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

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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 1.6-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 mortality results are mainly driven by men. Women, instead, anticipate the start of pension claim, possibly adjusting their labor supply.

JEL Codes: I10, I12, J14, J26

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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). 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). In an effort to support pensioners with lower benefits, many governments have introduced various forms of safety nets. However, little is known on 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 additional pension income can increase longevity and improve people's quality of life can 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). 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 pension benefits or pension eligibility age. Existing papers on the mortality response to changes in pension systems mostly focus on reforms adjusting the pension eligibility age (see, e.g., Hernaes et al. (2013); Shai (2018); Belles et al. (2022)) or bundling 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 mortality and health of low-income pensioners in the context of a German pension subsidy program. Several features of the program make it an ideal natural experiment. First, the subsidy amount is determined from contributions made before the program's announcement in 1992. Second, individuals are eligible for the subsidy only if they fulfill two conditions at retirement: at least 35 of contribution to the pension system and average earnings points accrued during working periods below a certain threshold. As pension income is a function of average earning points at retirement, the second condition identifies retirees with lower benefits, facing a higher risk of old-age poverty. These two eligibility criteria allow us to estimate the causal impact of additional pension income. Third, the the reform introducing this subsidy does not affect other pension system parameters, such as the statutory retirement age. This enables us to isolate the causal effect of additional pension income from that of other characteristics of pension systems. Fourth, as Germany has universal health care, the implications of a change in pension income are not tied to access to (subsidized) health

[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)).

care, as, for instance, in the U.S. (Ayyagari, 2019). This feature allows us to decouple the effect of additional income on mortality from the effect of losing access to health care. Fifth, enrollment in the program, as the subsidy is added directly to pension benefits without any application process. This ensures that the subsidy reaches all eligible retirees, including those who might not have enrolled due to incomplete information or transaction costs (Bertrand et al., 2004; Finkelstein and Notowidigdo, 2019).

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 58€/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 1.6 months (around a 0.2% increase). Specifically, eligibility reduces the probability of dying before age 65, and 70 by 0.8 percentage points (14.5%), 1.5 percentage points (5.9%), respectively. These estimates imply intent-to-treat pension income - mortality elasticities of -1.8 and -0.72, respectively. On average, we find no significant effects on the age at claiming pension. Heterogeneity analysis indicates that mortality responses are driven by men, despite the fact that they receive a smaller subsidy on average. Instead, eligible women claim their pension about 2 months earlier. We gather a few empirical findings that help explain gender differences: 1) differences in retirement age effects; 2) eligibility conditions might not identify actually poor women, thus the subsidy has a lower relative impact on their living standards; 3) eligible men are in worse health prior to claiming pension, thus additional income has a more money-for-buck for men.

The estimates are robust to several 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 estimate that a permanent increase in monthly pension income of 100€ (about a 14% increase) increases the age at death (censored at age 75) by around 2.8 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

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

when they were alive. We find that increases in pension income improve both mental and physical health. For example, 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. Furthermore, optimism and perceived financial constraints appear to be relevant drivers of improved health. We also 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. We show that poorer men (proxied by lack of home ownership) are more affected by the additional pension income.

Overall, our findings suggest that the pension subsidy for low-income workers in Germany had beneficial effects on both 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, even 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. Furthermore, the cost-benefit analysis suggests this policy is cost-effective. The net monetary benefits of the program are 183,785€per male recipient. A simple back-of-the-envelope calculation suggests that implementing a similar subsidy long-term, 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 but growing 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 (Sny-

der and Evans, 2006; Johnsen and Willén, 2022). Johnsen and Willén (2022) show that negative shocks to pension income had no impact on both employment and health care use of pensioners in Sweden. Snyder and Evans (2006) examine a cut in social security wealth for the "notch" cohort in the U.S. and find that a reduction in pension income reduces mortality in the U.S. The effects of changes in pension income on mortality are not necessarily symmetric. Johnsen and Willén (2022) and Snyder and Evans (2006) 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 could affect 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. On the one hand, this paper aligns with Ye (2022) and shows that eligible women anticipate retirement. Our results suggest this has a negative effect on women longevity and offsets the positive effect of the income increase, similarly to Snyder and Evans (2006). On the other hand, in the case of men, this paper studies a pension subsidy program with no effect on retirement age, 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 of older people by examining other social insurance programs (e.g., Eli, 2015; Bailey and Goodman-Bacon, 2015; Black et al., 2024; Gelber et al., 2023; Becker et al., 2024).[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. Their estimates imply an elasticity of mortality with respect to disability insurance income of around -0.6 to -1.0.

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

[3] A large literature examine the health and mortality effects of income by looking at transfer programs 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).

differs from these studies in two important aspects: 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.

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 an additional early retirement pathway from age 60 via the so-called women old-age pension. Almost all female recipients of the subsidy program born before 1952 are eligible for this pathway.[6]

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,

[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 women's pension pathway were: 1) at least 15-years of pension insurance contributions; and 2) at least 10 of the 15 years of pension insurance contributions need to have been acquired after age 40.

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 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 low wages. Specifically, individuals need to fulfill two criteria to become eligible for the subsidy. First, a worker should have at least 35 contribution years. Contribution years are a combination of full-value and reduced contribution periods. Full-value contribution periods are months during which compulsory contributions are paid according to the social security regulation, typically periods of gainful employment. Reduced contribution periods are months during which contributions are not or only partially paid. This could be, for instance, child-raising, education, unemployment, or long-term sick leave periods. This periods count towards retirement and subsidy eligibility but have a limited or no impact in the determination of pension benefits and amount of subsidy received.[10] Second, the average EPs from full-value contribution years (aep) 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 identifies workers with lowest pension benefits and more at risk for old-age poverty. 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. In 2015, the total payments for this subsidy program were approximately 3 billion euros.

The amount of subsidy eligible individuals receive is a function of contribution years and earning points accumulated before 1992. In particular, subsidy size is determined as:

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

[7] See Appendix B.1 for more details on the pension benefit calculation.
[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] See Online Appendix B.4 for more details of the composition of contribution periods.

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 (aep^{92}), and Figure A.1 depicts this relationship in the case of an individual who contributed 19 years to the pension system prior to 1992. Monthly subsidy is linearly increasing with aep^{92} for positive values until $aep^{92} = 0.5$, and decreases linearly afterwards, until reaching 0 for $aep^{92} = 0.75$. Furthermore, given aep^{92}, subsidy size is linearly increasing in T^92. See Ye (2022) for more details and Appendix B.3 for examples illustrating the calculation of the subsidy amounts.

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. The process is automatic for eligible pensioners, who do not need to apply to receive the subsidy. Pension income inclusive of the subsidy amount is directly credited into recipients' account.

The subsidy size formula implies that only individuals with full-value contributions before 1992 and $aep^{92} < 0.75$ receive a positive amount of subsidy. Hence, the program has a pre-determined expiration date, in that only individuals who started contributing before 1992 and were relatively poor in 1992 can receive a positive amount of subsidy. Furthermore, it prevents workers from manipulating the amount of subsidy they receive, and reduces incentives to manipulate aep at retirement. We discuss extensively potential margins of manipulation through labor supply choices in Section 4.1.

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). It includes time-invariant information (such as accumulative pension points, gender, birth month, number of children, and age at claiming pension), at the time when individuals 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 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.[11] In addition, we do not have information on occupation or education level of retirees.

Our baseline sample includes individuals who left the pension system due to death. We focus on German nationals residing in West Germany at time of death, in order to abstract from migration patterns and German reunification effects. Moreover, East Germans face different pension rules, which make comparison with West Germans harder. Then, we consider retirees who claimed old-age pension, as the subsidy is an old-age pension benefit. Furthermore, we restrict the sample to cohorts born between 1932 and 1942. The lower bound (1932) is chosen to include individuals who were at most 60 in 1992, and hence could not have retired before the introduction of the reform. The upper bound (1942) is chosen to include people who are at least 75 years old in 2018. This ensures uncensored estimates of the probability of dying before ages up to 75, as all cohorts in the sample could have at least reached that cut-off.[12] Finally, we restrict symmetrically around the eligibility conditions. We keep individuals within a 24-months bandwidth around the 35-contribution years cut-off, and within a 0.30 points bandwidth around the aep cut-off. That is, individuals in the baseline sample contributed more than 33 and strictly less than 37 years to the pension system, and whose aep at retirement is between 0.45 and 1.05 (approx. between 1200 and 3000 euro of gross monthly wage). In the robustness analysis, we vary the choice of sample selection around the birth cohorts, aep, and the contribution year eligibility conditions, both restricting and widening

[11] Because we do not observe the pension points accumulated before 1992, we cannot perform a regression kink design using aep^{92} as running variable, and exploiting the kink at 0.5 or 0.75 (see Figure A.1 for an illustration). Instead, Ye (2022) uses aep^{92} as running variable and the kink at $aep^{92} = 0.5$. It relies on a different dataset, including employment histories, from which aep^{92} can be computed, but with no information on death dates.

[12] Because of data limitations, we have limited information on mortality before age 60. Furthermore, including cohorts up to 1942 implies we observed a censored sample for deaths after age 76. Table A.4 shows 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.

each bandwidth. Our results are robust to each of these changes. Additionally, we verify that being eligible for the subsidy is not correlated with fulfilling the baseline sample restrictions. Table A.3 shows that the impact of eligibility conditions on being included in the baseline sample (column 1) and by gender (columns 2 and 3). We find no significant effect on being selected into our sample.

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 those fulfilling the 33-36 contribution years and 0.45-1.05 aep at retirement restrictions, the *baseline sample*.

The baseline sample contains 149,053 individuals, of whom 35% satisfy both conditions with aep below 0.75 and more than 35 contribution years. Age at death (censored at age 75) is on average around 72.2. 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 construct a measure of age at death that considers everyone who died after age 75 as if they had died at 75. Using this variable would at most lead to an under-estimation of the real effects of the subsidy on longevity and offers easy-to-interpret results. Throughout the paper, we estimate results both in terms of censored age at death and probability of dying before certain ages cutoffs. We show in Section 6 that these outcomes imply similar longevity gains. Individuals in the baseline sample have an average probability of dying before age 65, 70, and 75 of 5%, 25%, and 51% , respectively. They have a pension income of 706€/month, and have a 30% probability of being subsidy recipients. Conditional on being a recipient, they receive a subsidy of about 88€/month. They are on average age 56 in 1992, 65% female, and 60% married. Female pensioners have on average 2.2 children. Furthermore, they started to claim their current pension type at age 63, on average.

Overall, the baseline sample is comparable to the West German Pensioners and 1932-1942 samples, except for the share of women. The baseline sample is 65% female, while the *West German Pensioners* and *1932-1942* samples have 42% and 39% females, respectively. 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 have lower wages, thus lower aep and higher chances of $aep < 1$. On the other hand, women are granted a generous number of contribution years through child-raising periods, which makes them more likely to reach a higher number of contribution years.[13]

Table A.2 shows the characteristics of pensioners in our sample by gender. The majority of the subsidy recipients are female workers. Out of all treated individuals in our baseline sample, 79.5% are women. The reasoning is similar to before. First, women are more likely to be eligible for the

[13] In particular, the time of raising a child up to age 10 counts in the number of contribution years. The package is 10 years for one child, 15 years for two children and 20 years for more than two children. See Online Appendix **??** for more details.

subsidy program because their wages are, on average, lower than those of men. On average, aep at retirement is 0.68 in the women baseline sample and 0.81 in the men baseline sample. Second, child-raising periods make it relatively easier for women to reach the 35 years of contribution cut-off. This can be easily deduced from the number of children variable, which is estimated from child-subsidy or child-raising periods claims. Women are typically primary responsible for childcare and more likely to claim child-raising periods than their male partners. Thus, on average, women claimed contribution periods for 2.2 children, while men only for 0.11.

Overall, men are more likely to die before the age of 70, with a probability of 31 % compared to 22% for women. Age at death (censored at age 75) is around 72.5 for women, and 71.7 for men. Men receive about 829€/month of pension income, while women receive 640€/month. Women are also less likely 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.[14] 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).[15]

Our SHARE-RV sample contains West German old-age pensioners who were born after 1931.[16] 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.

[14] 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.

[15] 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.

[16] 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.

The SHARE-RV sample allows us to gain insights into how health conditions, financial constraints, and psychological feelings are affected by additional pension income. We consider the following 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 answers to the question "how often did you feel like money stopped you from participating in generally defined activities" as an indicator for perceived financial constraints. We also exploit self-reported measures of optimism, particularly the answer to the questions "how often do you feel like your life is full of opportunities" and "how often do you feel like the future looks good".[17]

Table A.6 shows that the baseline SHARE-RV sample is generally comparable to the West German Pensioners sample. The baseline sample perceive 104€/month less in pension income, and is in slightly worse health.[18] Table A.7 further shows the characteristics of 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, but their pension income is on average a smaller share of the total household income.

4 Empirical Strategy

Estimating the causal effects of income on mortality is challenging for various reasons. First, unobserved factors affecting both income and mortality might lead to spurious correlation between the two. Second, while income might affect health status, the reverse could also be true. For instance, pre-retirement health status might have affected earnings, leading to lower pension income in retirement and eventually affecting mortality. Third, changes in pension income might ultimately affect mortality directly, by affecting consumption, or indirectly, through labor supply choices. This paper exploits the eligibility conditions for an exogenous pension subsidy program to estimate the causal effect of pension income on mortality. First, we estimate 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.

[17] See Table A.5 gives an overview of how these variables are constructed and their scale.

[18] We also compare the baseline sample with a restricted sample if we impose the same restrictions as in the mortality data sample. The baseline and so-called restricted sample are generally comparable. However, sample size drops to 205 in the restricted sample.

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 98€ per month for women and 206€ per month for men between the two groups.

Individuals with aep below 0.75 and more than 35 contribution years could still receive no subsidy if their wages were high before 1992, as $aep_{92} > 0.75$ 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 eligible individuals receive a positive amount of subsidy, i.e. are subsidy recipients. This can be ex-ante explained for mainly two reasons. First,

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 pension income and mortality.

X_i contains the demographic characteristics, such as a male indicator, being married, not having any health insurance, having children[19] and pension benefits without subsidy. λ is the birth cohort fixed effect. τ is the contribution quarters fixed effect. The standard errors are clustered at the birth year level [20]. Because we have a small number of clusters, we also report the bootstrap p-values in

[19] 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.

[20] 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.

brackets in all tables.

The DID analysis identifies the impact of additional pension income under the assumption that, had the subsidy program do not exist, the evolution of mortality over the contribution year (from 33 to 36) for people with aep between 0.45 and 0.75 (pension benefits between 500 and 850€/month) would have been similar to trends in outcomes for pensioners with aep between 0.75 and 1.05 (pension benefits between 700 and 1200€/month). Because we look at people very close to the 0.75 earnings threshold and compare them across a narrow window of only two years around the 35 contribution years, it is more plausible that our identification assumption will be fulfilled. In the robustness checks, we verify results also hold around narrower and wider aep and wider contribution years bandwidths. The event-study analysis in section 5.2 provides support for the common-trend assumption, and the placebo analysis on groups with $aep > 0.75$ in Section 5.2.1 further support causal interpretation of our estimates.

Manipulation into Treatment Our empirical strategy relies on the assumption of absence of manipulation and self-selection into eligibility. If, instead, the existence of the subsidy and the knowledge of its eligibility conditions were to induce individuals to manipulate either one of aep^{92},aep, or the number of contribution years, our estimates would be biased. In particular, our estimates would be downwardly biased if healthier retirees self-selected into treatment, and would be upwardly biased in the opposite scenario. In the following, we argue that manipulation is rather unlikely or not supported by empirical evidence.

To receive a positive subsidy amount, one must in practice fulfill three conditions: (1) have more than 35 years of contributions, (2) have $aep < 0.75$ at retirement, and (3) have $aep^{92} < 0.75$ (otherwise the amount of subsidy is zero). In the following, we will refer to aep at retirement directly as aep.

First, 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 exogenous. Thus, selective behavior 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, this would mean accepting lower paid jobs in the years after 1992. We mentioned earlier that aep is highly correlated with aep^{92}, and that the higher the number of contribution periods before 1992, the closer will aep^{92} be to aep (Ye, 2022). Therefore, manipulation might be profitable only for somebody with aep^{92} below but close to 0.75 and aep before retirement

above but close to 0.75. Only a small share of pensioners fall into this group.[21] Moreover, the kinked subsidy schedule implies 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 anyone 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.2 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). Panels (c) and (d) show the distribution for women and men. 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 behavior 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.3 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 groups and similar for both gender. One possible explanation is that 35 years of contributions is also the eligibility requirement for the old-age pension for the long-term insured. IN particular, the long-term insured path allows people to retire at 63 instead of waiting until the statutory retirement age.

Figure A.3 (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.3 (b) shows that while the $aep \leq 0.75$ group has a large degree of bunching, this group also has a smaller mass between 35

[21] 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.

and 37 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. Panels (c) and (d) show the distribution for women and men, and we can see that this shift is slightly more pronounced for men, who are more likely to use the old-age for the long-term insured. 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. In the robustness test, we show that our results remain unchanged when we drop those retire exactly at 35 years of contribution (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, years of schooling, and socioeconomic status before retirement[22]. We also control

[22] 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.

for age at claiming pension, the contribution quarters 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). We discuss the key assumptions for a valid IV estimate in Appendix section D.

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. 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 behaviors to better understand the mechanisms.

5.1 Effects on Pension Income

First, we examine graphically the impact on the probability of receiving the subsidy and the amount of the subsidy received. Figure A.5(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.4. The similar pattern is observed when we look at the probability of receiving subsidies (Figure A.5(b)).

Furthermore, Figure A.6(a) shows pension benefits without subsidies by number of contribution years, for the treated and control groups. In absence of the subsidy, pension benefits increase approximately linearly with the number of contribution years. We do not see a change in the gap after the 35 years cutoff. In contrast, Figure A.6 (d) shows that the pension benefits with subsidies entail a permanent upward shift of the trajectory, decreasing the difference in pension benefits between the two groups. The patterns are similar when we look at men and women separately.

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). Subsidy eligibility increases the probability of receiving the subsidy by 69%, the amount of subsidy received, and pension income by 58€/month. While the estimates on the probability of being

a recipient and subsidy amount are not sensitive to varying controls, these matter for the effect on pension income. However, this is not surprising as the two groups differ in their lifetime earnings. Our identifying exogenous variation comes from a reduction in the difference of perceived pension income between treated of control group, a consequence of subsidy eligibility. Thus, to isolate this change, 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 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, supporting the parallel trend assumption.

5.2 Effects on Mortality

We now examine the effect of subsidy eligibility on mortality outcomes, first through descriptive graphical evidence and then through the DID analysis.

Figure A.7 plots the mean mortality outcomes for the control ($aep \geq 0.75$) and treatment ($aep < 0.75$) groups by number of contribution years. We observe two patterns. First, the probability of dying before 65 notably increases after 35 years of contributions, particularly among men (Figure A.7). This pattern emerges probably because 35 years of contributions qualify individuals for an early retirement option - the old-age pension for the long-term insured, which allows earlier retirement at age 63. This option is less utilized by women, who could retire at age 60 through a specific women's pension. The discontinuous increase in mortality is likely due to the negative association between retirement and mortality, which has been shown in the U.S. context (Fitzpatrick and Moore, 2018). Second, although the probability of dying before age 65 spikes after reaching 35 years of contribution for both groups, the gap widens after the cutoff. Similarly, we observe a similar evolution of mortality outcomes before the 35 year cutoff and a change in the trajectory in favor of the poorer group, likely due to additional pension income. This evidence suggests that the improvement in life expectancy for the poorer group partly comes from offsetting the harmful impact of retirement. As income and consumption drop at retirement (e.g., Hurst (2008); Battistin et al. (2009)), additional pension income could help low-income retirees better cope with the transition from work to retirement. However, these are raw scatter plots that do not control for important covariates. For example, without controlling for neither birth cohorts nor pension income without subsidy, the mortality rates of the poorer group are lower than those of the richer group. Therefore, we will turn to the regression results, which allow for a more precise analysis. We also show that our regression results are robust when dropping individuals with exactly 35 years of contribution.

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, and 70 by 0.8, and 1.5

percentage points, respectively. These correspond to 15.7% and 5.8% decreases with respect to the sample average. The estimates are not sensitive to varying controls. Corresponding 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. We show the 95 percent CI (shaded line) and the 90 percent CI (solid line) in Figure 2.

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, 8, and 12 years of claiming an old-age pension (hence also 4, 8 and 12 years after receiving the subsidies, respectively). Eligibility for the subsidy decreases the probability of dying between 62 and 69, and the probability of dying within 8 and 12 years from retirement by 1.5, 0.9 and 1.2 percentage points, respectively. Figure A.8 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 the second year for men. Moreover, the improvement in life expectancy is driven by the responses in the first five years after the subsidies are received.

5.2.1 Robustness Checks and Placebo Tests

We perform a number of robustness and placebo checks to ensure the robustness of our results.

First, we reproduce the DID estimates after varying sample selection criteria. Results are reported in Table A.10. In Column (2), we ensure the mortality results are robust to the exclusion of individuals who retired at exactly 35 years of contribution, or 420 months. In Column (3), we show the estimates remain similar when we narrow the bandwidth of aep to be even closer to the cutoff, i.e. between 0.6 and 0.9. This tackles the concern raised by pension income in our baseline control group still being substantially higher than in the treatment, group. In Column (4), we further show our results are also robust to a widening of the aep bandwidth, to 0.25 - 1.25, in line with the restrictions we will impose later on when exploring effects on health outcomes with survey data. Column (5) shows results are also maintained when expanding the contribution year bandwidth, to 30 and 40 years. Finally, estimates remain similar if younger cohorts are included in the sample, i.e. adding individuals born between 1943 and 1948, or if we restrict to cohorts born between 1932 - 1937, i.e. the cohorts born before the Second World War. For more detailed discussion, see Appendix E.

Second, conduct placebo tests by using a sample of ineligible individuals. We take the two

placebo samples consist of people of aep_i higher than 0.75 : $aep_i \in [0.8, 1.25]$ and $[1, 1.4]$ (columns (2) and (3) of Table A.11). These individuals are not eligible for the subsidies. We take a hypothetical cutoff in aep in these placebo checks. Even though we find some positive effect on pension income, 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.9. This exercise also helps to rule out the possibility that the estimated mortality impact is driven by differences in mortality responses to early retirement across income levels.

Then, we consider two placebo samples of people with lower or higher number of contribution years than in the baseline sample: $CY \in [29, 32]$, $CY \in [37, 40]$ (columns (3) and (4) of Table A.11). These individuals are not eligible for the subsidies. We take a hypothetical cutoff in CY (30 and 39, respectively) in these placebo checks. Again, we find none or small positive effects on pension income (less than 7€/month). We do not find significant effects on mortality. These tests rule out the possibility that other confounding factors are driving our reduced-form estimates.

5.2.2 Heterogeneous Mortality Effects

Table 2 reports the DID estimates by gender, marital status, income distribution and type of health insurance. Table A.12 shows the p-values testing the hypothesis that the coefficients by subgroup are equal.

By Gender 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.[23] 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 3 and 2.3 percentage points, respectively, while the effects for women are close to zero and insignificant. Age at death (censored at 75) increases by 0.23 years (2.8 months) for men, while there is no effect for women. On the other hand, we find that eligible women respond by retiring earlier. They start to claim a pension about 2 months earlier, which could partly contribute to the absence of mortality effects. In the following paragraph, we explore whether marital status and children lead to the gender difference. Section 6.1 provides a in-depth discussion of gender differences, combining evidence on health outcomes with the survey data.

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

By Marital Status and Children 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 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.13 shows that neither married nor not married women seem to experience mortality (columns (1) and (3)), despite similar first-stage estimates. Table A.12 shows the p-values testing the hypothesis that the coefficients by subgroups within the female sample are equal.[24] If household composition explains the absence of mortality effects for women, we would 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 non-mothers. Marital status and children do not seem to help explain why women's mortality outcomes are less responsive. Section 6.1 provides additional discussion of the gender differences.

Columns (5) and (6) of Table A.13 show heterogeneous effects by marital status for men. Here, we estimate a bigger effect on subsidy size for unmarried men. Nonetheless, mortality results are driven by married men. This might be due to the partner of married men are better at utilizing the additional resources to improve health status (Chen, 2022; Horstman, 2024).

By Subsidy Size Although pensioners in our treatment group are all poor, with below average monthly wage, it would be interesting to see if very poor and relative poor pensioners react differently. Columns (6) and (7) of Table 2 split the treatment group into ones with lower and higher aep, while keep the control group unchanged. Because the subsidy size is correlated with aep, essentially we compare individuals with varying subsidy size. Those with aep between 0.45 and 0.61 on average receive 87 euro additional monthly pension income, while those with aep between

[24] 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 heterogeneity analysis. We suspect that those ones who with missing status are widows.

0.61 and 0.75 receive 29 euro additional pension income per month. We find that those with more subsidy gain 0.16 years of life expectancy compared with 0.11 years of life expectancy for those with less subsidy. The estimated changes in the probability of dying before 65, 70 and 75 are also larger for the former group. However, Table A.12 shows that the differences across groups are not statistically significant.

In Table A.14, we further present the heterogeneous impacts by subsidy size for men and women separately. This exercise helps us to see if the improvement in life expectancy is driven by the ones receive more subsidies. Additionally, we show the estimated impacts on individuals with aep between 0.25 and 0.45 in columns (2) and (6), who have even lower average lifetime wage, despite receiving similar amount of pension subsidy due to the kinked subsidy schedule. This helps us to see whether the poorest pensioners' life expectancy benefit more.

We derive two main insights. First, the mortality impacts on men are driven by men with more subsidy, around 40 to 60 €per month of subsidy. Second, women do not experience any improvement in life expectancy, independently of subsidy size. In the next Section, we will explore results on age at claiming pension, which is instead affected for women.

By Health Insurance Status Finally, we 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 enroll in private health insurance.[25] As those with private health insurance have higher household incomes and better healthcare coverage, we expect that 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. People with private health insurance received a smaller subsidy, on average, mainly because they are more likely to be men. The age at death is postponed by 1.5 months (significant at the 10 percent level) for those with public health insurance, while it increases by 1.6 months for those with private health insurance, but the effect is insignificant. Taking into account the different magnitudes of the first-stage estimates, the results for mortality

[25] 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 cannot test the impact on out-of-pocket payments due to sample size limitations.

are similar, with the exception of the probability of dying before age 75.

5.3 Effects on Pension Claiming

Additional pension income can also change pension claiming behaviors, which could also affect health and mortality outcomes. Panel C of Table 1 reports the impact on age when the pension is claimed. We do not find any significant effects for the full sample. When we split the sample by gender, we find that an increase by 63€/month in pension income induces women to claim their pensions 2.1 months earlier (Column (2) of Table 2). The response is smaller but in the same ballpark as the claiming responses estimated in Ye (2022) for female recipients. [26] Tables A.14 further shows that the effects on age at claiming pension for women depend on the size of the subsidy they receive: women in the baseline sample with $aep \in [0.45 - 0.61]$ perceive the highest amount of subsidy (94€/month) and start claiming pension 3.2 months earlier.

Table A.15 further explore the impact of different early retirement pathways. We find that subsidy eligibility leads to an increase in the probability of claiming pension for the unemployed and claiming pension for the long-term insured and a decrease in claiming disability pension. This is reasonable given the strict requirements for claiming disability insurance (rigorous medical examinations) and the greater stigma associated with being labeled as disabled (Celhay et al., 2025). Pensioners with additional income can now afford to opt for other early retirement pathways, although claiming disability insurance at the same age entails less financial penalties.[27] When examining the impact by gender, we see a different pattern. Eligible women are more likely to use women's pension and the pension for long-term insured as early retirement pathways, rather than relying on the unemployed pathway. For eligible men, they substitute disability pension pathway with pension for the unemployed and pension for the long-term insured when additional income become available.

We also examine the heterogeneous impact on age at claiming by martial status, subsidy size and health insurance. Overall, we find that the decline in age at claiming pension is driven by women, pensioners eligible for a larger amount of subsidy and those with public health insurance.

[26] Ye (2022) shows that a 100 euro increase in the monthly subsidy induces female recipients to claim their pensions six months earlier. Our sample includes both recipients and non/recipients and we measure the intend to treat effect. This is probably why we find a smaller effect on age at claim for women in this paper. Note that we cannot use the same regression kink method as in Ye (2022) to examine the impact on recipients because we don't observe aep_{92} in our data.

[27] This is because disability insurance has a lower normal retirement age.

5.4 IV to Scale the Effect

To quantify the impact of an additional 100€of pension income on mortality and to compare it with the health outcomes using Survey data, we also the impacts in an IV framework. Table A.16 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 58€/month (63€/month for women, and 27€/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 A.16 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, and 70. These estimates are in line with DID results. We find that 100€ per month of additional pension income causes a decrease of 1.4, and 2.6 percentage points in the probability of dying before 65, and 70, respectively, in the full sample. The age at death censored at 75 increases by 2.8 months. Similar to the DID estimates, results on mortality are predominantly driven by men, who experience substantially larger improvements in mortality outcomes than women. We estimate a more than 6-months increase in age at death, and a reduction of the probability of dying before ages 70 and 75 by 7.1 and 7.2 percentage points, respectively. Women, on the other hand, do not experience any longevity gains, but claim pension about 3 months earlier. Moreover, the inclusion of a control for the age at which a pension was claimed does not affect the magnitude of the estimates.

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.17 compares the characteristics of individuals in the baseline sample with those of the eligible individuals, the compliers (subsidy recipients in the eligible group, 78% of all

eligible individuals) and the never-takers (individuals who received no subsidy despite of general subsidy eligibility, 22% 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 Survey Evidence: 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.[28] 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.

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.

Overall Health Table 3 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. The 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, eligibility for the subsidy program increases the pension income by 43€/month for women, and 58€/month for men in the SHARE-RV sample.[29]

[28] See Section 3.2 and Table A.5 for descriptions of these outcome variables.

[29] 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.

Table 3 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 65 percent of a standard deviation (significant at the 1 percent level) and the number of chronic diseases decreases by 80 percent of a standard deviation (significant at the 1 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 A.16. 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 1.4 standard deviations, self-perceived health by 2.1 standard deviations and reduces the depression index by 0.8 standard deviations and number of diagnosed chronic diseases by 2.3 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 1.1 standard deviation at the 1 percent significant level. For difficulties with IADLs, we find an overall decline of 0.6 standard deviations (significant at 10% level), 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.

Chronic Diseases Table 4 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.18 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, fractures of the hip, and the incidence of diabetes. Indeed, we find no effect of additional pension income on the probability of these occurring.[30]

Future Outlook In addition, we explore the impacts on perceived financial constraints and optimism in Table 4. 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 4 shows that an additional 100€ of monthly pension income reduces the days of alcohol consumption in the last 6 months by 82% of a standard deviation for men (significant at 10% level).[31] The overall probability of smoking at the time of the interview is reduced by about 3.3 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.

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.

[30] Potentially, higher pension incomes may affect the incidence of diabetes by allowing pensioners to afford healthier diets. In addition, less stress about money could also reduce the likelihood of obesity. However, diabetes is caused by genetic predisposition and obesity. These factors take many years to influence the onset of diabetes, and we find no significant effect of additional pension income on the likelihood of having diabetes. Note that we cannot distinguish between type I and type II diagnosis in the data.

[31] 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.

6 Discussions

6.1 Gender Differences

We find strong difference responses to additional pension income by gender. On the one hand, men benefit from a decrease in mortality and improvement in health and general life quality, without changes in their labor supply. On the other hand, women anticipate retirement, but their health and longevity remain unaffected.

Table A.14 shows that women' longevity is unaffected across values of aep. However, we observe dose-response relationship of age at claiming pension to subsidy size. The higher the amount of subsidy received, the earlier women start claiming pension. One explanation for gender difference could lie in adverse effect of early retirement on longevity, which could compensate the benefits of additional pension income for women. However, since men are the primary earners in most West German family, women with a low pension entitlement and low wage can either come from truly low-income families or from well-off families, as the household income is high. Thus, an alternative explanation could lie in the relative importance of the pension income increase to total household income and its capacity of improving living standards.

The analysis in Section 5.2.2 suggests that marital status and number of children do not explain the different gender responses in longevity. However, because we cannot link households, we still cannot rule out 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.

Exploiting survey data, we use two measures to proxy for truly low-income families and explore gender differences: a higher share of pension income in household income and non-homeowners households.[32] Table A.19 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.[33] Although suggestive, we find that poor women do not

[32]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 -0.24. And the correlation between one of the household members being a home owner and being married is 0.04. These two measures also capture different families, as the correlation between one of the household members being a home owner and the share of pension income is -0.17.

[33]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.

experience health status improvement (if anything, they seem to be worse-off). Table A.20 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 a home respond more strongly to additional pension income on measures of overall well-being, mental health, and optimism. 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.

Additionally, one more 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.21 compares the mortality and health outcomes in the absence of the subsidy by gender. We focus on pensioners within the baseline sample with more than 35 years of contributions but $aep > 0.75$, a sample similar to our treatment group. Indeed, this evidence suggests that potentially treated men are overall less healthy than women.

To further test the differences in health between eligible men and women, we utilize 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 use the same restrictions as in the RTWF baseline sample. We examine whether potentially eligible individuals in VSKT are in better or worse health before claiming the subsidy and whether the difference varies by gender. Table A.22 shows the effect of eligibility on the duration of sickness and the probability of experiencing any sickness before age 50 (and age 55). Columns 1–3 use West German pensioners (born 1932–1942) with 30–40 contribution years and average earnings points between 0.45 and 1.05. 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. Columns 4–6 restrict contribution years to 33–36. Note that when we make the same contribution years restriction as the baseline sample, the sample size is much smaller with only 113 men. Although much nosier, the estimates still suggest that eligible men are in worse health prior to claiming the subsidy. These findings imply that eligible individuals are less healthy, which is not surprising given that the subsidy program is targeted at lower-income

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).

6.2 Comparisons with Existing Literature

In Table 1, we show that eligibility for the pension subsidy increases pension income by 8.2% (58/706) and reduces the probability of dying before age 65, and 70 by 14.5% (0.008/0.055), and 5.9% (0.015/0.253), respectively. Therefore, we estimate ITT pension income-mortality elasticities of -1.77, and -0.72, which represent the percentage change in the probability of dying before age 65, and 70 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 -0.72 (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 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

[34]The IV estimates in Table A.16 show monthly pension income increase by 100 euro (around 14 percent increase) leads to a decrease in the probability of dying before age 65, and 70 of 25.5% (0.014/0.055), and 10.3% (0.026/0.253), respectively. The pension income-mortality elasticities calculated using the IV estimates are similar: -1.79, -0.73.

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.

Interestingly, Becker et al. (2024) find no mortality effects of increased DI benefits in Germany for DI recipients below age 60. However, the populations at study are clearly different. Becker et al. (2024) focus on mortality effects of younger people with server health conditions, while we focus on older people with low income.

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 0.016 percentage points per month (13.9%). Although the majority of the German population is covered by statutory health insurance, out-of-pocket

payments for healthcare services remain and account for 13% of total healthcare expenditure in Germany (WHO, 2023).[35] One possible channel of our results could be that additional income allows recipients to pay out-of-pocket for additional drugs and medical supplies. Unfortunately, the out-of-pocket payments is poorly recorded in SHARE, we can not test this possibility empirically. 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.[36]

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 [37]. At the same time, younger cohorts receive less subsidy as this subsidy program is gradually being phased out.[38] 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

[35] Bock et al. (2014) shows that the top three highest amount of out-of-pocket payments for elderly German public health insurance beneficiaries are medical supplies (such as electrical wheelchair), dental prostheses and payments for pharmaceuticals. See here for a detailed description of the co-payment regulations of the statutory health insurance in Germany.

[36] Various studies have shown 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) show that regular physical activity can reduce overall mortality of U.S. adults aged between 51 and 61 by 38% compared with sedentary individuals. Baade et al. (2011) find that colorectal cancer 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 in Australia.

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

[38] 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.

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 183,785€.[39] The fiscal cost of providing the subsidy for men is about 31,224€ per male subsidy recipient (assuming they retire at age 60). 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.[40] See Appendix F for more details.

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 utilizing 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 8.2% (about 58€) and a 1.6-month delay in age at death (censored at 75). The IV analysis shows that a 100€ increase in monthly pension income (about 14% increase) reduces the probability of dying before age 65, and 70 by 25.5%, and 10.3%, respectively. The heterogeneity analysis suggests that the mortality responses are driven by men, while women respond to additional income by anticipating pension claim. The analysis using survey data suggests that additional pension income also leads men to live healthier lives. Again, we find that women's health does not respond. We observe 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

[39] 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.

[40] We also perform a similar cost-benefit analysis for women. We take a pension income without subsidy of 623€/month (average value for eligible women) and a life-expectancy improvement of 1.9 months (based on non-significant 1 percentage point decrease in the probability of dying before 70). Life expectancy at age 60 is 25.41 years (305 months) for women. Additionally, we estimate eligible women retire about 3 months earlier. Thus, the cost of providing a retired woman with an additional 100€/month would be 34,249.8€. This implies a net monetary gain of about 7,479€ per subsidy recipient. However, given the effects on women are not statistically significant, one should be cautious when concluding that such a policy would be or not be cost-effective for women.

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. One possible direction would be examining changes in healthcare consumption, occupational differences, household dynamics. Indeed, the main limitation 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.

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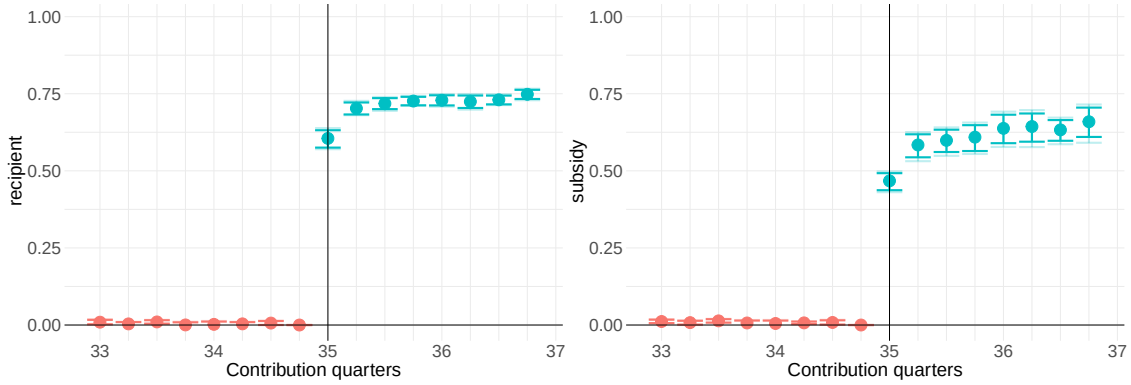
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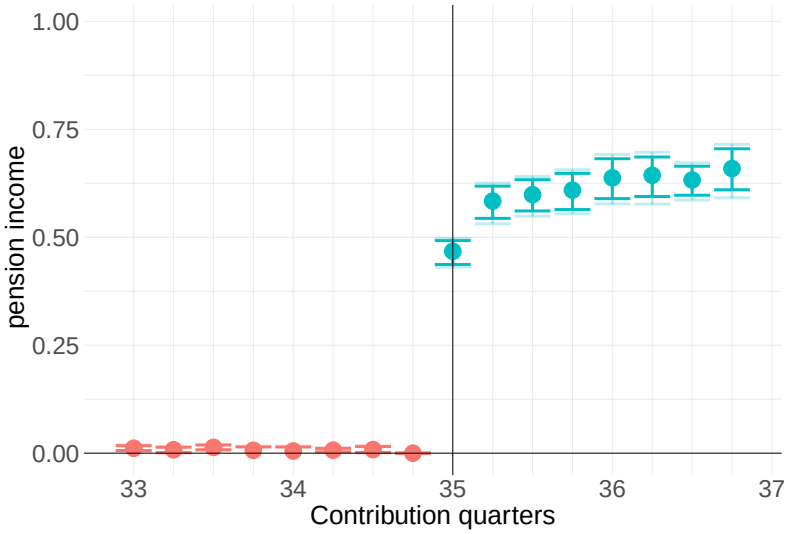
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Tables and Figures



(a) Probability of being a subsidy recipient

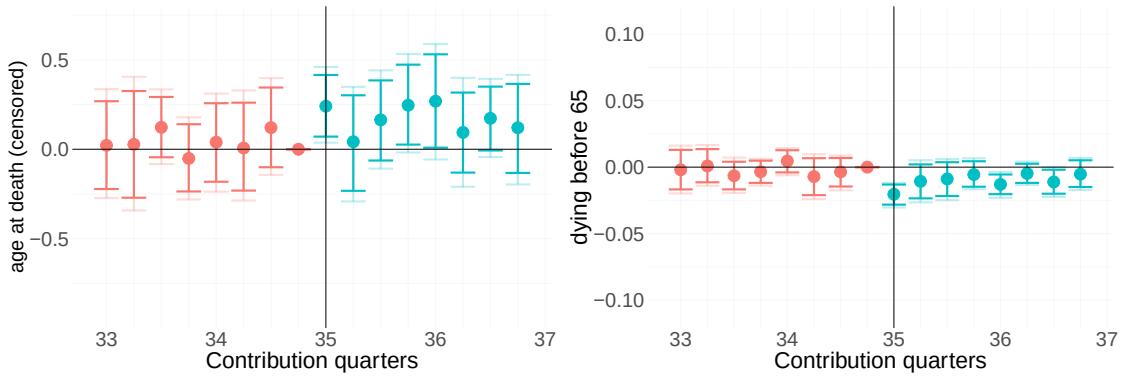
(b) Subsidy amount (100€)



(c) Pension income (100€)

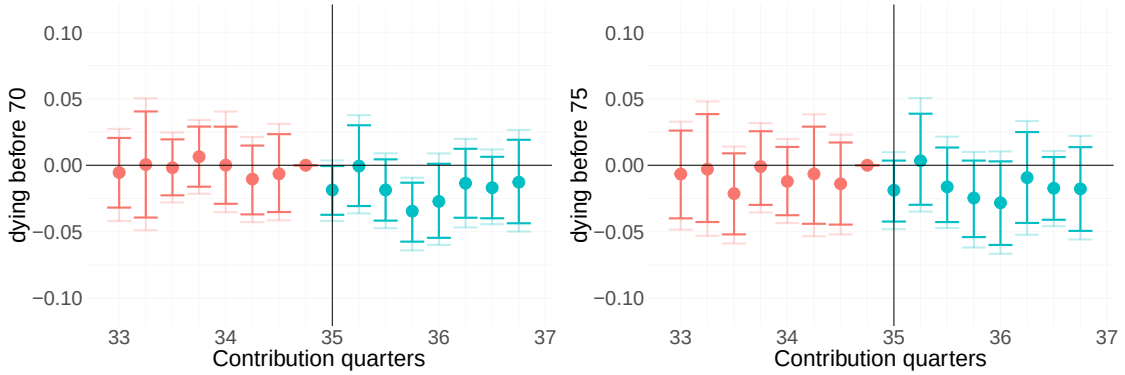
Figure 1: Event study coefficients in the baseline sample, first stage.

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



(a) Age at death

(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	0.701***	0.700***	0.693***	0.693***	0.297
	(0.010)	(0.010)	(0.008)	(0.008)	(0.457)
	[0.000]	[0.000]	[0.000]	[0.000]	
Subsidy	0.588***	0.587***	0.580***	0.579***	0.235
	(0.020)	(0.020)	(0.018)	(0.018)	(0.472)
	[0.000]	[0.000]	[0.000]	[0.000]	
Pension income	0.241**	0.238***	0.292***	0.579***	7.060
	(0.053)	(0.052)	(0.036)	(0.018)	(0.254)
	[0.001]	[0.001]	[0.000]	[0.000]	
Panel B: Impact on mortality					
Age at death	0.203***	0.191***	0.155**	0.136**	72.241
	(0.031)	(0.034)	(0.035)	(0.036)	(3.716)
	[0.000]	[0.001]	[0.003]	[0.009]	
Dying before 65	-0.010***	-0.010***	-0.010***	-0.008***	0.055
	(0.002)	(0.002)	(0.002)	(0.002)	(0.227)
	[0.000]	[0.000]	[0.000]	[0.000]	
Dying before 70	-0.022***	-0.021**	-0.017**	-0.015**	0.253
	(0.003)	(0.004)	(0.004)	(0.004)	(0.434)
	[0.001]	[0.002]	[0.003]	[0.004]	
Dying before 75	-0.018**	-0.015**	-0.010	-0.008	0.512
	(0.006)	(0.006)	(0.006)	(0.006)	(0.500)
	[0.017]	[0.037]	[0.128]	[0.186]	
Panel C: Impact on labour supply					
Age at claiming pension	-0.036	-0.031	0.020	-0.041	62.96
	(0.041)	(0.040)	(0.034)	(0.035)	(2.349)
	[0.417]	[0.459]	[0.555]	[0.295]	
Obs	149,053	149,053	149,053	149,053	149,053
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 an indicator for male, for having at least one child, and not having health insurance. PI without subsidy stands for monthly pension income without subsidy. Sample means 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		Subsidy size		Health insurance	
	Baseline	Women	Men	Married	Not married	High	Low	Public	Private
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Panel A: First stage									
Recipient	0.693***	0.705***	0.440***	0.655***	0.756***	0.758***	0.629***	0.728***	0.382***
	(0.008)	(0.009)	(0.007)	(0.008)	(0.009)	(0.012)	(0.007)	(0.007)	(0.013)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Subsidy	0.579***	0.632***	0.267***	0.559***	0.570***	0.874***	0.292***	0.618***	0.267***
	(0.018)	(0.015)	(0.009)	(0.015)	(0.023)	(0.034)	(0.007)	(0.018)	(0.010)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Pension income	0.579***	0.632***	0.267***	0.559***	0.570***	0.874***	0.292***	0.618***	0.267***
	(0.018)	(0.015)	(0.009)	(0.015)	(0.023)	(0.034)	(0.007)	(0.018)	(0.010)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Panel B: Impact on mortality									
Age at death	0.136**	0.028	0.234**	0.135**	0.121	0.163**	0.108**	0.121**	0.136
	(0.036)	(0.048)	(0.068)	(0.044)	(0.082)	(0.043)	(0.037)	(0.043)	(0.105)
	[0.009]	[0.575]	[0.009]	[0.019]	[0.191]	[0.006]	[0.021]	[0.028]	[0.223]
Dying before 65	-0.008***	-0.001	-0.005	-0.004	-0.014**	-0.008***	-0.009**	-0.007**	-0.014
	(0.002)	(0.003)	(0.003)	(0.003)	(0.004)	(0.002)	(0.002)	(0.002)	(0.008)
	[0.000]	[0.821]	[0.150]	[0.266]	[0.006]	[0.000]	[0.001]	[0.002]	[0.122]
Dying before 70	-0.015**	-0.004	-0.030**	-0.016**	-0.012	-0.018***	-0.012**	-0.014**	-0.013
	(0.004)	(0.004)	(0.010)	(0.005)	(0.009)	(0.005)	(0.004)	(0.005)	(0.016)
	[0.004]	[0.355]	[0.012]	[0.011]	[0.223]	[0.000]	[0.016]	[0.030]	[0.419]
Dying before 75	-0.008	-0.002	-0.023**	-0.012*	-0.001	-0.014*	-0.003	-0.009	0.006
	(0.006)	(0.008)	(0.010)	(0.006)	(0.012)	(0.006)	(0.006)	(0.007)	(0.018)
	[0.186]	[0.829]	[0.049]	[0.056]	[0.928]	[0.067]	[0.644]	[0.219]	[0.798]
Panel C: Impact on labor supply									
Age at claiming pension	-0.041	-0.172**	0.037	-0.053	-0.006	-0.120**	0.035	-0.070*	0.123
	(0.035)	(0.044)	(0.036)	(0.039)	(0.044)	(0.036)	(0.050)	(0.035)	(0.079)
	[0.295]	[0.005]	[0.350]	[0.211]	[0.892]	[0.014]	[0.493]	[0.084]	[0.151]
Obs	149,053	96,820	52,233	89,169	51,548	123,300	122,615	129,920	13,464
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 compare the impacts on individuals with ape between 0.45 and 0.61 with the impacts on individuals with aep between 0.61 and 0.75. Columns 8 and 9 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 health outcomes (IV estimates)

	All		Women		Men	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: First stage						
Pension income	0.414***	0.440***	0.416***	0.431***	0.573***	0.580***
	(0.037)	(0.037)	(0.044)	(0.044)	(0.077)	(0.076)
Panel B: IV						
CASP	0.693***	0.644***	-0.121	-0.094	1.461***	1.413***
	(0.239)	(0.226)	(0.274)	(0.266)	(0.422)	(0.415)
Self-reported heatlh	0.654***	0.658***	-0.289	-0.252	2.076***	2.063***
	(0.248)	(0.235)	(0.285)	(0.275)	(0.506)	(0.499)
Depression index	-0.532**	-0.506**	0.339	0.323	-0.774**	-0.753**
	(0.237)	(0.223)	(0.291)	(0.280)	(0.343)	(0.337)
Number of chronic diseases	-0.825***	-0.796***	-0.071	-0.092	-2.330***	-2.279***
	(0.257)	(0.244)	(0.278)	(0.271)	(0.596)	(0.583)
Difficulties with ADLAs	-0.147	-0.253	0.606*	0.525	-1.013***	-1.058***
	(0.266)	(0.260)	(0.350)	(0.337)	(0.390)	(0.398)
Difficulties with IADLAs	-0.472**	-0.482**	0.099	0.088	-0.628*	-0.630*
	(0.221)	(0.220)	(0.222)	(0.220)	(0.358)	(0.361)
Length hospital stay (nights)	-0.920	-0.996	2.630	2.540	-6.462	-6.525
	(2.062)	(1.947)	(1.875)	(1.813)	(5.715)	(5.658)
Long hospital stay ($\geq$14)	-0.036	-0.035	0.018	0.019	-0.039	-0.043
	(0.051)	(0.048)	(0.054)	(0.052)	(0.096)	(0.094)
First stage F-stat	124.30	141.51	87.53	96.23	55.86	58.70
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 4: Impact of pension income on other outcomes (IV estimates)

	All		Women		Men	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: First stage						
Pension income (100€)	0.414***	0.440***	0.416***	0.431***	0.573***	0.580***
	(0.037)	(0.037)	(0.044)	(0.044)	(0.077)	(0.076)
Panel B: IV						
(I) Chronic diseases						
Had a stroke	-0.018	-0.020	0.016	0.014	0.041	0.038
	(0.040)	(0.040)	(0.047)	(0.047)	(0.073)	(0.073)
Has chronical lung disease	-0.147**	-0.151**	-0.019	-0.029	-0.416***	-0.418***
	(0.062)	(0.059)	(0.069)	(0.067)	(0.146)	(0.144)
Has cataracts	-0.202***	-0.191**	-0.141	-0.140	-0.260**	-0.248**
	(0.078)	(0.075)	(0.098)	(0.096)	(0.119)	(0.117)
Has high blood pressure	-0.068	-0.050	0.233	0.233	-0.755***	-0.728***
	(0.118)	(0.112)	(0.147)	(0.143)	(0.215)	(0.210)
(II) Financial constraints and optimism						
Lack of money stops	-0.375	-0.335	-0.212	-0.216	-1.106**	-1.043**
	(0.244)	(0.232)	(0.288)	(0.280)	(0.438)	(0.431)
Feel full of opportunities	0.758***	0.665***	-0.020	-0.012	1.507***	1.436***
	(0.243)	(0.228)	(0.283)	(0.274)	(0.433)	(0.424)
Future looks good	0.658***	0.608***	0.186	0.183	1.097**	1.070**
	(0.245)	(0.231)	(0.288)	(0.279)	(0.426)	(0.420)
(III) Risky behaviours†						
Days/week alcohol (last 6 months)	-0.141	-0.045	-0.099	-0.065	-0.864*	-0.820*
	(0.289)	(0.276)	(0.334)	(0.324)	(0.465)	(0.455)
Is currently smoking	-0.362***	-0.332***	-0.283**	-0.257*	-0.261	-0.255
	(0.118)	(0.111)	(0.139)	(0.133)	(0.185)	(0.184)
Ever smoked daily	-0.114	-0.115	-0.082	-0.063	0.075	0.056
	(0.113)	(0.106)	(0.135)	(0.130)	(0.192)	(0.189)
First stage F-stat	124.30	141.60	87.53	96.23	55.86	58.70
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

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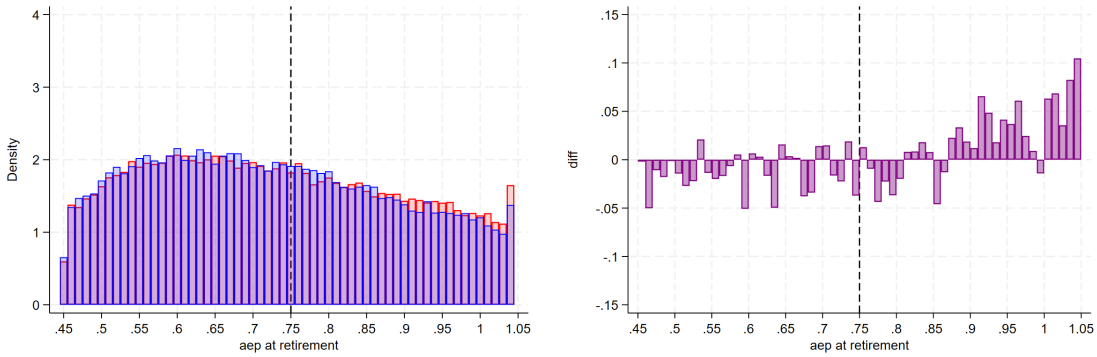
A Appendix Tables and Figures



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

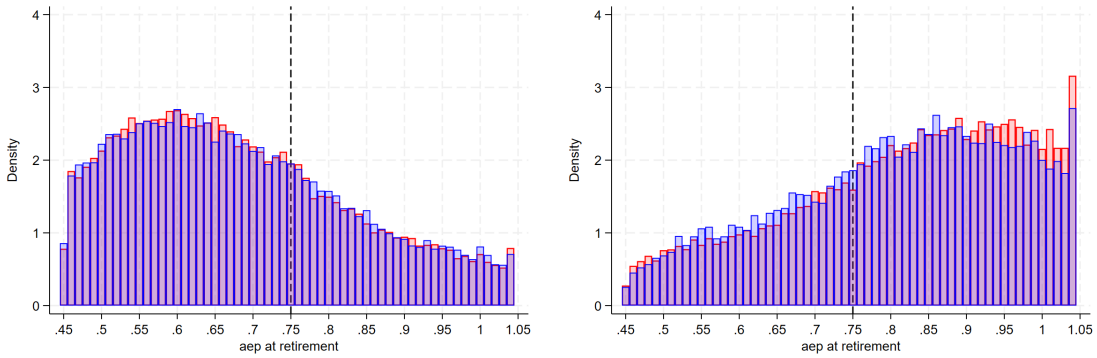
Notes: Figure A.1 displays the relationship between subsidy size and average earning points before 1992, in the case of an individual that contributed 19 years to the pension system before 1992. Horizontal axis indicates aep^{92} and corresponding monthly wage in parenthesis, while vertical axis indicates 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).



(a) Distribution

(b) Difference in distribution

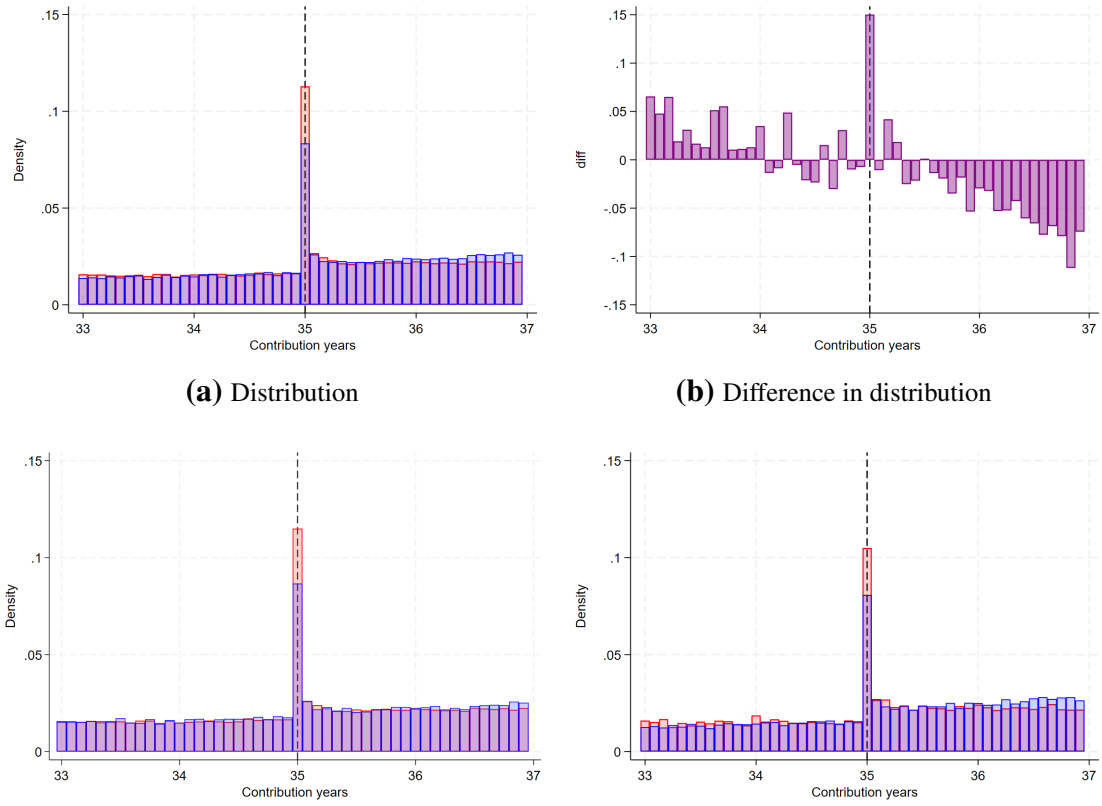


(c) Distribution, women

(d) Distribution, men

Figure A.2: Distribution of aep by contribution years above / below 35, full sample and by gender

Notes: Figure A.2 (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.2 (b) depicts the difference in density between the "above 35" and the "below 35" group. Figure A.2 (c) and (d) display the distribution for women and men.



(a) Distribution

(b) Difference in distribution

(c) Distribution, women

(d) Distribution, men

Figure A.3: Distribution of contribution years by aep below and above 0.75, full sample and by gender

Notes: Figure A.3 (a) displays the distribution of contribution years for groups with aep above (blue) and below 0.75 (red) in the baseline sample. Figure A.3 (b) shows the difference in distribution between below 0.75 and above 0.75 groups. Figures (c) and (d) display the distribution for women and men.

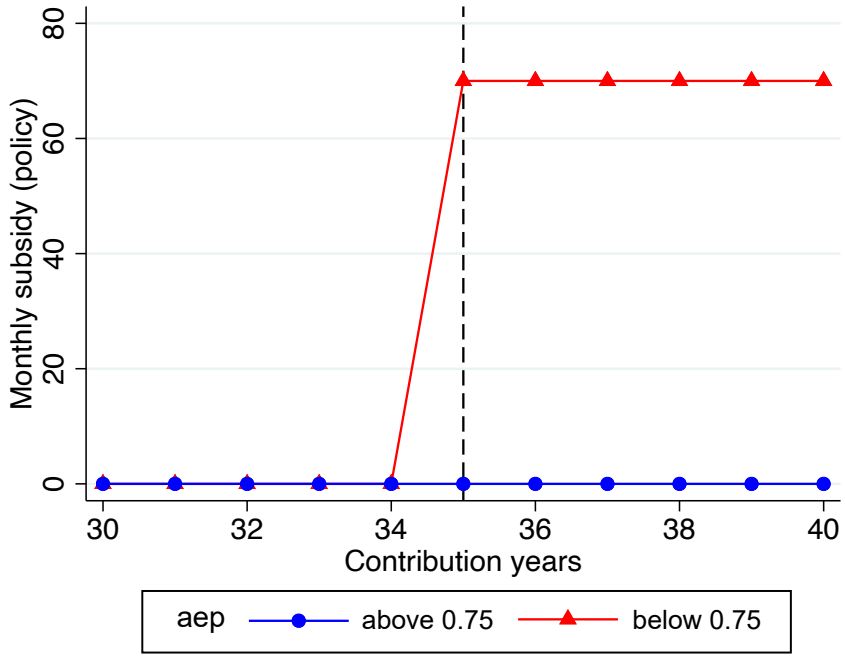
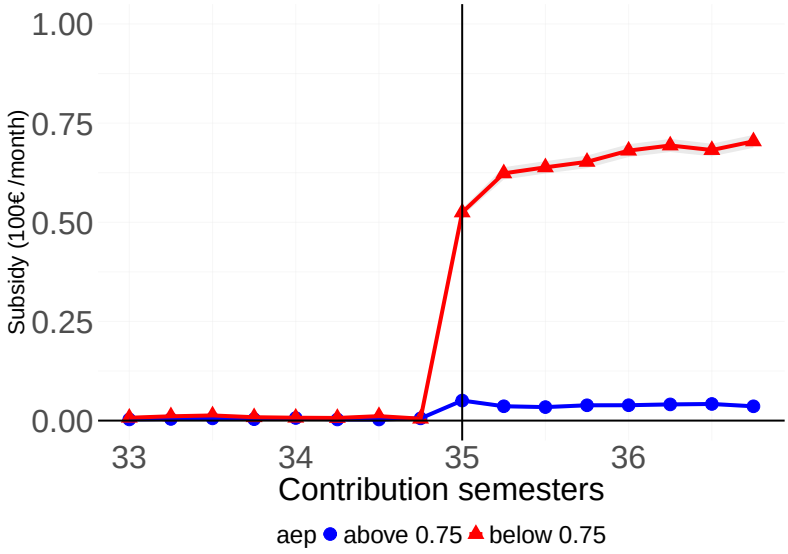
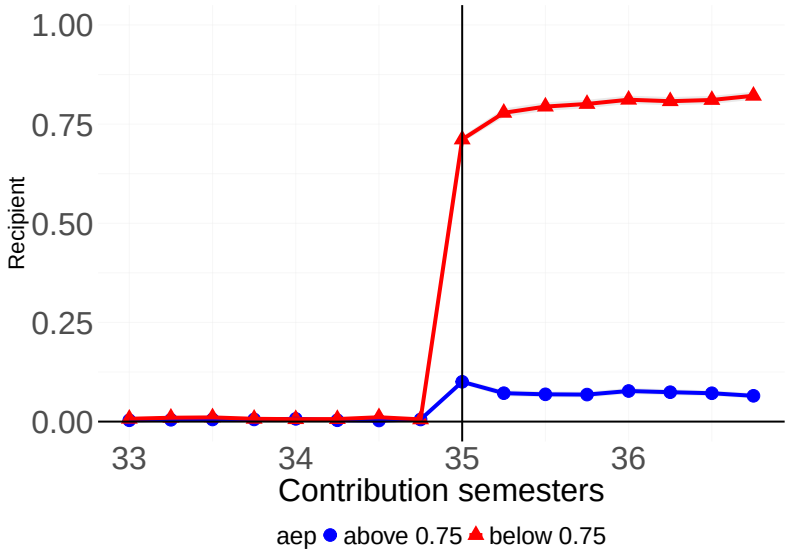


Figure A.4: Policy schedule of subsidy size by contribution years and by treatment status

Notes: Figure A.4 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.



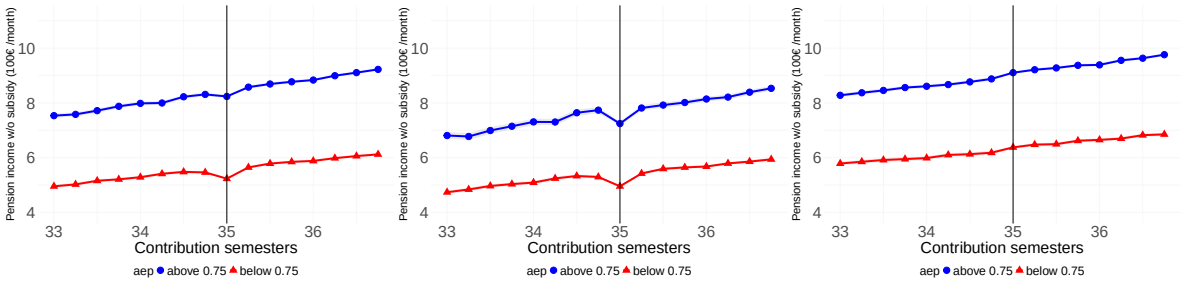
(a) Pension subsidy (100€)



(b) Probability of being a recipient

Figure A.5: First stage: mean probability of being a recipient and amount of pension subsidy by contribution years.

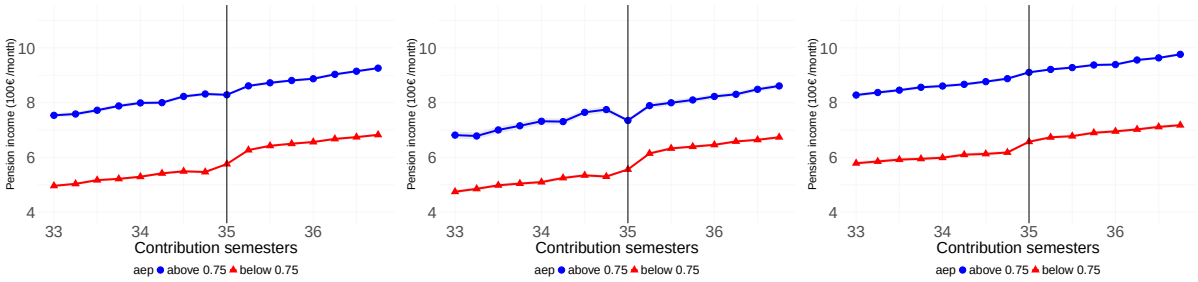
Notes: Figure A.5 displays the mean amount of pension subsidy (panel (a)) and the mean probability of being a subsidy recipient (panel (b)) by number of contribution years. Within the baseline sample, "$aep \geq 0.75$" (blue circles) indicates individuals with aep between 0.75 and 1.05 (pension benefits 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 (women)

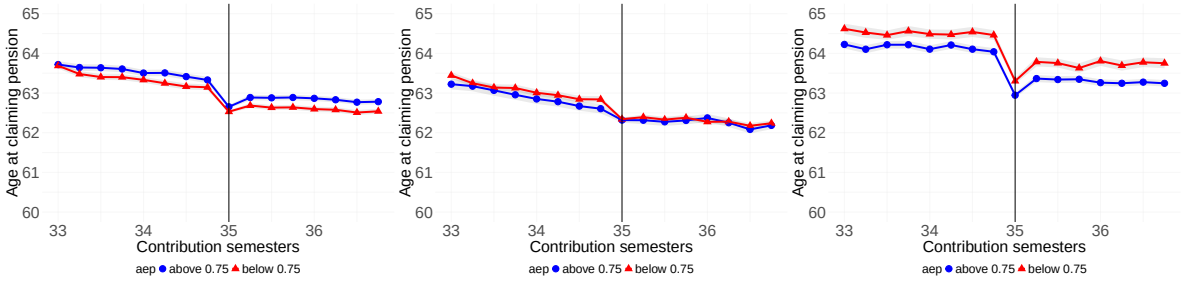
(c) Pension benefits w/o subsidy (men)



(d) Total pension benefits incl. subsidy

(e) Total pension benefits incl. subsidy (women)

(f) Total pension benefits incl. subsidy (men)



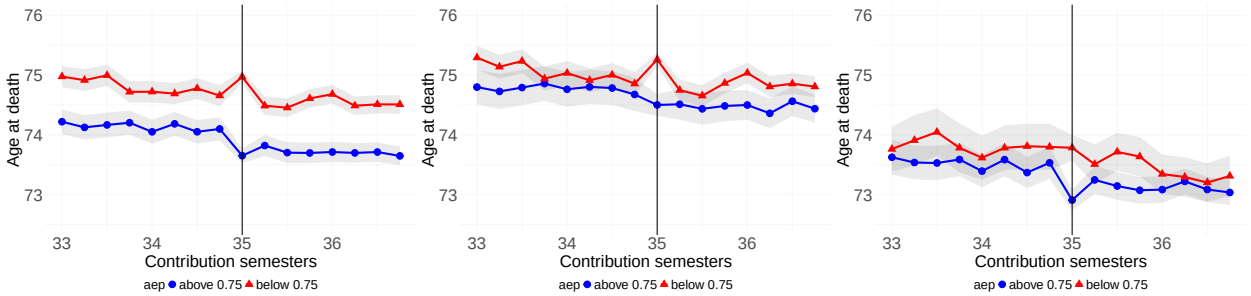
(g) Age at claiming pension

(h) Age at claiming pension (women)

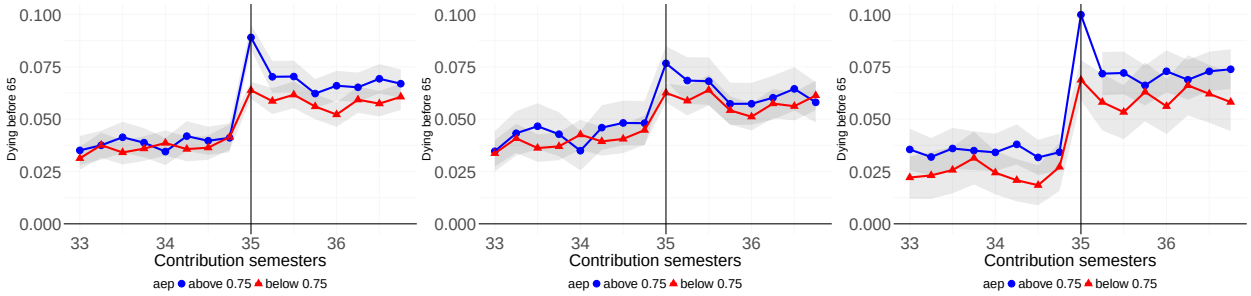
(i) Age at claiming pension (men)

Figure A.6: Scatter plot of pension income and age at claiming over contribution years by treatment status by gender

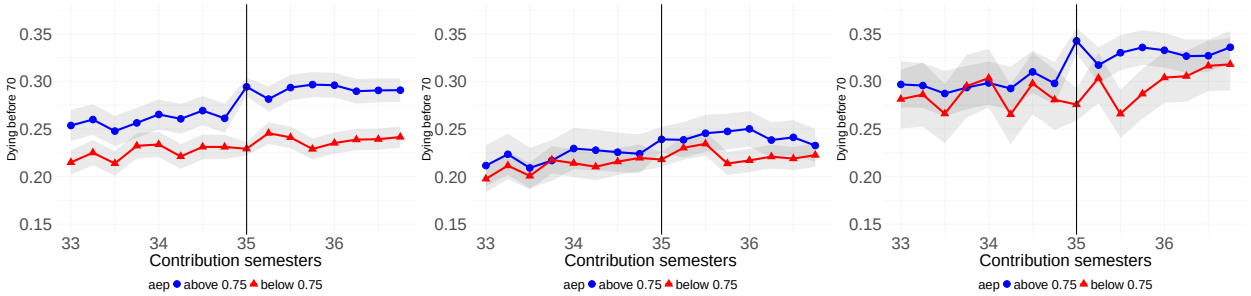
Notes: Figure A.6 displays the pension benefits with and without subsidy and age at claiming pension by treatment over contribution years by gender. The blue circles indicate individuals with aep between 0.75 and 1.05 (pension benefits between 700 and 1200€/month), while the red triangles indicate individuals with aep between 0.45 and 0.75 (pension benefits between 500 and 850€/month). Monetary values are expressed in hundred 2015 euro. The shadowed areas indicate the normally distributed 95% confidence interval.



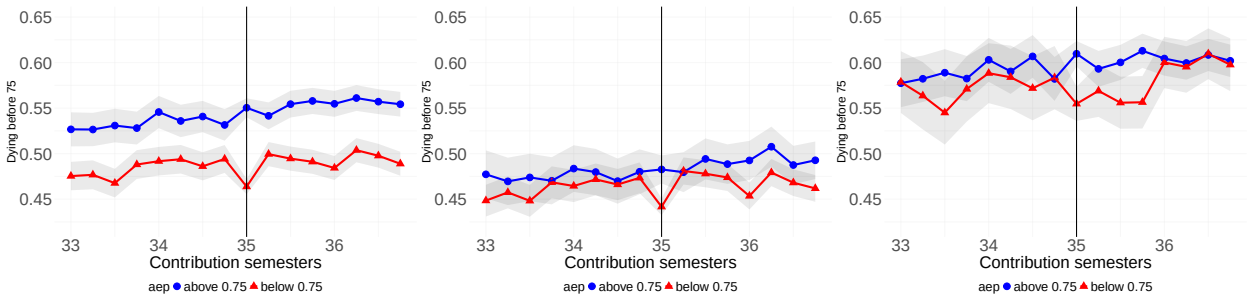
(a) Age at death **(b)** Age at death (women) **(c)** Age at death (men)



(d) Dying before 65 **(e)** Dying before 65 (women) **(f)** Dying before 65 (men)



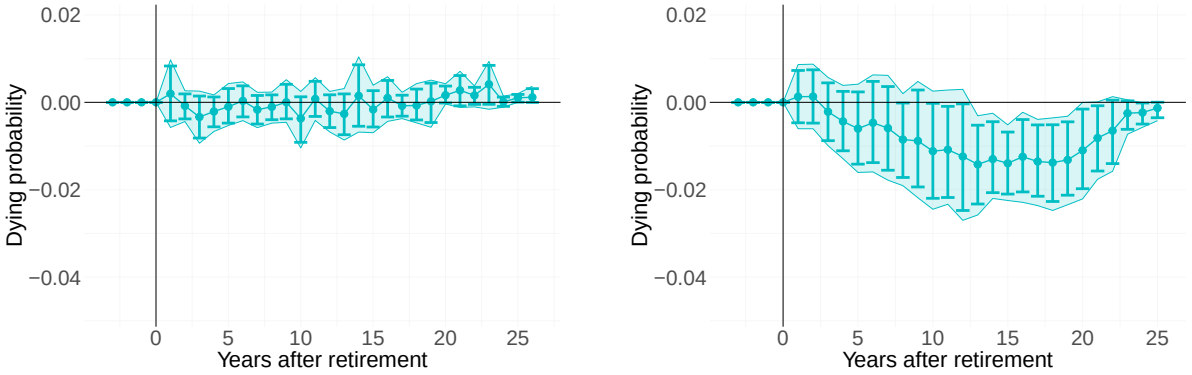
(g) Dying before 70 **(h)** Dying before 70 (women) **(i)** Dying before 70 (men)



(j) Dying before 75 **(k)** Dying before 75 (women) **(l)** Dying before 75 (men)

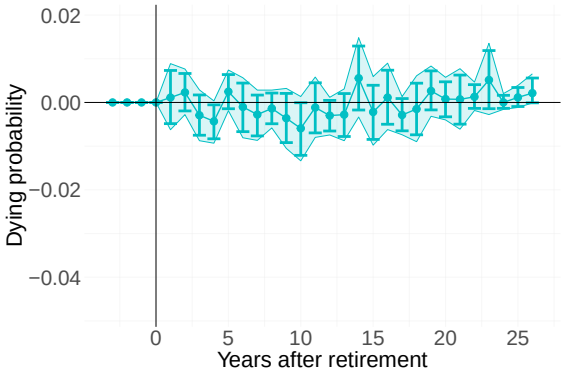
Figure A.7: Scatter plot of mortality outcomes over contribution years by treatment status by gender

Notes: Figure A.7 displays the mean mortality outcomes over contribution years by *aep* group by gender. The shadowed areas indicate the normal 95% confidence interval.

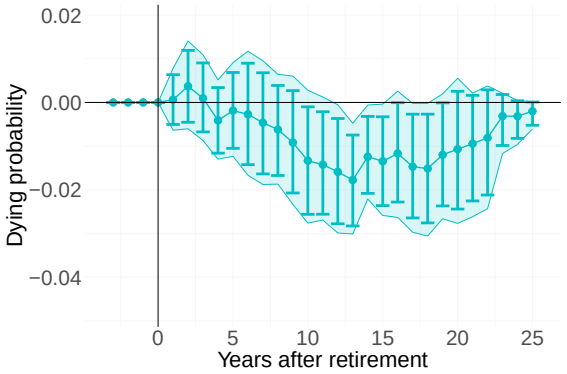


(a) All, hazard

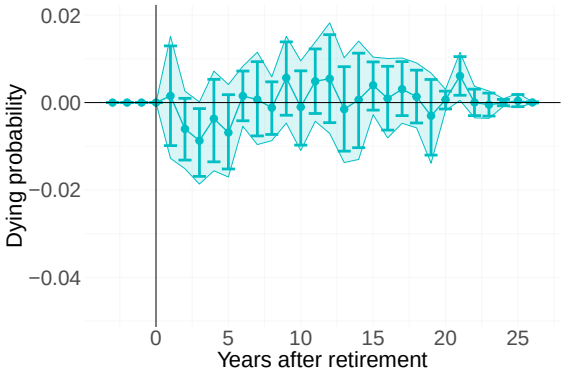
(b) All, cumulative hazard



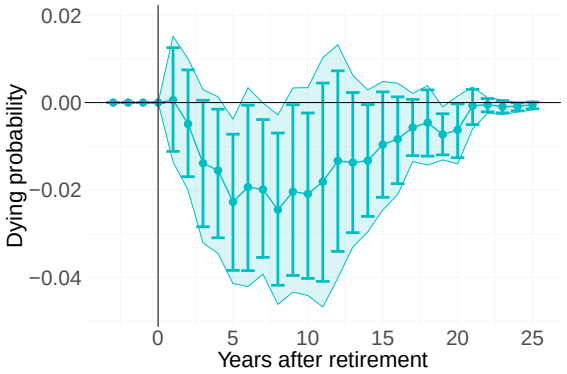
(c) Women, hazard



(d) Women, cumulative hazard



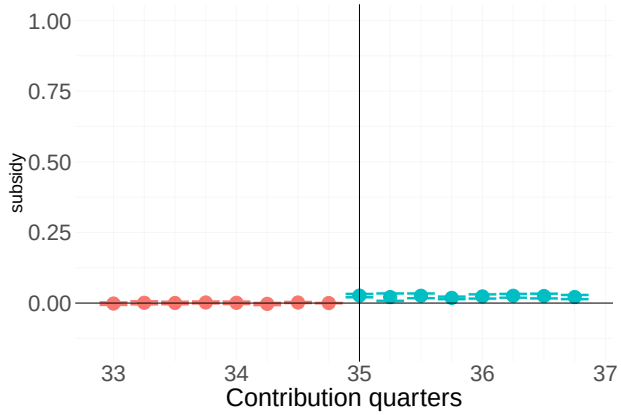
(e) Men, hazard



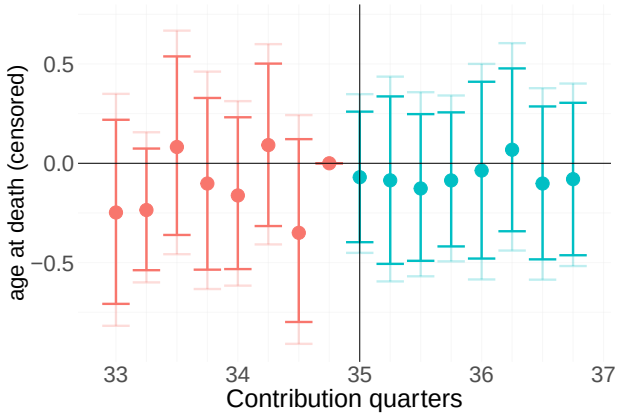
(f) Men, cumulative hazard

Figure A.8: Effect of eligibility on the probability of dying after retirement

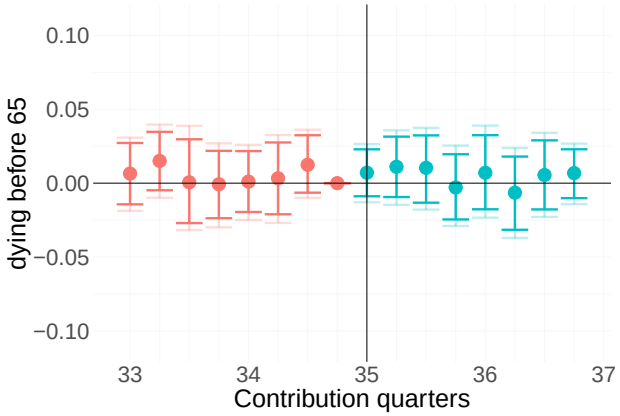
Notes: The left-hand column of Figure A.8 shows the reduced-form effects of eligibility for the a subsidy on the probability of dying in each year after retirement. That is, the impacts on the probability of dying within one year after retirement, between 1 and 2 years after retirement, 2 and 3 years, etc. The right-hand column of Figure A.8 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).



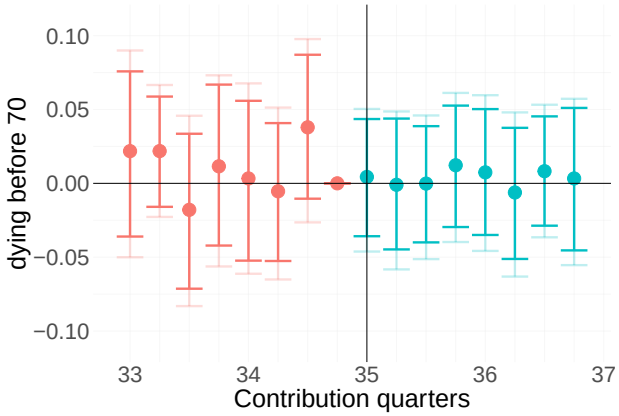
(a) Subsidy amount (100€)



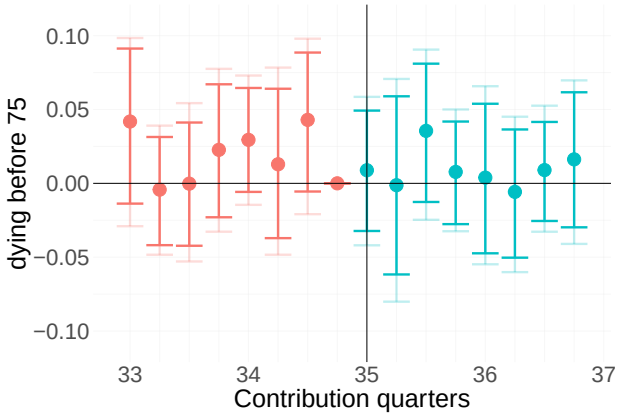
(b) Age at death



(c) Probability of dying before 65



(d) Probability of dying before 70



(e) Probability of dying before 75

Figure A.9: Placebo checks: event study coefficients in the $aep \in$ (0.8-1.25) placebo sample.

Notes: Figure A.9 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	74.33	5.82	149,053
Age at death (censored)	72.17	3.75	4,442,832	72.27	3.69	2,612,035	72.24	3.72	149,053
Dying before 60	0.00	0.00	4,442,649	0.00	0.00	2,612,036	0.00	0.00	149,053
Dying before 65	0.05	0.23	4,442,649	0.05	0.23	2,612,036	0.05	0.23	149,053
Dying before 70	0.27	0.44	4,442,649	0.25	0.43	2,612,036	0.25	0.43	149,053
Dying before 75	0.50	0.50	4,442,649	0.51	0.50	2,612,036	0.51	0.50	149,053
Pension income and subsidy related variables									
Pension income (PI, 100€)	9.67	5.84	4,442,832	10.37	5.77	2,612,035	7.06	2.25	149,053
Subsidy (100€)†	0.14	0.47	4,442,510	0.14	0.46	2,612,035	0.878	0.60	149,053
Subsidy recipient	0.13	0.33	4,442,649	0.13	0.33	2,612,036	0.30	0.46	149,053
PI w/o subsidy (100€)	9.53	5.90	4,442,510	10.22	5.84	2,612,035	6.83	2.32	149,053
Pension related characteristics									
CY	35.45	11.15	4,442,649	36.48	10.72	2,612,036	34.73	1.06	149,053
CY>35	0.64	0.48	4,442,649	0.69	0.46	2,612,036	0.63	0.48	149,053
aep	0.91	0.32	4,439,960	0.94	0.32	2,610,792	0.73	0.16	149,053
aep <0.75	0.34	0.47	4,442,649	0.30	0.46	2,612,036	0.56	0.50	149,053
Age at claiming pension	63.86	3.08	4,442,548	63.11	2.54	2,612,035	62.96	2.35	149,053
% claim disability pension	0.13	0.33	4,442,649	0.14	0.35	2,612,036	0.14	0.35	149,053
% claim unemployment pension	0.12	0.33	4,442,649	0.17	0.38	2,612,036	0.08	0.27	149,053
% claim women pension	0.09	0.29	4,442,649	0.13	0.33	2,612,036	0.25	0.43	149,053
Individual characteristics									
Birth year	1935.36	6.15	4,442,649	1936.41	2.97	2,612,036	1936.29	2.98	149,053
% male	0.58	0.49	4,442,649	0.61	0.49	2,612,036	0.35	0.48	149,053
% married	0.61	0.49	4,442,649	0.68	0.47	2,612,036	0.60	0.49	149,053
Number of children*	2.04	1.46	1,874,487	2.03	0.001	1,021,029	2.19	1.47	96,820
% private health insurance	0.11	0.31	4,442,649	0.11	0.31	2,612,036	0.09	0.29	149,053
% public health insurance	0.84	0.37	4,442,649	0.84	0.36	2,612,036	0.87	0.33	149,053

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 33 - 36. 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	72.53	3.63	72.52	3.68	72.53	3.59	71.71	3.82	71.83	3.82	71.68	3.82
Dying before 65	0.05	0.22	0.06	0.24	0.05	0.22	0.06	0.23	0.06	0.24	0.06	0.23
Dying before 70	0.22	0.42	0.22	0.42	0.22	0.42	0.31	0.46	0.29	0.46	0.31	0.46
Dying before 75	0.47	0.50	0.46	0.50	0.47	0.50	0.59	0.49	0.58	0.49	0.60	0.49
Pension income and subsidy related variables												
Pension income (PI, 100€)	6.40	2.21	6.23	1.79	6.53	2.47	8.29	1.77	6.86	1.07	8.65	1.73
Subsidy (100€)	0.33	0.53	0.72	0.59	0.04	0.18	0.06	0.24	0.27	0.48	0.00	0.03
Subsidy recipient	0.40	0.49	0.86	0.34	0.06	0.24	0.10	0.30	0.45	0.50	0.01	0.09
PI w/o subsidy (100€)	6.07	2.21	5.51	1.69	6.49	2.44	8.23	1.81	6.59	1.02	8.65	1.73
Pension related characteristics												
CY	34.70	1.06	35.42	0.49	34.16	1.05	34.79	1.05	35.43	0.49	34.62	1.09
CY>35	0.62	0.49	1.00	0.00	0.33	0.47	0.65	0.48	1.00	0.00	0.56	0.50
aep	0.68	0.15	0.60	0.08	0.75	0.16	0.81	0.15	0.63	0.08	0.86	0.13
aep <0.75	0.69	0.46	1.00	0.00	0.46	0.50	0.32	0.47	1.00	0.00	0.15	0.36
Age at claiming pension	62.57	2.37	62.31	2.26	62.77	2.43	63.68	2.13	63.63	2.08	63.69	2.15
% disability pension	0.13	0.33	0.19	0.40	0.08	0.27	0.17	0.37	0.23	0.42	0.15	0.36
% unemployment pension	0.03	0.18	0.03	0.17	0.04	0.19	0.15	0.36	0.09	0.29	0.17	0.38
% women's pension	0.38	0.49	0.36	0.48	0.40	0.49	0.00	0.00	0.00	0.00	0.00	0.00
Individual characteristics												
Birth year	1936.29	2.98	1936.04	2.97	1936.47	2.98	1936.31	2.97	1936.64	2.95	1936.22	2.96
% married	0.59	0.49	0.61	0.49	0.58	0.49	0.61	0.49	0.62	0.49	0.60	0.49
Number of children†	2.19	1.47	2.31	1.46	2.10	1.48	0.11	0.55	0.09	0.51	0.11	0.57
% private health insurance	0.06	0.23	0.05	0.23	0.06	0.24	0.15	0.36	0.22	0.41	0.14	0.34
% public health insurance	0.91	0.29	0.91	0.28	0.91	0.29	0.80	0.40	0.73	0.44	0.82	0.39
Observations	96,820		41,472		55,348		52,233		10,719		41,514	

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 33 and 36. 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: Sample selection.

	From full RTWF sample to baseline		
	All	Women	Men
	(1)	(2)	(3)
Eligibility ($D \times Above35$)	-0.008	-0.012	-0.002
	(0.008)	(0.008)	(0.006)
	[0.391]	[0.266]	[0.719]
aep< 0.75	0.004	-0.000	0.006
	(0.006)	(0.005)	(0.007)
	[0.531]	[0.922]	[0.459]
Obs	9,484,551	3,080,889	6,403,662
Adj. R-sqr	0.362	0.472	0.263
Contribution year FE	✓	✓	✓
Birth cohort FE	✓	✓	✓
Controls	✓	✓	✓
PI without subsidy	✓	✓	✓

Notes: Baseline sample defined as: residing in West Germany, holding German nationality, perceiving old-age pension, cohorts 1932 - 1942, aep_i between 0.45 and 1.05, contribution years between 33 and 36. Full sample includes anyone who died after age 60 while claiming or contributing to any pension, and born after 1900. Controls include indicators for having children, marital status, and not having health insurance. 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.4: 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	0.019		
	(0.015)		
	[0.227]		
Dying between 75-80		0.009	
		(0.008)	
		[0.406]	
Dying between 80-85			-0.003
			(0.003)
			[0.431]
Panel B: Women			
Dying between 50-60	0.016		
	(0.028)		
	[0.582]		
Dying between 75-80		0.005	
		(0.014)	
		[0.938]	
Dying between 80-85			0.014
			(0.008)
			[0.156]
Panel C: Men			
Dying between 50-60	0.000		
	(0.016)		
	[0.984]		
Dying between 75-80		0.027	
		(0.013)	
		[0.094]	
Dying between 80-85			-0.005
			(0.009)
			[0.590]
Obs (all)	29,805	87,409	100,631
Obs (women)	15,334	55,128	60,144
Obs (men)	14,471	32,281	40,487
Contribution year FE	✓	✓	✓
Birth cohort FE	✓	✓	✓
Controls	✓	✓	✓
PI without subsidy	✓	✓	✓

Notes: Column (1) shows the impact on the probability of dying between 50 and 60 by using cohorts born between 1945 and 1955, for which we observe the complete death 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 (2) shows the impact on the probability of dying between 75 and 80 by using 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 cohorts born between 1922 and 1931, for which we observe the complete death counts between ages 80 and 85. All regressions restrict to individuals with 33 - 36 contribution years and aep between 0.45 and 1.05. 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.5: 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
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.5 describes main output variables used from the SHARE-RV.
Source: SHARE data documentation.

Table A.6: 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.6 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.7: 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.7 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.8: Event study estimates in baseline sample.

	(aep<0.75) × quarters of contribution														
	33Q1	33Q2	33Q3	33Q4	34Q1	34Q2	34Q3	35Q1	35Q2	35Q3	35Q4	36Q1	36Q2	36Q3	36Q4
Panel A: First stage															
Recipient	0.009**	0.004	0.010**	0.000	0.002	0.004	0.006*	0.605***	0.703***	0.718***	0.726***	0.729***	0.724***	0.730***	0.748***
	(0.004)	(0.003)	(0.003)	(0.005)	(0.005)	(0.003)	(0.004)	(0.015)	(0.011)	(0.010)	(0.007)	(0.009)	(0.011)	(0.008)	(0.008)
	[0.027]	[0.263]	[0.011]	[0.947]	[0.657]	[0.236]	[0.080]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Subsidy	0.011**	0.008*	0.013**	0.007	0.005	0.007**	0.008**	0.468***	0.584***	0.599***	0.609***	0.638***	0.644***	0.633***	0.659***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)	(0.002)	(0.004)	(0.014)	(0.020)	(0.019)	(0.022)	(0.025)	(0.025)	(0.019)	(0.026)
	[0.005]	[0.053]	[0.007]	[0.148]	[0.327]	[0.011]	[0.041]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Pension income	0.011**	0.008*	0.013**	0.007	0.005	0.007**	0.008**	0.468***	0.584***	0.599***	0.609***	0.638***	0.644***	0.633***	0.659***
	(0.003)	(0.003)	(0.003)	(0.004)	(0.005)	(0.002)	(0.004)	(0.014)	(0.020)	(0.019)	(0.022)	(0.025)	(0.025)	(0.019)	(0.026)
	[0.005]	[0.053]	[0.007]	[0.148]	[0.327]	[0.011]	[0.041]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Panel B: Impact on mortality															
Age at death	0.022	0.027	0.123	-0.051	0.039	0.007	0.121	0.241**	0.042	0.164	0.246*	0.269*	0.094	0.173	0.120
	(0.134)	(0.161)	(0.092)	(0.105)	(0.120)	(0.132)	(0.123)	(0.098)	(0.148)	(0.121)	(0.123)	(0.145)	(0.123)	(0.097)	(0.136)
	[0.870]	[0.866]	[0.209]	[0.616]	[0.744]	[0.955]	[0.354]	[0.023]	[0.796]	[0.219]	[0.071]	[0.093]	[0.446]	[0.105]	[0.398]
Dying before 65	-0.002	0.001	-0.006	-0.003	0.005	-0.007	-0.004	-0.020***	-0.011	-0.009	-0.006	-0.013**	-0.005	-0.011*	-0.005
	(0.008)	(0.007)	(0.006)	(0.005)	(0.005)	(0.008)	(0.006)	(0.004)	(0.007)	(0.007)	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)
	[0.806]	[0.900]	[0.271]	[0.460]	[0.345]	[0.369]	[0.577]	[0.000]	[0.163]	[0.262]	[0.345]	[0.017]	[0.256]	[0.051]	[0.370]
Dying before 70	-0.005	0.001	-0.002	0.006	0.000	-0.010	-0.006	-0.019*	-0.001	-0.019	-0.035**	-0.027	-0.014	-0.017	-0.013
	(0.014)	(0.022)	(0.011)	(0.013)	(0.016)	(0.014)	(0.017)	(0.010)	(0.017)	(0.013)	(0.013)	(0.015)	(0.014)	(0.012)	(0.017)
	[0.703]	[0.970]	[0.870]	[0.612]	[0.995]	[0.451]	[0.702]	[0.091]	[0.975]	[0.177]	[0.007]	[0.110]	[0.354]	[0.203]	[0.464]
Dying before 75	-0.007	-0.003	-0.021	-0.001	-0.012	-0.007	-0.014	-0.019	0.003	-0.016	-0.025	-0.028	-0.009	-0.017	-0.018
	(0.018)	(0.022)	(0.016)	(0.015)	(0.014)	(0.020)	(0.017)	(0.013)	(0.019)	(0.016)	(0.015)	(0.017)	(0.019)	(0.013)	(0.018)
	[0.722]	[0.904]	[0.221]	[0.964]	[0.404]	[0.747]	[0.432]	[0.182]	[0.898]	[0.342]	[0.145]	[0.127]	[0.623]	[0.198]	[0.337]
Panel C: Impact on labour supply															
Age at claiming pension	0.061	0.018	-0.097	-0.038	-0.046	-0.065	-0.058	-0.020	-0.025	-0.038	-0.054	-0.087	-0.023	-0.055	-0.037
	(0.059)	(0.083)	(0.084)	(0.082)	(0.059)	(0.077)	(0.071)	(0.065)	(0.063)	(0.090)	(0.073)	(0.089)	(0.083)	(0.071)	(0.088)
	[0.328]	[0.833]	[0.274]	[0.647]	[0.470]	[0.458]	[0.484]	[0.771]	[0.695]	[0.722]	[0.512]	[0.367]	[0.787]	[0.479]	[0.683]
Obs	149,053														
Contribution year FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Birth cohort FE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
PI without subsidy	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Notes: Estimates for baseline sample. Restrictions: 1932-1942 birth cohorts, 33-36 contribution years, 0.45-1.05 aep. Controls include having children, not having health insurance, and 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	-0.015***	-0.007	-0.029**
	(0.004)	(0.005)	(0.010)
	[0.000]	[0.202]	[0.011]
Dying between 70 - 75	0.007	0.003	0.006
	(0.004)	(0.005)	(0.009)
	[0.112]	[0.617]	[0.467]
Dying within 4 years	-0.004	-0.004	-0.016*
	(0.004)	(0.004)	(0.008)
	[0.256]	[0.340]	[0.072]
Dying within 8 years	-0.009*	-0.006	-0.025**
	(0.005)	(0.006)	(0.010)
	[0.094]	[0.288]	[0.031]
Dying within 12 years	-0.012*	-0.016**	-0.013
	(0.007)	(0.007)	(0.011)
	[0.098]	[0.044]	[0.264]
Obs	149,053	96,820	52,233
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 4, 8, and 12 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 (having children, 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]	[0.25,1.25]	[0.45,1.05]	[0.45, 1.05]	[0.45, 1.05]
CY $\in$	33 - 36	33 - 36	33 - 36	33 - 36	30 - 40	33 - 36	33 - 36
exactly at 35 CY	keep	drop	keep	keep	keep	keep	keep
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel A: First stage							
Recipient	0.694***	0.718***	0.621***	0.713***	0.734***	0.685***	0.699***
	(0.008)	(0.008)	(0.008)	(0.007)	(0.008)	(0.008)	(0.012)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Subsidy	0.581***	0.612***	0.306***	0.631***	0.654***	0.548***	0.617***
	(0.019)	(0.021)	(0.008)	(0.016)	(0.023)	(0.023)	(0.017)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Pension income	0.581***	0.612***	0.306***	0.631***	0.654***	0.548***	0.617***
	(0.019)	(0.021)	(0.008)	(0.016)	(0.023)	(0.023)	(0.017)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Panel B: Impact on mortality							
Age at death	0.138**	0.109**	0.105**	0.131**	0.140**	0.113**	0.136*
	(0.036)	(0.040)	(0.038)	(0.030)	(0.029)	(0.033)	(0.051)
	[0.006]	[0.027]	[0.020]	[0.002]	[0.001]	[0.010]	[0.062]
Dying before 65	-0.009***	-0.006**	-0.007**	-0.009***	-0.007**	-0.008***	-0.010***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.001)	(0.002)	(0.003)
	[0.000]	[0.008]	[0.002]	[0.000]	[0.001]	[0.000]	[0.000]
Dying before 70	-0.015**	-0.014**	-0.013**	-0.014**	-0.016**	-0.012**	-0.014***
	(0.004)	(0.005)	(0.005)	(0.004)	(0.004)	(0.005)	(0.005)
	[0.004]	[0.015]	[0.035]	[0.007]	[0.003]	[0.024]	[0.000]
Dying before 75	-0.008	-0.007	-0.002	-0.007	-0.011**	-0.008	-0.007
	(0.006)	(0.006)	(0.009)	(0.005)	(0.004)	(0.005)	(0.008)
	[0.191]	[0.291]	[0.834]	[0.198]	[0.025]	[0.166]	[0.312]
Panel C: Impact on labor supply							
Age at claiming pension	-0.032	-0.053	-0.073*	-0.012	-0.165***	-0.014	-0.068
	(0.034)	(0.037)	(0.038)	(0.024)	(0.036)	(0.031)	(0.041)
	[0.377]	[0.194]	[0.089]	[0.653]	[0.000]	[0.658]	[0.188]
Obs	149,053	134,148	81,508	185,429	401,932	172,458	95,740
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 $aep \in [0.6 - 0.9]$. Column (4) takes individuals with $aep \in [0.25 - 1.25]$ and with 20-50 contribution years, in line with the SHARE-RV baseline sample restrictions. Column (5) expands the cohorts restriction to 1932-1948. Column (6) restricts the baseline sample to those born between 1932 and 1937. 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**			
$aep \in$	[0.45,1.05]	[0.8,1.25]	[1.0,1.4]	[0.45,1.05]	[0.45,1.05]
CY	[33,36]	[33,36]	[33,36]	[29,32]	[37,40]
cutoff: $aep <$	0.75	1.0	1.2	0.75	0.75
cutoff: $CY \geq$	35	35	35	30	39
	(1)	(2)	(3)	(4)	(5)
Panel A: First stage					
Recipient	0.694***	0.025***	0.035**	0.001	0.016**
	(0.008)	(0.002)	(0.006)	(0.001)	(0.004)
	[0.000]	[0.000]	[0.002]	[0.526]	[0.006]
Subsidy	0.581***	0.019***	0.023***	0.000	0.068***
	(0.019)	(0.002)	(0.004)	(0.002)	(0.006)
	[0.000]	[0.000]	[0.001]	[0.838]	[0.000]
Pension income	0.581***	0.019***	0.023**	0.000	0.068***
	(0.019)	(0.002)	(0.004)	(0.002)	(0.006)
	[0.000]	[0.000]	[0.001]	[0.838]	[0.000]
Panel B: Impact on mortality					
Age at death	0.138**	0.005	-0.254	-0.022	0.051
	(0.036)	(0.035)	(0.173)	(0.028)	(0.030)
	[0.006]	[0.881]	[0.193]	[0.432]	[0.119]
Dying before 65	-0.009***	-0.001	0.024**	0.000	0.000
	(0.002)	(0.002)	(0.009)	(0.002)	(0.002)
	[0.000]	[0.496]	[0.019]	[0.883]	[0.979]
Dying before 70	-0.015**	0.000	0.031	0.004	-0.005
	(0.004)	(0.004)	(0.017)	(0.004)	(0.003)
	[0.004]	[0.947]	[0.114]	[0.332]	[0.118]
Dying before 75	-0.008	-0.006	0.010	0.003	-0.002
	(0.006)	(0.006)	(0.018)	(0.005)	(0.003)
	[0.191]	[0.336]	[0.603]	[0.508]	[0.548]
Panel C: Impact on labor supply					
Age at claiming pension	-0.032	0.002	-0.060	-0.100**	-0.106**
	(0.034)	(0.009)	(0.091)	(0.025)	(0.025)
	[0.377]	[0.865]	[0.521]	[0.009]	[0.005]
Obs	149,053	225,276	71,534	107,589	236,877

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. Columns (2) and (3) takes the same contribution year restriction but varying the aep restriction and cut-offs. Column (2) restricts aep to be between 0.8 and 1.25 with a placebo cut-off at 1.0, column (3) restricts aep to be between 1.0 and 1.4 with a placebo cut-off at 1.2. Columns (6) and (7) takes the same aep restriction but varying the contribution years restriction and cut-offs. Column (4) restricts contribution year to 29 and 32 years with a placebo cutoff at 30, column (5) restricts contribution year to be between 37 and 40 with placebo cut-off at 39. 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: P-value on significance in difference of point estimates for heterogeneous effects (Table 2 and Table A.13)

	Table 2				Table A.13	
	Gender	Marital status	Subsidy size	Health insurance	Child	Marital status
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: First stage						
Recipient	0.000	0.000	0.000	0.000	0.000	0.000
Subsidy	0.000	0.474	0.000	0.000	0.000	0.661
Pension income	0.474	0.920	0.000	0.000	0.000	0.661
Panel B: Impact on mortality						
Age at death	0.031	0.888	0.144	0.927	0.454	0.955
Dying before 65	0.433	0.126	0.834	0.463	0.612	0.523
Dying before 70	0.029	0.709	0.245	0.932	0.269	0.879
Dying before 75	0.080	0.400	0.113	0.447	0.286	0.762
Panel C: Impact on labour supply						
Age at claiming pension	0.001	0.298	0.926	0.056	0.460	0.068

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) (3) and (4) report differences by gender (women - men), by marital status (married - not married), by subsidy size (high - low) and by type of health insurance (public - private), corresponding to the estimates in Table 2. Columns (5) and (6) report the differences by having children (yes-no) and by marital status (married - not married) for women, corresponding to the estimates in Table A.13. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Source: Authors' calculations from the RTWF data.

Table A.13: Heterogeneity effects by marital status and 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	0.677***	0.753***	0.687***	0.789***	0.315***	0.645***
	(0.011)	(0.008)	(0.010)	(0.008)	(0.010)	(0.014)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Subsidy	0.611***	0.618***	0.612***	0.779***	0.205***	0.363***
	(0.015)	(0.020)	(0.015)	(0.028)	(0.010)	(0.019)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Pension income	0.611***	0.618***	0.612***	0.779***	0.205***	0.363***
	(0.015)	(0.020)	(0.015)	(0.028)	(0.010)	(0.019)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Impact on mortality						
Age at death	0.038	0.030	0.012	0.131	0.285***	0.089
	(0.061)	(0.106)	(0.044)	(0.154)	(0.072)	(0.096)
	[0.545]	[0.805]	[0.796]	[0.420]	[0.000]	[0.396]
Dying before 65	0.001	-0.004	-0.002	0.004	-0.002	-0.011
	(0.003)	(0.005)	(0.003)	(0.010)	(0.005)	(0.006)
	[0.826]	[0.488]	[0.530]	[0.722]	[0.623]	[0.134]
Dying before 70	-0.006	-0.004	-0.001	-0.019	-0.034**	-0.013
	(0.005)	(0.011)	(0.004)	(0.015)	(0.012)	(0.010)
	[0.290]	[0.757]	[0.795]	[0.223]	[0.008]	[0.215]
Dying before 75	-0.005	0.001	0.003	-0.027	-0.031**	-0.004
	(0.009)	(0.017)	(0.006)	(0.027)	(0.009)	(0.014)
	[0.651]	[0.958]	[0.627]	[0.353]	[0.003]	[0.787]
Impact on labour supply						
Age at claiming pension	-0.105**	-0.214**	-0.121**	-0.191	-0.095*	0.241**
	(0.039)	(0.051)	(0.037)	(0.105)	(0.044)	(0.071)
	[0.025]	[0.003]	[0.009]	[0.112]	[0.052]	[0.011]
Obs	57,416	32,638	84,114	12,706	31,753	18,910
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. With respect to bootstrapped p-values: *** p<0.01, ** p<0.05, * p<0.1. *Source*: Authors' calculations from the RTWF data.

Table A.14: Heterogeneity effects by subsidy size and gender (DID estimates)

	Women				*Men*			
	Baseline	**Treatment heterogeneity samples**			**Baseline**	**Treatment heterogeneity samples**		
Treatment $aep \in$	[0.45,0.75]	[0.25,0.45]	[0.45,0.61]	[0.61,0.75]	[0.45,0.75]	[0.25,0.45]	[0.45,0.61]	[0.61,0.75]
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
First stage								
Recipient	0.705***	0.728***	0.772***	0.629***	0.440***	0.603***	0.414***	0.459***
	(0.009)	(0.023)	(0.011)	(0.008)	(0.007)	(0.011)	(0.021)	(0.010)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Subsidy	0.632***	0.886***	0.937***	0.297***	0.267***	0.600***	0.405***	0.178***
	(0.015)	(0.026)	(0.028)	(0.006)	(0.009)	(0.008)	(0.024)	(0.005)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Pension income	0.632***	0.886***	0.937***	0.297***	0.267***	0.600***	0.405***	0.178***
	(0.015)	(0.026)	(0.028)	(0.006)	(0.009)	(0.008)	(0.024)	(0.005)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Impact on mortality								
Age at death	0.028	0.054	0.025	0.028	0.234**	0.392**	0.496***	0.068
	(0.048)	(0.066)	(0.049)	(0.054)	(0.068)	(0.138)	(0.083)	(0.089)
	[0.575]	[0.421]	[0.604]	[0.646]	[0.009]	[0.023]	[0.000]	[0.412]
Dying before 65	-0.001	0.000	0.001	-0.002	-0.005	-0.006	-0.011**	-0.001
	(0.003)	(0.005)	(0.003)	(0.003)	(0.003)	(0.007)	(0.004)	(0.004)
	[0.821]	[0.946]	[0.818]	[0.538]	[0.150]	[0.423]	[0.014]	[0.767]
Dying before 70	-0.004	-0.006	-0.004	-0.004	-0.030**	-0.032	-0.057***	-0.012
	(0.004)	(0.008)	(0.005)	(0.005)	(0.010)	(0.018)	(0.011)	(0.011)
	[0.355]	[0.458]	[0.410]	[0.475]	[0.012]	[0.109]	[0.001]	[0.266]
Dying before 75	-0.002	-0.017*	-0.006	0.004	-0.023**	-0.055**	-0.049***	-0.007
	(0.008)	(0.009)	(0.009)	(0.008)	(0.010)	(0.019)	(0.013)	(0.013)
	[0.829]	[0.097]	[0.493]	[0.654]	[0.049]	[0.031]	[0.000]	[0.556]
Impact on labour supply								
Age at claiming pension	-0.172**	-0.190*	-0.265**	-0.070	0.037	-0.076	0.060	0.022
	(0.044)	(0.101)	(0.039)	(0.069)	(0.036)	(0.138)	(0.072)	(0.042)
	[0.005]	[0.085]	[0.002]	[0.394]	[0.350]	[0.600]	[0.435]	[0.600]
Obs	96,820	69,701	77,477	74,691	52,233	44,454	45,823	47,924
Contribution year FE	✓	✓	✓	✓	✓	✓	✓	✓
Birth cohort FE	✓	✓	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓	✓	✓
PI without subsidy	✓	✓	✓	✓	✓	✓	✓	✓

Notes: This table shows the impact of eligibility for the pension subsides by aep subgroups and gender. Columns 1 shows baseline results. Columns 2 and 6 keep the same control group as in baseline, but uses as treatment group individuals with $aep \in [0.25, 0.45]$, while keeping the same restrictions on birth cohorts and contribution years as in baseline. Columns 3 and 7 use individuals with $aep \in [0.45, 0.61)$ as treatment group. Columns 4 and 11 take individuals with $aep \in [0.61, 0.75)$ as treatment group. 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.15: Impact of subsidy eligibility on pension claiming pathways (DID estimates)

	All	**Women**	**Men**
	(1)	(2)	(3)
Disability pension	-0.027***	0.013	-0.034**
	(0.005)	(0.007)	(0.009)
	[0.000]	[0.104]	[0.000]
Pension for the unemployed	0.031***	-0.004**	0.035**
	(0.005)	(0.002)	(0.014)
	[0.000]	[0.004]	[0.047]
Women's pension	0.002	0.022**	-
	(0.005)	(0.008)	-
	[0.716]	[0.016]	-
Pension for long-term insured	0.014**	0.022*	0.041**
	(0.006)	(0.011)	(0.012)
	[0.023]	[0.055]	[0.018]
Obs	149,053	96,820	52,233
Contribution year FE	✓	✓	✓
Birth cohort FE	✓	✓	✓
Controls	✓	✓	✓
PI without subsidy	✓	✓	✓

Notes: This table shows the impact of being eligible for the pension subsidy on pension claiming pathways. Standard errors clustered by birth cohort are in parentheses, bootstrapped p-values in brackets. *** p<0.01, ** p<0.05, * p<0.1.
Source: Authors' calculations from the RTWF data.

Table A.16: Impact of pension income on mortality (IV estimates)

	All		Women		Men	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: First stage						
Pension income	0.579***	0.579***	0.632***	0.628***	0.267***	0.267***
(instr.=eligible)	(0.017)	(0.017)	(0.014)	(0.014)	(0.009)	(0.009)
Panel B: IV						
Impact on mortality						
Age at death	0.235***	0.251**	0.037	0.082	0.652***	0.608***
	(0.060)	(0.067)	(0.068)	(0.071)	(0.177)	(0.169)
	[0.008]	[0.010]	[0.617]	[0.301]	[0.009]	[0.008]
Dying before 65	-0.014***	-0.016***	-0.001	-0.007	-0.008	-0.004
	(0.003)	(0.003)	(0.003)	(0.004)	(0.008)	(0.009)
	[0.000]	[0.000]	[0.687]	[0.135]	[0.348]	[0.674]
Dying before 70	-0.026***	-0.028***	-0.007	-0.010	-0.071**	-0.067**
	(0.007)	(0.007)	(0.007)	(0.007)	(0.024)	(0.023)
	[0.005]	[0.005]	[0.343]	[0.186]	[0.019]	[0.022]
Dying before 75	-0.015	-0.015	-0.001	-0.002	-0.072**	-0.070**
	(0.010)	(0.010)	(0.012)	(0.012)	(0.028)	(0.028)
	[0.187]	[0.179]	[0.901]	[0.848]	[0.042]	[0.046]
Impact on labour supply						
Age at claiming pension	-0.071	-	-0.275***	-	0.130	-
	(0.057)	-	(0.057)	-	(0.097)	-
	[0.279]	-	[0.001]	-	[0.225]	-
First stage F-stat	22,000	22,000	16,000	16,000	6,058.48	6,070.35
Obs	149,053	149,053	116,515	116,515	68,914	68,914
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 A.17: 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€)	0.23	0.47	0.63	0.60	0.81	0.56	0.00	0.00	0.000
Subsidy recipient	0.30	0.46	0.78	0.41	1.00	0.00	0.00	0.00	-
PI w/o subsidy (100€)	6.83	2.32	5.73	1.64	5.65	1.63	6.01	1.62	0.000
Individual characteristics									
Birth year	1936.29	2.98	1936.16	2.98	1936.08	2.94	1936.44	3.07	0.000
% male	0.35	0.48	0.21	0.40	0.12	0.32	0.51	0.50	0.000
% married	0.60	0.49	0.61	0.49	0.59	0.49	0.69	0.46	0.000
Number of children†	2.19	1.47	2.31	1.46	2.28	1.44	2.51	1.57	0.000
% private health insurance	0.09	0.29	0.09	0.28	0.05	0.22	0.22	0.41	0.000
% public health insurance	0.87	0.33	0.88	0.33	0.92	0.28	0.73	0.44	0.000
Obs.	149,053		52,191		40,681		11,510		
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.17 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.18: Impact of pension income on other diseases (IV estimates)

	All		Women		Men	
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: First stage						
Pension income (100€)	0.414***	0.440***	0.416***	0.431***	0.573***	0.580***
	(0.037)	(0.037)	(0.044)	(0.044)	(0.077)	(0.076)
Panel B: IV						
Has cancer	0.032	0.037	-0.030	-0.019	0.045	0.040
	(0.063)	(0.060)	(0.069)	(0.067)	(0.112)	(0.110)
Has parkinson	0.014	0.013	0.024*	0.024*	-0.003	-0.003
	(0.009)	(0.009)	(0.014)	(0.014)	(0.003)	(0.004)
Had hip femoral fracture	-0.006	-0.009	-0.033	-0.034	-0.049	-0.053
	(0.034)	(0.032)	(0.030)	(0.031)	(0.081)	(0.080)
Has diabetes	0.010	-0.014	0.136	0.105	-0.119	-0.110
	(0.095)	(0.091)	(0.106)	(0.103)	(0.185)	(0.183)
First stage F-stat	124.30	141.60	87.53	96.23	55.86	58.70
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.19: 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	0.736***	0.908***	0.531***	0.239***	0.167**	0.455***
	(0.109)	(0.119)	(0.162)	(0.059)	(0.073)	(0.106)
Panel B: IV						
CASP	0.761**	0.015	3.796**	0.911	-0.186	1.944**
	(0.369)	(0.349)	(1.507)	(0.706)	(1.169)	(0.763)
Self-reported health	0.126	-1.064***	2.852**	1.439*	0.047	3.093***
	(0.338)	(0.366)	(1.216)	(0.797)	(1.278)	(1.095)
Depression index	-0.783**	0.157	-1.582*	-1.209	0.797	-2.119**
	(0.339)	(0.364)	(0.850)	(0.791)	(1.406)	(0.842)
Number of chronic diseases	-0.294	0.423	-2.238**	-2.876***	-2.577	-2.708***
	(0.380)	(0.396)	(1.037)	(0.961)	(1.651)	(0.916)
Difficulties with ADLAs	-0.048	0.783	0.710	-0.276	0.143	-0.955*
	(0.522)	(0.579)	(0.505)	(0.530)	(0.974)	(0.573)
Long hospital stay ($\geq$14)	0.150*	0.155**	0.448	-0.388**	-0.562*	-0.136
	(0.079)	(0.073)	(0.492)	(0.163)	(0.303)	(0.142)
Lack of money stops	-0.432	-0.279	-0.256	-1.264*	-1.924	-1.810**
	(0.335)	(0.357)	(0.795)	(0.740)	(1.408)	(0.787)
Feel full of opportunities	1.144***	0.673*	1.490	0.717	-0.842	2.058**
	(0.438)	(0.401)	(1.613)	(0.710)	(1.189)	(0.872)
Future looks good	1.074***	0.413	3.695**	0.688	-0.175	1.688**
	(0.384)	(0.390)	(1.495)	(0.716)	(1.272)	(0.851)
Days/week alcohol (last 6 months)	0.102	0.149	0.746	0.523	1.557	-1.281*
	(0.393)	(0.396)	(0.956)	(0.850)	(1.449)	(0.710)
Ever smoked daily	-0.668***	-0.763***	0.064	-0.029	0.988	-0.503
	(0.211)	(0.182)	(0.752)	(0.352)	(0.767)	(0.331)
Observations	487	199	288	676	470	206
First stage F-stat	41.76	47.31	9.52	15.66	4.79	15.29
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.20: Heterogeneity by any household member owning a house (IV estimates)

	Home ownership			Without home ownership		
	All	Women	Men	All	Women	Men
	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: First stage						
Pension income	0.358***	0.350***	0.350***	0.528***	0.560***	0.586***
	(0.043)	(0.049)	(0.049)	(0.067)	(0.073)	(0.142)
Panel B: IV						
CASP	0.642**	-0.235	1.338*	0.566	-0.161	2.734***
	(0.315)	(0.394)	(0.698)	(0.356)	(0.345)	(0.962)
Self-reported heatlh	0.473	-0.850*	2.839***	0.713**	0.077	2.364**
	(0.344)	(0.445)	(0.986)	(0.356)	(0.343)	(0.963)
Depression index	-0.379	0.581	-0.642	-0.544	0.271	-2.567***
	(0.321)	(0.439)	(0.599)	(0.367)	(0.373)	(0.871)
Number of chronic diseases	-0.858***	-0.009	-3.926***	-0.271	0.122	-2.193***
	(0.327)	(0.362)	(1.218)	(0.345)	(0.378)	(0.830)
Difficulties with ADLAs	-0.538*	0.289	-2.402***	-0.023	0.337	-0.744
	(0.325)	(0.460)	(0.828)	(0.404)	(0.407)	(0.840)
Long hospital stay ($\geq$14)	-0.051	0.018	-0.062	-0.030	-0.031	-0.183
	(0.067)	(0.082)	(0.149)	(0.074)	(0.062)	(0.188)
Lack of money stops	-0.345	-0.244	-0.485	-0.480	-0.174	-1.029
	(0.327)	(0.408)	(0.731)	(0.345)	(0.344)	(0.909)
Feel full of opportunities	0.995***	0.053	2.282***	0.316	0.029	2.027**
	(0.329)	(0.401)	(0.847)	(0.354)	(0.360)	(0.866)
Future looks good	0.214	-0.423	1.221*	1.206***	0.728**	3.295***
	(0.325)	(0.416)	(0.683)	(0.359)	(0.354)	(1.050)
Days/week alcohol (last 6 months)	0.086	-0.170	-0.902	-0.222	0.048	-1.342
	(0.412)	(0.486)	(0.893)	(0.419)	(0.452)	(1.293)
Ever smoked daily	-0.185	0.016	-0.137	-0.681***	-0.751***	-0.525
	(0.158)	(0.188)	(0.339)	(0.196)	(0.216)	(0.383)
Observations	1,468	852	616	860	513	347
First stage F-stat	68.60	51.60	17.95	62.94	58.44	17.10
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.21: 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	72.42	71.62	0.000	RTWF
Dying before 65	0.06	0.06	0.000	RTWF
Dying before 70	0.26	0.35	0.000	RTWF
Dying before 75	0.48	0.60	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.21 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.22: Impacts of eligibility on sickness leaves before age 50 (VSKT Data)

	CY 30–40			CY 33–36		
	Full sample	Women	Men	Full sample	Women	Men
	(1)	(2)	(3)	(4)	(5)	(6)
Duration of sickness before age 50	1.110***	0.681*	5.606***	-0.256	-0.702	4.512**
	(0.401)	(0.365)	(1.823)	(0.465)	(0.461)	(2.121)
	[0.002]	[0.054]	[0.009]	[0.595]	[0.142]	[0.031]
Mean Dep. Variable	1.296	1.169	1.865	1.460	1.266	2.309
Prob (sick leave before age 50)	0.074*	0.069	0.157	-0.073	-0.101**	0.254
	(0.044)	(0.046)	(0.132)	(0.045)	(0.047)	(0.157)
	[0.074]	[0.143]	[0.241]	[0.118]	[0.031]	[0.132]
Mean Dep. Variable	0.218	0.207	0.271	0.228	0.215	0.288
Duration of sickness before age 55	1.907***	1.617***	6.005***	-0.787	-1.126*	3.144
	(0.511)	(0.485)	(2.236)	(0.607)	(0.587)	(3.059)
	[0.000]	[0.000]	[0.009]	[0.201]	[0.061]	[0.301]
Mean Dep. Variable	1.798	1.635	2.530	1.987	1.755	3.003
Prob (sick leave before age 55)	0.122***	0.114**	0.195	-0.079*	-0.113**	0.250
	(0.046)	(0.050)	(0.131)	(0.048)	(0.050)	(0.154)
	[0.012]	[0.028]	[0.130]	[0.107]	[0.029]	[0.132]
Mean Dep. Variable	0.256	0.245	0.308	0.266	0.252	0.324
Contribution year FE	✓	✓	✓	✓	✓	✓
Birth cohort FE	✓	✓	✓	✓	✓	✓
Controls	✓	✓	✓	✓	✓	✓
PI without subsidy	✓	✓	✓	✓	✓	✓
Contribution Years (CY) Range		30–40			33–36	
Observations	2924	2517	407	1021	908	113

Notes: Table A.22 reports the impact of eligibility for the subsidy on health status before retirement, proxied by duration of sickness and probability of taking sick leave before age 50 and 55. Estimates are shown for the full sample, women, and men. Sample restriction: West German pensioners born between 1932 and 1942 with 33 to 36 contribution years and average earning points at retirement between 0.45 and 1.05. The two samples differ by the restriction on Contribution Years (CY): 30–40 vs. 33–36. All regressions control for contribution year and birth cohort fixed effects, as well as additional covariates. Duration is measured in months; sick leave dummy equals 1 if any sickness occurred before the age threshold.
Source: Authors' calculations from 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]

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

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).

Workers can claim the standard old-age pension (SGB VI §235) at age 65 throughout our sample period. The eligibility condition is at least 5 years of contributions. For cohorts 1947 to 1964, this age will gradually increase by one month for each birth-year from age 65 to 67. These changes began in 2012 and will be complete in 2030 (See SGB VI §235(2)).

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 penalizing early claiming. The increase in statutory retirement age and the financial penalty for early claiming 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 women born between 1932 and 1942, The changes in ERA, FRA and the corresponding deductions when claim at the ERA remain rather stable.

Women could claim pension the earliest at age 60, either via the *women's pension*. Women with at least 15 years of contributions, of which at least 10 must have occurred after age 40, were eligible for the women's pathway. The penalty for retiring at 60 via women's pension was phased in gradually in monthly increments. The FRA for women's pension was increased from 60 to 65 by monthly steps since the cohort of 1941. 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.

Another way to claim pension as early as age 60 is via *pension for severely disabled*. Workers who have lost their earnings capacity can claim the old-age pension for disabled workers. This pathway is also referred to as invalidity pathway. The eligibility condition is having lost of at least 50% of one's earnings capacity and at least 35 years of waiting period, which include, for example, periods of raising a child who is less than 10 years old. The ERA for this pathway was 60 for our sample. It is scheduled to gradually increase to age 62 between the 1952 and 1963 cohorts. The FRA for retiring at 60 via disabled pension was increased gradually by 1 month for each month of birth from 60 to 63 for cohorts 1941 to 1943. It is scheduled to gradually increase from age 63 to 65 for the 1952 to 1963 cohorts.

Another possible way to claim pension at age 60 is via *old-age pension due to unemployment*. The eligibility requirements for the UI 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 a half, or in old-age part-time work. For cohorts younger than 1946, ERA

remained at 60. However, the FRA has increased gradually from 60 to 65 between the 1937 and 1941 cohorts. Therefore, for cohorts born after 1937, the penalty to claim at 60 ranges from 3.6% to 18%.

At age 63, workers with at least 35 years of contributions to claim the *old-age pension for long-term insured* as early as age 63 (SGB VI §236). The FRA without penalty for early claims was 63 until the 1936 cohort. It was increased gradually, in monthly steps, from age 63 to 65 for cohorts 1937 to 1938 and remained at 65 until the 1948 cohort. The ERA, meanwhile, remained stable at age 63. Hence, workers eligible for this pathway could always claim as early as age 63, however they faced an actuarial adjustment in the form of a 0.3% permanent pension reduction per each month they retired in advance of the FRA. For cohorts born after 1938, the penalty to claim at 63 remained at 7.2%.

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.4 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 after age 75 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.4 show that eligibility has no significant impact on probability of dying between these older ages.

D Details on IV Assumptions

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 has economically small impacts on 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.

E Details on Robustness

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, we enlarge the bandwidth of contribution years to 30-40 in column (5). Results remain similar to baseline estimates. Fourth, 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 (6)-(8) 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, and with the additional cohorts and larger CY bandwidth, respectively. Columns (7)-(11) 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. The only exception is Column (5), when we include retirees with less and more contribution years than our baseline bandwidth.

F 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

[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 $aep \in [0.45, 1.05]$.

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 10.4 months for men.

Our IV estimates for men imply a 6.7 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 6.7 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 183,785€.

Lastly, we calculate the fiscal cost of providing the subsidy. Given an average pre-subsidy pension income of 686€/month for men in our treatment group, a 100€ increase in monthly pension benefits will cost about 31,224€ 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 21.75 years or 261 months. Thus, the net cost of the additional life expectancy due to a subsidy of 100€/month for the average male recipient is 100€*(261+10.4)+686€*10.4, which is about 31,224€. 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 152,561€ on average per male subsidy recipient. pension subsidy program was cost-effective in increasing the life expectancy of male recipients.