Pension Reform: Disentangling Retirement and Savings Responses

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Abstract

In January 2006 the Dutch government implemented a pension reform that substantially reduced the pension wealth of workers born in 1950 or later. At the same time a tax facilitated savings plan was introduced that substantially reduced saving costs of all workers, irrespective of birth year. This paper uses linked administrative and survey data to assess the effect of the reform on savings and retirement behavior of two virtually identical male cohorts that only differ in their treatment status: the treated (born in 1950) and controls (born in 1949). We find that the average worker almost fully counters the unanticipated drop in public pension wealth, with later retirement. This is consistent with low substitution rates between private and public wealth for older workers. High wage earners participate more often in the tax facilitated saving program and treated workers who participate in this savings program fully compensate the loss in public pension wealth with private wealth. An unintended side effect of the introduction of the tax facilitated savings plan is that in particular high wage earners who are not affected by the pension reform decide to retire even sooner that initially planned.

Keywords: natural experiment, regression discontinuity, retirement behavior, labor supply, substitution between private and public pension wealth.

JEL codes: J26, H55, J14

1. Introduction

Most industrialized countries have sophisticated pension systems that provide substantial pension benefits after retirement. These benefits have important effects on employees' intertemporal work and savings choices. However, as a result of population ageing and declining fertility, many of these countries have started to implement major pension reforms aimed at increasing the labor supply of older workers. Of importance is whether and to what extend individuals adjust their retirement and savings plans in response to changes in pension wealth. This paper looks at the effect of a large and unanticipated change in pension wealth on private savings decisions and retirement expectations and realizations of Dutch public sector workers born in 1949 and 1950.

In the summer of 2005 it was announced by the public sector's pension fund that as of January 2006 the pension rights of those born in 1950 (or later) were substantially reduced, while the pension rights of those born in 1949 (or earlier) were unaffected. The 1949 cohort (aged 57 in 2006) could retire at age 62 and 3 months at 70% of their gross wages. For the 1950 cohort the gross replacement rate dropped to 64% if they wanted to retire at age 62 and 3 months, or they had to work an additional 13 months to obtain the 70% of their slightly older counterparts. At the same time of the pension reform in 2006, the Dutch government introduced the so called `Life course savings' (Levensloopregeling) program, a tax facilitated savings program that permitted tax-free savings of up to 12% of annual earnings in a fund that could be used to finance periods of non-employment, such as a sabbatical or early retirement. The introduction of the life course savings program thus enables all workers - those treated by the pension reform as well as those who are unaffected - to privately save at lower costs. Of relevance here is that the reform involved a permanent and substantial change in pension wealth, that it was unanticipated,

implemented within six months and announced late in the game for the cohorts that we consider. This all implies that workers had to reconsider previously made retirement and savings decisions.

How many additional months will the affected cohort work? Do they increase their private savings to (partly or fully) compensate for the loss in public pension wealth? To address these questions we use linked administrative and survey data over the period 2007-2014 in which we observe pension rights, individual retirement expectations, decisions to participate in savings programs and actual retirement choices of public sector workers born in 1949 and 1950. This setup enables us to apply a sharp regression discontinuity design to measure the short run response (one year after the implementation of the reform) and the longer run response (up to 8 years after the reform).

Our paper is of direct relevance for the retirement literature, but can also be placed in the literature on the substitution between public pension wealth and private savings. Reasoning along the lines of the standard life cycle model, public pension wealth will affect the accumulation of other forms of private savings. In a more general life cycle model with endogenous retirement the effect of public pension wealth is ambiguous (Feldstein, 1974). Moreover, the rate of substitution between private and public pension wealth depends on a range of factors, such as tax incentives, the relative rate of return rate to private assets, financial literacy, liquidity constraints, how myopic individuals are etc (Alessie, Angelini & van Santen, 2013). Therefore the degree of substitution between private and public savings in practice has often been the subject of many empirically oriented papers. It is found that private and public pension wealth are no perfect substitutes and that the degree of substitution varies across different studies (between around 20% to 67%, see for instance Feldstein (1974), Feldstein and Pellechio (1979), Gale (1998), Bernheim (2002), Engelhardt &Kumar (2011) and the literature

reviewed in Alessie et al. (2013). Attanasio & Rohwedder (2003) and Attanasio & Bruggiavini (2003) find that the degree of substitution between private and public pension wealth may also depend on the stage of the life cycle that individuals are in. Both studies find that the degree of substitution between private and public wealth decreases with age.

What is left implicit in the larger part of these studies is the role labor supply plays in the degree of substitution between private and public pension wealth. Labor supply is an important choice variable for older workers confronted with unexpected losses in pension wealth. Workers can in theory postpone retirement in such a way to fully compensate for the loss in pension wealth. This would imply that in the absence of additional savings, stabilization of post retirement income is the main motive and that this is derived at no loss in current consumption. This would be consistent with low substitution rates between private and public wealth for older workers. Low substitution rates between private and public pension wealth could also arise when workers choose not to increase savings, stick to the earlier planned retirement age and thus accept lower post-retirement income.

Our paper is closest to Botazzi et al. (2006) and McFall (2011). Botazzi et al. (2006) exploit a series of pension reforms that took place in Italy between 1992 and 1997 to estimate the effects of these reforms on households' retirement expectations and private wealth accumulations. In their analyses they effectively compare the pre-reform behavior of cohorts of private sector workers, public sector workers and self-employed with post-reform behavior. Their findings indicate that workers have revised their expectations in accordance with the incentives of the reforms and that there is a substantial off-set between private and perceived public pension wealth. McFall (2011) exploits the 2008 stock market crash to test whether retirement plans in the US in 2009 react to a wealth shock in a way that is consistent with a life

cycle model with retirement choice. She finds that among the 306 workers in her sample who hold private pension wealth, average wealth loss between July 2008 and June 2009 is associated with an increase in expected retirement of about 2.5 months.

Our study differs from these previous studies because we isolate a single and clear reform that led to a sharp discontinuity design, i.e. the assignment rule was simple and clear and implied a strong differential treatment of workers born around January 1, 1950. This approach has several advantages. First, the reform had an as good as exogenous 'bite' in pension rights applied to all treated workers in our estimation sample but not the workers in the control group. In McFall (2011) the effect of the stock market crash is confined to a specific group of workers, namely those holding private assets in sufficient amounts to influence retirement behavior.[1] Second, because we exclusively focus in our estimations on workers born in 1949 and 1950, the treatment and control groups are not subject to other differential policy treatments which can bias our results. In Botazzi et al. (2006) the treatment period covers a long period (1992-2000) and therefore it is not possible to isolate the differential impact of several pension reforms that occurred during this period. Moreover, their sample includes a wide age range and especially for the younger workers (entering the labor market after 1995) they are not able to fully exclude differential treatment in other domains of the social security system. Third, our paper includes detailed heterogeneity analyses which provide information on the extent to which the substitution rates between private and public wealth and labor supply differs with important worker characteristics. Finally, our results partly confirm the earlier results of Botazzi et al. (2006). Workers revise their expectations in accordance with the incentives provided by the pension reform. However, while they found that there is a substantial off-set between private and

[1] In this paper wealth is defined as wealth in checking, savings, money market accounts, bonds, mutual funds, stocks, and real estate (excluding primary homes).

perceived public pension wealth, we show that substitution rates between private and public wealth are generally low, but vary greatly with income.

More specifically, our analyses show that the treatment group immediately adjusts their retirement expectations with about 10 months. The drop in pension wealth is equivalent to 13 months of earlier retirement. The difference in expectations between the treated and untreated cohorts remained relatively stable in later years, Our results thus imply that the average treated worker repairs the drop in their pension rights mainly at the expense of leisure in retirement (10 months). However, the savings rate (as measured by participation in the tax facilitated life course savings program) is more than twice the savings rate of the controls. The group who participates in the savings program (16% of the treated and 7% of the controls) state that they expect to finance about 9 and 13 months of earlier retirement, for the control and treated cohort, respectively. For this group of participants in the savings program the difference of 4 months between the treated and controls can be interpreted as the pure crowding out effect induced by the drop in pension wealth, while the 9 months of saved earlier retirement of the control group can be interpreted as the impact of the reduction of savings costs (the tax exemption that applies to the life course savings program). Actual retirement, observed 8 years after the reform in 2014, was in strong accordance with previously expressed retirement expectations. Our findings thus show that individuals are forward looking and that the reform had the intended effect on the labor supply for the larger part of the workers, namely those who have no sufficient means to substantially increase private savings to counter the effect of the reform. For these workers substitution rates between private and public wealth are low. They are financially constraint and choose to sacrifice retirement years to maintain current and post retirement consumption. Seen from this perspective unanticipated reforms announced late in the game can be very effective. On

the other hand there is a group of mostly high wage workers who are less affected by the reform. These workers participate in the tax facilitated life course savings program and are therefore able to cushion the impact of the reform by private wealth. There exists thus considerable heterogeneity in the substitution rates between public and private wealth. A further unintended side effect of the introduction of the tax facilitated savings plan is that in particular high wage earners who are not affected by the drop in pension wealth decide to retire even sooner than initially planned.

This paper proceeds as follows. Section 2 describes the Dutch pension system and the 2006 reform of the public sector's pension system. Section 3 describes the data and variables used in the analyses. Section 4 presents the results of our empirical analyses. Finally, Section 5 summarizes and discusses the implications of our findings.

2. The Dutch pension system and the 2006 reform

2.1 The Dutch pension system

The Dutch pension system consists of three pillars. The first pillar is the AOW which is the basic public old age pension provided by the government to all residents of the Netherlands when they reach the statutory retirement age (65 in 2006). The AOW is a pay-as-you-go system in which current payments are financed by income taxes and provides a flat-rate pension benefit that is related to the net minimum wage.

The second pillar consists of earning-related sector pensions. These pension schemes are predominantly of the defined benefit type and fully funded. Sector pensions are negotiated between unions and employer organizations at the sector or firm level and are usually set forth in collective agreements. Participation is mandatory for individual workers, ensuring that each

worker is covered by sector pension. The Pensions and Savings Act (*Pensioen en Spaarfondsenwet*) until 2007 and the Pensions Act from 2007 onwards (*Pensioenwet*) dictates that the administration of the sector pension schemes in the second pillar is delegated to pension funds to which both employers and employees have to contribute. The sector pension schemes allow workers to retire before the statutory retirement age of the public pension. Until 2006, contributions to the sectoral early retirement schemes were tax deductible, which substantially increased their financial attractiveness. This tax advantage amounted to about 25% of the net early retirement allowance, which is partly a result of the progressive tax system (Euwals et al., 2006). Typically, contributions to the sector pension schemes were such that in 2006 a public sector employee who had served for 40 years in the public sector could retire at the age of 62 and three months at a gross replacement rate of 70% of average yearly earnings since 2004. As a result, early retirement, facilitated by preferential tax treatment of sector pension schemes, was the social norm in the Netherlands. Approximately 80% of all workers retired at the age of 62 or younger before 2006, and only 6% retired at the age of 65 (Statistics Netherlands, 2009).

The third pillar finally consists of all voluntarily built-up savings supplementary to the public and sector pensions. These are offered by private insurance companies and typically yield annuity payments at retirement age. Due to the well-established public and sector pension systems, the third pillar is less well developed in the Netherlands. It provides only 5% of the retirement income that is provided by the second pillar of the pension system (Bovenberg and Gradus, 2015).

2.2 The 2006 reform of the pension system

In 2006, the government abolished the favorable tax deductibility of contributions to early retirement schemes that are part of the second pillar of the Dutch pension system for all employees born in 1950 or later. In response to the abolishment of the favorable tax treatment, the government and the unions in the public sector negotiated in the summer of 2005 a new pension scheme that became effective on January 1st, 2006, for workers born in 1950 or later and for those born before 1950 who had not worked continuously in the public sector since April 1, 1997. This new scheme, called 'ABP Flexible Pension Scheme', is administered by the public sector's pension fund (Algemeen Burgelijk Pensioenfonds, (ABP)). In the Netherlands, like in other countries, there has been an ongoing debate about the sustainability of the pension system and the need to reform. Therefore, the announcement of a reform was not entirely unexpected. Unexpected was the speed at which the reform was implemented as well as the strong differential treatment of workers born around January 1, 1950, which came as a surprise when it was announced on July 5, 2005.

This new ABP Flexible Pension Scheme involves (i) a drop in pension benefits, (ii) a small increase in pension contribution payments to partly account for the drop in pension benefits resulting from (i), and (iii) stronger incentives to continue working, generated by penalties on pension income when retiring before the statutory pension age (AOW) and by supplements for later retirement. Furthermore, the eligibility age for early pension benefits is increased to 60 years and workers can decide to continue working until their 70th birthday.[1]

Workers born before 1950 remained entitled to the old, more generous early retirement scheme if they have worked continuously in the public sector since April 1, 1997. This means

[1] It is not mandatory for employers to keep employees when they become eligible for the AOW. They are allowed to discharge these employees when reaching the eligibility age.

that such workers can still retire early, between ages 55 and 65. Retirement at age 62 years and three months yields a pension benefit for those born before 1950 at a gross replacement rate of 70% of average yearly earnings since 2004 (equivalent to an annual benefit of €31.500 for the median worker in our sample). Due to the reform, a typical employee born in 1950 or later with 40 years of tenure obtains a gross replacement rate of 64% when retiring at the age of 62 years and three months (equivalent to an annual benefit of €28.500 for the median worker in our sample). To attain a replacement rate of 70%, these workers had to postpone retirement by 13 months.

At the time of the pension reform in 2006, the Dutch government also introduced the `Life course savings' (Levensloopregeling) program, a tax facilitated savings program. The program, open to all workers, irrespective of their year of birth, permitted tax-free savings of up to 12% of annual earnings in a fund that can be used to finance periods of non-employment, such as a sabbatical or early retirement.[2] The savings accounts were held at insurance companies, banks or subsidiary companies of pension funds. Various life course saving products were offered. Life course saving accounts could take the form of traditional savings, an investment account or a mix between both products. All workers are allowed to save up to a maximum of 210% of their annual earnings in the fund. At a gross replacement rate of 70% this would cover three years of early retirement. Those who were born in the years 1950 through 1954 and therefore had less time to save 210% than the older cohorts were allowed to save more than 12% of their annual earnings, as long as the cumulative maximum does not exceed 210% of annual earnings. It must be noted, however, that workers of the 1950 cohort must save approximately 16% of their annual earnings for six years to finance early retirement at age 62 (rather than at age

[2] It is compulsory for employers to allow their employees to take up leave that is financed by the Life course savings program.

63 and 1 month). It is likely that only a very small fraction of such workers are willing or capable of saving such a high share of their earnings each year before retirement. Nevertheless, we expect workers treated by the reform who do not wish to change their retirement plans but do plan to repair part of their pension wealth to invest more in these savings as, due to the tax exemption, it is the cheapest saving product in the Netherlands.

Besides the introduction of the ABP Flexible Pension Scheme, there are no other institutional changes that differentially affect the 1949 and 1950 cohort in 2006. We can therefore apply a sharp regression discontinuity design. For the internal validity of our research design it is crucial that workers born in 1950 are aware of the consequences of the new pension system for their individual situation. After the announcement of the reform in the summer of 2005, the pension fund ABP launched a massive campaign to inform its clients about the new pension and Life course savings scheme and to explain its financial implications. In a special newsletters unions, employer organizations and the ABP jointly explained the ABP Flexible Pension Scheme. Furthermore, all 1.2 million ABP members received a personalized letter about the core characteristics of the new scheme along with a complete electronic service package for public service employers. Therefore, one can assume that on January 1, 2006, most public sector employees born after 1949 and their employers were indeed familiar with the exogenous shock in their pension rights. Of course this needs to be verified empirically. We do this when discussing the descriptive analyses in the next section.

3. Data collection and descriptive analyses

3.1 Data collection

We use survey data that we match to administrative data for a panel of male full-time employees in the public sector who were born in 1949 or 1950.[3,4] The administrative data are available from 2006 until 2014 and contain detailed information on individuals' accrued pension rights at the ABP, retirement status, pension benefits, annual wage, number of contractual working hours, tenure in the public sector, and the employment subsector.

The panel survey data started one year after the new pension system in 2007 and was repeated annually until 2012. The data in the first wave in 2007 were gathered in two stages. In the first stage, all 27,719 male public sector workers in the Netherlands who were born in 1949 or 1950 were invited in January 2007 to participate in our internet survey by requesting their e-mail addresses. The invitation letter, sent by surface mail, included general information about the social usefulness of the survey but did not disclose information about the research question and the nature of our research strategy. We did not inform potential participants that the invitation letter was only sent to public sector employees born in 1949 and 1950. The letter also explicitly assured confidentiality. In the second stage, the 11,458 workers who sent their e-mail address received in March 2007 an e-mail with a link to the survey. References to the nature of our research question and research strategy were also carefully avoided in the survey.

In total, 8,516 individuals completed the questionnaire in 2007. Our analyses are restricted to full time employees who have worked continuously in the public sector since 1997

[3] Data from 2008-2009 were also used in earlier work (see De Grip et al. (2012)).

[4] The survey and administrative data are only available for these two specific birth cohorts. We focus on male employees because in the Netherlands in this birth cohort the male worker is usually the main family wage earner and only a small selective fraction of women in this cohort is still working at the age of 57/58.

until 2006 and did not work in strenuous jobs (e.g. firemen, policemen).[5] For these workers, the pension reform is clear and simple, as age is the only criterion that determines whether a worker is eligible for the restricted or the more generous retirement scheme, guaranteeing the internal validity of regression discontinuity design. The final estimation sample in 2007 consists of 6,702 men, of whom 3,468 were born in 1950 and 3,234 were born in 1949. The response rates to the survey for the two birth cohorts are virtually identical in 2007, 30.5% and 31.0% for the treated and controls, respectively (see also De Grip et al (2012) who use the same data).

The survey was repeated in March of every year until 2012. The response was 4,142 in 2008, 6,048 in 2009, 5,600 in 2010, and 4,020 in 2011. The increase in the response in 2009 is due to a renewed invitation to participate in our internet survey by again requesting workers' e-mail addresses. This invitation was sent to counter panel attrition. There was no significant difference in response rates to the survey between the two birth cohorts in the period 2008-2011. Appendix B provides more information on sample attrition and whether this was selective with respect to the treatment.[6]

De Grip et al. (2012) and Montizaan et al. (2009, 2011, 2016) exploited the same dataset to estimate the impact of retrenchment in pension rights on short-term workers' health and well-being, and human capital investments. These studies differ from this paper as they not analyze the impact of the 2006 pension reform on retirement planning and savings behavior.

[5] Firemen and ambulance and police personnel still have other retirement schemes that allow early retirement between the ages 55-62 against a replacement rate of at least 70%.

[6] More specifically, Tables B1-B4 in Appendix B show that the response rates do not differ between workers born in 1949 or 1950 and that this result does not change when we use additional sample selection criteria. The tables also show that attrition after 2007 is unrelated to the treatment.

3.2 Measuring retirement expectations and private savings behavior

Our main interest lies in investigating how the change in the pension system affects retirement expectations and realizations and saving decisions of public sector workers. To elicit retirement expectations before the reform took place, we asked respondents in 2007 the following survey question: 'At what age did you expect to retire five years ago?'. To measure the development in retirement preferences and expectations after the reform we annually asked two questions in the survey: 1) 'At what age do you expect to definitively stop working?'; and 2) `What would be your pension benefit be as a percentage of your net wage income if you retire at the age of 62?'.

There is a literature on retirement expectations and there seems to be a general consensus that retirement expectations measured in this way quite accurately match realizations (Bernheim, 1989; 2009; Dwyer and Hu, 2000; Chan and Stevens, 2004; Benítez-Silva and Dwyer 2005). In this paper we observe expectations for eight years as well as actual retirement realizations until 2014 and therefore we can in addition to the behavioral response to the policy reform examine how well expectations match retirement realizations.

The reform changed the pension wealth directly and in addition also introduced a tax facilitated savings program that allowed tax free savings up to 12% of annual earnings (the 'Life course savings' program, see the previous section). The introduction of this savings program may therefore also have induced changes in (retirement) savings behavior. Our survey includes annually several questions on pension savings that enable us to analyze such behavioral responses. First, the survey includes a question whether the respondent participated in the life course savings program. For those who participated in the life course savings program, it was also asked how many months of earlier retirement they planned to finance out of this life course savings program (only in the 2009 wave). This direct question will enable us to also disentangle

the underlying mechanisms driving the adjustments in retirement planning. We return to this later in section 4. Second, the survey asked whether respondents made additional savings arrangements for their pension in the past year and how many alternative sources of (pension) wealth they have access to. These alternative pension products include 1) pensions build up at pension funds other than ABP; 2) life annuities; 3) life insurance; 4) savings in excess over €15,000; 5) investments; 6) inheritance and 7) other pension insurance products. Moreover the survey asked whether respondents have a partner with own income; have a partner with an own pension; and whether workers have positive net housing wealth (the value of the house minus the mortgage). This enables us to control not only for individual wealth but also for the major components of household wealth.

3.3 Descriptive analyses: comparing the treated and control cohort

Since our empirical analyses exploit the sharp discontinuity in pension treatment induced by the natural experiment it is of crucial importance for the internal validity of our natural experimental approach that 1) the individuals in the treatment and control groups are sufficiently similar in order to ascribe the difference in retirement expectations, realizations and savings behavior between the treatment and the control groups to the pension reform and that 2) the reform was well understood and actually created a sharp discontinuity in expectations.

First, as already mentioned, while attrition was substantial, survey participation rates of both cohorts were very similar for each year of the panel survey (see Tables B1 and B2 of Appendix B). Second, Table 1 shows descriptive statistics for the treatment and control groups for the 2007 wave. While the first two columns show the respective means, the last column tests whether the differences are significant. Table 1 confirms that job and personal characteristics and

the sector in which employees are employed are indeed similar across both cohorts. We also performed this test for the following years 2008-2012 and find no significant differences in observables between the treated and untreated respondents (results available upon request).

Concerning personal characteristics, we observe that approximately 67% of public sector workers are highly educated, 90% are married, and are, on average, in good health. The higher educated are overrepresented in the public sector and this is confirmed in other (Dutch) datasets. Most respondents are employed in the government (47%) and education (41%) sectors and work fulltime.

Of the set of wealth variables there is one variable that is significantly different at conventional levels between the control and the treatment groups: the response to the question whether individuals participated in the tax facilitated `Life Course Savings' program. Of the 1949 cohort only 6.4% participate in this `Life course savings' program. Of the 1950 cohort, this fraction is more than two times higher (about 16%). Because this tax facilitated program was introduced at the same time as the pension reform, the participation rates in the life course savings program can for the treated be seen as a direct response to a reduction in savings costs plus the drop in pension wealth. For the controls it is a direct response to a reduction in savings cost.

3.4 The respondents understood the consequences of the reform.

As we mentioned at the end of Section 2, the consequences of the reform were communicated well to the affected cohorts. Moreover, employees receive annually a detailed overview of their pension rights which shows them exactly how much pension benefits they would receive when they were to retire at different ages. Sample means confirm that respondents have a good

overview of their pension and of the consequences of the reform. Respondents born in 1949 expect, on average, a pension benefit at a net replacement rate of 72% if they had to retire at age 62, while employees born in 1950 anticipate a replacement rate of 66% at this age. This difference is statistically significant and is remarkably close to the difference in the actual (gross) replacement rates of 70% and 64%, for the 1949 and 1950 cohort, respectively. Figure 1 depicts this graphically. Each dot represents the average expected pension benefit for individuals born in a specific birth month. The figure confirms once more that the respondents understood the consequences of the reform: there is a strong discontinuity in the expected pension benefit around the threshold date of January 1, 1950. The same figure for later years displays a similar pattern (See Table A1 of the Appendix).

The average response to the retrospective survey question on the respondents' expected retirement age 5 years ago (measured in 2007) does not differ significantly between the treated and the control groups. This also becomes clear from Figure 2, a graphical representation of the expected retirement age before the reform (in 2002) for workers born in 1949 and 1950. The figure shows that there is no clear break around the age threshold.[7] Things look very different for the expected retirement age one year after the reform: those born in 1949 expect on average to retire at age 62 years and eight months, while those born in 1950 expect to retire at age 63 years and six months. Figure 3 shows this discontinuity graphically. Note that the expected age of retirement reflects both the changes in the pension system as well as the behavioral response from the respondent to this reform. The fact that this is close to the 13 months that people had to additionally work is in that respect surprising and suggests that most workers are not willing to sacrifice much of current and future consumption for previously planned leisure. Note that in

[7] We additionally performed a Kolmogorov-Smirnov test for equality of distribution functions. The test indicates that there are significant differences between the distribution of both cohorts.

2007 the respondents are 57 or 58 and consequently their expectations may change over time. Below we examine this more closely.

4. Empirical implementation and results

4.1 Empirical implementation

As a first start to examine (the adjustment in) expectations we will estimate the following regression:

$$dER_{it} = ER_{it} - ER_{i2002} = \alpha_0 + \alpha_1 I(1950)_i + \alpha_2 B_i + \alpha_3 B_i^2 + \alpha_4 X_{it} + \varepsilon_{it} \quad (1)$$

Where ER_{it} is the expected retirement age in year t, I(1950) is an indicator for the 1950 cohort, B stands for the running variable birth date (expressed in days, normalized to 0 at December 31 of 1949, and divided by 100) and X is a set of observed individual characteristics, some of which are obtained from the survey and some from the administrative database.[8] In the previous section it was confirmed that prior to the reform there exist no differences in retirement expectations, i.e. expectations in 2002 were identical (see figure 2 and table A2 of the appendix). Therefore we may equally well estimate (1) in levels of ER_{it}. We will perform both estimations and show that results are extremely similar. In the next sections we consider both short run effects (t=2007) and longer run effects t=2008,…,2011.

The reform differentially affected the two cohorts and entailed two changes: i) a reduction in pension wealth and ii) a tax facilitated savings program that effectively changed the return of additional savings due to lower costs of savings. The individual worker had thus to

[8] Note that a Regression Discontinuity Design requires differential age (B) trends for the Treated and Controls. Additional regressions with differential age trends did not change the results at all. Indeed, Figure 2 shows that there are no age effects.

reconsider previously made choices that consider both labor supply and savings decisions, where the latter may in turn (indirectly) affect labor supply. Equation (1) can therefore be seen as a reduced form equation where the treatment effect (parameter α_1) is the compound effect of the direct effect of the change in pension wealth on labor supply and the indirect effect of additional savings. This indirect savings effect is a direct measure of the degree of substitution between public and private wealth and consists of an effect due to the drop in pension wealth plus an effect due to lower savings costs.

Similarly, for savings *S* we can write:

$$S_{it} = \beta_0 + \beta_1 I(1950)_i + \beta_2 B_i + \beta_3 B_i^2 + \beta_4 X_{it} + \varepsilon_{it} \qquad (2)$$

Rather than the actual amount of savings we observe whether an individual has saved in various ways to finance retirement (See section 3). For *S* we distinguish whether they have participated in the life course savings program; and whether they have made (other) additional savings in the past years to supplement their pension.[9] Note that the life course savings program introduced at the time of the reform was accessible to both cohorts and therefore β_1 measures the additional effect for the treated (1950) cohort. *S* and *dER* are jointly determined and therefore besides our (single) instrument more information is required to tease out the direct and indirect effects contained in α_1 (and β_1). Fortunately, the 2009 survey also contains a question about the number of months the participants in the life course savings program expected to finance from this program. Via this question we can obtain an estimate of the indirect savings effect induced by the reform. We will get back to this in one of the sections below.

[9] We observe a range of other measures, such as whether the respondents have a positive net housing wealth, whether their partner has an income etc (see Section 3). These are unlikely to be a direct response to the pension reform and therefore only used in a later section where we look at heterogeneous effects.

4.2 The short run effects of the reform

Retirement expectations one year after the reform

The first two columns of Table 2 provide the OLS results of equation (1) for 2007. The treatment dummy refers to the average treatment effect of the reform for the cohort born in 1950. When comparing Columns 1 and 2 one can conclude that adding controls does not alter the parameter estimate of interest. This, once more, confirms that the treatment and control groups, besides birth year are very similar. The table also includes a regression where the left hand side of (1) is replaced by the retirement expectation in 2007 (Columns 3 and 4). A priori one would not expect to find differences in the effect of the treatment dummy. After all, in Section 3 (Table 1) we already noted that retirement expectations five years ago (2002) where virtually identical for the two cohorts. Indeed, the coefficients of the treatment dummy are very similar. Therefore and for reasons that will be stated in the later section on the long run effects we will proceed with the results of Columns 3 and 4 (i.e. the regression results of ER_{it}).

The coefficient of interest (α_1) indicates that in the short run workers affected by the reform expect to work about 0.8 years (about 10 months) longer. Since the drop in pension wealth is equivalent to 13 months of earlier retirement, our results imply that the average treated worker repairs the drop in their pension rights mainly at the expense of leisure in retirement, and only marginally decreases post retirement consumption (the remaining 3 months). It is important to note here (see also section 4.1) that this is the total average treatment effect on the treated and it consists of two opposing forces: the adjustment in retirement years (the direct effect) when no additional savings were made plus the effect of additional savings in the life course savings to repair the drop in pension rights (the indirect effect).

Figure 3 confirms that the size of the effect of the reform is a little less than one year. However, a comparison with Figure 2 shows that also the controls (1949 cohort) have adjusted their expectations slightly upwards. This might be caused by anticipation of the controls to further reforms that may also affect their pension wealth.

Savings one year after the reform

Table 3 provides the results for two of our savings measures that we expect to be responsive to the reform: whether individuals participated in the tax facilitated life course savings program (Columns 1 and 2) and whether they had extra pension savings over and above the ABP pension in the previous year (Columns 3 and 4). Figure 4 gives a graphical representation. Columns 1 and 2 tell us that the probability to participation in the life course savings program is about 8 percentage point higher for the treated cohort. This effect is virtually unchanged when we add additional regressors. Of these regressors the wage and the years individuals have contributed to the pension system have a notable and significant effect. Taking the mean of these variables into account (see Table 1), we can conclude that the wage effect is by far the most dominant factor in explaining participation in the life course savings program[10]. Apparently the wage effect reflects the ability to save. Columns 3 and 4 show that there is no significant treatment effects on 'extra pension savings'.[11] . A further look at the other coefficients in Column 4 reveals that the effect of the number of years of contribution to the pension system has a sizeable effect, more than three times the coefficient in Column 2. This hints that the contribution years to the pension system may reflect the need to save and that these savings already existed prior to the reform.. In sum:

[10] A one standard deviation change in the log wage (mean 10.7) results in a change of 0.025 (2.5 percentage points). For the difference between the top (11.10) and bottom decile (9.98) this results in an effect 10% points.
[11] We also looked at other forms of savings in the data. None of these regressions resulted in significant treatment effects.

the drop in pension wealth and the reduction in savings costs primarily affected savings via the life course savings program. Wage has a strong independent effect (irrespective of treatment status) on the decision to participate in the tax-exempted life course savings program. The number of years of contributions to the pension system has an additional, independent effect on both participation in the life course savings program and additional savings to supplement pension income.

The life course savings program, introduced at the same time as the pension reform, facilitated savings at lower costs for both the treated and the controls. The treated are thus confronted with a drop in their pension wealth and an opportunity to save at lower cost. The controls were only affected by the latter change in the system. Observed changes in (life course) savings of the controls is therefore most likely the response to the reduction in the costs of savings, while for the treated observed changes are the sum of savings increase induced by the drop in public pension wealth and savings induced by the lower costs of savings. For the participants of the life course savings program the 2009 survey also included a question about the number of months they planned to finance from this savings account. Figure 5 presents this graphically. The smoothed line indicates that those born in 1949 plan to finance about 9 months earlier retirement from their savings account. The average for the affected (1950) cohort is about 4 months higher. These 4 months can thus be interpreted as the pure substitution effect between private and public pension wealth, i.e. the pure crowding-out effect due to the drop in public pension wealth. The figure also suggests that treated workers who are participating in the life course savings program plan to fully counter the intended effect of the reform on retirement (13 months later retirement).About 4 months can be ascribed to the drop in pension wealth induced by the reform and about 9 months due to reduced savings costs (tax exemption).

The results of table 2 indicated that on average the treated work about 10 months longer (0.814*12=9,8 months). Of the total sample of the treated the about 16% who participated in the life course savings program intend not to work 13 months longer (see figure 5), but rather stick to the previously set retirement age. This implies that the treated who do not participate in the program expect to work 9,8/0,84 = 11,7 months longer, i.e. almost completely the intended effect of the reform. Hence these workers are not willing to sacrifice future pension income for more leisure years in retirement and counter the drop in public pension wealth by sacrificing leisure (retirement years). The results of Table 3 indicated that wage is the dominant factor in explaining the decision to participate in the life course savings program. In light of the above this may imply that it is primarily the lower wage workers who are induced or maybe even forced by financial constraints to postpone retirement.

4.3 Longer run effects

Developments in retirement expectations (2008-2011)

The above shows strong initial responses to the reform on retirement. Of interest is whether retirement expectations change in the longer run and ultimately whether expectations match realizations. To start with expectations in the longer run, we estimate model (1) for the years 2008 up to 2011. Note that those born in 1949 (the controls) will turn 62 in 2012, the age at which this cohort can retire with a 70% replacement rate of 70%. This cohort can also retire at earlier ages with lower replacement rates. This holds also for the 1950 cohort who have to be 63 (in 2013) in order to receive a 70% replacement rate. In 2011 13.8% of the 1949 cohort has retired. For the 1950 cohort this is 3.7%. After 2011 these fractions rapidly increase (notably for

the 1949 cohort, we return to actual retirement patterns in the next section). For this reason we restrict ourselves to retirement expectations in the time frame 2008-2011.

Model (1) could be estimated for the expected retirement age (*ERit*) or the change in the expected age of retirement relative to 2002 (*dERit = ERit - ERi*$_{2002}$). To calculate *dERit* for later years one always needs to condition on presence in 2007, as this is the wave where the retrospective question regarding the retirement expectations (expectations in 2002) was asked. This strongly reduces the number of observations for later years. Sample attrition rates were high in 2008. Therefore in later years refreshment samples were taken in order to increase the number of observations and to assure that the sample remained representative (see also Section 3). These additional observations can be used in the *ERit* regressions, which improves efficiency of the estimates and reduces attrition bias.[12] We therefore choose to use *ERit* (Table 5) instead of *dERit*, but report results for the latter in Table A3 in Appendix A. The results of Table 5 are very similar to those of Table A3.

The first column 1 of Table 5 repeats the results of Column 1 of Table 2, while the other columns show the results for later years. The most important result is that the treatment effect on the expected retirement age remains statistically and economically significant over the years and thus does not disappear. The treatment indicator is, however, smaller for 2009. For 2010 and 2011 the effects are again closer to expectations in 2007. Figure 6 (retirement expectations) and Figure A1 (retirement benefit expectations) provide more information that might explain the patterns. Figure 6 shows that the smaller effect in 2009 is primarily due to higher expected retirement ages of the controls (born in 1949). In 2009 the consequences of the financial crises

[12] Note, however, that a further analyses of attrition (Appendix B) indicated that attrition was not selective with respect to the outcome variables.

for pensions became clearer and the controls may have expected that sooner or later this will also affect their pension wealth and eligibility conditions for early retirement.[13] This is also reflected in the retirement benefit expectations for 2009 (Figure A1). The controls (and the treated) also have adjusted their benefit expectations downward. For the later years (2010 and 2011) expectations of both cohorts have risen again, coming closer to the 0.8 years in 2007. This might be due to very early retirement of some workers, increasing the average of those remaining in the sample. Alternatively, in the aftermath of the financial crises both cohorts may have adjusted their retirement expectations upwards and expectation about benefits downward. Indeed, the plots in Figure A1 show for both cohorts substantially lower benefit expectations. While the idea of a more pessimistic outlook may be a plausible explanation, one still cannot dismiss the idea that actual retirement may influence the patterns. After all, those with relatively high benefit levels may have decided to retire earlier, reducing average expected benefit levels in the remaining sample.

Retirement realizations

The survey data are linked to administrative data containing information on actual retirement up to March 2014. This implies that those born in the first months of 1949 turn 65, the statutory retirement age. Therefore, besides differences in pension rights and eligibility conditions, also the pure age effect will lead to substantially higher retirement ages for the controls. Figure 7 confirms this. Retirement rates of the 1949 cohort range from about 70% to more than 90% for those born in the first quarter of the year. In contrast, retirement rates of the 1950 cohort are 40-50 percentage points lower. The regression results in Table 6 show, controlling for age, that the

[13] The 2008 recession led to substantial deficits in the ABP fund, which led to temporary cutbacks in pension benefits and withholds indexation. This was communicated to the workers and displayed in the media.

pure treatment effect is about 23 percentage points. This indicates that the reform did what it was intended to do: postponing retirement. Table 7 shows the retirement age distribution for the two cohorts. At each age retirement rates of the controls are much higher, but also note that the retirement rates of the treated seems to lag with about one year. More specifically, the fraction of treated retired at age 61 is about the same as the retirement rate of the controls at age 60. The same holds for the other ages of the treated, with the exception for age 64. We only observe actual retirement up to March 1st of 2014, implying that in March 2014, the treated born in the first quarter are 64, while the rest will turn 64 in the course of the year. In each year retirement dates are mostly concentrated at the start of the new year and after the summer vacation. Therefore, for the treated, the fraction of the 64 year old retirees may be lower than the comparable fraction of 64 years old in the controls whose number is based on the entire calendar year (2013). To conclude, the results in Table 7 confirm that the reform postponed retirement by about one year, as intended by the reform.

The above suggests that those affected by the reform choose to work longer, rather than sacrificing pension income for earlier retirement. In earlier sections we also saw that about 16% of the affected cohort choose to participate in the tax facilitated life course program and that these workers intended to fully counter the effect of the reform. Unfortunately, those participating in the life course savings program are not administered as retired when they take a self-financed leave before the actual date of retirement. We therefore cannot check this with the administrative data, but it is conceivable that a fraction of the of the workers that are now observed in the data to retire later in fact may have stopped working earlier.

The effectiveness of the program in postponing retirement may have to do with how the program was implemented. It was announced “late in the game” and implemented only a few

months after its announcement. As a consequence not all workers may have gathered sufficient means to fully counter the reform with additional savings, either because they were not in the (financial) position to save sufficiently, or because they were not willing to sacrifice current consumption. It is therefore likely that the behavioral response to the reform may differ across subgroups, notable those with higher wages and other sources of wealth. We turn to this below.

4.4 Heterogeneous effects

We ran separate OLS regressions on different subsamples to examine heterogeneous responses to the reform. For each subsample we look at short-term (2007) retirement expectations, participation in the life course savings program, and retirement realizations in March 2014. We basically look at two sets of variables that are related to retirement planning and savings behavior: the set of wage, wealth, education, and family variables (A); and a set of individual risk aversion and financial decision making variables (B).[14]

The definition of the set of wage, education and wealth variables are self–explanatory and inclusion of heterogeneity analyses with these variables can be easily justified. One can expect that workers with higher wages, more education, and who self-report net positive housing wealth to have overall accumulated more private wealth and therefore have more opportunities to maintain current and post-retirement consumption levels, while keeping leisure years in retirement close to what was initially (i.e. before the reform) planned. Previous research

[14] Poor health may force individuals to retire early (see for instance Anderson & Burkhauser (1984), or Lindeboom and Kerkhofs (2009) and the literature reviewed in this study) and Banks et al. (2005) find that workers in poor health are less responsive to financial incentives of the pension system. Similarly, Lindeboom and Melnychuk (2015) find that individuals with symptoms of depression make different investment choices. We therefore also performed heterogeneity analyses with the self-reported number of sick days and self-reported life expectancy. We do not find significant heterogeneity effects on retirement expectations or savings. However, for actual retirement, however, we find strong effects for those with more sick days and a those who expect to have lower chances to survive up to the age of 80. This results appears to be driven by the fact that in general those in poor health have fewer financial resources. Regressions shows that the significant interaction effect between health and the treatment on the retirement status in 2014 disappears after the inclusion of interactions with income and/or education.

furthermore has shown that retirement decisions of members within families are related (see e.g. Gustman and Steinmeier, 2004) and that the financial impact of the pension reform is larger for workers who have to provide for a family and whose partner does not contribute to the household (pension) income (Bloemen et al., 2015). We therefore also ran separate regressions for whether respondents indicated that they have a partner who will also receive a pension.

The set of variables related to financial decision making variables consists of risk aversion, financial risk aversion, and self-reported capability to make decision in complex situations. Risk attitude plays an important role in inter-temporal decision making under uncertainty and therefore it may also affect degree of substitution between private and public pension wealth. A lack of respondents' ability to make decisions in complex situations is expected to lead to procrastination behavior and lower levels of wealth accumulation (Banks et al. 2010).

A measure of risk aversion is derived from the responses to the survey question "How do you see yourself: Are you in general a person who takes risk or do you try to evade risks? Please self-grade your choice (ranging between 0 (extremely risk averse) and 10 (extremely willing to take risk))". We reverse the scale of the answers and consider people to have a low risk aversion when they gave a grade above five (upper quartile).[15] The financial decision making variable is derived from the same question, adapted for financial decision making. The capability to make difficult decisions is measured by the survey question "To what extent are you in general able to make a financial decision, even when the decisions are of a complex nature? Please self-grade your choice (ranging between 0 and 10, with 10)". We construct an indicator for the bottom quartile, i.e. those who are less able to make a decision in such situations. Item non-response is quite high for these variables.

[15] This survey question is extensively used to elicit risk preferences (see e.g. Dohmen et al. 2011). .

The top panel of Table 8 shows the results for short run retirement expectations, the middle panel for participation in the life course savings program and the bottom panel for the retirement status in 2014. The p-values in the one but last row of each panel are based on the coefficient of the treatment dummy and the heterogeneity variable in fully interacted models. Below we briefly discuss the main findings.

We find some differences in the impacts of the reform on the short-term retirement expectations by different subgroups, but none of these are significant at the standard levels (top panel of table 8). There might be power problems for the financial decision making variables. The second panel of Table 8 shows the results for participation in the life course savings program. Here we observe sizeable and significant differences between different subgroups related to financial decision makings variables. Again, the impact of the reform is not significantly different by respondents' income, education, or wealth. The treatment effect on life course savings is extremely small and not statistically significant for workers who are in the top quartile of the risk and financial risk aversion distributions, while we observe a considerable treatment effect for workers in the other quartiles of this distribution. In first instance this may seem to be counterintuitive. However, there are several reasons for this result. The first is that it is likely that risk averse workers will put greater value to maintaining present and future consumption levels at the cost of future labor supply. Secondly, the result might also be explained by the fact that a life course saving account is not like a traditional savings account, but often involves a mix between traditional saving and investments in stocks or bonds and thus involves more risk than traditional saving products.

We further find that workers who have difficulties to decide in complex situations do not respond to the reform whereas for the others we find a large and statistically significant treatment

effect. This is indeed consistent with the idea that respondents who have difficulties in making decisions in financially complex situations do procrastinate in such situations and accumulate less wealth (Banks et al. 2010).

Finally, for actual retirement status in 2014 we find strong differential effects for wage and education, but not for the other variables. The treatment effects of those with higher wages and higher education are almost half the effects of their lower wage and lower educated counterparts. This suggests that ultimately the better off in terms of wages (and education) are able to cushion the impact of the reduction in pension wealth on retirement. While we do not find effects on life course savings in the second panel of Table 8, it is primarily the high wage earners who participate in the life course savings program life (cf the dominant wage effect in Table 3) and Furthermore, high wage workers have more alternative sources of wealth from which they can finance earlier retirement.[16] It is, however, a bit strange that the results for retirement realizations do not agree with the results for the retirement expectations where no significant differences in treatment effects are found. Note however, that table 8 shows there are sizable differences in the treatment effects of the different wage groups. Furthermore, retirement expectations are measured at 2007 and regressions for later years (available upon request) show that also for later years sizeable effect size differences remain and that for 2010 this even becomes significant (p-value of 0.003). Note however, that 2010 and later years the fraction of retirees increases substantially and that this dynamic selection also depends on wages, making it difficult to formally test for wage related treatment effects in later years. We therefore did not pursue this further.

[16] More specifically, workers in the top wage quartile participate more often in the life course savings program (15,4%), have a partner with an own income (59%), have more often positive net housing wealth (75%), had extra pension savings in the past year (26%) and have more alternative wealth sources (2.63). For the total sample these numbers are 11%, 57%, 68% 23% and 2.36, respectively.

To summarize the above, we find heterogeneous effects for different subgroups, but primarily for retirement realizations in 2014 and participation in the life course savings program. The most notable differences on actual retirement behavior are found for the high wage and the highly educated, for savings it is the variables related to risk aversion and (financial) decision making in complex situations.

5. Summary, discussion & conclusion

This paper looks at the response of retirement expectations, actual retirement and savings to an unanticipated reform of the pension system that was implemented in January 2006. The reform affected workers born in 1950 (or later) and led to a substantial loss in pension wealth. Those born prior to 1950 (the controls) could retire at the age of 62 with a replacement rate of 70% of an average of wages earned in the past 10 years. The affected cohort in our sample (the treated) had to work 13 months longer to obtain the same replacement rate, or they could retire at age 62 with a replacement rate of 64%. At the same time the government launched a tax facilitated savings program ('life course savings program') that permitted tax free saving up to 12% of an annual income. This program was open to all workers (treated and controls).

We find strong behavioral responses to the reform. Expectation data show that one year after the reform affected workers expect on average to work about 10 months longer. The drop in pension wealth is equivalent to 13 months of earlier retirement, so our results suggest that the average treated worker repairs the drop in their pension rights mainly at the expense of leisure in retirement and to a lesser extent by decreasing post retirement consumption. The difference in retirement expectations between treated and controls remained stable in later years and is close to differences actual retirement rates observed in 2014. Observed retirement patterns by age

indicate that the affected workers work an additional year, as intended by the program. It thus appears that that the reform was very effective in raising retirement ages for the larger part of the sample.

Savings rates of the treated, as measured by participation in the tax facilitated retirement savings program, are around 16%, which is more than twice the savings rate of the controls. Those participating in the program state that they expect to finance about 9 and 13 months of earlier retirement, for the control and treated cohort, respectively. The 9 months savings of the controls can be interpreted as the response to a reduction in savings costs (due to the introduction of the life course savings program). For the treated the savings effect is the sum of increased private savings induced by the drop in public pension wealth and additional savings induced by the lower costs of savings. The 4 months difference between the treated and controls can therefore be interpreted as the pure savings effect implied by the drop in pension wealth, i.e. the pure crowding out effect. All in all, this means that the treated participating in the life course savings program are likely to fully counter the drop in public pension wealth by additional savings in the life course savings program.

The effectiveness of the reform for the larger part of the workers may have to do with the implementation of the reform. The reform was unexpected, implemented shortly after its announcement and was late in the game for workers studied here. At the time of the implementation in January 2006 the affected cohort in our sample was 56 years old, leaving them with 6 years to save a one year leave if they desired to retire at age 62 rather than age 63. It is conceivable that this was not possible for the larger part of the workers (i.e the 84% of the treated who did not participate in the savings program), unless they were willing to sacrifice (much of) current consumption to finance earlier retirement. These workers thus had to face the

choice to work longer and/or accept a loss in post-retirement consumption. Our findings indicate that workers not participating in the savings program choose to work substantially longer. It thus appears that for these workers stabilization of post-retirement income/consumption is the main motive and that this is derived at no loss in current consumption. This is consistent with low substitution rates between private and public wealth for older workers faced with reforms at the end of their working life.

We also show the 16% of workers who participate in the life course savings program are less affected by the reform and that they plan to stick to their previously planned retirement date. These workers are mostly high wage workers who also hold more alternative sources of wealth, allowing them to absorb the loss in pension wealth with private wealth. For these workers private wealth fully crowds out public pension wealth. An unintended side effect of the introduction of the tax facilitated savings plan is that in particular high wage earners who participate in the savings program, but who are not affected by the pension reform (the controls) decide to retire even sooner than initially planned.

Are the results generalizable to other countries, other sectors and other workers? Obviously, our findings cannot be generalized to younger cohorts that are also affected by the reform. Cohorts, born (say) in the 1960's have more time to accumulate private wealth and therefore it is likely that the effects of the reform will be smaller for these cohorts. Also, it is unclear whether the same extension of working life can be expected in other sectors of the economy. The public sector is atypical in the sense that workers are on average much higher educated and face different working conditions than workers in other sectors of the economy. In sectors with strenuous working conditions, such as the construction sector, workers' health may limit working life extensions and therefore the effect of a similar reform on retirement rates

might be smaller in first instance. However, workers in these sectors are also lower educated, have a lower wage and are likely to have less wealth to compensate losses in pension wealth.

The essential lesson from this paper is that reforms announced late in the game have substantial effects on retirement patterns, but that most of the effect is confined to workers who are financially constraint and who cannot counter public pension wealth losses with private wealth. These are generally lower wage workers. This is relevant for workers in all countries, irrespective from the specifics of the country's pension system.

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Table 1 Characteristics for the affected and not affected respondent (2007)

	Affected by the reform	Not affected by the reform	Min	Max	P-value[1]
Personal characteristics					
Low education level	0.132	0.125	0	1	0.835
High education level	0.671	0.681	0	1	0.532
Married	0.904	0.919	0	1	0.661
Bad health	2.070	2.080	1	5	0.126
Job characteristics					
Number of years contributed to the pension fund	30.262	31.762	10	45.579	0.565
Log wage	10.788	10.801	9.69	12.89	0.748
Number of contractual work hours	0.996	0.996	0.26	1.25	0.945
Sectors					
Government	0.481	0.452	0	1	0.756
Education	0.446	0.479	0	1	0.618
Privatized	0.073	0.069	0	1	0.715
Alternative income and savings					
Life course savings	0.155	0.064	0	1	0.000
Extra pension savings in previous year	0.254	0.210	0	1	0.191
Partner with own income	0.749	0.728	0	1	0.154
Partner with own pension	0.571	0.572	0	1	0.816
positive net housing wealth	0.687	0.684	0	1	0.271
Number of alternative wealth sources	2.365	2.359	0	9	0.702
Retirement expectations					
Expected retirement benefit	66.725	72.272	30	135	0.000
Expected retirement age	63.472	62.734	57	70	0.000
Expected retirement age before the reform	61.390	61.489	53	70	0.620

1 The last column reports the p-values of the treatment dummy from a regression of the variable in question on treatment and age.

Table 2 Expected age of retirement in 2007 and the difference between the expected age of retirement in 2007 and 2002: OLS results

	(1)	(2)	(3)	(4)
Dependent variable:	ER(2007)-ER(2002) Change in Retirement expectations		ER(2007) Expected Retirement Age 2007	
Treatment dummy	0.845***	0.879***	0.814***	0.814***
	(0.102)	(0.102)	(0.081)	(0.081)
Birth date / 1000	-0.042	-0.047	-0.208	-0.274
	(0.240)	(0.239)	(0.194)	(0.192)
Birthdate squared	-1.463**	-1.426**	-0.144	-0.242
	(0.626)	(0.627)	(0.511)	(0.505)
Married		0.264***		0.057
		(0.097)		(0.079)
Low educated		-0.015		-0.229***
		(0.102)		(0.077)
High educated		-0.205**		0.063
		(0.086)		(0.068)
Wage (ln)		-0.385***		0.124
		(0.124)		(0.103)
Number of contribution years to the pension fund		0.028***		-0.052***
		(0.005)		(0.004)
Constant	1.313***	4.624***	62.701***	62.993***
	(0.065)	(1.322)	(0.050)	(1.099)
Observations	6605	6476	6702	6569
Adjusted R^2	0.041	0.062	0.046	0.093

Standard errors in parentheses. Other control variables included in Columns 2 and 4: sector dummies.
* p < 0.10, ** p < 0.05, *** p < 0.01

Table 3 Savings in 2007: results from a linear probability model

	(1)	(2)	(3)	(4)
Dependent variable:	Life course savings		Extra pension savings in previous year	
Treatment dummy	0.082***	0.083***	0.027	0.028
	(0.017)	(0.017)	(0.021)	(0.021)
Birth date / 1000	0.026	0.020	0.047	0.026
	(0.041)	(0.040)	(0.050)	(0.049)
Birth date squared	0.042	0.030	-0.013	-0.022
	(0.108)	(0.107)	(0.131)	(0.129)
Married		0.016		0.022
		(0.014)		(0.018)
Low educated		-0.004		-0.061***
		(0.013)		(0.017)
High educated		0.018		0.019
		(0.014)		(0.017)
Wage (ln)		0.090***		0.010
		(0.022)		(0.026)
Number of contribution years to the pension fund		-0.003***		-0.010***
		(0.001)		(0.001)
Constant	0.067***	-0.843***	0.219***	0.393
	(0.009)	(0.229)	(0.013)	(0.271)
Observations	5245	5244	6645	6633
Adjusted R^2	0.020	0.039	0.002	0.026

Standard errors in parentheses. Other control variables included in Columns 2 and 4: sector dummies.
* p < 0.10, ** p < 0.05, *** p < 0.01

Table 4 Months early retirement financed from the life course savings program in 2009: OLS results

Dependent variable:	(1) Months early retirement financed from the life course savings program	(2)
	Column 1	Column 2
Treatment dummy	4.241**	4.323**
	(1.748)	(1.830)
Birth date / 1000	0.476	-0.196
	(4.168)	(4.287)
Birth date squared	3.596	0.728
	(10.846)	(11.180)
Married		0.781
		(1.595)
Low educated		-1.111
		(1.722)
High educated		1.979
		(1.204)
Wage (ln)		-1.393
		(1.530)
Number of contribution years to the pension fund		-0.092
		(0.081)
Constant	8.972***	25.255
	(1.336)	(17.126)
Observations	601	589
Adjusted R^2	0.030	0.046

Standard errors in parentheses. Other control variables included in Column 2: sector dummies. * p < 0.10, ** p < 0.05, *** p < 0.01. The number of observations is lower as we focus in this table on workers who participate in the life course savings program.

Table 5 Longer run effects in retirement expectations

Dependent variable: Expected retirement age	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011
Treatment dummy	0.814***	0.531***	0.347***	0.652***	0.698***
	(0.081)	(0.094)	(0.079)	(0.076)	(0.086)
Birth date / 1000	-0.208	0.042	0.364*	0.044	-0.202
	(0.194)	(0.227)	(0.190)	(0.182)	(0.207)
Birthdate squared	-0.144	0.274	0.548	0.552	0.996*
	(0.511)	(0.602)	(0.504)	(0.479)	(0.547)
Constant	62.701***	62.732***	63.000***	63.132***	63.451***
	(0.050)	(0.057)	(0.046)	(0.046)	(0.053)
Observations	6702	4062	6084	5600	4020
Adjusted R^2	0.046	0.029	0.023	0.051	0.048

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6 Retired in 2014: results from a linear probability model

Dependent variable: Retired in 2014	(1)	(2)
Treatment dummy	-0.245***	-0.224***
	(0.029)	(0.029)
Birth date / 1000	-0.553***	-0.592***
	(0.062)	(0.062)
Birthdate squared		0.928***
		(0.160)
Constant	0.623***	0.569***
	(0.017)	(0.020)
Observations	4419	4419
Adjusted R^2	0.214	0.219

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7 Percentage of people retired by age

Percentage of people retired at age	Treated	Control
60	2.59	7.24
61	6.05	12.84
62	13.84	27.21
63	26.19	57.30
64	29.48	69.08

Table 8 Heterogeneous effects on the expected retirement age and life course savings in 2007 and actual retirement in 2014

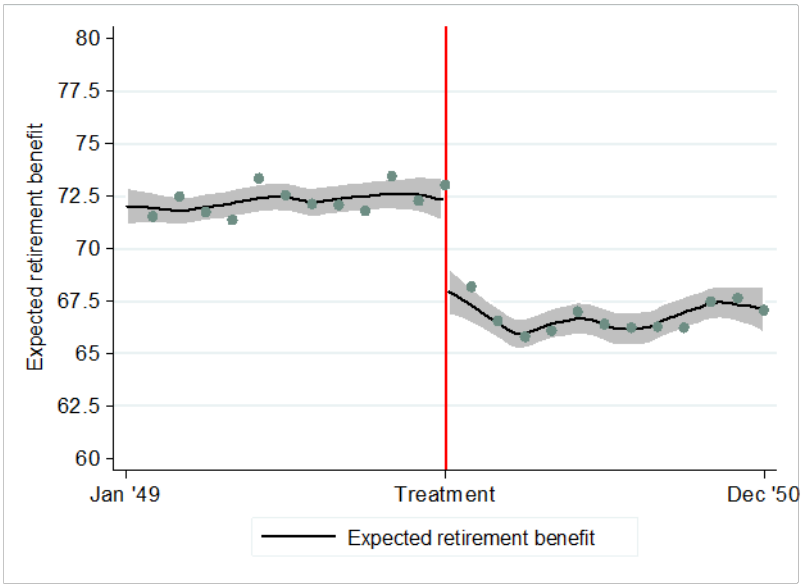
Expected retirement age in 2007	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**	**(14)**
	Income, education, and wealth								**Financial decision making**					
Dependent variable: Expected retirement age in 2007	Wage top 25%	Wage other	High education level	Other education (low and intermediate) levels	Partner has own pension	Partner has no own pension	Positive net housing wealth	No positive net housing wealth	Risk aversion top 25%	Risk aversion other	Financial Risk aversion top 25%	Financial Risk aversion other	Capability to take difficult decisions bottom 25%	Capability to take difficult decisions other
Treatment dummy	0.643***	0.867***	0.713***	0.977***	0.746***	0.957***	0.729***	0.891***	0.916***	0.704***	0.914***	0.618***	0.623***	0.378*
	(0.171)	(0.093)	(0.098)	(0.145)	(0.113)	(0.145)	(0.103)	(0.158)	(0.165)	(0.103)	(0.159)	(0.137)	(0.226)	(0.225)
Birth date / 1000	0.113	-0.300	-0.071	-0.346	-0.100	-0.037	-0.107	-0.201	-0.227	-0.159	-0.288	0.003	-0.434	-1.038*
	(0.414)	(0.218)	(0.234)	(0.344)	(0.268)	(0.346)	(0.247)	(0.369)	(0.409)	(0.250)	(0.388)	(0.324)	(0.546)	(0.594)
Birthdate squared	0.762	-0.473	-0.487	0.419	-0.329	-0.406	0.047	0.325	-0.721	0.227	0.364	0.732	-2.948**	0.671
	(1.102)	(0.574)	(0.613)	(0.921)	(0.702)	(0.933)	(0.652)	(0.973)	(1.105)	(0.665)	(1.022)	(0.854)	(1.460)	(1.642)
Constant	62.862***	62.652***	62.862***	62.406***	62.728***	62.751***	62.700***	62.783***	62.766***	62.788***	62.751***	62.731***	63.532***	63.579***
	(0.111)	(0.055)	(0.060)	(0.089)	(0.070)	(0.090)	(0.063)	(0.097)	(0.107)	(0.063)	(0.098)	(0.080)	(0.163)	(0.161)
Observations	1,673	5,029	4,499	2,172	3,327	2,112	4,079	1,866	1,210	3,847	1,444	2,227	680	828
P-value test whether the difference in the treatment dummy is significant	**0.248**		**0.131**		**0.250**		**0.388**		**0.275**		**0.158**		**0.441**	
R-squared	0.037	0.051	0.043	0.057	0.045	0.077	0.041	0.058	0.070	0.038	0.061	0.035	0.030	0.004
Life course savings in 2007														
Treatment dummy	0.088**	0.079***	0.087***	0.069***	0.056**	0.080***	0.084***	0.045*	0.018	0.105***	0.032	0.125***	0.000	0.143***
	(0.038)	(0.019)	(0.022)	(0.026)	(0.025)	(0.024)	(0.022)	(0.023)	(0.038)	(0.022)	(0.035)	(0.029)	(0.055)	(0.044)
Birth date / 1000	0.140	-0.011	0.048	-0.019	0.117**	-0.035	0.042	0.026	0.202**	-0.025	0.129	-0.038	0.171	-0.096
	(0.093)	(0.043)	(0.052)	(0.062)	(0.060)	(0.057)	(0.053)	(0.056)	(0.094)	(0.054)	(0.087)	(0.071)	(0.131)	(0.116)
Birthdate squared	0.394	-0.079	0.106	-0.098	0.100	0.004	0.078	0.067	0.260	0.014	0.225	0.158	-0.037	0.414
	(0.252)	(0.114)	(0.139)	(0.160)	(0.160)	(0.151)	(0.141)	(0.149)	(0.252)	(0.146)	(0.228)	(0.192)	(0.341)	(0.323)
Constant	0.090***	0.059***	0.077***	0.045***	0.088***	0.042***	0.073***	0.043***	0.086***	0.063***	0.076***	0.045***	0.097**	0.026
	(0.022)	(0.010)	(0.012)	(0.014)	(0.014)	(0.012)	(0.012)	(0.012)	(0.023)	(0.012)	(0.020)	(0.015)	(0.040)	(0.025)
Observations	1,388	3,857	3,615	1,629	2,656	2,055	3,286	1,874	975	3,084	1,151	1,806	546	681
P-value test whether the difference in the treatment dummy is significant	**0.821**		**0.606**		**0.481**		**0.212**		**0.047**		**0.043**		**0.043**	
R-squared	0.040	0.016	0.025	0.014	0.024	0.015	0.023	0.011	0.026	0.022	0.020	0.030	0.012	0.023

Table 8 continued

Retired in 2014	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**	**(7)**	**(8)**	**(9)**	**(10)**	**(11)**	**(12)**	**(13)**	**(14)**
	Income, education and wealth								**Financial decision making**					
Dependent variable: Retired in 2014	Wage top 25%	Wage other	High education level	Other education (low and intermediate) levels	Partner has own pension	Partner has no own pension	Positive net housing wealth	No positive net housing wealth	Risk aversion top 25%	Risk aversion other	Financial Risk aversion top 25%	Financial Risk aversion other	Capability to take difficult decisions bottom 25%	Capability to take difficult decisions other
Treatment dummy	-0.180***	-0.298***	-0.222***	-0.365***	-0.252***	-0.320***	-0.266***	-0.240***	-0.275***	-0.246***	-0.284***	-0.269***	0.015	0.077
	(0.046)	(0.025)	(0.028)	(0.038)	(0.032)	(0.039)	(0.029)	(0.043)	(0.050)	(0.030)	(0.048)	(0.039)	(0.078)	(0.062)
Birth date / 1000	-0.709***	-0.513***	-0.620***	-0.434***	-0.603***	-0.468***	-0.592***	-0.546***	-0.602***	-0.606***	-0.499***	-0.573***	-0.805***	-0.940***
	(0.101)	(0.056)	(0.061)	(0.084)	(0.069)	(0.088)	(0.062)	(0.096)	(0.110)	(0.066)	(0.106)	(0.084)	(0.182)	(0.151)
Birthdate squared	0.616**	0.509***	0.441***	0.719***	0.747***	0.290	0.588***	0.553**	0.794***	0.438***	0.961***	0.210	1.759***	2.168***
	(0.260)	(0.143)	(0.156)	(0.216)	(0.176)	(0.231)	(0.159)	(0.250)	(0.276)	(0.168)	(0.271)	(0.215)	(0.468)	(0.408)
Constant	0.568***	0.665***	0.634***	0.654***	0.634***	0.667***	0.650***	0.604***	0.659***	0.633***	0.652***	0.662***	0.228***	0.188***
	(0.031)	(0.016)	(0.018)	(0.025)	(0.020)	(0.026)	(0.018)	(0.028)	(0.032)	(0.019)	(0.030)	(0.025)	(0.060)	(0.047)
Observations	1,713	5,136	4,589	2,204	3,377	2,158	4,150	1,902	1,241	3,914	1,465	2,268	694	842
P-value test whether the difference in the treatment dummy is significant	**0.024**		**0.002**		**0.180**		**0.614**		**0.582**		**0.808**		**0.364**	
R-squared	0.221	0.252	0.225	0.285	0.247	0.253	0.255	0.209	0.265	0.238	0.248	0.252	0.118	0.134

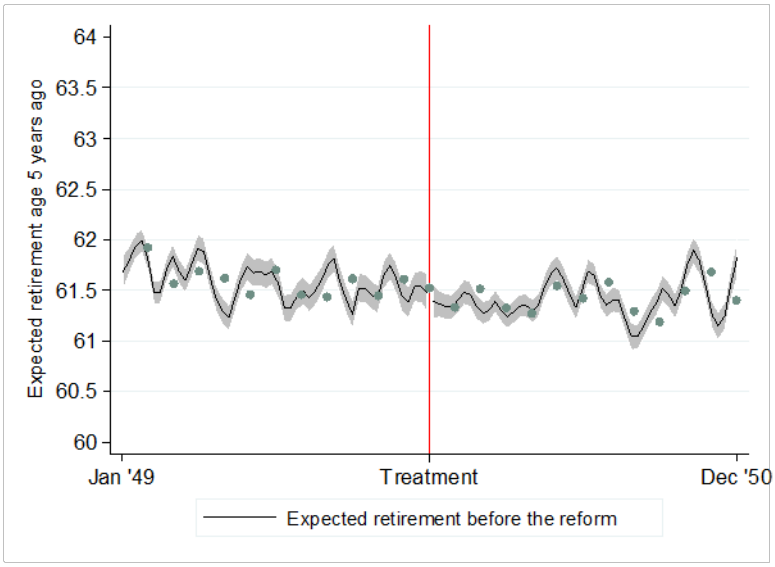
Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Figure 1 Expected retirement benefit in 2007



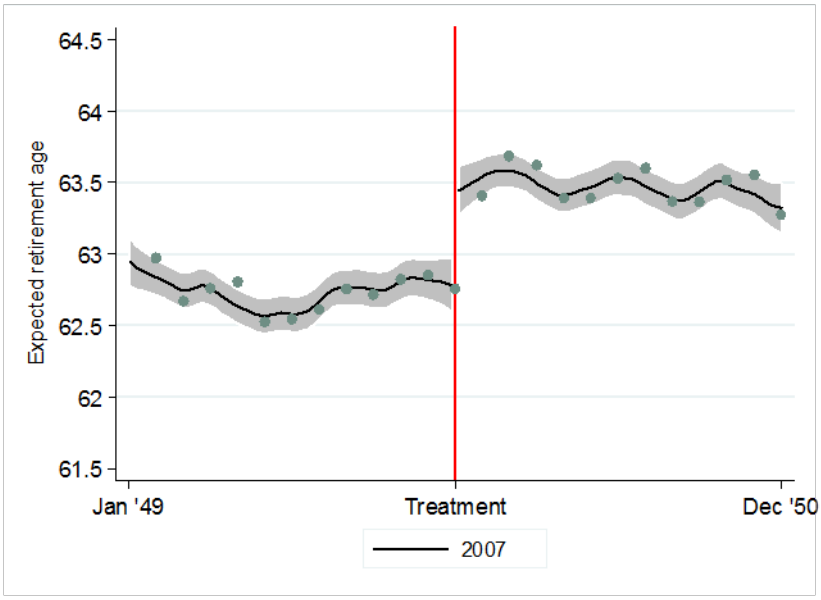
The figure presents the expected retirement benefit (for two successive birth months). The vertical line marks the threshold dividing the control and treatment groups.

Figure 2 Expected retirement age before the reform



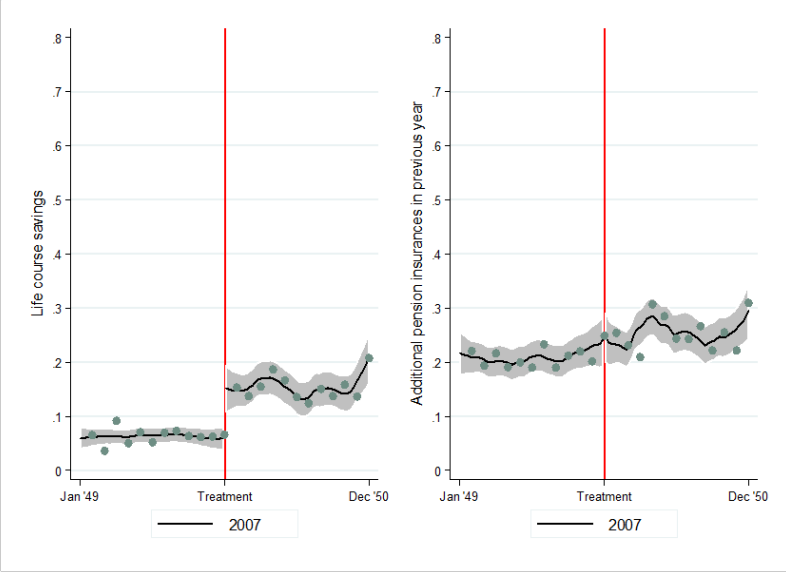
The figure presents the expected retirement age in 2002 (retrospectively measured in 2007). The vertical line marks the threshold dividing the control and treatment groups.

Figure 3 Expected retirement age one year after the reform (2007)



The figure presents the expected retirement age in 2007 (for two successive birth months). The vertical line marks the threshold dividing the control and treatment groups.

Figure 4 Additional pension wealth (2007)



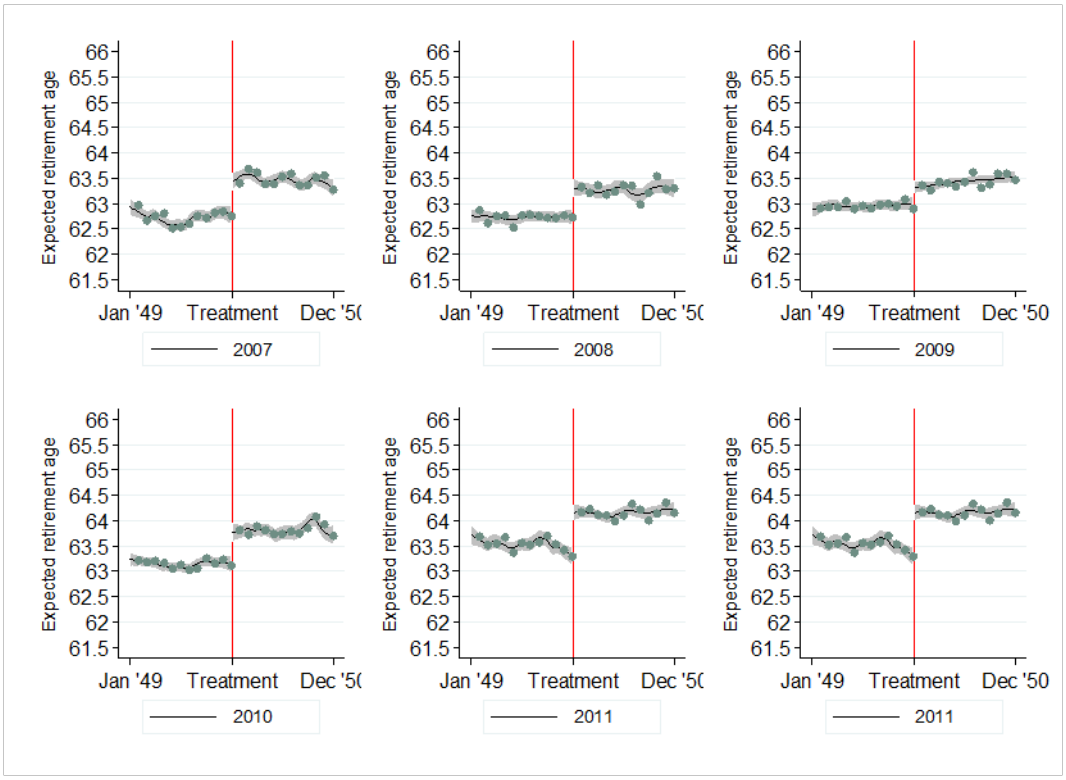
The figures present information on participation in the life course savings program and whether workers invested in additional pension insurance in the previous year (for two successive birth months). The vertical line marks the threshold dividing the control and treatment groups.

Figure 5 Months earlier retirement due to Life course savings (2009)



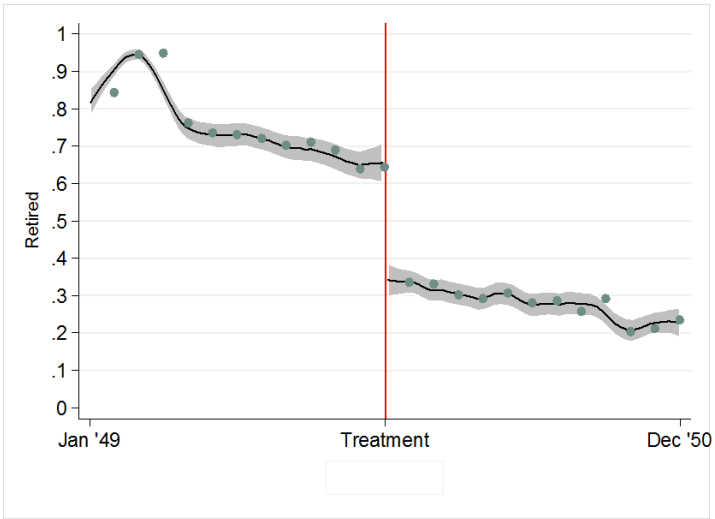
The figure presents the number of months that workers expect to save in the life course savings program (for two successive birth months). The vertical line marks the threshold dividing the control and treatment groups.

Figure 6 Developments in expected age of retirement



The figures present the expected retirement age for the period 2007-2011 (for two successive birth months). The vertical line marks the threshold dividing the control and treatment groups.

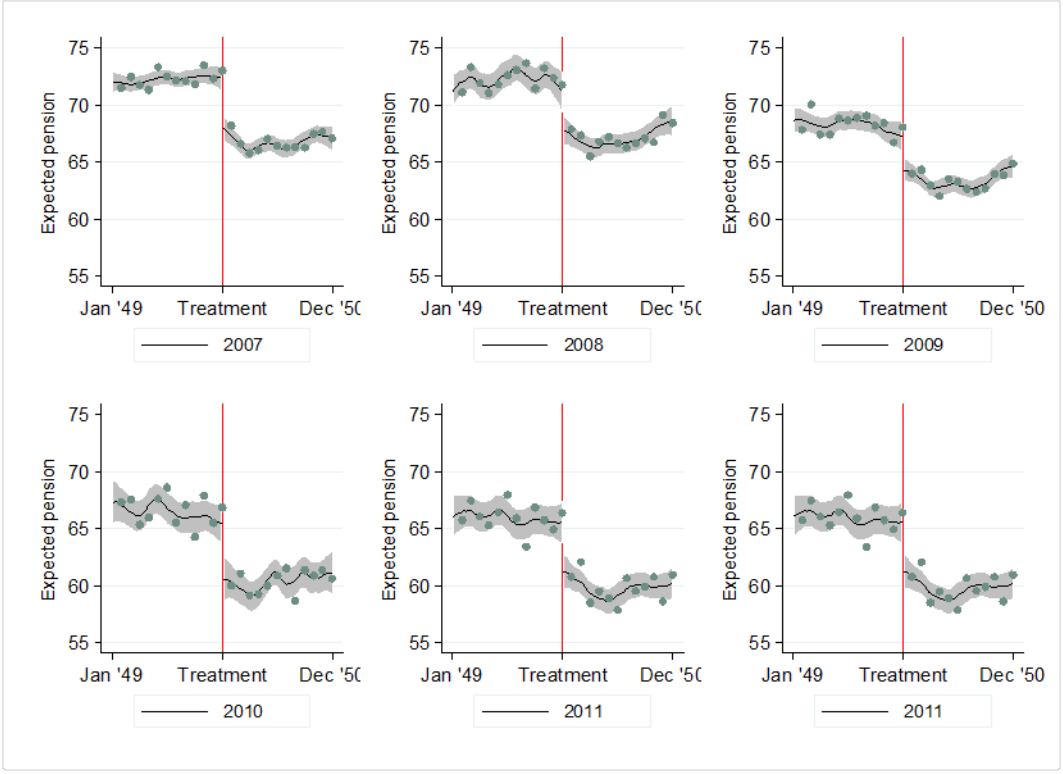
Figure 7 Retirement realizations in 2014



The figure presents the retirement rates in 2014(for two successive birth months). The vertical line marks the threshold dividing the control and treatment groups.

Appendix A

Figure A1 Expected pension benefits in the longer run



The figures present the expected retirement benefits for the period 2007-2011 (for two successive birth months). The vertical line marks the threshold dividing the control and treatment groups.

Table A1 Retirement expectations in 2002

Expected retirement age in 2002	(1)	(2)
Treatment dummy	-0.054	-0.074
	(0.109)	(0.106)
Birth date /100	-0.105	-0.196
	(0.258)	(0.251)
Birth date^2	1.530**	1.337**
	(0.688)	(0.669)
Married		-0.216**
		(0.106)
Low educated (intermediate education is ref)		-0.203*
		(0.107)
High educated		0.280***
		(0.094)
Wage (ln)		0.520***
		(0.137)
Number of contribution years to the pension fund		-0.082***
		(0.006)
Constant	61.398***	58.313***
	(0.071)	(1.466)
Number of observations	6696	6564
Adjusted R-squared	0.001	0.078

Standard errors in parentheses. Other control variables included: sector dummies. * p < 0.10, ** p < 0.05, *** p < 0.01

Table A2 Longer run effects in the difference in retirement expectations before and after the reform (dER_{it}): OLS results

	(1)	(2)	(3)	(4)	(5)
ER(t)-ER(2002)	2007	2008	2009	2010	2011
Treatment dummy	0.845***	0.793***	0.577***	0.664***	0.819***
	(0.102)	(0.136)	(0.147)	(0.151)	(0.178)
Birth date / 1000	-0.042	-0.238	0.181	0.423	0.253
	(0.240)	(0.319)	(0.351)	(0.357)	(0.430)
Birthdate squared	-1.463**	-1.211	-0.743	-1.096	-0.391
	(0.626)	(0.836)	(0.920)	(0.951)	(1.142)
Constant	1.313***	1.246***	1.470***	1.689***	1.812***
	(0.065)	(0.087)	(0.092)	(0.098)	(0.115)
Observations	6605	3612	3220	2947	2146
Adjusted R^2	0.041	0.030	0.023	0.039	0.045

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix B Sample attrition

Table B1 Number of individuals after selections

	Number of individuals		Percentage of population	
	Affected by the reform	Not affected by the reform	Affected by the reform	Not affected by the reform
Population				
2007	14,251	13,468		
2008	14,247	13,467		
2009	14,247	13,465		
2010	14,199	13,415		
2011	14,199	13,412		
Sample before selections				
2007	4,341	4,175	30	31
2008	3,079	2,990	22	22
2009	3,952	3,758	28	28
2010	3,730	3,607	26	27
2011	2,841	2,730	20	20
Sample after selection employed				
2007	3,950	3,780	28	28
2008	3,041	2,906	21	22
2009	3,856	3,629	27	27
2010	3,599	3,324	25	25
2011	2,603	2,345	18	17
Sample after selection employed and individuals without FLO arrangements				
2007	3,686	3,326	26	25
2008	2,862	2,589	20	19
2009	3,529	3,083	25	23
2010	3,352	2,916	24	22
2011	2,505	2,143	18	16
Sample after selection employed and individuals without FLO arrangements and without career breaks				
2007	3,559	3,309	25	25
2008	2,770	2,577	19	19
2009	3,424	3,053	24	23
2010	3,256	2,882	23	21
2011	2,437	2,116	17	16
Sample after selection employed and individuals without FLO arrangements and without career breaks and expected retirement age is not missing				
2007	3,468	3,234	24	24
2008	2,072	2,070	15	15
2009	3,196	2,888	22	21
2010	2,969	2,631	21	20
2011	2,173	1,847	15	14

Table B2 OLS results: selection into the survey

Participation in the survey	(1) 2007	(2) 2008	(3) 2009	(4) 2010	(5) 2011
Treated (affected by the policy)	-0.005	-0.006	-0.002	-0.006	-0.003
	(0.006)	(0.005)	(0.005)	(0.005)	(0.005)
Constant	0.310***	0.222***	0.279***	0.269***	0.204***
	(0.004)	(0.004)	(0.004)	(0.004)	(0.003)
Observations	27719	27714	27712	27614	27611
R-squared	-0.000	0.000	-0.000	0.000	-0.000

Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table B3 Sample averages in 2007: People who stay in the survey in later years vs non-respondents

	Affected by the reform	Not affected by the reform	P-value	Affected by the reform	Not affected by the reform	P-value
	Participated in later waves			Non-respondents in later waves		
Personal characteristics						
Low education level	0.121	0.104	0.289	0.143	0.136	0.680
High education level	0.706	0.702	0.459	0.624	0.678	0.446
Married	0.912	0.927	0.845	0.901	0.911	0.950
Job characteristics						
Number of years contributed to the pension fund	30.925	31.631	0.722	30.928	32.113	0.900
Log of early wage income	10.815	10.822	0.298	10.770	10.784	0.344
Number of contractual work hours	0.996	0.997	0.750	0.996	0.995	0.994
Sectors						
Government	0.477	0.441	0.625	0.483	0.457	0.537
Education	0.454	0.492	0.423	0.438	0.479	0.622
Privatized	0.069	0.066	0.534	0.078	0.064	0.344
Alternative income and savings						
Life course savings	0.160	0.068	0.000	0.157	0.058	0.016
Extra pension savings in previous year	0.251	0.212	0.339	0.271	0.219	0.079
Partner with own income	0.744	0.727	0.219	0.745	0.736	0.427
Pension with own pension	0.577	0.571	0.309	0.567	0.581	0.281
Positive net housing wealth	0.709	0.686	0.069	0.672	0.691	0.600
Number of alternative wealth sources	2.407	2.380	0.925	2.252	2.425	0.310
Retirement expectations						
Expected retirement benefit	66.631	71.656	0.000	67.674	72.765	0.000
Expected retirement age	63.507	62.981	0.000	63.316	62.498	0.000
Expected retirement age before the reform	61.387	61.685	0.617	61.197	61.241	0.081

Table B4 Expected age of retirement in 2007 interacted with dummy for attrition in later years: OLS results

	Expected Retirement Age 2007	
	(1)	(2)
Treatment dummy	0.724***	0.729***
	(0.098)	(0.097)
Attrition	-0.424***	-1.848
	(0.101)	(2.225)
Attrition * Treatment	0.171	0.168
	(0.167)	(0.166)
Birth date / 1000	-0.298	-0.370
	(0.243)	(0.237)
Birthdate squared	0.561	0.329
	(0.656)	(0.642)
Married		-0.004
		(0.107)
Low educated		-0.243**
		(0.100)
High educated		-0.001
		(0.083)
Wage (ln)		0.041
		(0.136)
Number of contribution years to the pension fund		-0.051***
		(0.006)
Constant	62.900***	64.134***
	(0.061)	(1.451)
Observations	6,702	6,569
Adjusted R^2	0.061	0.113

Standard errors in parentheses. Other control variables included: sector dummies.
* p < 0.10, ** p < 0.05, *** p < 0.01