2014," *Jama*, 2016, *315* (16), 1750–1766.

Collett, David, *Modelling survival data in medical research*, Chapman and Hall/CRC, 2015.

Cribb, Jonathan and Carl Emmerson, "Can't wait to get my pension: the effect of raising the female early retirement age on income, poverty and deprivation," *Journal of Pension Economics*

& Finance, 2019, *18* (3), 450–472.

Currie, Janet and Hannes Schwandt, "Mortality inequality: The good news from a county-level approach," *Journal of Economic Perspectives*, 2016, *30* (2), 29–52.

de Grip, Andries, Maarten Lindeboom, and Raymond Montizaan, "Shattered dreams: the effects of changing the pension system late in the game," *The Economic Journal*, 2012, *122* (559), 1–25.

de Leon, Carlos F Mendes, Stephen S Rapp, and Stanislav V Kasl, "Financial strain and symptoms of depression in a community sample of elderly men and women: A longitudinal study," *Journal of Aging and Health*, 1994, *6* (4), 448–468.

Destatis, "Life Table from the Federal Statistical Office Germany—GENESIS-Online," 2023. Data retrieved on July 2023, https://www-genesis.destatis.de/genesis/online.

Dow, William H, Anna Godøy, Christopher Lowenstein, and Michael Reich, "Can labor market policies reduce deaths of despair?," *Journal of Health Economics*, 2020, *74*, 102372.

Eibich, Peter, "Understanding the effect of retirement on health: Mechanisms and heterogeneity," *Journal of Health Economics*, 2015, *43*, 1–12.

Eli, Shari, "Income effects on health: Evidence from union army pensions," *The Journal of Economic History*, 2015, *75* (2), 448–478.

Engelhardt, Gary V and Jonathan Gruber, "Social security and the evolution of elderly poverty," 2004.

_ , _ , and Cynthia D Perry, "Social security and elderly living arrangements evidence from the social security notch," *Journal of Human Resources*, 2005, *40* (2), 354–372.

Engels, Barbara, Johannes Geyer, and Peter Haan, "Pension incentives and early retirement," *Labour Economics*, 2017. EALE conference issue 2016.

Evans, William N and Craig L Garthwaite, "Giving mom a break: The impact of higher EITC payments on maternal health," *American Economic Journal: Economic Policy*, 2014, *6* (2), 258–90.

_ and Timothy J Moore, "The short-term mortality consequences of income receipt," *Journal of Public Economics*, 2011, *95* (11-12), 1410–1424.

Finkelstein, Amy and Matthew J Notowidigdo, "Take-up and targeting: Experimental evidence from SNAP," *The Quarterly Journal of Economics*, 2019, *134* (3), 1505–1556.

Fitzpatrick, Maria D and Timothy J Moore, "The mortality effects of retirement: Evidence from Social Security eligibility at age 62," *Journal of Public Economics*, 2018, *157*, 121–137.

Frijters, Paul, John P Haisken-DeNew, and Michael A Shields, "The causal effect of income on health: Evidence from German reunification," *Journal of Health Economics*, 2005, *24* (5), 997–1017.

Gardner, Jonathan and Andrew Oswald, "How is mortality affected by money, marriage, and stress?," *Journal of Health Economics*, 2004, *23* (6), 1181–1207.

Gelber, Alexander, Adam Isen, and Jae Song, "The role of social security benefits in the initial increase of older women's employment: Evidence from the social security notch," in "Women Working Longer: Increased Employment at Older Ages," University of Chicago Press, 2017, pp. 239–268.

_ , Timothy Moore, Zhuan Pei, and Alexander Strand, "Disability insurance income saves

lives," *Journal of Political Economy*, 2023, *131* (11), 000–000.
Goda, Gopi Shah, Ezra Golberstein, and David C Grabowski, "Income and the utilization of long-term care services: Evidence from the Social Security benefit notch," *Journal of Health Economics*, 2011, *30* (4), 719–729.
Golberstein, Ezra, "The effects of income on mental health: evidence from the social security notch," *The Journal of Mental Health Policy and Economics*, 2015, *18* (1), 27.
Gorry, Aspen, Devon Gorry, and Sita Nataraj Slavov, "Does retirement improve health and life satisfaction?," *Health economics*, 2018, *27* (12), 2067–2086.
Haan, Peter, Daniel Kemptner, and Holger Lüthen, "The rising longevity gap by lifetime earnings–Distributional implications for the pension system," *The Journal of the Economics of Ageing*, 2020, *17*, 100199.
Hagen, Johannes, "The effects of increasing the normal retirement age on health care utilization and mortality," *Journal of Population Economics*, 2018, *31* (1), 193–234.
Hernaes, Erik, Simen Markussen, John Piggott, and Ola L Vestad, "Does retirement age impact mortality?," *Journal of Health Economics*, 2013, *32* (3), 586–598.
Huang, Wei and Chuanchuan Zhang, "The power of social pensions: Evidence from China's new rural pension scheme," *American Economic Journal: Applied Economics*, 2021, *13* (2), 179–205.
ILO, "Social Protection for Older Persons: Key Policy Trends and Statistics," *Social Protection Department, ILO*, 2014.
Insler, Michael, "The health consequences of retirement," *Journal of Human Resources*, 2014, *49* (1), 195–233.
Jensen, Robert T and Kaspar Richter, "The health implications of social security failure: evidence from the Russian pension crisis," *Journal of Public Economics*, 2004, *88* (1-2), 209–236.
Johnsen, Julian V and Alexander Willén, "The effect of negative income shocks on pensioners," *Labour Economics*, 2022, *76*, 102175.
Kahneman, Daniel and Alan B Krueger, "Developments in the measurement of subjective well-being," *Journal of Economic perspectives*, 2006, *20* (1), 3–24.
Kikuchi, Hiroyuki, Shigeru Inoue, I-Min Lee, Yuko Odagiri, Norie Sawada, Manami Inoue, and Shoichiro Tsugane, "Impact of moderate-intensity and vigorous-intensity physical activity on mortality," *Medicine and Science in Sports and Exercise*, 2018, *50* (4), 715–721.
Krtilová, Veronika Kočiš, Lewe Bahnsen, and Diana De Graeve, "The out-of-pocket burden of chronic diseases: the cases of Belgian, Czech and German older adults," *BMC Health Services Research*, 2021, *21* (1), 1–13.
Krueger, Alan B and Jörn-Steffen Pischke, "The effect of social security on labor supply: A cohort analysis of the notch generation," *Journal of Labor Economics*, 1992, *10* (4), 412–437.
Kuhn, Andreas, Stefan Staubli, Jean-Philippe Wuellrich, and Josef Zweimüller, "Fatal attraction? Extended unemployment benefits, labor force exits, and mortality," *Journal of Public Economics*, 2020, *191*, 104087.
Kuhn, Ursina, Markus M Grabka, and Christian Suter, "Early retirement as a privilege for the rich? A comparative analysis of Germany and Switzerland," *Advances in Life Course Research*, 2021, *47*, 100392.

Li, Jing, Jonathan S Skinner, Kathleen McGarry, Lauren Hersch Nicholas, Shao-Pang Wang, Evan Bollens-Lund, and Amy S Kelley, "Declines in Wealth Among US Older Adults at Risk of Dementia," *JAMA neurology*, 2023.

Lindahl, Mikael, "Estimating the effect of income on health and mortality using lottery prizes as an exogenous source of variation in income," *Journal of Human Resources*, 2005, *40* (1), 144–168.

Lindqvist, Erik, Robert Östling, and David Cesarini, "Long-run effects of lottery wealth on psychological well-being," *The Review of Economic Studies*, 2020, *87* (6), 2703–2726.

Marmot, Michael, "The health gap: the challenge of an unequal world," *The Lancet*, 2015, *386* (10011), 2442–2444.

Mazzonna, Fabrizio and Franco Peracchi, "Are older people aware of their cognitive decline? Misperception and financial decision making," 2020.

McInerney, Melissa, Jennifer M Mellor, and Lauren Hersch Nicholas, "Recession depression: mental health effects of the 2008 stock market crash," *Journal of Health Economics*, 2013, *32* (6), 1090–1104.

Michaud, Pierre-Carl and Arthur Van Soest, "Health and wealth of elderly couples: Causality tests using dynamic panel data models," *Journal of Health Economics*, 2008, *27* (5), 1312–1325.

Miglino, Enrico, Nicolás Navarrete H, Gonzalo Navarrete H, and Pablo Navarrete H, "Health effects of increasing income for the elderly: evidence from a Chilean pension program," *American Economic Journal: Economic Policy*, 2023, *15* (1), 370–393.

Morris, Todd, "The unequal burden of retirement reform: Evidence from Australia," *Economic Inquiry*, 2022, *60* (2), 592–619.

Preston, Samuel H, "The changing relation between mortality and level of economic development," *Population Studies*, 1975, *29* (2), 231–248.

Richardson, Caroline R, Andrea M Kriska, Paula M Lantz, and Rodney A Hayward, "Physical activity and mortality across cardiovascular disease risk groups.," *Medicine and Science in Sports and Exercise*, 2004, *36* (11), 1923–1929.

Ridley, Matthew, Gautam Rao, Frank Schilbach, and Vikram Patel, "Poverty, depression, and anxiety: Causal evidence and mechanisms," *Science*, 2020, *370* (6522).

Rossi, Amanda, Anastasia Dikareva, Simon L Bacon, and Stella S Daskalopoulou, "The impact of physical activity on mortality in patients with high blood pressure: a systematic review," *Journal of hypertension*, 2012, *30* (7), 1277–1288.

Saporta-Eksten, Itay, Ity Shurtz, and Sarit Weisburd, "Social Security, Labor Supply, and Health of Older Workers: Quasi-Experimental Evidence from a Large Reform," *Journal of the European Economic Association*, 2021, *19* (4), 2168–2208.

Sarfati, Hedva, "Old-age income poverty," in "Pensions at a Glance 2017. OECD and G20 indicators," OECD, 2017, p. 374.

Schünemann, Johannes, Holger Strulik, and Timo Trimborn, "The gender gap in mortality: How much is explained by behavior?," *Journal of Health Economics*, 2017, *54*, 79–90.

Schwandt, Hannes, "Wealth shocks and health outcomes: Evidence from stock market fluctuations," *American Economic Journal: Applied Economics*, 2018, *10* (4), 349–77.

Shai, Ori, "Is retirement good for men's health? Evidence using a change in the retirement age in

Israel," *Journal of Health Economics*, 2018, *57*, 15–30.

Snyder, Stephen E and William N Evans, "The effect of income on mortality: evidence from the social security notch," *The Review of Economics and Statistics*, 2006, *88* (3), 482–495.

Stock, James H. and David A. Wise, "Pensions, the Option Value of Work, and Retirement," *Econometrica*, 1990, *58* (5), 1151–1180.

Tarkiainen, Lasse, Pekka Martikainen, Mikko Laaksonen, and Tapani Valkonen, "Trends in life expectancy by income from 1988 to 2007: decomposition by age and cause of death," *J Epidemiol Community Health*, 2012, *66* (7), 573–578.

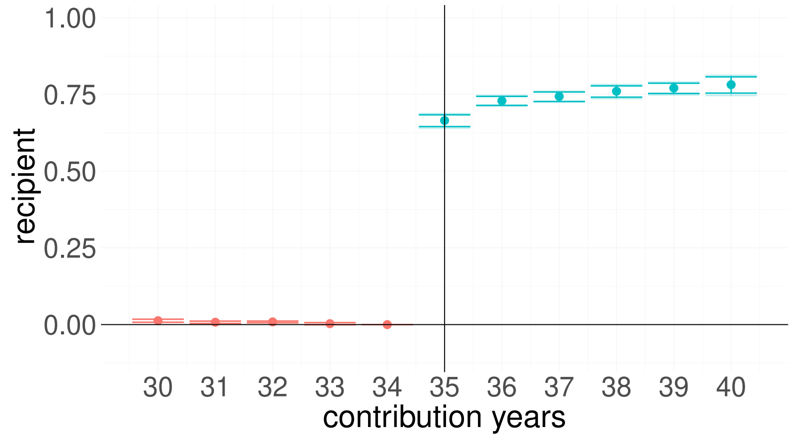
Wenau, Georg, Pavel Grigoriev, and Vladimir Shkolnikov, "Socioeconomic disparities in life expectancy gains among retired German men, 1997–2016," *J Epidemiol Community Health*, 2019, *73* (7), 605–611.

WHO, "World Health Organization, Global Health Expenditure Database-NHA indicators," 2023. Accessed 20 Oct 2023, http://apps.who.int/nha/database/ViewData/Indicators/en.

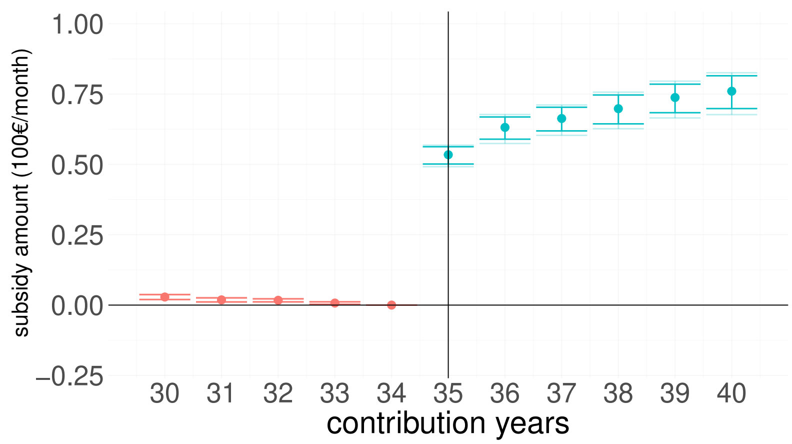
Ye, Han, "The Effect of Pension Subsidies on the Retirement Timing of Older Women," *Journal of the European Economic Association*, 2022, *20* (3), 1048–1094.

Ziebarth, Nicolas R, "Social insurance and health," *Health Econometrics*, 2018.

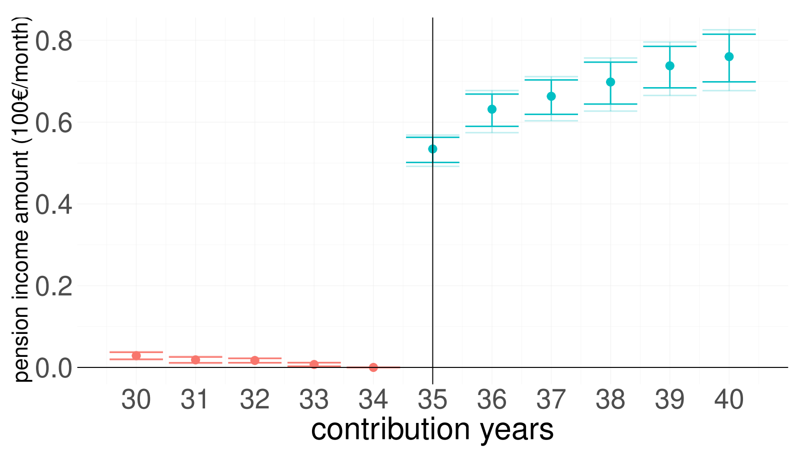
Tables and Figures



(a) Probability of being a subsidy recipient



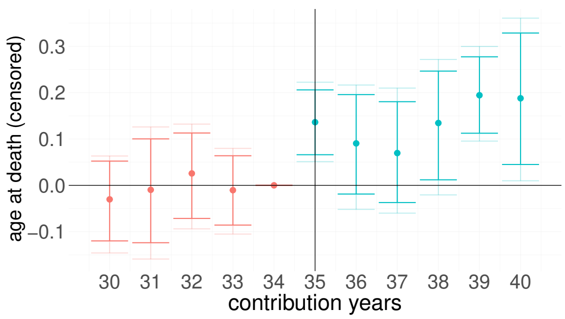
(b) Subsidy amount (100€)



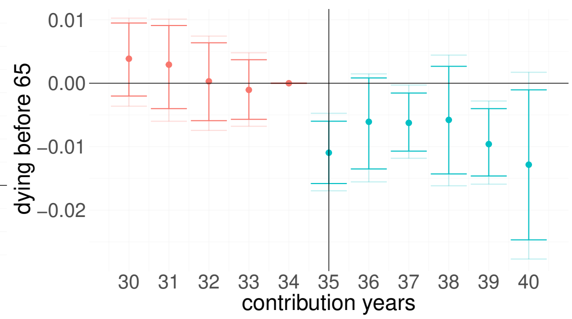
(c) Pension income (100€)

Figure 1: Event study coefficients in the baseline sample, first stage.

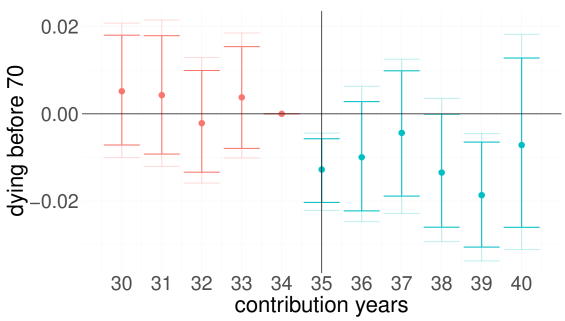
Notes: Figure 1 displays the event study coefficients for first-stage outcomes in the baseline sample. All subfigures plot the 95 percent CI (shadowed line) and 90 percent CI (solid line).



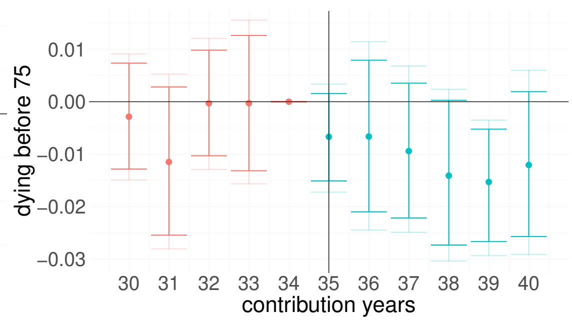
(a) Age at death (censored)



(b) Probability of dying before 65



(c) Probability of dying before 70



(d) Probability of dying before 75

Figure 2: Event study coefficients in the baseline sample.

Notes: Figure 2 displays the event study coefficients for main mortality outcomes in the baseline sample. All subfigures plot the 95 percent CI (shadowed line) and 90 percent CI (solid line).

Table 1: Impact of subsidy eligibility (DID estimates)

	(1)	(2)	(3)	(4)	Mean
Panel A: First stage					
Recipient	0.755***	0.754***	0.731***	0.730***	0.285
	(0.010)	(0.010)	(0.008)	(0.008)	(0.452)
	[0.000]	[0.000]	[0.000]	[0.000]	
Subsidy	0.686***	0.686***	0.658***	0.646***	0.245
	(0.027)	(0.027)	(0.023)	(0.021)	(0.502)
	[0.000]	[0.000]	[0.000]	[0.000]	
Pension income	-0.140	-0.141	0.011	0.646***	7.526
	(0.082)	(0.082)	(0.057)	(0.021)	(2.684)
	[0.137]	[0.136]	[0.874]	[0.000]	
Panel B: Impact on mortality					
Age at death (censored)	0.236***	0.273***	0.154***	0.135**	72.216
	(0.036)	(0.031)	(0.025)	(0.027)	(3.692)
	[0.000]	[0.000]	[0.001]	[0.002]	
Dying before 65	-0.008***	-0.009***	-0.009***	-0.009***	0.051
	(0.001)	(0.001)	(0.001)	(0.001)	(0.220)
	[0.001]	[0.001]	[0.001]	[0.000]	
Dying before 70	-0.026***	-0.029***	-0.016**	-0.014**	0.257
	(0.004)	(0.004)	(0.003)	(0.004)	(0.437)
	[0.001]	[0.000]	[0.002]	[0.004]	
Dying before 75	-0.022**	-0.029***	-0.011**	-0.008*	0.519
	(0.007)	(0.005)	(0.004)	(0.004)	(0.500)
	[0.029]	[0.001]	[0.020]	[0.088]	
Panel C: Impact on labour supply					
Age at claiming pension	-0.267***	-0.253***	0.024	0.010	63.102
	(0.043)	(0.038)	(0.015)	(0.015)	(2.382)
	[0.001]	[0.001]	[0.187]	[0.547]	
Obs	401,932	401,932	401,932	401,932	401,932
Contribution year FE	✓	✓	✓	✓	-
Birth cohort FE		✓	✓	✓	-
Controls			✓	✓	-
PI without subsidy				✓	-

Notes: This table shows the impact of being eligible for the pension subsidy on a list of first-stage, mortality and labour supply outcomes. Sample: RTWF baseline sample. Columns 1, 2, 3 and 4 show the results with contribution year fixed effects, adding birth cohort fixed effects, adding controls, adding income control, respectively. Control includes being married, having children, perceiving unemployment, disability or women pension, not having health insurance, male dummy. PI without subsidy stands for monthly pension income without subsidy. Sample means for the control group are reported in Column 5. "Age at claiming pension" refers to the age at which the individual started to claim the pension they are currently receiving. Monetary values are expressed in hundred 2015 euro. Standard errors clustered at birth cohort level are in parentheses, bootstrapped p-values are in brackets. With respect to bootstrapped p-values: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.
Source: Authors' calculations from the RTWF data.

Table 2: Heterogeneous effects (DID estimates)

		Gender		Marital status		Health insurance	
	Baseline	Women	Men	Married	Not married	Public	Private
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
First stage							
Recipient	0.730***	0.754***	0.499***	0.693***	0.789***	0.763***	0.377***
	(0.008)	(0.006)	(0.006)	(0.008)	(0.009)	(0.006)	(0.009)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Subsidy	0.646***	0.711***	0.326***	0.630***	0.629***	0.682***	0.274***
	(0.021)	(0.019)	(0.011)	(0.017)	(0.025)	(0.021)	(0.013)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Pension income	0.646***	0.711***	0.326***	0.630***	0.629***	0.682***	0.274***
	(0.021)	(0.019)	(0.011)	(0.017)	(0.025)	(0.021)	(0.013)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Impact on mortality							
Age at death (censored)	0.135**	0.036	0.170**	0.132**	0.117**	0.144**	0.084
	(0.027)	(0.035)	(0.046)	(0.025)	(0.038)	(0.030)	(0.061)
	[0.002]	[0.331]	[0.007]	[0.002]	[0.019]	[0.002]	[0.194]
Dying before 65	-0.009***	-0.004**	-0.004	-0.007**	-0.010**	-0.010***	-0.012**
	(0.001)	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.004)
	[0.000]	[0.038]	[0.103]	[0.003]	[0.005]	[0.000]	[0.012]
Dying before 70	-0.014**	-0.004	-0.021**	-0.015***	-0.012*	-0.015**	-0.007
	(0.004)	(0.004)	(0.007)	(0.003)	(0.005)	(0.004)	(0.009)
	[0.004]	[0.249]	[0.014]	[0.001]	[0.054]	[0.005]	[0.451]
Dying before 75	-0.008*	-0.001	-0.014**	-0.010**	-0.002	-0.009*	0.000
	(0.004)	(0.006)	(0.005)	(0.004)	(0.006)	(0.005)	(0.008)
	[0.088]	[0.876]	[0.034]	[0.050]	[0.773]	[0.085]	[0.999]
Impact on labour supply							
Age at claiming pension	0.010	-0.001	-0.039**	0.018	0.022	0.004	0.034
	(0.015)	(0.016)	(0.015)	(0.016)	(0.017)	(0.011)	(0.024)
	[0.547]	[0.958]	[0.033]	[0.318]	[0.221]	[0.724]	[0.226]
Obs	401,932	249,822	152,110	238,362	141,198	356,736	31,161
Contribution year FE	✓	✓	✓	✓	✓	✓	✓
Birth cohort FE	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓
PI without subsidy	✓	✓	✓	✓	✓	✓	✓

Notes: This table shows heterogeneous effects of being eligible for pension subsides. Column 1 shows the impact for the baseline sample. Columns 2 and 3 show the results by gender. Columns 4 and 5 show the results by marital status. Columns 6 and 7 show results by health insurance status. Monetary values are expressed in hundred 2015 euro. Standard errors clustered by birth cohort are in parentheses, bootstrapped p-values in brackets. With respect to bootstrapped p-values: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.
Source: Authors' calculations from the RTWF data.

Table 3: Impact of pension income on mortality (IV estimates)

	All		**Women**		**Men**	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: First stage						
Pension income	0.646***	0.646***	0.711***	0.711***	0.326***	0.326***
(instr.=eligible)	(0.021)	(0.021)	(0.019)	(0.019)	(0.011)	(0.011)
Panel B: IV						
Impact on mortality						
Age at death (censored)	0.209**	0.206**	0.050	0.050	0.523**	0.554**
	(0.040)	(0.040)	(0.048)	(0.048)	(0.139)	(0.134)
	[0.002]	[0.002]	[0.334]	[0.336]	[0.007]	[0.004]
Dying before 65	-0.013**	-0.012***	-0.005*	-0.005*	-0.011	-0.012*
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	[0.002]	[0.001]	[0.060]	[0.050]	[0.110]	[0.071]
Dying before 70	-0.022**	-0.021**	-0.007	-0.007	-0.060**	-0.060**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	[0.003]	[0.003]	[0.185]	[0.187]	[0.013]	[0.012]
Dying before 75	-0.014**	-0.013**	-0.003	-0.003	-0.038**	-0.039**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	[0.040]	[0.046]	[0.688]	[0.693]	[0.030]	[0.028]
Impact on labour supply						
Age at claiming pension	0.030	-	0.007	-	-0.038	-
	(0.001)	-	(0.001)	-	(0.002)	-
	[0.373]	-	[0.823]	-	[0.375]	-
First stage F-stat	906.9	905.9	1,340.6	1,335.9	887.8	886.5
Obs	401,932	401,790	249,822	249,752	152,110	152,038
Contribution years FE	✓	✓	✓	✓	✓	✓
Birth cohort FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
PI without subsidy	✓	✓	✓	✓	✓	✓
Age at claiming pension		✓		✓		✓

Notes: This table shows the effect on mortality of an increase in pension income of 100 euros per month. Panel A reports first-stage estimates and panel B reports the IV estimates. The instrument for pension income is an indicator of eligibility for pension subsidy. Pension income is calculated based on total earning points at retirement. In addition to a list of controls, pension income without subsidy, birth cohort fixed effects and contribution year fixed effects in the odd columns, the even columns control for age at claiming pensions. Columns 1 and 2 show the results for the baseline sample. Columns 3 to 6 show the results for women and men respectively. Monetary values are expressed 2015 in hundred euro. Standard errors clustered by birth cohort are in parentheses, bootstrapped p-values in brackets. With respect to bootstrapped p-values: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.
Source: Authors' calculations from the RTWF data.

Table 4: Impact of pension income on health outcomes (IV estimates)

	All		Women		Men	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: First stage						
Pension income	0.438***	0.438***	0.432***	0.432***	0.593***	0.593***
(instr.=eligible)	(0.036)	(0.036)	(0.043)	(0.043)	(0.074)	(0.074)
Panel B: IV						
CASP	0.565**	0.550**	-0.164	-0.163	1.280**	1.279**
	(0.226)	(0.223)	(0.266)	(0.260)	(0.405)	(0.404)
Self-perceived health	0.432*	0.459**	-0.365	-0.353	1.787***	1.734***
	(0.231)	(0.228)	(0.272)	(0.264)	(0.480)	(0.474)
Depression	-0.417*	-0.415*	0.398	0.384	-0.658**	-0.645**
	(0.224)	(0.220)	(0.283)	(0.277)	(0.330)	(0.328)
Chronic diseases	-0.575**	-0.597**	0.026	0.014	-1.967***	-1.936***
	(0.237)	(0.235)	(0.263)	(0.259)	(0.559)	(0.556)
Difficulties with ADLs	-0.169	-0.205	0.588*	0.558	-1.013**	-0.968**
	(0.264)	(0.264)	(0.343)	(0.339)	(0.401)	(0.394)
Difficulties with IADLs	-0.442**	-0.451**	0.096	0.094	-0.569	-0.549
	(0.216)	(0.218)	(0.218)	(0.220)	(0.360)	(0.354)
Length hospital stay (nights)	-0.146	-0.344	2.954	2.745	-5.714	-5.515
	(1.982)	(1.945)	(1.854)	(1.787)	(5.640)	(5.626)
Long hospital stay (≥14)	-0.017	-0.019	0.026	0.026	-0.025	-0.019
	(0.048)	(0.047)	(0.052)	(0.051)	(0.093)	(0.093)
Number hospital stays	0.255	0.235	0.500**	0.474**	-0.374	-0.359
	(0.175)	(0.172)	(0.200)	(0.195)	(0.348)	(0.347)
First stage F-stat	136.4	142.1	92.2	96.9	59.3	57.9
Obs	2,328	2,328	1,365	1,365	963	963
Contribution year FE	✓	✓	✓	✓	✓	✓
Birth cohort FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
PI without subsidy	✓	✓	✓	✓	✓	✓
Retirement age		✓		✓		✓

Notes: This table shows the effect on health outcomes of an increase in pension income of 100 euros per month. Panel A reports first-stage estimates and panel B reports the IV estimates. The instrument for pension income is an indicator for eligibility for the pension subsidy. Pension income is calculated based on total earning points at retirement. Estimates are based on standardised outcomes and thus measure effects in percent of the standard deviation from mean. In addition to a list of controls (number of schooling years, married, having children, interaction between having children and being in contact with them at least once a week, interaction between having children and all children having a job, SES indicators, being a house owner, male), pension income without subsidy, birth cohort fixed effects and contribution year fixed effects in the odd columns, the even columns control for age at claiming pensions. Columns 1 and 2 show the results for the baseline sample. Columns 3 to 6 show the results for women and men respectively. Monetary values are expressed in hundred 2015 euro. Standard errors clustered by birth cohort are in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' calculations from the SHARE-RV data.

Table 5: Impact of pension income on other outcomes (IV estimates)

	All		**Women**		**Men**	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: First stage						
Pension income	0.438***	0.438***	0.432***	0.432***	0.593***	0.593***
(instr.=eligible)	(0.036)	(0.036)	(0.043)	(0.043)	(0.074)	(0.074)
Panel B: IV						
(I) Chronic diseases						
Had a stroke	-0.012	-0.011	0.019	0.019	0.044	0.046
	(0.040)	(0.040)	(0.047)	(0.047)	(0.072)	(0.072)
Has chronical lung disease	-0.127**	-0.130**	-0.016	-0.016	-0.387***	-0.380***
	(0.059)	(0.059)	(0.067)	(0.067)	(0.141)	(0.140)
Has cataracts	-0.169**	-0.165**	-0.133	-0.129	-0.211*	-0.212*
	(0.075)	(0.074)	(0.096)	(0.095)	(0.115)	(0.115)
Has high blood pressure	-0.012	-0.014	0.267*	0.261*	-0.668***	-0.672***
	(0.113)	(0.111)	(0.144)	(0.141)	(0.205)	(0.204)
(II) Financial constraints and optimism						
Lack of money stops	-0.334	-0.327	-0.203	-0.199	-0.981**	-0.995**
	(0.234)	(0.230)	(0.283)	(0.277)	(0.423)	(0.425)
Feel full of opportunities	0.647**	0.612**	-0.057	-0.051	1.378**	1.404***
	(0.231)	(0.226)	(0.278)	(0.271)	(0.418)	(0.419)
Future looks good	0.506**	0.502**	0.117	0.116	0.928**	0.915**
	(0.233)	(0.229)	(0.282)	(0.275)	(0.410)	(0.406)
(III) Risky behaviours†						
How often consumed alcohol	-0.165	-0.121	-0.169	-0.150	-0.848*	-0.883*
	(0.278)	(0.274)	(0.325)	(0.317)	(0.459)	(0.464)
Is currently smoking	-0.341**	-0.320**	-0.270**	-0.248*	-0.245	-0.252
	(0.113)	(0.110)	(0.136)	(0.132)	(0.183)	(0.183)
Ever smoked daily	-0.118	-0.098	-0.063	-0.033	0.034	0.034
	(0.108)	(0.106)	(0.132)	(0.128)	(0.186)	(0.186)
First stage F-stat	136.4	142.1	92.2	96.9	59.4	57.9
Obs	2,328	2,328	1,365	1,365	963	963
Contribution year FE	✓	✓	✓	✓	✓	✓
Birth cohort FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
PI without subsidy	✓	✓	✓	✓	✓	✓
Retirement age		✓		✓		✓

Notes: This table shows the effect on chronic diseases of an increase in pension income of 100 euros per month. Panel A reports first-stage estimates and panel B reports the IV estimates. The instrument for pension income is an indicator for eligibility for the pension subsidy. In addition to a list of controls, pension income without subsidy, birth cohort fixed effects and contribution year fixed effects in the odd columns, the even columns control for age at claiming pensions. Columns 1 and 2 show the results for the baseline sample. Columns 3 to 6 show the results for women and men respectively. Monetary values are expressed in hundred 2015 euro. Standard errors clustered by birth cohort are in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' calculations from the SHARE-RV data.
† Sample size for these outputs is 1,426 (840 women). First stage F-statistics above 39.

Live Longer and Healthier: Impact of Pension Income for Low-Income Retirees

Chiara Malavasi
University of Mannheim, ZEW

Han Ye
University of Mannheim, IZA, ZEW

Online Appendix

List of Figures

List of Tables

A Appendix Tables and Figures

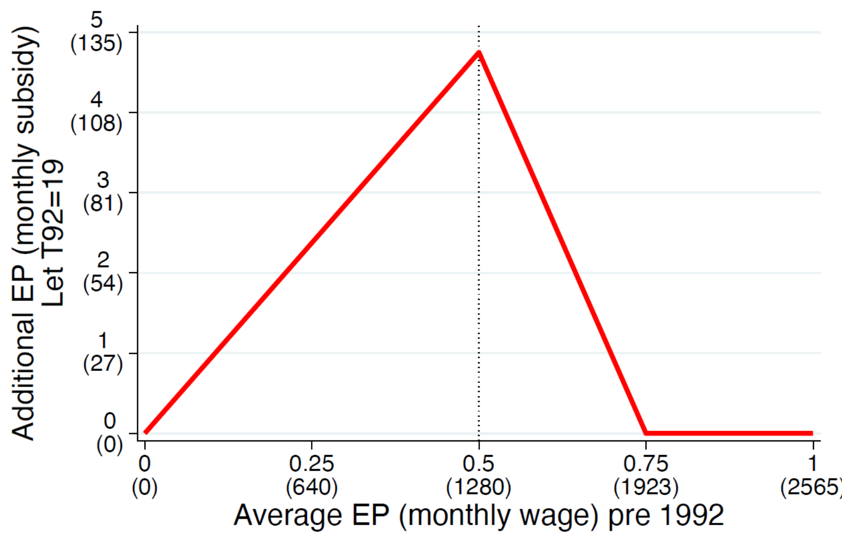


Figure A.1: Relationship between subsidy size and aep^{92}.

Notes: Figure A.1 displays the relationship between subsidy size and average earning points before 1992, in the case of an individual that contributed 19 years to the pension system before 1992. Horizontal axis indicates aep^{92} and corresponding monthly wage in parenthesis, while vertical axis indicates the additional earning points the individual is entitled to from the subsidy program, and the corresponding monetary subsidy amount (in 2015€) in parenthesis.
Source: Figure 1 in Ye (2022).

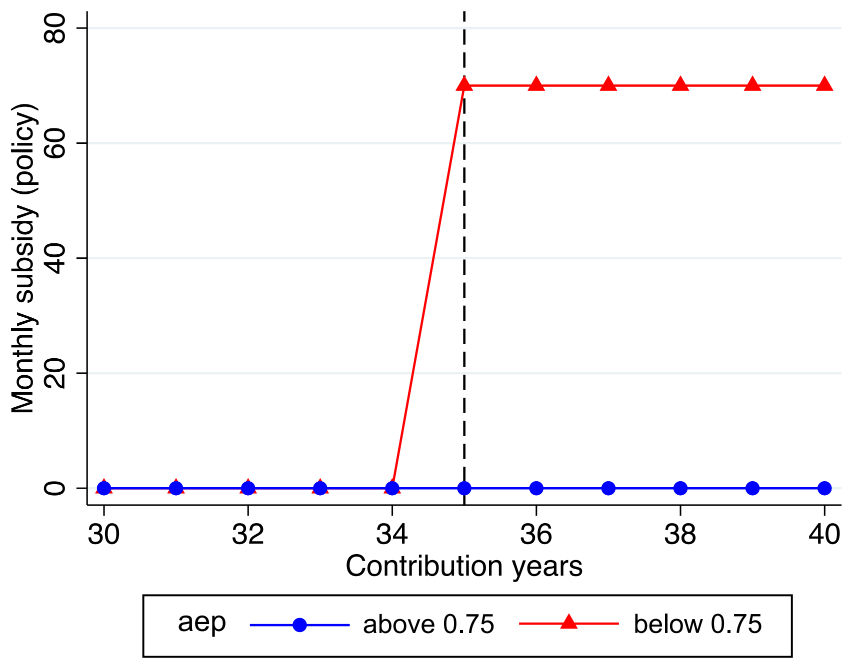
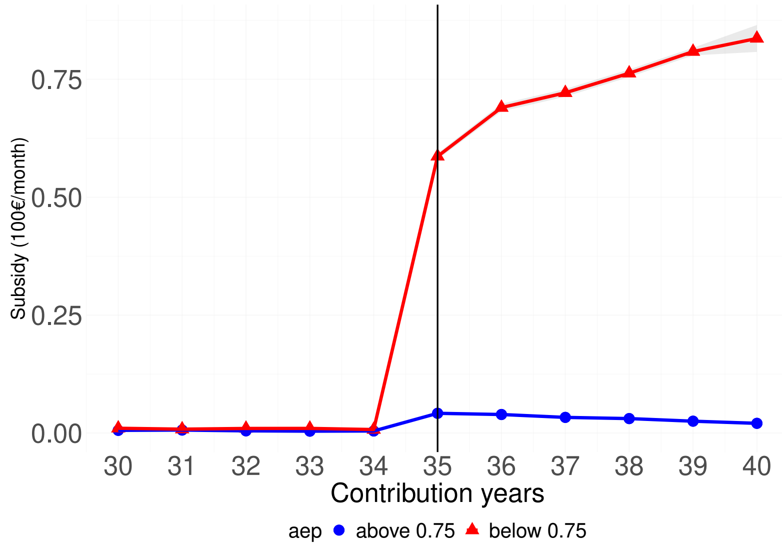
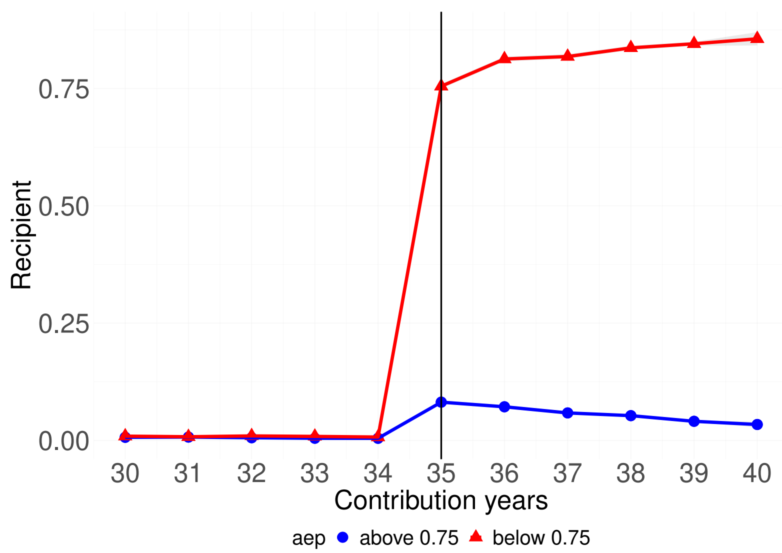


Figure A.2: Policy schedule of subsidy size by contribution years and by treatment status

Notes: Figure A.2 displays the pension subsidy schedule by contribution years and by treatment status according to the policy. The control group (blue dots) consists of pensioners with average earnings points at retirement higher than 0.75 and lower than 1.05, while the treatment group (red triangles) consists of pensioners with average earnings points at retirement between 0.45 and 0.75. The average monthly subsidy of 65 euro is the sample mean for treated pensioners with 35 to 40 years of contributions.



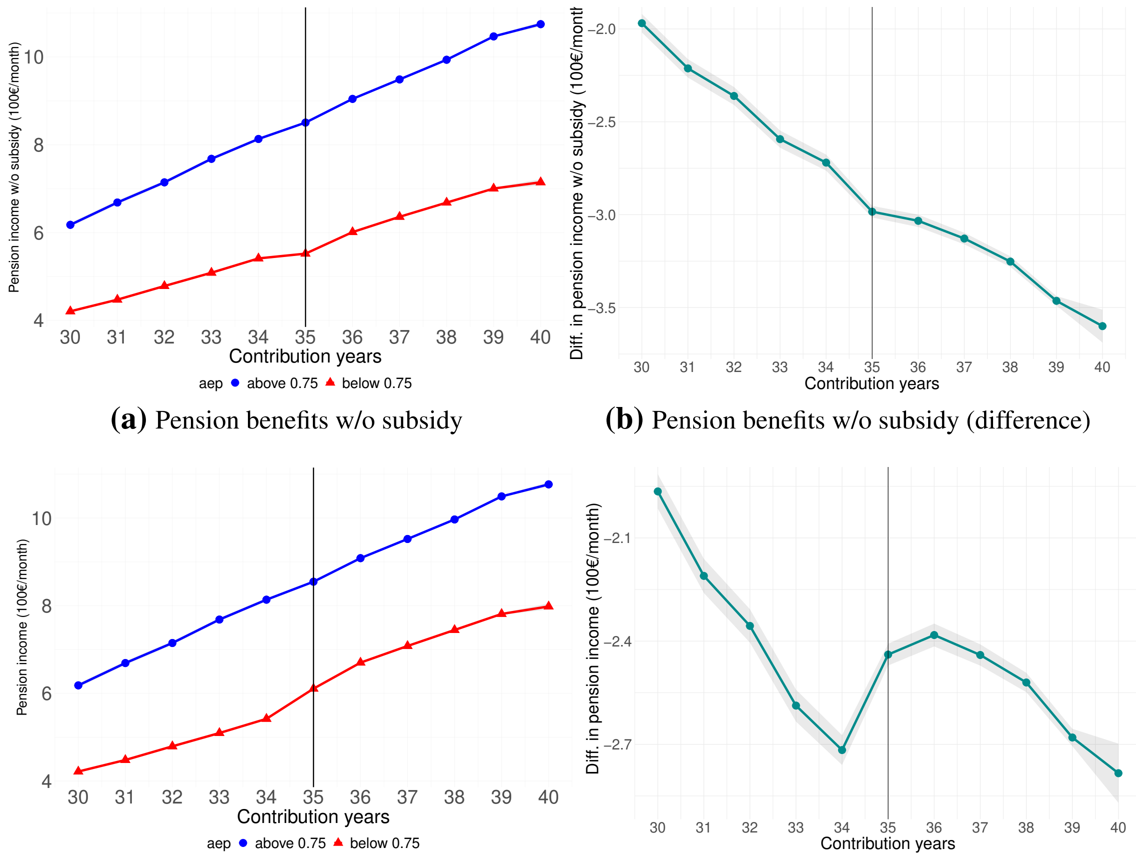
(a) Pension subsidy (100€)



(b) Probability of being a recipient

Figure A.3: First stage: mean probability of being a recipient and amount of pension subsidy by contribution years.

Notes: Figure A.3 displays the mean amount of pension subsidy (panel (a)) and the mean probability of being a subsidy recipient (panel (b)) by number of contribution years. Within the baseline sample, "$aep \geq 0.75$" (blue circles) indicates individuals with aep between 0.75 and 1.05 (pension benefits between 1050 and 1500€/month) while "$aep < 0.75$" (red triangles) indicates individuals with aep between 0.45 and 0.75 (pension benefits between 600 and 1050€/month). Monetary values are expressed in hundred 2015 euro. The shadowed areas indicate the normally distributed 95% confidence interval.



(a) Pension benefits w/o subsidy

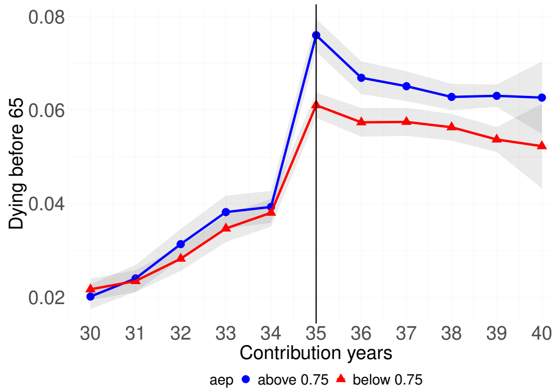
(b) Pension benefits w/o subsidy (difference)

(c) Total pension benefits incl. subsidy

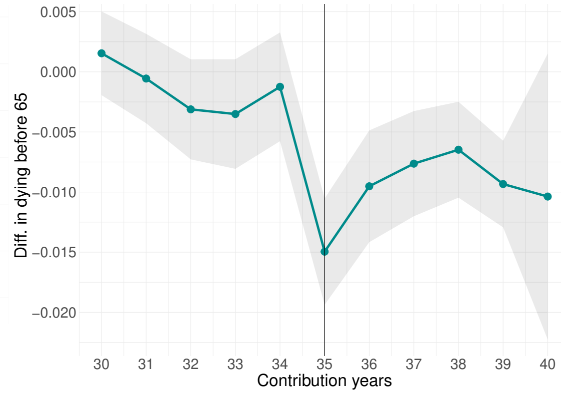
(d) Total pension benefits incl. subsidy(difference)

Figure A.4: Scatter plot of pension benefits over contribution years by treatment status.

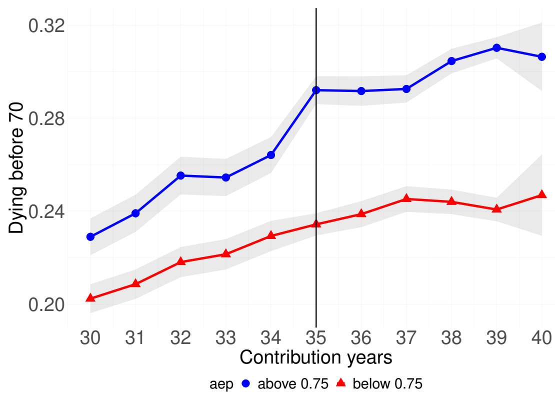
Notes: Figure A.4 shows the average pension benefits with and without subsidy over contribution years. Figures (a) and (c) show the average values by treatment over contribution years. The blue circles indicate individuals with aep between 0.75 and 1.05 (pension benefits between 700 and 1200€/month), while the red triangles indicate individuals with aep between 0.45 and 0.75 (pension benefits between 500 and 850€/month). Figures (b) and (d) show the difference between the means of the two groups (below group - above group). Monetary values are expressed in hundred 2015 euro. The shadowed areas indicate the normally distributed 95% confidence interval.



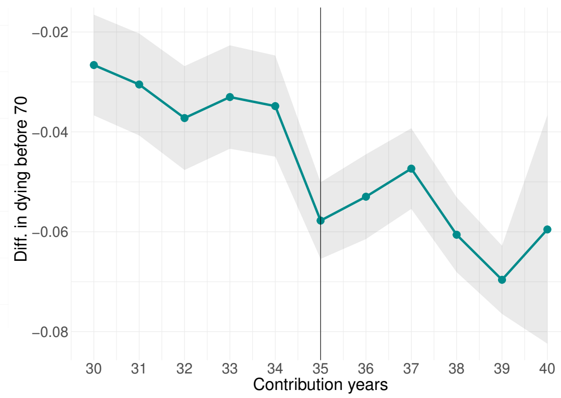
(a) Dying before 65



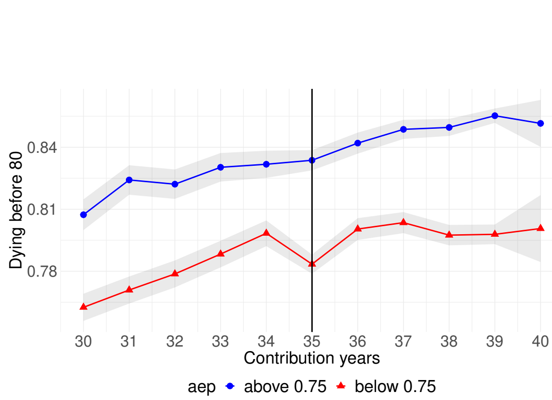
(b) Dying before 65 (difference)



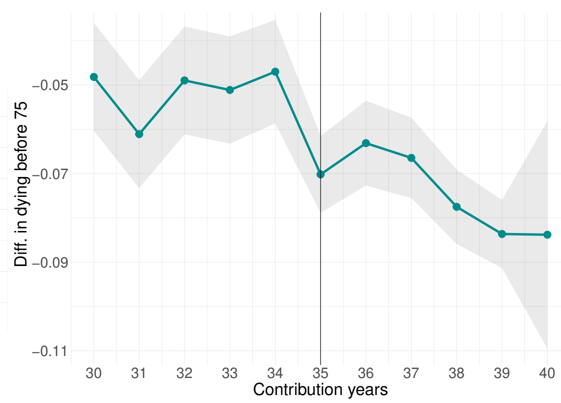
(c) Dying before 70



(d) Dying before 70 (difference)



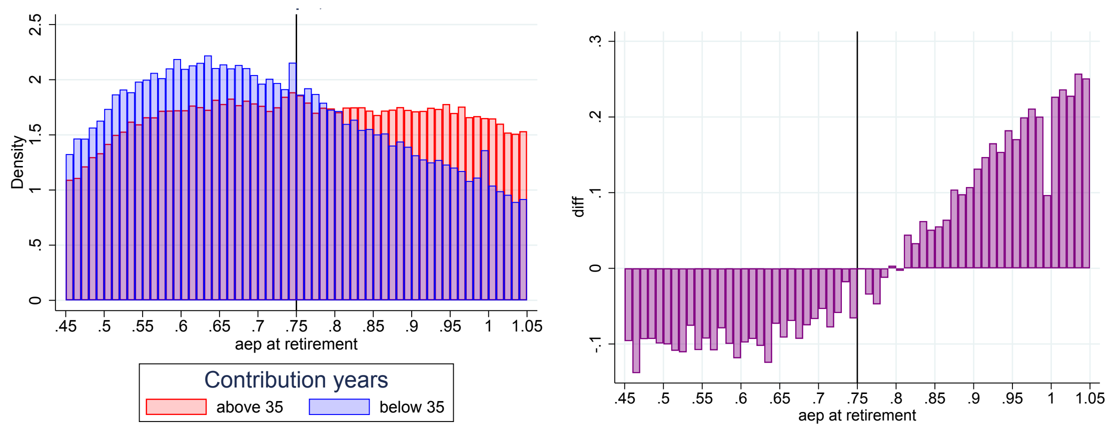
(e) Dying before 75



(f) Dying before 75 (difference)

Figure A.5: Scatter plot of mortality outcomes over contribution years by treatment status

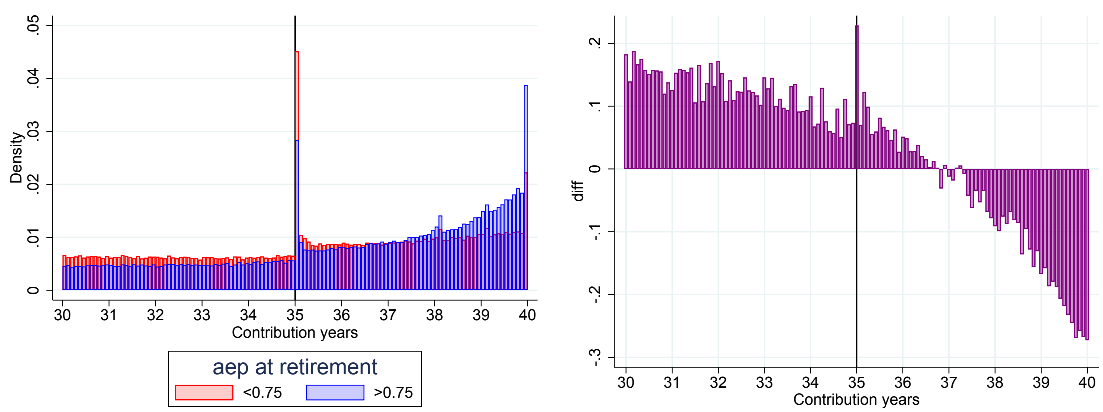
Notes: Figure A.5 displays the mean mortality outcomes over contribution years by aep group. Figures (a), (c) and (e) show the average probablity of dying before age 65, 70 and 75 for the $aep < 0.75$ (red triangles) and the $aep \geq 0.75$ (blue circles) group over contribution years. Figures (b), (d) and (f) depict the difference between the means of the two groups for these outcomes (below group - above group). The shadowed areas indicate the normal 95% confidence interval.



(a) Distribution **(b)** Difference in distribution

Figure A.6: Distribution of aep by contribution years above and below 35

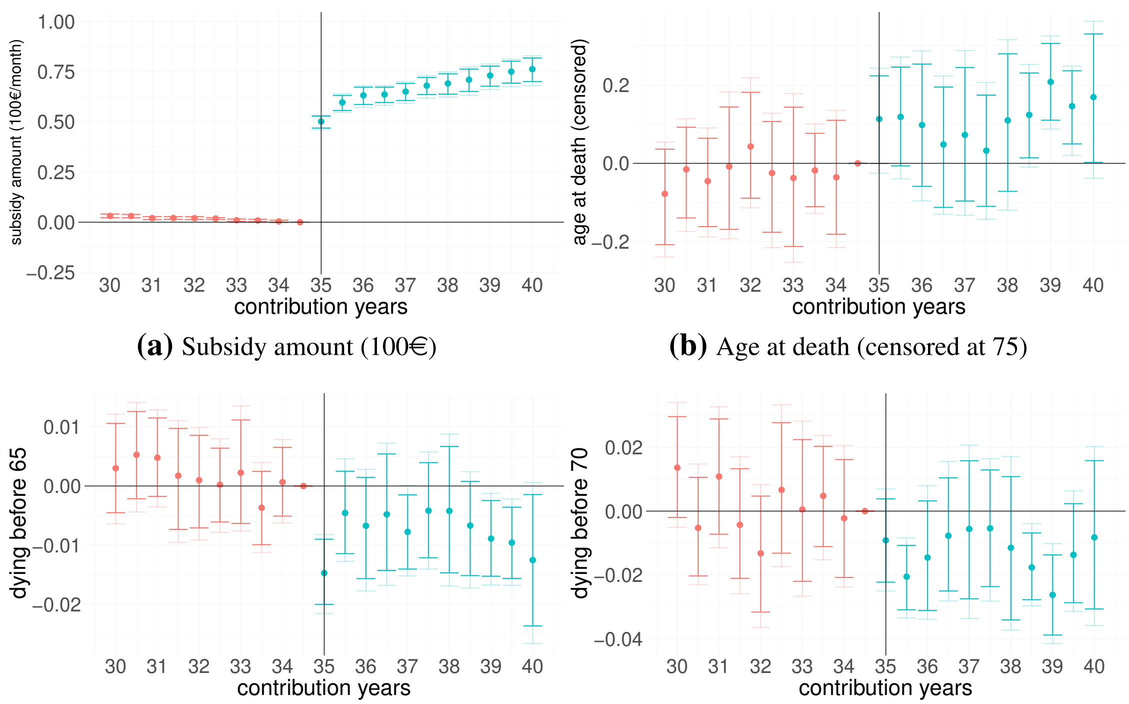
Notes: Figure A.6 (a) displays the distribution of aep for groups with contribution years above ("above 35", red) and below 35 ("below 35", blue) in the baseline sample. Figure A.6 (b) depicts the difference in density between the "above 35" and the "below 35" group.



(a) Distribution **(b)** Difference in distribution

Figure A.7: Distribution of contribution years by aep below and above 0.75

Notes: Figure A.7 (a) displays the distribution of contribution years for groups with aep above (blue) and below 0.75 (red) in the baseline sample. Figure A.7 (b) shows the difference in distribution between below 0.75 and above 0.75 groups.



(a) Subsidy amount (100€)

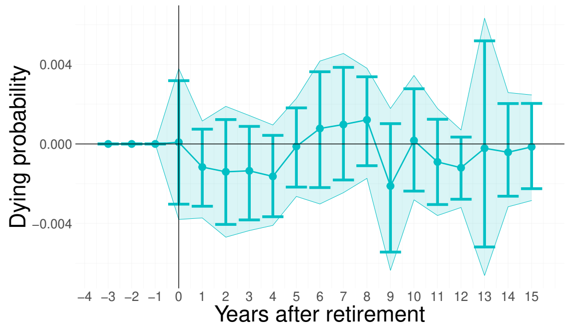
(b) Age at death (censored at 75)

(c) Probability of dying before 65

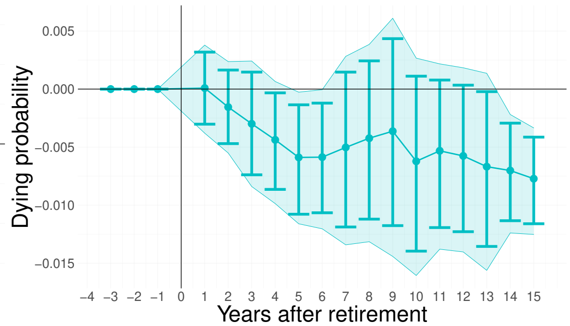
(d) Probability of dying before 70

Figure A.8: Robustness checks: event study coefficients by contribution semester in the baseline sample

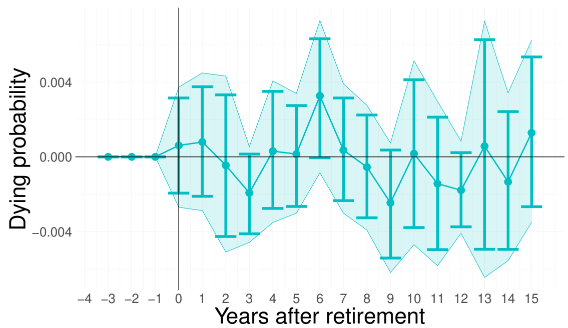
Notes: Figure A.8 displays the event study coefficients for subsidy amount (first stage) and mortality outcomes in the baseline sample using contribution semesters as time variable. All subfigures plot the 95 percent CI (shadowed line) and 90 percent CI (solid line).



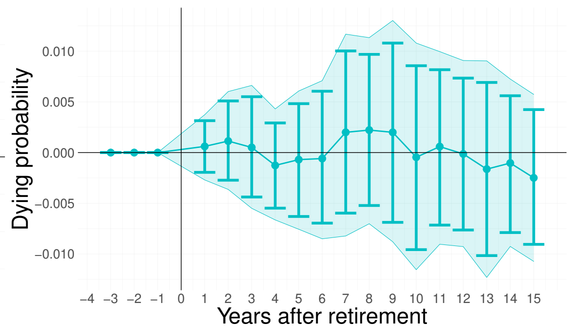
(a) All, hazard



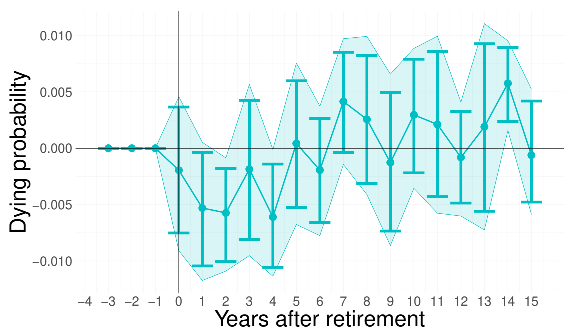
(b) All, cumulative hazard



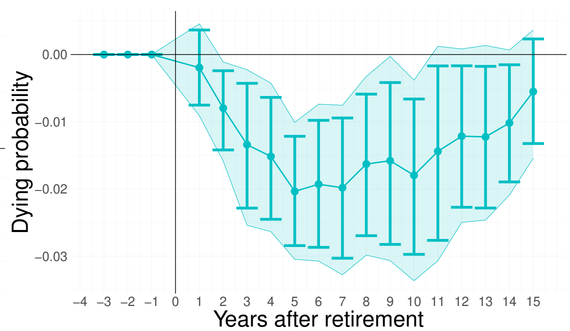
(c) Women, hazard



(d) Women, cumulative hazard



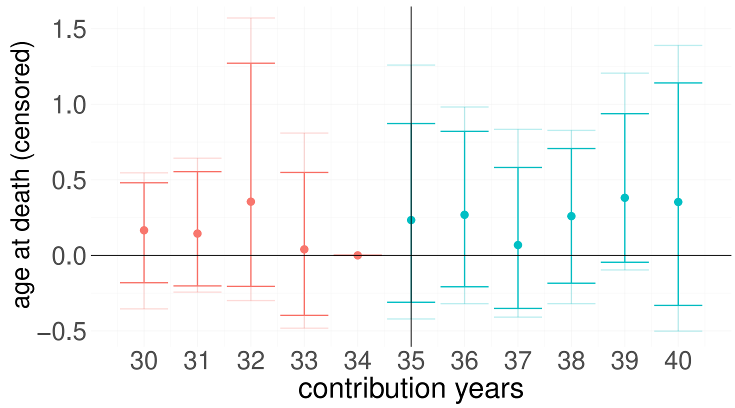
(e) Men, hazard



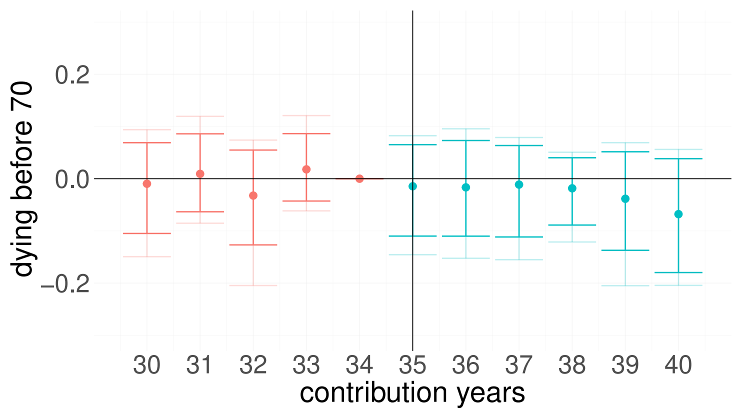
(f) Men, cumulative hazard

Figure A.9: Effect of eligibility on the probability of dying after retirement

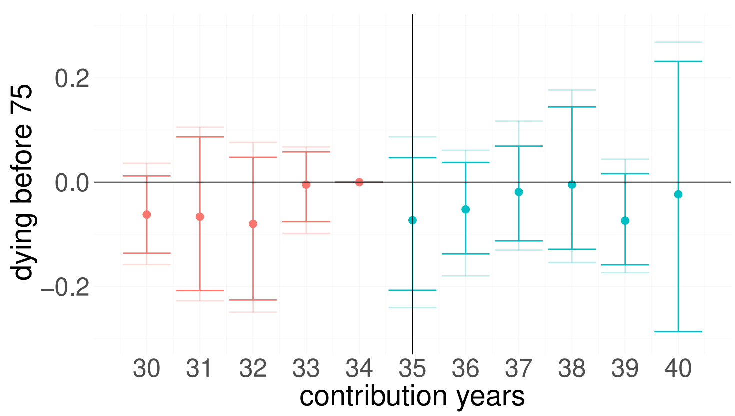
Notes: The left-hand column of Figure A.9 shows the reduced-form effects of eligibility for the a subsidy on the probability of dying in each year after retirement. That is, the impacts on the probability of dying within one year after retirement, between 1 and 2 years after retirement, 2 and 3 years, etc. The right-hand column of Figure A.9 shows the reduced-form impact of eligibility for the a subsidy on the probability of dying at each year after retirement. That is, the effects on the probability of dying 1 year, 2 years, ... and 15 years after retirement. All figures show the 95 percent CI (shaded area) and the 90 percent CI (solid line).



(a) Age at death (censored at 75)



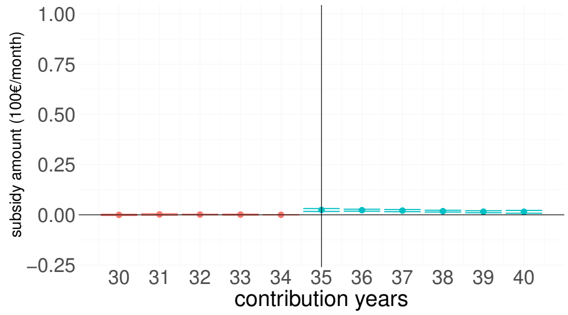
(b) Probability of dying before 70



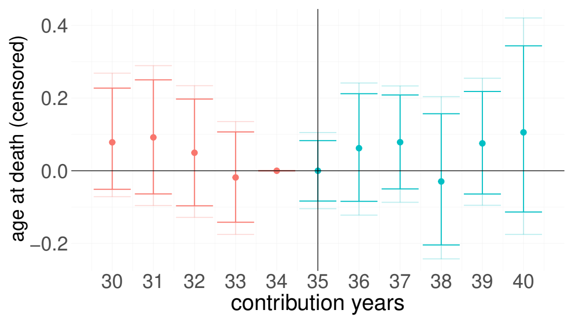
(c) Probability of dying before 75

Figure A.10: Placebo checks: event study coefficients in the 1922-1931 sample.

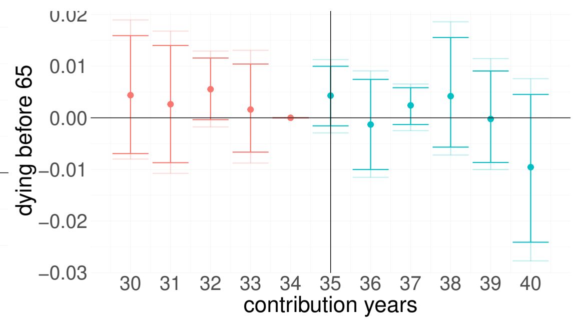
Notes: Figure A.10 displays the event study coefficients for mortality outcomes in the 1922-31 placebo sample. All subfigures plot the 95 percent CI (shadowed line) and 90 percent CI (solid line).



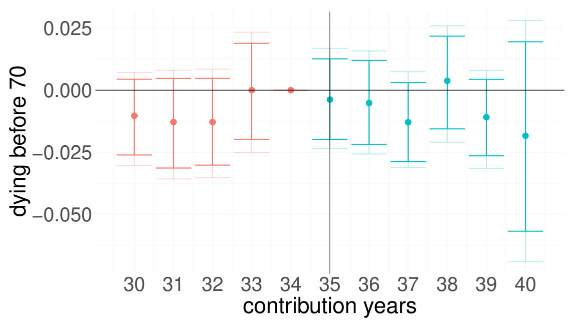
(a) Subsidy amount (100€)



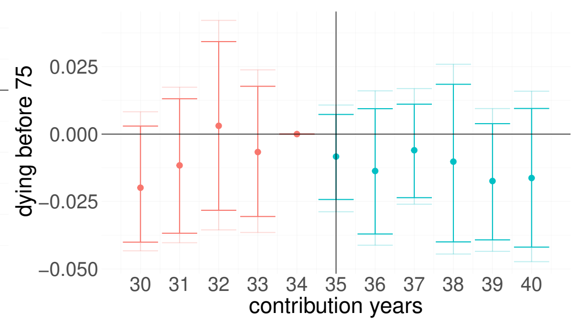
(b) Age at death (censored at 75)



(c) Probability of dying before 65



(d) Probability of dying before 70



(e) Probability of dying before 75

Figure A.11: Placebo checks: event study coefficients in the $aep \in$ (0.8-1.25) placebo sample.

Notes: Figure A.11 displays the event study coefficients for pension income (first stage) and mortality outcomes in the $aep \in$ (0.8-1.25) placebo sample. Placebo cut-off at $aep = 1$. All subfigures plot the 95 percent CI (shadowed line) and 90 percent CI (solid line).

Table A.1: Summary statistics (RTWF)

	West German Pensioners			Cohorts 1932 - 1942			Baseline Sample		
	Mean	Std.Dev.	N	Mean	Std.Dev.	N	Mean	Std.Dev.	N
Mortality outcomes									
Age at death	75.10	6.93	4,442,649	74.34	5.76	2,612,036	74.27	5.79	401,932
Age at death (censored)	72.17	3.75	4,442,832	72.27	3.69	2,612,035	72.22	3.69	401,932
Dying before 65	0.05	0.23	4,442,649	0.05	0.23	2,612,036	0.05	0.22	401,932
Dying before 70	0.27	0.44	4,442,649	0.25	0.43	2,612,036	0.26	0.44	401,932
Dying before 75	0.50	0.50	4,442,649	0.51	0.50	2,612,036	0.52	0.50	401,932
Pension income and subsidy related variables									
Pension income (PI, 100€)	9.67	5.84	4,442,832	10.37	5.77	2,612,035	7.53	2.68	401,932
Subsidy (100€)†	1.14	0.79	562,597	1.12	0.74	335,238	0.86	0.60	114,732
Subsidy recipient	0.13	0.33	4,442,649	0.13	0.33	2,612,036	0.29	0.45	401,932
PI w/o subsidy (100€)	9.53	5.90	4,442,510	10.22	5.84	2,612,035	7.28	2.64	401,932
Pension related characteristics									
CY	35.45	11.15	4,442,649	36.48	10.72	2,612,036	35.47	2.87	401,932
CY>35	0.64	0.48	4,442,649	0.69	0.46	2,612,036	0.66	0.47	401,932
aep	0.91	0.32	4,439,960	0.94	0.32	2,610,792	0.74	0.17	401,932
aep <0.75	0.34	0.47	4,442,649	0.30	0.46	2,612,036	0.52	0.50	401,932
Age at claiming pension	63.86	3.08	4,442,548	63.11	2.54	2,612,035	63.10	2.38	401,932
% claim disability pension	0.13	0.33	4,442,649	0.14	0.35	2,612,036	0.13	0.34	401,932
% claim unemployment pension	0.12	0.33	4,442,649	0.17	0.38	2,612,036	0.08	0.27	401,932
% claim women pension	0.09	0.29	4,442,649	0.13	0.33	2,612,036	0.23	0.42	401,932
Individual characteristics									
Birth year	1935.36	6.15	4,442,649	1936.41	2.97	2,612,036	1936.27	2.97	401,932
% male	0.58	0.49	4,442,649	0.61	0.49	2,612,036	0.38	0.49	401,932
% married	0.61	0.49	4,442,649	0.68	0.47	2,612,036	0.59	0.49	401,932
Number of children*	2.04	1.46	1,874,487	2.03	1.43	1,021,029	2.18	1.48	249,822
% private health insurance	0.11	0.31	4,442,649	0.11	0.31	2,612,036	0.08	0.27	401,932
% public health insurance	0.84	0.37	4,442,649	0.84	0.36	2,612,036	0.89	0.32	401,932

Notes: Table A.1 reports descriptive statistics for the *West German Pensioners* sample, the *1932-1942* sample and the *baseline* sample. *West German Pensioners* sample restricts to those who died between 1994 and 2018 and were residing in West Germany, holding German citizenship and claiming old-age pension at time of death. *1932-1942* sample further restricts to individuals born between 1932 and 1942. *Baseline* sample further adds aep (average earning points from full contribution periods) and contribution years (CY) restrictions, respectively to the bandwidths of 0.45 - 1.05 and 30 - 40. Number of children is imputed from child-benefits claims. † conditional on being a recipient. * only reported for women in the sample.
Source: Authors' calculations from the RTWF data.

Table A.2: Summary statistics by gender by treatment status (RTWF)

	Women						*Men*					
	Baseline		**Treatment** $aep \in [0.45, 0.75)$		**Control** $aep \in [0.75, 1.05)$		**Baseline**		**Treatment** $aep \in [0.45, 0.75)$		**Control** $aep \in [0.75, 1.05)$	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
Mortality outcomes												
Age at death (censored)	72.56	3.57	72.61	3.55	72.46	3.62	71.65	3.81	71.86	3.69	71.57	3.86
Dying before 65	0.05	0.21	0.05	0.21	0.05	0.22	0.06	0.23	0.05	0.21	0.06	0.24
Dying before 70	0.22	0.41	0.21	0.41	0.23	0.42	0.32	0.47	0.30	0.46	0.33	0.47
Dying before 75	0.47	0.50	0.46	0.50	0.49	0.50	0.60	0.49	0.58	0.49	0.61	0.49
Pension income and subsidy related variables												
Pension income (PI, 100€)	6.68	2.52	6.05	2.17	7.96	2.61	8.92	2.14	6.76	1.40	9.73	1.67
Subsidy (100€)	0.36	0.57	0.51	0.63	0.05	0.22	0.06	0.26	0.21	0.47	0.00	0.03
Subsidy recipient	0.40	0.49	0.56	0.50	0.09	0.28	0.09	0.29	0.32	0.47	0.01	0.09
PI w/o subsidy (100€)	6.32	2.45	5.54	1.95	7.90	2.60	8.86	2.12	6.55	1.28	9.73	1.67
Pension related characteristics												
CY	35.18	2.88	35.11	2.87	35.30	2.91	35.96	2.78	35.23	2.80	36.23	2.72
CY>35	0.63	0.48	0.62	0.49	0.64	0.48	0.73	0.45	0.64	0.48	0.76	0.43
aep	0.69	0.15	0.60	0.08	0.87	0.08	0.83	0.15	0.63	0.08	0.91	0.08
aep <0.75	0.67	0.47	1.00	0.00	0.00	0.00	0.27	0.45	1.00	0.00	0.00	0.00
Age at claiming pension	62.75	2.44	62.76	2.43	62.72	2.47	63.68	2.15	64.00	2.01	63.56	2.19
% disability pension	0.11	0.31	0.11	0.31	0.11	0.31	0.17	0.38	0.13	0.33	0.19	0.39
% unemployment pension	0.03	0.18	0.03	0.18	0.04	0.19	0.15	0.35	0.12	0.33	0.15	0.36
% women's pension	0.38	0.48	0.37	0.48	0.38	0.49	0.00	0.00	0.00	0.00	0.00	0.00
Individual characteristics												
Birth year	1936.24	2.98	1936.09	2.99	1936.57	2.93	1936.30	2.95	1936.57	3.01	1936.20	2.92
% married	0.58	0.49	0.59	0.49	0.55	0.50	0.61	0.49	0.60	0.49	0.62	0.49
Number of children†	2.18	1.48	2.27	1.44	1.97	1.53	0.09	0.52	0.09	0.50	0.09	0.52
% private health insurance	0.05	0.22	0.05	0.21	0.06	0.23	0.12	0.33	0.20	0.40	0.09	0.29
% public health insurance	0.92	0.28	0.92	0.27	0.91	0.28	0.84	0.37	0.75	0.44	0.87	0.33
Observations	249,822		167,597		82,225		152,110		41,523		110,587	

Notes: Table A.2 reports descriptive statistics for *women* and *men* in the *baseline* sample, treatment and control groups. *Baseline* sample restricts to those who died between 1994 and 2018 and were residing in West Germany, holding German citizenship and claiming old-age pension at time of death, born between 1932 and 1942 and aep (average earning points from full contribution periods) between 0.45 and 1.05 and contribution years (CY) between 30 and 40. Treatment group is defined as those with $aep < 0.75$ while control group are those with $aep \geq 0.75$.

Source: Authors' calculations from the RTWF data.

†Number of children is imputed from child-benefits claims.

Table A.3: Definition of health, financial constraints and optimism variables in SHARE-RV data

	Definition	Scale
CASP	Quality-of-life scale for early old-age individuals considering both mental and physical health.	0-57, the higher the better
Self-reported health	Self-reported evaluation of own's health.	0 (Poor) - 4 (Excellent)
Depression index	EURO-D Measure of Depressive Symptoms in the Aging Population, measured as number of reported symptoms of depression.	0 - 12
Number of chronic diseases	Number of chronic diseases currently treated for: heart attack, high blood pressure, high blood cholesterol, stroke, diabetes, chronic lung disease, cancer, ulcer, parkinson, cataracts, hip femoral fracture.	0 - 11
Difficulties with ADLs	Difficulties with Activities of Daily Living.	0 - 5
Difficulties with IADLs	Difficulties with Instrumental Activities of Daily Living.	0 - 3
Had a stroke	Currently treated for stroke or cerebral vascular disease.	0 - 1
Chronic lung disease	Currently treated for chronic lung disease.	0 - 1
Cataracts	Currently treated for cataracts.	0 - 1
High blood pressure	Currently treated for high blood pressure.	0 - 1
Low money stops	How often does money stop from doing things.	0 (never) - 3 (often)
Full of opportunities	How often feels life is full of opportunities.	0 (never) - 3 (often)
Future looks good	How often future looks good.	0 (never) - 3 (often)
How often consumed alcohol	How often consumed alcohol in the past six months.	1 (not at all) - 7 (almost every day)
Is currently smoking	Regular smoker at the time of the interview.	0 - 1
Ever smoked daily	Has ever smoked on a daily basis.	0 - 1

Notes: Table A.3 describes main output variables used from the SHARE-RV.
Source: SHARE data documentation.

Table A.4: Summary statistics (SHARE-RV)

	West German Pensioners		**Baseline Sample**		**Restricted Sample**	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
Outcome variables						
Health measures						
CASP	39.47	5.33	39.04	5.41	38.02	5.85
Self-reported heatlh	1.71	0.96	1.63	0.95	1.60	0.97
Depression index	2.18	1.93	2.30	1.97	2.48	2.20
Number of chronic diseases	1.44	1.28	1.46	1.31	1.54	1.32
ADLA	0.18	0.65	0.17	0.61	0.23	0.74
Professional care at home	0.04	0.19	0.04	0.19	0.09	0.28
Hospital overnight stays	0.21	0.41	0.21	0.41	0.22	0.41
Stroke	0.05	0.21	0.04	0.20	0.04	0.19
Chronical lung disease	0.09	0.28	0.11	0.31	0.10	0.30
Cataracts	0.13	0.34	0.12	0.33	0.12	0.33
High blood pressure	0.50	0.50	0.51	0.50	0.49	0.50
Feelings measures						
Low money stops	1.02	1.05	1.12	1.09	1.12	1.13
Life full of opportunities	2.26	0.83	2.19	0.86	2.06	0.90
Future looks good	2.24	0.84	2.18	0.86	2.06	0.85
Risky behaviours						
How often consumed alcohol	3.77	2.09	3.59	2.05	3.31	1.94
Smoke currently	0.16	0.37	0.19	0.39	0.13	0.33
Ever smoked daily	0.48	0.50	0.50	0.50	0.31	0.46
Pension income and subsidy						
Pension income per month (PI, 100€)	10.93	6.37	9.89	4.35	9.61	2.17
Subsidy per month (100€)	0.12	0.37	0.19	0.45	0.42	0.64
Subsidy recipient	0.13	0.34	0.21	0.41	0.38	0.49
PI without subsidy per month (100€)	10.46	6.36	9.40	4.29	8.01	1.97
Pension related characteristics						
CY	35.01	13.70	37.34	10.07	35.54	2.99
CY>35	0.63	0.48	0.66	0.47	0.60	0.49
aep	0.99	0.53	0.83	0.25	0.72	0.17
aep<0.75	0.33	0.47	0.41	0.49	0.59	0.49
Age at claiming pension	63.19	2.32	62.83	2.10	62.18	2.05
Self-reported retirement age*	62.81	2.54	62.61	2.53	61.22	3.59
Individual and household characteristics						
Birth year	1942.78	6.11	1943.69	5.71	1939.07	2.77
% Male	0.54	0.50	0.46	0.50	0.30	0.46
% Married	0.79	0.41	0.78	0.41	0.71	0.45
Household size	1.96	0.66	1.96	0.67	1.91	0.75
Number of children	1.02	1.42	1.16	1.45	1.69	1.79
Age at first child	24.37	4.62	24.45	4.75	23.98	4.90
Age at last child	29.36	5.43	29.14	5.39	29.01	5.33
% all children employed	0.55	0.50	0.54	0.50	0.53	0.50
% contact children ≥1/week	0.51	0.50	0.49	0.50	0.50	0.50
Months unemployed before 1992	3.90	10.42	5.36	12.45	7.21	15.49
Years of schooling	12.19	3.27	11.67	2.88	11.31	2.62
Owns a house	0.48	0.50	0.44	0.50	0.36	0.48
Household income per month (100€)	32.07	37.58	29.60	32.95	24.97	17.01
Pension/household income share	0.40	0.26	0.40	0.24	0.41	0.21
Observations	3,775		2,328		205	

Notes: Table A.4 reports descriptive statistics for the SHARE-RV sample. *West German Pensioners* sample includes old-age German retirees residing in West Germany. *Baseline* sample further restricts to those born after 1931, with 15 to 55 contribution years (CY) and average earning points at retirement (*aep*) between 0.25 and 1.25. SHARE-RV *Restricted* sample uses the same restrictions as the RTWF baseline sample. * only available for 944, 609 and 32 observations for each sample.
Source: Authors' calculations from the SHARE-RV data.

Table A.5: Summary statistics by gender (SHARE-RV sample)

	All		**Women**		**Men**	
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
Outcome variables						
Health measures						
CASP	39.04	5.41	39.23	5.15	38.81	5.70
Self-reported heatlh	1.63	0.95	1.68	0.95	1.56	0.95
Depression index	2.30	1.97	2.52	1.99	2.04	1.91
Number of chronic diseases	1.46	1.31	1.37	1.28	1.58	1.35
ADLA	0.17	0.61	0.15	0.60	0.19	0.62
Professional home care	0.04	0.19	0.03	0.18	0.04	0.20
Hospital overnight stays	0.21	0.41	0.19	0.39	0.24	0.43
Stroke	0.04	0.20	0.03	0.18	0.05	0.22
Chronical lung disease	0.11	0.31	0.10	0.31	0.11	0.32
Cataracts	0.12	0.33	0.13	0.34	0.11	0.31
High blood pressure	0.51	0.50	0.49	0.50	0.53	0.50
Feelings measures						
Low money stops	1.12	1.09	1.09	1.07	1.15	1.11
Life full of opportunities	2.19	0.86	2.23	0.84	2.15	0.87
Future looks good	2.18	0.86	2.21	0.83	2.15	0.89
Risky behaviours						
Consumed alcohol (days/week)	3.59	2.05	3.20	1.88	4.06	2.15
Smoke currently	0.19	0.39	0.17	0.38	0.20	0.40
Ever smoked daily	0.50	0.50	0.39	0.49	0.63	0.48
Pension income and subsidy						
Pension income per month (PI, 100€)	9.89	4.35	8.17	3.44	11.94	4.44
Subsidy per month (100€)	0.19	0.45	0.29	0.52	0.06	0.32
Subsidy recipient	0.21	0.41	0.34	0.48	0.05	0.21
PI without subsidy per month (100€)	9.40	4.29	7.48	3.46	11.68	4.07
Pension related characteristics						
CY	37.34	10.07	33.61	9.70	41.78	8.59
CY>35	0.66	0.47	0.51	0.50	0.84	0.37
aep	0.83	0.25	0.72	0.21	0.96	0.22
aep<0.75	0.41	0.49	0.63	0.48	0.16	0.37
Age at claiming pension	62.83	2.10	62.51	2.17	63.21	1.94
Self-reported retirement age*	62.61	2.53	62.29	2.67	63.01	2.30
Individual and household characteristics						
Birth year	1943.69	5.71	1944.28	5.64	1942.99	5.73
Married	0.78	0.41	0.75	0.43	0.81	0.39
Household size	1.96	0.67	1.90	0.63	2.02	0.71
Number of children	1.16	1.45	2.06	1.37	0.08	0.49
Age at first child	24.45	4.75	24.32	4.68	28.30	5.32
Age at last child	29.14	5.39	29.00	5.35	33.15	5.10
% all children employed	0.54	0.50	0.54	0.50	0.53	0.50
% contact children ≥1/week	0.49	0.50	0.52	0.50	0.46	0.50
Months unemployed bf 1992	5.36	12.45	5.33	11.60	5.39	13.40
Years of schooling	11.67	2.88	11.43	2.85	11.95	2.88
Own a house	0.44	0.50	0.44	0.50	0.44	0.50
Household income per month (100€)	29.60	32.95	30.22	32.47	28.85	33.52
Pension/household income share	0.40	0.24	0.33	0.21	0.50	0.25
Observations	2,328		1,365		963	

Notes: Table A.5 reports descriptive statistics for the baseline SHARE-RV sample. Sample includes old-age German retirees residing in West Germany, born after 1931, with 15 to 55 contribution years (CY) and average earning points at retirement (aep) between 0.25 and 1.25. * only available for 609 observations.
Source: Authors' calculations from the SHARE-RV data.

Table A.6: Sample selection

	From full RTWF sample		From West German Pensioners
	Baseline	West German Pensioner	1932-1942
	(1)	(2)	(3)
Eligibility ($D \times Above35$)	-0.016*	-0.111	0.003
	(0.008)	(0.020)	(0.018)
	[0.096]	[0.186]	[0.152]
Obs	10,030,277	10,030,277	4,442,649
Adj. R-sqr	0.323	0.295	0.163
Contribution year FE	✓	✓	✓
Birth cohort FE	✓	✓	✓
Controls	✓	✓	✓
PI without subsidy	✓	✓	✓

Notes: This table reports the impact of eligibility for the pension subsidy on the probability of being selected in the baseline sample. Column 1 and 2 shows the probability of being selected into the baseline sample (West German pensioners whose aep are between 0.45 and 1.05 and contribution years are between 30 and 40 and born between 1932 and 1942.) and the probability of being a West German Pensioner (residing in West Germany, holding German nationality, claimed old-age pension). Column 3 shows the probability of being born between 1932 to 1942 from the 'West German Pensioner' sample. All specifications control for married, having children, health insurance status, male, birth cohort fixed effects, contribution year fixed effects and pension income without subsidy. Monetary values are expressed in hundred 2015 euro. Standard errors clustered by birth cohort are in parentheses, bootstrapped p-values are in brackets. With respect to bootstrapped p-values: *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' calculations from the RTWF data.

Table A.7: Impact on mortality before 60 and after 75 (DID estimates)

Birth cohorts	1945-1955	1932-1937	1922-1931
	(1)	(2)	(3)
Panel A: All			
Dying between 50-60	0.010		
	(0.006)		
	[0.129]		
Dying between 75-80		0.004	
		(0.004)	
		[0.438]	
Dying within 80-85			-0.003
			(0.003)
			[0.364]
Panel B: Women			
Dying between 50-60	0.015		
	(0.011)		
	[0.202]		
Dying between 75-80		0.003	
		(0.009)	
		[0.828]	
Dying within 80-85			0.001
			(0.004)
			[0.797]
Panel C: Men			
Dying between 50-60	0.012		
	(0.008)		
	[0.157]		
Dying between 75-80		0.004	
		(0.005)	
		[0.484]	
Dying within 80-85			-0.003
			(0.005)
			[0.506]
Obs (all)	117,671	320,853	360,673
Obs (women)	58,655	189,998	206,438
Obs (men)	59,016	130,855	154,235
Contribution year FE	✓	✓	✓
Birth cohort FE	✓	✓	✓
Controls	✓	✓	✓
PI without subsidy	✓	✓	✓

Notes: This table shows the impact of eligibility for the pension subsidy on probability of dying before 60 and after 75. All regressions restrict to individuals with 30 - 40 contribution years and aep between 0.45 and 1.05. Panel B focuses on women and panel C on men only. Column (1) shows the impact on the probability of dying between 50 and 60 by using a sample of cohorts born between 1945 and 1955, for which we observe the complete death counts between ages 50 and 60. Because some of these individuals died before claiming pension, we assume they would have retired at age 63 had they not died. Column (1) shows the impact on the probability of dying between 75 and 80 by using a sample of cohorts born between 1932 and 1937, for which we observe the complete death counts between ages 75 and 80. Column (3) shows the impact on the probability of dying between 80 and 85 by using a sample of cohorts born between 1922 and 1931, for which we observe the complete death counts between ages 80 and 85. All specifications control for contribution year fixed effects, birth cohort fixed effects, a list of controls (being married, having children, claiming or contributing for widow pension, disability pension or old-age pension, not having health insurance, male dummy) and monthly pension income without subsidy. Standard errors clustered by birth cohort are in parentheses, bootstrapped p-values in brackets. With respect to bootstrapped p-values: *** $p<0.01$, ** $p<0.05$, * $p<0.1$. *Source*: Authors' calculations from the RTWF data.

Table A.8: Event study estimates in baseline sample.

	(aep<0.75) × years of contribution									
	30	31	32	33	35	36	37	38	39	40
Panel A: First stage										
Recipient	0.013***	0.008***	0.009***	0.003	0.665***	0.729***	0.744***	0.760***	0.771***	0.782***
	(0.003)	(0.002)	(0.001)	(0.002)	(0.010)	(0.008)	(0.008)	(0.010)	(0.009)	(0.015)
	[0.001]	[0.000]	[0.000]	[0.131]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Subsidy	0.029***	0.018***	0.017***	0.007**	0.534***	0.632***	0.663***	0.698***	0.738***	0.760***
	(0.005)	(0.004)	(0.003)	(0.002)	(0.016)	(0.021)	(0.023)	(0.028)	(0.028)	(0.032)
	[0.001]	[0.000]	[0.000]	[0.011]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Pension income	0.029***	0.018***	0.017***	0.007**	0.534***	0.632***	0.663***	0.698***	0.738***	0.760***
	(0.005)	(0.004)	(0.003)	(0.002)	(0.016)	(0.021)	(0.023)	(0.028)	(0.028)	(0.032)
	[0.001]	[0.000]	[0.000]	[0.011]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Panel B: Impact on mortality										
Age at death (censored)	-0.030	-0.010	0.026	-0.011	0.136**	0.091	0.070	0.134*	0.194**	0.188**
	(0.048)	(0.061)	(0.048)	(0.041)	(0.038)	(0.058)	(0.059)	(0.063)	(0.045)	(0.077)
	[0.601]	[0.875]	[0.614]	[0.813]	[0.008]	[0.163]	[0.277]	[0.078]	[0.002]	[0.041]
Dying before 65	0.004	0.003	0.000	-0.001	-0.011**	-0.006	-0.006**	-0.006	-0.010***	-0.013*
	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.004)	(0.002)	(0.005)	(0.003)	(0.006)
	[0.249]	[0.474]	[0.931]	[0.702]	[0.004]	[0.186]	[0.041]	[0.271]	[0.000]	[0.075]
Dying before 70	0.005	0.004	-0.002	0.004	-0.013**	-0.010	-0.004	-0.013*	-0.019**	-0.007
	(0.007)	(0.007)	(0.006)	(0.006)	(0.004)	(0.007)	(0.008)	(0.007)	(0.007)	(0.011)
	[0.461]	[0.572]	[0.733]	[0.573]	[0.002]	[0.180]	[0.584]	[0.098]	[0.008]	[0.516]
Dying before 75	-0.003	-0.011	0.000	0.000	-0.007	-0.007	-0.009	-0.014	-0.015**	-0.012
	(0.005)	(0.008)	(0.006)	(0.007)	(0.004)	(0.008)	(0.007)	(0.007)	(0.006)	(0.007)
	[0.619]	[0.211]	[0.963]	[0.964]	[0.170]	[0.402]	[0.195]	[0.106]	[0.013]	[0.139]
Panel C: Impact on labour supply										
Age at claiming pension	0.009	-0.001	0.014	0.004	-0.027	0.038*	0.033	0.017	0.021	0.001
	(0.024)	(0.022)	(0.020)	(0.018)	(0.019)	(0.017)	(0.021)	(0.014)	(0.018)	(0.026)
	[0.723]	[0.976]	[0.509]	[0.820]	[0.196]	[0.053]	[0.143]	[0.291]	[0.325]	[0.979]
Obs	401,932									
Contribution year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Birth cohort FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PI without subsidy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: Estimates for baseline sample. Restrictions: 1932-1942 birth cohorts, 30-40 contribution years, 0.45-1.05 *aep*. Controls include having children, not having health insurance, receiving unemployment, disability or women's pension, male dummy. Monetary values are expressed in hundred 2015 euro. Standard errors clustered by birth cohort are in parentheses, bootstrapped p-values in brackets. With respect to bootstrapped p-values: *** p<0.01, ** p<0.05, * p<0.1. *Source*: Authors' calculations from the RTWF data.

Table A.9: Impact of subsidy eligibility on other measures of mortality (DID estimates)

	All (1)	**Women** (2)	**Men** (3)
Dying between 62 - 69	-0.011***	-0.003	-0.016**
	(0.003)	(0.002)	(0.006)
	[0.001]	[0.179]	[0.031]
Dying between 70 - 75	0.007*	0.004	0.007
	(0.003)	(0.005)	(0.005)
	[0.054]	[0.408]	[0.198]
Dying within 4 years	-0.004*	-0.001	-0.015**
	(0.002)	(0.002)	(0.005)
	[0.084]	[0.586]	[0.014]
Obs	401,932	249,822	152,110
Contribution year FE	✓	✓	✓
Birth cohort FE	✓	✓	✓
Controls	✓	✓	✓
PI without subsidy	✓	✓	✓

Notes: This table shows the impact of eligibility for the pension subsidy on a list of alternative measures of mortality: probabilities of dying between age 62 and 69, probabilities of dying between age 70 and 75, probabilities of dying within four years from the age at which they started claiming the current pension. Column 1 shows the impact for the baseline sample. Columns 2 and 3 show the results by gender. All specifications control for contribution year fixed effects, birth cohort fixed effects, a list of controls (being married, having children, claiming unemployment, disability or women's pension, not having health insurance, male dummy) and monthly pension income without subsidy. Standard errors clustered by birth cohort are in parentheses, bootstrapped p-values in brackets. With respect to bootstrapped p-values: *** $p<0.01$, ** $p<0.05$, * $p<0.1$.
Source: Authors' calculations from the RTWF data.

Table A.10: Robustness checks (DID estimates)

	Baseline	1932-1942		1932-1948			1932-1937		
$aep \in$	[0.45,1.05]	[0.45,1.05]	[0.6,0.9]	[0.45, 1.05]	[0.45,1.05]	[0.6,0.9]	[0.45, 1.05]	[0.45,1.05]	[0.6,0.9]
exactly at 35 CY	keep	drop	keep	keep	drop	keep	keep	drop	keep
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
First stage									
Recipient	0.730***	0.741***	0.667***	0.722***	0.732***	0.653***	0.742**	0.754**	0.681***
	(0.008)	(0.008)	(0.009)	(0.008)	(0.008)	(0.010)	(0.009)	(0.008)	(0.010)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.016]	[0.016]	[0.000]
Subsidy	0.646***	0.660***	0.354***	0.610***	0.622***	0.338***	0.689***	0.706***	0.374**
	(0.021)	(0.023)	(0.010)	(0.026)	(0.027)	(0.012)	(0.015)	(0.015)	(0.008)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.016]
Pension income	0.646***	0.660***	0.354***	0.610***	0.622***	0.338***	0.689***	0.706***	0.374***
	(0.021)	(0.023)	(0.010)	(0.026)	(0.027)	(0.012)	(0.015)	(0.015)	(0.008)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Impact on mortality									
Age at death (censored)	0.135**	0.125**	0.104**	0.113**	0.105**	0.085**	0.148***	0.141***	0.117***
	(0.027)	(0.028)	(0.031)	(0.026)	(0.026)	(0.028)	(0.034)	(0.036)	(0.030)
	[0.002]	[0.002]	[0.006]	[0.004]	[0.006]	[0.014]	[0.000]	[0.000]	[0.000]
Dying before 65	-0.009***	-0.008***	-0.006***	-0.009***	-0.008***	-0.006***	-0.011***	-0.010***	-0.006**
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
	[0.000]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.000]	[0.000]	[0.016]
Dying before 70	-0.014**	-0.014**	-0.013**	-0.011**	-0.011**	-0.009**	-0.015***	-0.015***	-0.015***
	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
	[0.004]	[0.007]	[0.010]	[0.011]	[0.015]	[0.043]	[0.000]	[0.000]	[0.000]
Dying before 75	-0.008*	-0.007	-0.005	-0.008**	-0.008*	-0.005	-0.008	-0.007	-0.004
	(0.004)	(0.004)	(0.005)	(0.003)	(0.003)	(0.004)	(0.005)	(0.005)	(0.007)
	[0.088]	[0.102]	[0.355]	[0.045]	[0.054]	[0.277]	[0.219]	[0.219]	[0.500]
Dying before 80	-0.001	-0.001	-0.003	-0.002	-0.001	-0.003	-0.001	-0.001	-0.004
	(0.002)	(0.002)	(0.004)	(0.002)	(0.002)	(0.003)	(0.004)	(0.004)	(0.007)
	[0.440]	[0.587]	[0.511]	[0.284]	[0.340]	[0.475]	[0.688]	[0.859]	[0.516]
Impact on labour supply									
Age at claiming pension	0.010	0.016	-0.001	0.009	0.014	-0.001	0.021	0.029	0.000
	(0.015)	(0.018)	(0.008)	(0.013)	(0.015)	(0.008)	(0.020)	(0.023)	(0.008)
	[0.547]	[0.451]	[0.875]	[0.535]	[0.440]	[0.947]	[0.344]	[0.312]	[0.969]
Obs	401,932	387,027	216,320	464,444	447,740	250,294	260,367	283,983	139,445
Contribution year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Birth cohort FE	✓	✓	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓
PI without subsidy	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: This table shows the robustness of the estimates by varying sample selection. Column (1) shows the results for the baseline sample. Column (2) excludes individuals who retired after exactly 35 years of contribution (420 months). Column (3) takes individuals with $aep \in [0.6 - 0.9]$. In addition to expanding the cohorts restriction to 1932-1948, columns (4) (5) and (6) maintain the same aep and contribution year restriction, excludes individuals that retired exactly at 35 years of contribution and takes individuals with $aep \in [0.6 - 0.9]$, respectively. Columns (7)-(9) restrict the baseline sample to those born between 1932 and 1937. Column (8) further excludes those that retired exactly after 35 eas of contribution. Column (8) considers only individual with $aep \in [0.6 - 0.9]$. All specifications control for contribution year fixed effects, birth cohort fixed effects, a list of controls (being married, having children, claiming unemployment, disability or women's pension, not having health insurance, male dummy) and monthly pension income without subsidy.Standard errors clustered by birth cohort are in parentheses, bootstrapped p-values in brackets. With respect to bootstrapped p-values: *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' calculations from the RTWF data.

Table A.11: Placebo checks (DID estimates)

	Baseline	Placebo			
cohort range	1932 - 1942	1922 - 1931	1932 - 1942		
$aep \in$	[0.45,1.05]	[0.45,1.05]	[0.8,1.25]	[1.0,1.4]	[0.8, 1.7]
cutoff: $aep <$	0.75	0.75	1.0	1.2	1.02 (median)
	(1)	(2)	(3)	(4)	(5)
Panel A: First stage					
Recipient	0.730***	0.845***	0.025***	0.023***	0.029***
	(0.008)	(0.013)	(0.002)	(0.004)	(0.003)
	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]
Subsidy	0.646***	0.931***	0.019***	0.015***	0.021***
	(0.021)	(0.030)	(0.002)	(0.002)	(0.003)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Pension income	0.646***	0.931***	0.019***	0.015***	0.021***
	(0.021)	(0.030)	(0.002)	(0.002)	(0.003)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Pension income w/o subsidy	-0.647***	-0.887***	-0.185***	-0.105	-0.423***
	(0.062)	(0.028)	(0.038)	(0.078)	(0.070)
	[0.000]	[0.000]	[0.000]	[0.206]	[0.000]
Panel B: Impact on mortality					
Age at death (censored)	0.135**	0.017	0.005	0.016	-0.023
	(0.027)	(0.024)	(0.035)	(0.084)	(0.032)
	[0.002]	[0.510]	[0.881]	[0.847]	[0.474]
Dying before 65	-0.009***	-	-0.001	0.003	-0.001
	(0.001)	-	(0.002)	(0.005)	(0.002)
	[0.000]	-	[0.496]	[0.599]	[0.461]
Dying before 70	-0.014**	-0.018	0.000	-0.002	0.003
	(0.004)	(0.016)	(0.004)	(0.009)	(0.003)
	[0.004]	[0.305]	[0.947]	[0.813]	[0.358]
Dying before 75	-0.008*	-0.003	-0.006	-0.001	-0.001
	(0.004)	(0.025)	(0.006)	(0.011)	(0.004)
	[0.088]	[0.920]	[0.336]	[0.909]	[0.853]
Panel C: Impact on labour supply					
Age at claiming pension	0.010	0.258	0.002	0.054**	0.012
	(0.015)	(0.145)	(0.009)	(0.023)	(0.011)
	[0.547]	[0.107]	[0.865]	[0.047]	[0.316]
Obs	401,932	2,607	225,276	225,276	269,117
Contribution year FE	✓	✓	✓	✓	✓
Birth cohort FE	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓
PI without subsidy	✓	✓	✓	✓	✓

Notes: This table shows the impact of eligibility for the pension subsidy for a list of placebo samples. Column (1) shows the results for the baseline sample. Column (2) takes cohorts born between 1922 and 1932 whose year of claiming first and current pension is before 1992 and keeps the same contribution years and aep restrictions and cut-offs as in the baseline. Column (3)-(5) takes the same cohort and contribution year restrictions as the baseline sample but varying the aep restriction and aep cut-off. Column (3) restricts aep to be between 0.8 and 1.25 with placebo cut-off at 1.0, column (4) restricts aep to be between 1.0 and 1.4 with placebo cut-off at 1.2, and column (5) restricts aep to be above 0.8 and placebo cut-off at this sample's median aep (1.02).Standard errors clustered by birth cohort are in parentheses, bootstrapped p-values in brackets. With respect to bootstrapped p-values: *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' calculations from the RTWF data.

Table A.12: Heterogeneity effects by gender (DID estimates)

	Women				*Men*	
	Marital status		**Children**		**Marital status**	
	Married	Not married	Yes	No	Married	Not married
	(1)	(2)	(3)	(4)	(5)	(6)
First stage						
Recipient	0.727***	0.798***	0.737***	0.825***	0.383***	0.674***
	(0.009)	(0.006)	(0.008)	(0.007)	(0.011)	(0.016)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Subsidy	0.696***	0.690***	0.699***	0.791***	0.277***	0.392***
	(0.017)	(0.020)	(0.020)	(0.022)	(0.009)	(0.022)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Pension income	0.696***	0.690***	0.699***	0.791***	0.277***	0.392***
	(0.017)	(0.020)	(0.020)	(0.022)	(0.009)	(0.022)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Impact on mortality						
Age at death (censored)	0.058*	0.003	0.042	-0.005	0.144**	0.180**
	(0.028)	(0.052)	(0.038)	(0.099)	(0.057)	(0.050)
	[0.058]	[0.959]	[0.294]	[0.951]	[0.030]	[0.006]
Dying before 65	-0.004**	-0.004	-0.004*	-0.004	-0.002	-0.004
	(0.002)	(0.003)	(0.002)	(0.006)	(0.002)	(0.003)
	[0.040]	[0.189]	[0.079]	[0.503]	[0.338]	[0.248]
Dying before 70	-0.008**	0.000	-0.005	0.001	-0.018*	-0.022**
	(0.002)	(0.007)	(0.004)	(0.010)	(0.009)	(0.006)
	[0.015]	[0.998]	[0.232]	[0.884]	[0.066]	[0.005]
Dying before 75	-0.003	0.005	-0.001	-0.004	-0.012**	-0.014
	(0.006)	(0.009)	(0.005)	(0.018)	(0.005)	(0.008)
	[0.660]	[0.617]	[0.919]	[0.839]	[0.035]	[0.123]
Impact on labour supply						
Age at claiming pension	0.026	-0.026	0.006	0.001	-0.094***	0.041*
	(0.022)	(0.016)	(0.018)	(0.021)	(0.017)	(0.019)
	[0.278]	[0.145]	[0.774]	[0.977]	[0.001]	[0.056]
Obs	145,287	87,310	215,577	34,245	93,075	53,888
CY FE	✓	✓	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Income	✓	✓	✓	✓	✓	✓

Notes: This table shows the impact of eligibility for the pension subsides by subgroups and gender. Columns 1 and 2 show the results by marital status for women. Columns 3 and 4 show results by whether having a child or not for women. Columns 5 and 6 show the results by marital status for men. Monetary values are expressed in hundred 2015 euro. Standard errors clustered by birth cohort are in parentheses, bootstrapped p-values in brackets. Standard errors clustered by birth cohort are in parentheses, bootstrapped p-values in brackets. With respect to bootstrapped p-values: *** p<0.01, ** p<0.05, * p<0.1. *Source*: Authors' calculations from the RTWF data.

Table A.13: P-value on significance in difference of point estimates for heterogeneous effects (Table 2 and Table A.12)

	Table 2			Table A.12	
	Gender	Marital status	Health insurance	Child	Marital status
	(1)	(2)	(3)	(4)	(5)
First stage					
Recipient	0.000	0.000	0.000	0.000	0.322
Subsidy	0.000	0.920	0.000	0.048	0.538
Pension income	0.000	0.920	0.000	0.956	0.000
Impact on mortality					
Age at death (censored)	0.023	0.632	0.390	0.705	0.567
Dying before 65	0.769	0.305	0.623	0.407	0.338
Dying before 70	0.019	0.377	0.446	0.037	0.350
Dying before 75	0.077	0.087	0.385	0.245	0.297
Impact on labour supply					
Age at claiming pension	0.225	0.694	0.126	0.833	0.000

Notes: This table shows the bootstrapped p-values on the significance of differences in point estimates in heterogeneous effects. The Null-Hypothesis is that the point estimates in subgroups (e.g. male vs. female) are identical. P-values higher than 0.1 indicate that we cannot reject the H0 with a probability higher than 90%. The null hypothesis (H0) is that the point estimates from the heterogeneous groups are significantly different. Columns (1) (2) and (3) report differences by gender (women - men), by marital status (married - not married) and by type of health insurance (public - private), corresponding to the estimates in Table 2. Columns (4) and (5) report the differences by having children (yes-no) and by marital status (married - not married), corresponding to the estimates in Table A.12. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.
Source: Authors' calculations from the RTWF data.

Table A.14: Summary statistics for the compliers

	Baseline		Eligible group		Compliers		Never takers		C-NT
	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.	P-value
RTWF Sample									
Pension income and subsidy related variables									
Subsidy (100€)	0.24	0.50	0.71	0.64	0.88	0.60	0.00	0.00	0.000
Subsidy recipient	0.29	0.45	0.81	0.39	1.00	0.00	0.00	0.00	-
PI w/o subsidy (100€)	7.28	2.64	6.32	1.75	6.27	1.75	6.55	1.71	0.000
Individual characteristicsinformation									
Birth year	1936.27	2.97	1936.25	2.98	1936.16	2.94	1936.62	3.14	0.000
% male	0.38	0.49	0.20	0.40	0.13	0.33	0.53	0.50	0.000
% married	0.59	0.49	0.59	0.49	0.57	0.49	0.66	0.47	0.000
Number of children	1.39	1.57	1.80	1.57	1.95	1.52	1.16	1.60	0.000
% private HI	0.08	0.27	0.07	0.26	0.04	0.20	0.21	0.41	0.000
% public HI	0.89	0.32	0.90	0.30	0.94	0.25	0.74	0.44	0.000
Obs.	401,932		130,362		105,938		24,424		
SHARE-RV Sample									
Pension income and subsidy related variables									
Subsidy (100€)	0.19	0.45	0.68	0.71	1.05	0.62	0.00	0.00	0.000
Subsidy recipient	0.21	0.41	0.65	0.48	1.00	0.00	0.00	0.00	-
PI without subsidy (100€)	9.40	4.29	7.50	1.72	7.30	1.79	7.86	1.52	0.000
Individual and household characteristics									
Birth year	1943.69	5.71	1945.87	5.15	1945.57	5.03	1946.42	5.32	0.000
% male	0.46	0.50	0.24	0.43	0.17	0.37	0.38	0.49	0.000
% married	0.78	0.41	0.81	0.40	0.76	0.43	0.89	0.32	0.585
Household size	1.96	0.67	1.98	0.63	1.97	0.69	2.01	0.52	0.782
Number of children	1.16	1.45	1.58	1.36	1.67	1.33	1.40	1.40	0.000
Age at first child	24.45	4.75	23.46	3.88	22.97	3.87	24.62	3.68	0.000
Age at last child	29.14	5.39	28.44	5.58	27.87	5.70	29.78	5.04	0.000
% all children employed	0.54	0.50	0.55	0.50	0.55	0.50	0.56	0.50	0.555
% contacts children $\geq$1/week	0.49	0.50	0.52	0.50	0.52	0.50	0.52	0.50	0.220
Months unemployed before 1992	5.36	12.45	7.89	17.21	6.80	15.82	9.92	19.43	0.004
Years of schooling	11.67	2.88	11.37	2.69	10.91	2.39	12.24	2.98	0.000
Own a house	0.44	0.50	0.39	0.49	0.33	0.47	0.50	0.50	0.000
Household income (100€)	29.60	32.95	28.47	28.18	25.52	30.18	34.01	23.08	0.037
Pension/household income	0.40	0.24	0.38	0.21	0.43	0.22	0.30	0.18	0.703
Observations	2328		493		322		171		

Notes: Table A.14 reports descriptive statistics for the compliers and never takers. Eligible group consists of individuals fullfil both eligibility conditions. Compliers are subsidy recipients in eligible group and never takers are not subsidy recipient in the eligible group. Last column reports p-values of differences in means between compliers and never takers. *Source*: Authors' calculations from the RTWF and SHARE-RV data.

Table A.15: Impact of pension income on other diseases (IV estimates)

	All		Women		Men	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: First stage						
Pension income	0.438***	0.438***	0.432***	0.432***	0.593***	0.593***
(instr.=eligible)	(0.036)	(0.036)	(0.043)	(0.043)	(0.074)	(0.074)
Panel B: IV						
Has cancer	0.029	0.038	-0.036	-0.027	0.034	0.036
	(0.064)	(0.065)	(0.077)	(0.080)	(0.111)	(0.111)
Has parkinson	0.016	0.016	0.026*	0.027*	-0.001	-0.002
	(0.010)	(0.011)	(0.015)	(0.016)	(0.002)	(0.003)
Has hip femoral fracture	-0.008	-0.008	-0.028	-0.030	-0.141	-0.140
	(0.034)	(0.035)	(0.035)	(0.036)	(0.100)	(0.100)
Has diabetes	0.044	0.047	0.152	0.144	-0.196	-0.193
	(0.087)	(0.088)	(0.098)	(0.101)	(0.172)	(0.172)
First stage F-stat	145.6	142.7	102.1	97.5	62.1	62.0
Obs	2,328	2,328	1,365	1,365	963	963
Contribution year FE	✓	✓	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Retirement age		✓		✓		✓

Notes: This table shows the effect on probability of having a list diseases of an increase in pension income of 100 euro per month. Panel A reports first-stage estimates and panel B reports the IV estimates. The instrument for pension income is an indicator for eligibility for pension subsidy. In addition to a list of controls, pension income without subsidy, birth cohort fixed effects and contribution year fixed effects in the odd columns, the even columns control for age at claiming pensions. Columns 1 and 2 show the results for the baseline sample. Columns 3 to 6 show the results for women and men respectively. Monetary values are expressed in hundred 2015 euro. Standard errors clustered by birth cohort are in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
† Smaller estimation sample of 1,753 observations (1,018 women and 735 men). First-stage F between 40 and 115 for all specifications. First stage estimated coefficients remain similar.
Source: Authors' calculations from the SHARE-RV data.

Table A.16: Heterogeneity by share of pension income over total household income (IV estimates)

	Share of pension income over total household income					
	Above 50%, "Poor"			**Below 50% "Well-off"**		
	All	Women	Men	All	Women	Men
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: First stage						
Pension income (100€)	0.736***	0.854***	0.493***	0.243***	0.173**	0.469***
	(0.108)	(0.119)	(0.170)	(0.059)	(0.074)	(0.106)
Panel B: IV						
CASP	0.729*	0.024	3.808**	0.858	-0.319	2.289***
	(0.372)	(0.374)	(1.744)	(0.701)	(1.131)	(0.855)
Self-reported heatlh	0.056	-1.064***	1.735	0.980	-0.289	2.715***
	(0.334)	(0.382)	(1.125)	(0.757)	(1.241)	(1.029)
Depression index	-0.813**	0.128	-2.048*	-1.125	0.842	-2.228***
	(0.349)	(0.392)	(1.165)	(0.774)	(1.368)	(0.848)
Number of chronic diseases	-0.211	0.360	-1.073	-2.661***	-2.492	-2.478***
	(0.376)	(0.414)	(1.105)	(0.938)	(1.596)	(0.901)
ADLA	-0.058	0.700	0.980	-0.248	0.081	-0.859
	(0.520)	(0.618)	(0.711)	(0.534)	(0.947)	(0.615)
Stroke	-0.055	-0.021	-0.021	-0.004	-0.024	0.122
	(0.070)	(0.081)	(0.103)	(0.103)	(0.201)	(0.085)
Chronical lung disease	-0.098	0.004	-0.145	-0.002	0.076	-0.315*
	(0.110)	(0.119)	(0.239)	(0.149)	(0.270)	(0.188)
Cataracts	-0.053	0.085	-0.423	-0.496*	-0.882	-0.065
	(0.112)	(0.126)	(0.259)	(0.256)	(0.548)	(0.189)
High blood pressure	-0.034	-0.015	0.986	-0.102	0.774	-1.150***
	(0.169)	(0.189)	(0.694)	(0.349)	(0.690)	(0.418)
Low money stops	-0.408	-0.378	-0.022	-1.283*	-1.765	-2.263**
	(0.334)	(0.380)	(0.976)	(0.732)	(1.332)	(0.885)
Life full of opportunities	1.144**	0.721*	2.062	0.635	-0.938	2.202**
	(0.445)	(0.436)	(1.814)	(0.699)	(1.156)	(0.899)
Future looks good	1.031***	0.475	3.656**	0.506	-0.477	1.811**
	(0.388)	(0.415)	(1.709)	(0.699)	(1.224)	(0.868)
Observations	487	199	288	676	470	206
First stage F-stat	42.2	41.4	7.4	15.7	5.0	15.9
Contribution year FE	✓	✓	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Retirement age	✓	✓	✓	✓	✓	✓

Notes: This table shows the heterogeneous effect on mortality of an increase in pension income of 100 euro per month by share of pension income (without subsidy) over total household income (without subsidy). Panel A reports first-stage estimates and panel B reports the IV estimates. The instrument for pension income is an indicator for eligibility for pension subsidy. Columns 1, 2 and 3 show the results for the subgroup with pension income share above 50% for all, women and men. Columns 4, 5 and 6 to 6 show the results for the subgroup with pension income share below 50% for all, women and men. Standard errors clustered by birth cohort are in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' calculations from the SHARE-RV data.

Table A.17: Heterogeneity by any household member owning a house (IV estimates)

	Home ownership			Without home ownership		
	All (1)	Women (2)	Men (3)	All (4)	Women (5)	Men (6)
Panel A: First stage						
Pension income (100€)	0.361***	0.351***	0.351***	0.512***	0.585***	0.584***
	(0.043)	(0.049)	(0.049)	(0.068)	(0.078)	(0.141)
Panel B: IV						
CASP	0.517*	-0.233	0.961	0.610*	-0.262	2.731***
	(0.311)	(0.388)	(0.676)	(0.370)	(0.335)	(0.934)
Self-reported heatlh	0.230	-0.848**	1.966**	0.764**	0.035	2.285**
	(0.333)	(0.430)	(0.836)	(0.367)	(0.322)	(0.953)
Depression index	-0.311	0.572	-0.353	-0.554	0.296	-2.566***
	(0.316)	(0.431)	(0.573)	(0.377)	(0.359)	(0.871)
Number of chronic diseases	-0.698**	0.005	-3.332***	-0.194	0.242	-2.069**
	(0.315)	(0.350)	(1.093)	(0.350)	(0.356)	(0.811)
Difficulties with ADLAs	-0.483	0.285	-2.005***	-0.004	0.355	-0.742
	(0.328)	(0.454)	(0.766)	(0.418)	(0.396)	(0.841)
Had a stroke	-0.028	0.005	0.098	-0.026	-0.008	0.168
	(0.050)	(0.062)	(0.096)	(0.077)	(0.070)	(0.182)
Has chronical lung disease	-0.092	0.012	-0.472**	-0.106	0.092	-0.551**
	(0.079)	(0.092)	(0.238)	(0.095)	(0.094)	(0.280)
Has cataracts	-0.177*	-0.080	-0.466*	-0.226*	-0.179	-0.205
	(0.106)	(0.134)	(0.240)	(0.117)	(0.118)	(0.191)
Has high blood pressure	0.255	0.584***	-1.194***	-0.026	0.073	-0.570
	(0.166)	(0.218)	(0.406)	(0.163)	(0.170)	(0.374)
Lack of money stops	-0.307	-0.238	-0.364	-0.437	-0.007	-1.021
	(0.324)	(0.404)	(0.731)	(0.358)	(0.333)	(0.910)
Feel full of opportunities	0.923***	0.050	2.030**	0.375	0.017	2.063**
	(0.327)	(0.400)	(0.815)	(0.373)	(0.352)	(0.879)
Future looks good	0.030	-0.430	0.654	1.316***	0.596*	3.325***
	(0.323)	(0.412)	(0.645)	(0.383)	(0.339)	(1.032)
Observations	1,468	852	616	860	513	347
First stage F-stat	69.959	51.460	17.766	56.709	55.903	17.096
Contribution year FE	✓	✓	✓	✓	✓	✓
Cohort FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
Retirement age	✓	✓	✓	✓	✓	✓

Notes: This table shows the heterogeneous effect on mortality of an increase in pension income of 100 euro per month by whether any household member of the individual owns a house. Panel A reports first-stage estimates and panel B reports the IV estimates. The instrument for pension income is an indicator for eligibility for pension subsidy. Columns 1, 2 and 3 show the results for the subgroup having assets for all, women and men. Columns 4, 5 and 6 to 6 show the results for the subgroup doesn't have any assets for all, women and men. Standard errors clustered by birth cohort are in parentheses, *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' calculations from the SHARE-RV data.

Table A.18: Summary statistics for people with $aep > 0.75$ and more than 35 years of contribution by gender

	Women (1)	**Men** (2)	**P-value diff.** (3)	**Source** (4)
Mortality measures				
Age at death (censored)	72.49	72.31	0.000	RTWF
Dying before 65	0.06	0.06	0.000	RTWF
Dying before 70	0.22	0.24	0.000	RTWF
Dying before 75	0.47	0.50	0.000	RTWF
Health measures				
CASP	39.62	38.58	0.007	SHARE-RV
Self-reported heatlh	1.88	1.53	0.000	SHARE-RV
Depression index	2.30	2.14	0.266	SHARE-RV
Number of chronic diseases	1.24	1.62	0.000	SHARE-RV
ADLA	0.12	0.22	0.034	SHARE-RV
Feelings measures				
Low money stops	1.09	1.14	0.541	SHARE-RV
Life full of opportunities	2.32	2.11	0.001	SHARE-RV
Future looks good	2.25	2.14	0.059	SHARE-RV
Risky behaviours				
Consumed alcohol (days/week)	3.41	4.12	0.000	SHARE-RV
Smoke currently	0.25	0.22	0.480	SHARE-RV
Ever smoked daily	0.45	0.65	0.000	SHARE-RV

Notes: Table A.18 reports descriptive statistics for people with $aep > 0.75$ and contribution years above 35 by gender. Those individuals are not eligible for subsidy only because of having higher aep. Columns 1 and 2 shows the average values for women and men, column 3 the pvalue of the difference in means between the two groups, column 4 indicate the data source.
Source: Authors' calculations from the RTWF and SHARE-RV data.

Table A.19: Impacts of Eligibility on sickness leaves before age 50 (VSKT data)

	Full sample (1)	Women (2)	Men (3)
Duration of sickness before age 50	1.110***	0.681*	5.606***
	(0.401)	(0.365)	(1.823)
	[0.002]	[0.054]	[0.009]
Mean Dep. Variable	1.296	1.169	1.865
Prob (having sick leave before age 50)	0.074*	0.069	0.157
	(0.044)	(0.046)	(0.132)
	[0.074]	[0.143]	[0.241]
Mean Dep. Variable	0.218	0.207	0.271
Duration of sickness before age 55	1.907***	1.617***	6.005***
	(0.511)	(0.485)	(2.236)
	[0.000]	[0.000]	[0.009]
Mean Dep. Variable	1.798	1.635	2.530
Prob (having sick leave before age 55)	0.122***	0.114**	0.195
	(0.046)	(0.050)	(0.131)
	[0.012]	[0.028]	[0.130]
Mean Dep. Variable	0.256	0.245	0.308
Contribution year FE	✓	✓	✓
Birth Cohort FE	✓	✓	✓
Controls	✓	✓	✓
PI without subsidy	✓	✓	✓
Observations	2924	2517	407

Notes: Table A.19 reports the impact of eligibility for the subsidy on health status before retirement proxies by duration of sickness before age 50 and probablity of taking up any sick leave before age 50. We show the impacts for the full sample, women and men, respectively. Sample restriction: West German pensioners born between 1932 and 1942 with 30 to 40 contribution years and average earning points at retirement between 0.45 and 1.05. Duration of sickness before age 50 is measures in months. The dummy of being sick before 50 takes value 1 if duration of sickness before age 50 is above zero.

Source: Authors' calculations from the SUFVSKT 2002, 2004-2006.

B Additional Details on Institution

B.1 Details on pension benefit formula

The main determinant of pension benefits is the sum of the individually accumulated earnings points (Entgeltpunkte, (EP)). Essentially, for each year τ of contributions, a worker i accumulates some earnings points $EP_{i\tau}$, which are determined by the individual wage $w_{i\tau}$ relative to the average wage of all the insured $\bar{w_\tau}$. For example, a worker whose wage is half of the average wage in the contribution year τ will accumulate 0.5 points in that year. Equation 1 shows the monthly pension benefits for individual i who retires in year t.

$$PB_{it} = \underbrace{(\sum_{\tau} EP_{i\tau} + \text{ Subsidy}_i)}_{\text{Personal Pension Base}} \times PV_t \text{ , where } EP_{i\tau} = \frac{w_{i\tau}}{\bar{w_\tau}} \tag{A.1}$$

The amount of pension benefit PB_{it} is the personal pension base multiplied by the pension value.

This benefit level will also be adjusted by an adjustment factor AF_{it}. The adjustment factor penalizes early claims. Benefit levels decrease by 0.3% for each month before the full retirement age is reached. However, the deductions of 3.6% per year of delayed claiming are low by international standards and not actuarially fair. As a consequence, there still exists a positive implicit tax on working, even after accounting for the financial penalty. The pension benefit also depends on the type of pension. This factor is equal to one for the old-age pension, and is less than one for disability pensions. Almost all subsidy recipients claim an old-age pension.

The worker's personal pension base is the sum of the EPs accumulated over time, plus additional EPs credited by the subsidy program. For example, an average wage earner with 15 contribution years accumulates 15 EPs. At the time of the claim t, this personal pension base is scaled up by the pension value PV_t, which is determined aggregately by factors such as the average wage of all insured, the contribution rate and demographic changes. This pension value PV_t is adjusted on July 1 of each year. For example, one EP was equivalent to 31.03 euros per month in 2018. Overall, workers with short contribution years or low relative wage incomes are more likely to face old-age poverty. On average, one less year of full value contribution decreases the gross replacement rate by around 1.17%. This is one of the reasons that women are the majority of the subsidy recipients as they have short employment periods and a lower wage over their life cycle.

Pensioners can work while claiming their pensions, however, they face a stringent earnings test between the early retirement age (ERA) and the normal retirement age (NRA). If pensioners work at jobs paid more than 450 euros per month, they need to file for partial retirement. This makes working at a regular job while claiming a full pension impossible. After the NRA, pension recipients no longer face earnings tests.[1]

B.2 Pension reforms and pension pathways

Since the 1990s, there has been a number of pension reforms, which introduced the early retirement actuarial adjustment (Berkel and Börsch-Supan, 2004), increased the statutory retirement ages (Engels et al., 2017), encouraged a tax-advantaged private savings plan (Börsch-Supan et al., 2015) and included a sustainability factor in the pension benefits formula (Börsch-Supan et al., 2004).

Several alternate pathways make retiring before the regular retirement age 65 possible in Germany. There are four main early retirement pathways: old-age pensions for women, old-age pensions due to unemployment (and part-time work), old-age pensions for the long-term insured and old-age pensions for severely disabled persons. Each pathway has its own eligibility conditions. Each pathway has also its own full retirement age (FRA) and early retirement age (ERA). For example, age 60 is the early retirement age for the women's pension pathway. Age 63 is the early retirement age for the long-term insured pathway.

The pension reforms in the past few decades typically reduce public pension generosity by raising the retirement age and penalise early claimants. The increase in statutory retirement age and the financial penalty for early claimants were phased in gradually in monthly increments. An individual can claim, at the earliest, at the ERA, however each year before FRA renders a 3.6% benefit deduction. (See Engels et al. (2017) for more details). For cohorts 1932 to 1942 in our baseline sample, women can claim pension the earliest at age 60, either via the pension for women or via pension for severely disabled. The changes in ERA, FRA and the corresponding deductions when claim at the ERA for the cohort born 1932 to 1942 remain rather stable. Only cohorts born in 1941 and 1942 are affected by the pension reforms. Namely, the financial incentives to claim a pension at age 60 have also changed for women. The 1992 pension reform has increased the FRA from 60 to 65 by monthly steps since the cohort of 1941. This entails a 3.6% benefit deduction for each year claimed before FRA. The penalty for retiring at 60 was phased in gradually in monthly increments. For the cohort born in 1941, the penalty is 7.2%. For the cohort born in 1942, the penalty is 10.8%. It stabilised at 18% for cohorts born after 1945.

[1] The benefits that are "taxed" away due to the earnings test are not lost but postponed at an actuarially fair rate.

B.3 An example of pension subsidy calculation

The *de jure* eligibility condition of the subsidy program requires only the average monthly EP of full-value contribution years at retirement (aep^t) to be less than 0.0625 (t is the year of retirement). Yet, because the average monthly EP of full-value contribution periods before 1992 (aep_i^{92}) cannot exceed 0.0625 after the subsidy, this implies that the *de facto* eligibility condition requires both aep^t and aep_i^{92} to be less than 0.0625. Following is one example showing how pension benefits and subsidy are calculated, provided the German Pension Office website:

Example: Calculation of the monthly average The total EPs for the contribution periods are 46.6909. Of this total amount, 31.6900 earning points are attributed to the 517 months of full-value contribution period. Of the 31.6900 earning points, 26.5000 earning points are attributed to 400 months of full-value contribution before 31.12.1991.

Solution

- Dividing 31.6909 earning points by 517 months gives us 0.0613 earning points. The monthly average of all full-value contribution periods does not reach (is below) the value of 0.0625.
- Dividing 26.5000 earning points by 400 months gives us 0.0663 earning points. The monthly average of all full-value contribution periods until 31.12.1991 reaches/is above the value of 0.0625.
- Therefore, additional (extra/add-on) earning points do not have to be calculated.

B.4 Details on pension-related periods

The total creditable/pension period (Wartezeit/Anrechenbare Zeiten) is approximately composed of the contribution period ((SGB VI § 55 Beitragszeiten) and the consideration period (SGB VI § 57 Berücksichtigungszeiten). The contribution periods consist of full value contribution periods (Vollwertigen Beiträgen) and reduced contribution periods (Beitragsgeminderte). Full value contribution periods are periods when compulsory contributions are paid according to the social security regulation. Reduced contribution periods include periods of unemployment, sickness and vocational training. During those periods, EPs are accumulated even though the worker has made no contributions. The consideration periods include child-raising periods. The time of raising a child to age 10 counts in the consideration period. The package is 10 years for one child, 15 years for two children and 20 years for more than two children.

C Data Appendix

Our main dataset covers the universe of pensioners who left the the German public pension system between 1994 and 2018, provided by the German State Pension Fund (FDZ-RV). For the main analysis, we further restrict our sample to individuals born between 1932 and 1942 and who left the pension system due to death. For these cohorts, we observe all deaths that occurred between the ages of 62 and 76, as we only observe deaths that occurred between 1994 and 2018. For some of the older cohorts, we can observe deaths between 76 and 86; for some of the younger cohorts, we can observe deaths between 52 and 62. One potential concern for identification is that deaths before age 62 and deaths after age 76 can be affected by the eligibility conditions of the pension subsidy. In other words, we might have an eligible population who are healthier or less healthier to start with if that is the case.

To rule out this concern, we perform the following analysis. First, we check the impact of eligibility for the pension subsidy on probability dying between age 50 and 60 by using cohorts born between 1945 and 1955. For these cohorts, we observe all counts of death between 50 and 60. Note that because the subsidy is only available after claiming a pension, it is unlikely that subsidy eligibility affects death before claiming a pension. The only possibilities for selection are 1) anticipation effect, and 2) that the mortality trend between these ages changes by years of contributions and earnings levels exactly at the two cutoffs for pension subsidy. For people who died before claiming a pension, we impute contribution years at retirement by assuming a retirement age of 63. Therefore are only around 2% of the sample for whom we have made this correction. Column 1 of Table A.7 shows that eligibility has no significant impact on probability dying between ages of 50 and 60 and the coefficient is close to zero and insignificant for the full sample and for men and women.

Second, we check the impact of eligibility for the pension subsidy on death before age 76 by using older cohorts. Specifically, we examine the impact on the probability of dying between the ages of 75 and 80 by using cohorts born between 1932 and 1937 and the probability of dying between 80 and 85 by using cohorts born between 1922 and 1931. Columns 2 and 3 of Table A.7 show that eligibility has no significant impact on probability of dying between these older ages.

D Details on Robustness and Placebo Tests

Robustness Tests Several exercises further establish the robustness of the estimates. Table A.10 shows the DID estimates by varying sample selection. First, column (2) shows that the estimates are robust to the exclusion of individuals who retired after exactly 420 months (35 years). Second, we narrow the bandwidth of aep to 0.6-0.9 in column (3). While the first stage effects on subsidy size and pension income are smaller,[2] the estimated changes in the probability of being a recipient and in mortality outcomes are similar to the baseline estimates. Third, our estimates are also robust to the inclusion of individuals born 1943 to 1948 and when restricting the analysis to cohorts born between 1932 and 1937, i.e. the cohorts born before the Second World War. Columns (4)-(6) show the estimates with the additional cohorts, with the additional cohorts while excluding individuals who retire with 420 months worth of contribution periods, with the additional cohorts and narrower aep restriction, respectively. Columns (7)-(9) show the estimates with cohorts 1932 to 1937. The estimated impacts are similar to the baseline results. For each specification, we also estimate the impact on the age at which individuals begin to claim pension benefits (panel (c)), and the point estimates are always close to zero.

Placebo Tests First, we use a placebo sample of individuals born between 1922 and 1931 with the same aep and contribution year restriction as the baseline sample (column (2) of Table A.11). Because these individuals were over 60 in 1992, it is possible that they had already retired. In such cases, even if they fulfill the eligibility conditions, they will not receive the subsidy. However, these older cohorts could receive pension income support according to a scheme introduced in 1973, which had different eligibility conditions than the 1992 scheme.[3]. Hence, the 1922-1931 cohort sample serves as an ideal placebo sample to test the causality of our estimates. Unfortunately, we cannot estimate a first stage for this sample due to data limitations. We only observe the subsidy amount in the 1992 scheme. Nonetheless, we can estimate the mortality responses using this sample. Indeed, we find no significant effect of the 1992 subsidy eligibility conditions on mortality (column (2) of Table A.11). Estimated event study coefficients are depicted in Figure A.10. Note that because we only observe deaths which occurred between 1994 and 2018, we can only credibly measure probability of dying before 70 and 75 for these cohorts. In Table A.7, we further look at the probability of dying between 75 and 85 for these cohorts, and we also do not

[2]This is a consequence of the subsidy schedule, which decreases with aep^{92} after the 0.5 cutoff (see Figure A.1). Because aep^{92} and aep are highly correlated, individuals with $aep \in [0.6, 0.75]$ are more likely to have $aep^{92} > 0.5$, on average, than individuals with $aep \in [0.45, 1.05]$.

[3]The pension subsidy scheme (*Rente nach Mindesteinkommen*) was in place since 1973. This was ruled by §55a of the *Arbeiterrentenversicherungs-Neuregelungsgesetzes*, §54b of the *Angestelltenversicherungs-Neuregelungsgesetzes* and §10a of the *Knappschaftsrentenversicherungs-Neuregelungsgesetzes*. The eligibility conditions for this subsidy scheme relied on the number of mandatory contribution periods (*Pflichtbeitragszeit*) and not on the overall number of contribution years, as in the 1992 scheme. Specifically, one need to have a minimum of 25 mandatory contribution periods to be eligible for the 1973 pension subsidy. Then, in the same spirit as the 1992 pension subsidy scheme, the subsidy size was linked to contributions made before 1973.

find any significant responses.

Second, we take the following three placebo samples: people with $aep_i \in [0.8, 1.25]$, people with $aep_i \in [1, 1.4]$ and people with $aep_i \in [0.8, 1.7]$ (column (3) to (5) of Table A.11). These individuals do not fulfill the aep eligibility conditions. We take a hypothetical cutoff in aep in these placebo checks. We still find some positive effect on subsidy size and pension income, even though the size is an order of magnitude smaller (around 2 euro more per month). We do not find any significant impact on mortality. Estimated event study coefficients for the $aep_i \in [0.8, 1.25]$ sample are depicted in Figure A.11.

E Calculation of the Monetary Gain in Life Expectancy

We perform a simple cost-benefit analysis by computing the associated increase in the value of a statistical life when receiving an additional 100€ pension benefits per month. Following are the steps of this calculation.

First, by combining our estimated improvements in the probability of dying before 70 and the life tables for the average German (Destatis, 2023), we calculate an implied average improvement of life expectancy at 60 of about 4.7 months for men.

Our IV estimates for men imply a 6 percentage point increase in the probability of surviving to age 70, conditional on living past age 60. Thus, the cumulative product of survival probabilities between ages 60 and 70 increases by 6 percentage points. We then calculate life expectancy at age 60 using this formula: life expectancy at age τ is calculated as $\sum_{j=\tau}^{\tau^m} \prod_{q=1}^{\tau^m-\tau} s(q)$, where τ_m is the maximum attainable age (Collett, 2015). We assume $\tau_m = 100$. In the last step, we compute the gain in life expectancy as the difference between our estimated life expectancy at age 60 and the life expectancy implied by the life tables for the average German in 2000 (Destatis, 2023), which is considered as the life expectancy without the subsidy-induced increase in survival probability.

Second, we calculate the gain in the value of a statistical life. We use the value of a statistical life year at age 60 implied by Aldy and Viscusi (2007), which is 262,910€ . Thus, for each 100€ subsidy, the mortality improvements for men are worth 102,395€.

Lastly, we calculate the fiscal cost of providing the subsidy. Given an average pre-subsidy pension income of 704€/month for men in our treatment group, a 100€ increase in monthly pension benefits will cost about 26,751.6€ per male subsidy recipient. According to the life table for Germany in 2000 (Destatis, 2023), the life expectancy of men at the age of 60 is 19.68 years or 236.16 months. Thus, the net cost of the additional life expectancy due to a subsidy of 100€/month for the average male recipient is 100€*(236.16+3.9)+704€*3.9, which is 26,751.6€. As we do not find any significant changes in the age when the pension is claimed, we do not take into account the loss of tax revenue due to early retirement.

Therefore, the net monetary benefit of the life expectancy gains in our sample is about 75,643€ on average per male subsidy recipient. pension subsidy program was cost-effective in increasing the life expectancy of male recipients.