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Incentives, Health, and Retirement*
Evidence from a Finnish Pension Reform

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We analyse the effects of changes in retirement incentives on retirement behaviour, and in particular whether individuals' health status modifies the effects of retirement incentives. We study these issues in the context of the Finnish pension reform of 2005, utilising detailed individual-level administrative data on health and retirement behaviour. Our results indicate that changes in economic incentives matter for retirement behaviour. Many types of individuals react to retirement incentives, and the reaction to economic incentives does not appear to vary according to the individuals' health status in a systematic way. Hence there does not seem to be a trade-off between providing incentives to postpone retirement and equal treatment of individuals with different health status.

JEL-codes: H55, J26

Keywords: Pension reform, retirement incentives, health

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1 Introduction

Many countries faced with the challenge of population ageing have implemented pension reforms with the objective of extending working lives and improving the sustainability of public finances (OECD, 2019). A key tool in these reforms has been to provide financial incentives for individuals to postpone retirement. However, an interesting question is whether these incentives can only be utilised by persons who have relatively good health and are therefore better able to continue working. Because of a positive correlation between health and socioeconomic status, the benefits of working longer may then be reaped primarily by high-income individuals. Therefore, a new kind of efficiency-equity trade off may arise: improving incentives could increase the employment of older workers, but it may also increase income inequality among them.

While the impact of retirement incentives on the decision to continue working has been examined by a large number of earlier studies — we discuss the literature below — ours is one of the first papers on this potential trade-off. We conduct our analysis in the context of a Finnish pension reform implemented in 2005, which influenced retirement incentives very differently across the population. The reform enables us to utilise exogenous variation in the incentives to retire. A key focus in this paper is the potential heterogeneity in individual reactions to retirement incentives. If individuals react differently to these incentives, and if the strength of the reaction is correlated for example with one's health or labour market situation, the reform could indeed lead to troublesome equity consequences.

Overall, the way individuals react to incentives is a huge question in economics. Individuals may not make optimal economic decisions for many reasons, for example due to differences in time preferences (Tanaka, Camerer and Nguyen, 2010), risk behaviour (Gloede, Menkhoff and Waibel, 2015), liquidity constraints (Carvalho, Meier and Wang, 2016) or their level of self-control (Bernheim, Ray and Yeltekin, 2015). Potential differences in terms of health (Decker and Schmitz, 2016) and cognitive abilities (Dohmen et al. 2010; Mani et al. 2013) have also been analysed. In our context, a connection between health and reactions to incentives may arise, for example as follows: reacting to tax-benefit policies in an optimal way often requires difficult financial calculations and long-term planning. If an individual's attention is drawn to other problems associated with her current life situation, her ability to engage in long-term planning may be hindered. Shah, Mullainathan and Shafir (2012) discuss this issue in the context of poverty; we conjecture that a similar mechanism may be operational if an individual is preoccupied with health problems.

We analyse individual reactions to retirement incentives, and the potential efficiency-equity trade-off outlined above, in the context of the Finnish 2005 pension reform. The reform changed the full retirement age from 65 to allow for a more flexible retirement window with the minimum age at 63 and an upper age of 68. The reform also generated extensive variation in financial incentives to postpone retirement. The effects of the incentives varied according to various dimensions, in particular age and accrued pension. For example, the incentives to postpone retirement increased for people with a low accrued pension but a high salary at the age of 63, and typically worsened for people with a long career but a low current salary. We utilise this rich variation in incentives to estimate the effects of the reform on retirement behaviour, and to analyse potential heterogeneity in this response according to health status.

Our paper connects to the large literature on the effects of pension reforms on retirement behaviour. The effects of incentives on retirement have been studied for example in Furgeson, Strauss and Vogt (2006), Coile and Gruber (2007), Hanel (2010), Brown (2013), Johansson, Laun and Palme (2014), Manoli and Weber (2016), Hernæs et al. (2016) and Engels, Geyer and Haan (2017). Some of them find strong responses to retirement incentives, but the results vary considerably. Van Rijn et al. (2014) and Leijten et al. (2015) studied the connection between health and retirement behaviour. They found that ill health increases the likelihood of early old-age retirement, but these papers did not analyse reactions to retirement incentives per se.[1] Kerkhofs, Lindeboom and Theeuwes (1999) estimate the impact of incentives on the retirement decision, while at the same time controlling for health, without examining the interaction between health and incentives.

The paper closest to ours is the study by Garcia-Gomez, Galama, van Doorslaer and Lopez-Nicolas (2017). They first build a theory model, which describes the role of health in mediating the impact of financial incentives on retirement behaviour. The model predicts that wealthier individuals (compared to poorer individuals) are more likely to retire for health reasons and that health problems make older workers more responsive to financial incentives encouraging retirement. Their empirical results, utilising Dutch reforms and administrative data, support the theory. When examining the interaction effect of health and retirement incentives they focus on health shocks, defined as unpredicted hospitalisations. Our study departs from

[1]Gustman and Steinmeier (2018) also examine how health influences the role of economic incentives for the decision to retire and found that health does not affect responses to retirement incentives. However, their approach is very different to ours. They build a structural labour supply model with retirement and then simulate the impacts of changing incentives on people retiring, whereas we use a quasi-experimental setting to obtain causal estimates of how incentives influence retirement decisions among people with different health status.

this by investigating a wider variety of health variables, such as mental health and sickness absence. All our health indicators are objective measures (as opposed to self-reported health status) and lagged by one period, mitigating the potential endogeneity of health on labour market outcomes. The benefit of working with a larger set of health measures is that by doing so we can cover key spheres of health that are also significant determinants of retirement.

There have also been some earlier analyses of the Finnish reform. Uusitalo and Nivalainen (2013) examined the mean response to the reform and found evidence of relatively strong effects of the incentives created by the reform on retirement decisions. They did not analyse the potential heterogeneity in the reactions to the reform, which is crucial for understanding the associated efficiency-equity trade-offs. Leinonen et al. (2016) on the other hand analysed how the effects of the reform varied between individuals with different health status, and found that relatively healthier individuals were induced to retire earlier by the reform. They did not examine the role of incentives, and how those were affected by the reform at the individual level. Gruber et al. (2019) also analysed the main effects of the reform, with a focus on the effect of the change in the statutory retirement age. We control for the effect of age limits in our analysis. The unique contribution of our study is that we focus on differential reactions to incentives. Health differences are prominent, especially among the elderly population, and we provide a comprehensive assessment of the effects of retirement incentives, and this major national reform, on different types of individuals.[2]

Our results indicate that on average individuals react to working incentives in an expected manner: The better the incentives to postpone retirement are, the more likely the individual is to postpone retirement. Furthermore, many types of individuals appear to react to retirement incentives, and it therefore does not seem to be the case that the ability to take advantage of better incentives is limited to any specific group. On average, less healthy individuals retire earlier, as expected, but our results do not indicate strong and consistent differences in reactions to incentives between population groups defined according to health status, using a wide variety of health indicators. Individuals with a spell of sickness absence in the previous year — a health measure specifically related to the ability to work — do seem to react to incentives less strongly than other groups, however.

[2]In a somewhat different context, Hall et al. (2020) analysed individual differences in reactions to an active labour market programme targeted at young people, and found that young individuals who are in a difficult overall life situation (e.g. school dropouts and individuals suffering from mental health problems) do not react to activation. This implies that active labour market policies may not help individuals at risk of social exclusion. Since health problems are more relevant for the elderly, studying these issues in the context of pension reforms appears particularly relevant.

The rest of the paper is organised as follows. Section 2 introduces the Finnish pension system and the 2005 reform. Section 3 presents the empirical strategy. Preliminary results are presented in Section 4, and the robustness of the findings is discussed in Section 5. Conclusions are offered in the final section.

2 The Finnish pension system and the 2005 reform

The Finnish pension system has two elements: 1) earnings-related pensions and 2) residence-based national pensions. Participation in the earnings-related pension system is mandatory and covers virtually all earnings and workers. The level of an individual's pension is determined by her working history, the earnings received and age at retirement. National pensions and the so-called guarantee pension (introduced in 2011 to guarantee a minimum level of income to all pensioners living in Finland) are proportional to the earnings-related pension. They are paid to those individuals who have a low accrued pension. Each euro of accrued earnings-related pension cuts national pensions by 50 cents and the maximum amount of the national pension was 529.68 euro per month in 2005. Also, the marital status of the individual affects the amount of the national pension.

The Finnish pension system has statutory retirement ages for full and early old-age pensions, explained in more detail below. In addition to these two, there are several alternative retirement paths, which differ in their eligibility criteria. The different pathways include part-time pension, disability pension, and unemployment pension (abolished in the 2005 reform).

The first reform laws were passed in the middle of 2003, and the new rules took effect as of January 2005. An information campaign about the reform was implemented already in the beginning of 2004.

Before 2005, the full (or default) retirement age (FRA) was 65 years. Early old-age retirement (ERA) was possible from the age of 60 onwards. Accrued pensions were cut by 0.4% for each month of early retirement before the age of 65. Delaying retirement after the age of 65 increased the accrued pension by 0.6% for each month. The level of pensions was calculated based on earnings for the last 10 years before retirement. It was limited to 60% (66% for public-sector workers) of the highest annual salary for those years. Some public sector workers also had different retirement ages depending on their occupation. Pensions started to accrue at the age of 23 and the accrual rate until age 59 was 1.5%. For 60- to 65-year-olds, the accrual rate was 2.5%. A so-called halfway index[3] was used to convert accrued pensions to the

[3] 50% consumer price index and 50% earnings index

retirement year's money and to adjust pensions paid to those under 65 years old. For those over 65 years old, the earnings-related pension index was used to adjust the pension paid.[4]

The 2005 reform changed the fixed FRA to a flexible FRA. Since 2005 it has been possible to fully retire after the age of 63 and an individual's entire working history is taken into account in calculating the pension payments. The age limit of the ERA, on the other hand, was increased to 62. Early retirement cut pensions by 0.6% for each month of early retirement before the age of 63. Postponing retirement after the age of 68 increased pensions by 0.4% per month. In the reform, the eligibility age for the full national pension remained the same, but the eligibility age for the early national pension changed from 60 to 62. The penalty for claiming the national pension early did not change. Also, the reform introduced a so-called life-expectancy coefficient that takes into account the increase in life-expectancy, and induced a permanent cut in pensions. Each birth-cohort has its own value of the coefficient and it was first applied in 2010 for the birth-cohort of 1948 onward.

In addition to age limits and the associated rules, accrual rates changed as well. Following the reform, the accrual rate for the 18–52-year-olds was 1.5%. Between the ages 53 to 62, the accrual rate was 1.9%. For 63- to 68-year-olds, the reform introduced a so-called 'super' accrual rate of 4.5%, where the aim was to encourage people to keep working after the minimum eligibility retirement age. Further, pensions that accrued after the age of 63 no longer influenced an individual's national pension. The halfway index was replaced by a wage coefficient[5] and the reform abolished the differences in the regulations between public and private sector workers.

The above changes to the retirement system implied that the reform had different implications for different cohorts of individuals. The important message here is that the reform created variation in incentives between population groups and over time, and this variation can be utilised to estimate the causal effects of the reform.

3 Empirical strategy

3.1 Data and the sample

We use individual-level annual updated administrative data from the Finnish Centre for Pensions and Statistics Finland. In addition to crucial information on pensions and retirement decisions, the data includes a large set of individual demographic

[4] 80% consumer price index and 20% earnings index

[5] 20% consumer price index and 80% earnings index

and labour market characteristics. In addition, the data contains a wide range of individual health indicators based on register data on hospital treatments and drug prescriptions. The sources for the health data are the National Institute for Health and Welfare (THL) and the Social Insurance Institution of Finland (Kela). The sample is an 11% random sample of all persons residing in Finland for at least one year during 1987–2007 and the data for these individuals covers the years 2000–2015.

In the analysis, we concentrate on early and full old-age retirement and we include individuals entitled to national pensions (we model national pensions as well). In Section 5, we check the robustness of our findings by focusing on individuals receiving only earnings-related pensions, since they are the most affected by the changes in incentives caused by the reform.[6]

Our main sample includes private sector workers aged between 62 and 68 years (at the end of the year) who are in the labour force. Being in the labour force is defined as not having retired earlier. In one robustness check we exclude individuals who were unemployed in the previous year. We focus on 62- to 68-year-old individuals, because they are able to retire (early or full) both before and after the reform. However, the possibility for early old-age retirement was abolished in 2013 and this rule was applied for the first time in 2014. Therefore, the years 2014 and 2015 are excluded from the analysis. All workers other than private sector workers are excluded from the sample, because of the inaccuracy of the data and some differences in the accrual rules between sectors. Our sample size is around 36,000 individual-year observations.

We choose to exclude disability pensions from the main analysis since we want to focus on retirement that is based more directly on the decision of an individual. In Section 5, we examine the sensitivity of our results to the way in which disability pensions are handled, and show that our results are robust in this respect too.

As mentioned above, the reform took effect in 2005, but full information about the reform was available already in 2004. We exclude the years 2004 and 2005 from our analysis to abstract from potential anticipation effects.

3.2 Measuring the financial incentives to retire

We use the changes in total *Pension wealth*, when retirement is postponed by one year, to measure the financial incentives related to retirement. A similar approach

[6]The reform did not change the eligibility age for full national pension or the penalty for early claiming within that system.

has been used e.g. in Coile and Gruber (2007).[7] We define pension wealth as the present value of the stream of future pension incomes until age one hundred. The benefit of using pension wealth instead of the annual pension is that it measures the financial incentives of postponing retirement more broadly. Analysing changes in pension wealth takes into account how postponing retirement affects future pensions, as well as the fact that pension payments are then received for one year less. Formally, pension wealth is defined as:

$$PW_r = \sum_{s=r}^{100} \pi_s \beta^{s-r} I^{s-r} P_r(r) \tag{1}$$

Where r indicates the age of retirement, $P_r(r)$ is annual pension including national pension (in year 2000 euros) when retired at age r, s is age, π_s represents gender and age dependent survival probability (from Statistics Finland) and β is the discount factor ($\beta = 0.97$). After retirement, pensions are increased according to an index I in real terms.[8] In the calculations of I we use the average annual growth rates of the consumer price index, earnings index and national pension index from 1995 to 2015. For the first one we use 1.59%, for the second one we use 3.13% and for the third one 1.8%. We also convert pension wealth into year 2000 euros using the consumer price index.

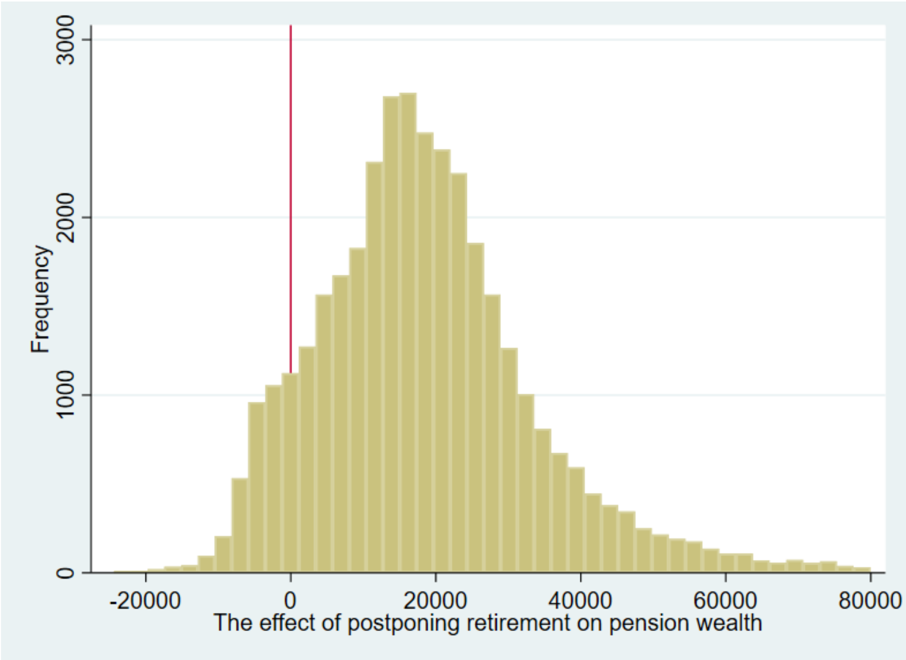
Our measure for financial incentives is the relative change in pension wealth when retirement is postponed by one year:

$$\Delta \ln(PW_r) = \ln(PW_{r+1}) - \ln(PW_r) \tag{2}$$

[7]Other measures for the incentive to stay in the labour force used in the literature are the option value measure (see Stock and Wise (1990)) and the peak value of pension wealth (see Coile and Gruber (2007)). The option value is formed by calculating the individual's utility at different retirement dates. These levels of utilities are compared to that with the highest utility (optimal retirement date) and this difference gives the measure for the incentive to retire at any given point in time. We choose not to use this measure, because it would require making additional assumptions about individuals' risk aversion and consumption and leisure preferences. The peak value is similar to the option value, without the need for making additional assumptions about individual preferences. The peak value approach compares the highest level of pension wealth with the current-year level of pension wealth. One potential worry with the peak value measure is that it does not take into account how many years are needed to postpone retirement to reach the optimal level of pension wealth.

[8]Before 2005, pensions were tied to the halfway index (for under 65-year-olds) and to the earnings-related pension index (those 65 or older) and after that only to the earnings-related pension index. National pensions are tied to the national pension index (before and after the reform).

We calculate pension wealth for each individual for every year using the accrual rules in place during a particular year. In the calculations, we use information about the individual's overall accrued pension at the end of 2004. The source for this variable is the Finnish Centre for Pensions. We further assume that the retirement date is always December 31. The main reason is that individuals who are not retired at all do not have any retirement date to use, and a fixed date within the year ensures comparability. Second, for the retirement year and the year after retirement, we use earnings from the year before retirement multiplied by the earnings index.



Note: Values are in year 2000 euros.

Figure 1: Change in pension wealth when retirement is postponed by one year

Figure 1 shows how postponing retirement by one year alters pension wealth (measured in year 2000 euros). For the majority of individuals, postponing retirement increases their pension wealth and on average the increase is around 25,000 euros. However, the effect of delaying retirement varies substantially among individuals. For some individuals, postponing retirement decreases pension wealth, whereas for some their pension wealth increases by over 80,000 euros. Typically, individuals with negative incentives have small wages compared to their accrued pension.

To isolate the effect of the reform on the incentives and pension wealth, we adopt a micro-simulation type approach. We first calculate pension wealth including national pensions[9] and the incentives to postpone retirement for every individual with

[9]Appendix B.1 contains some descriptive figures with earnings-related pensions only.

both rules, and then compare these two. Since wealth and incentives are calculated for each individual under both rules for the whole study period, the only difference between the calculated values is due to the changes in the rules. Figure 2 illustrates how the reform overall changed the effect (in year 2000 euros) of postponing retirement by one year on pension wealth. On average the effect is slightly negative, indicating that the reform on average mildly worsened the financial incentives to delay retirement. However, the effect is not the same for every individual and there is large variation as to how the reform affected incentives.

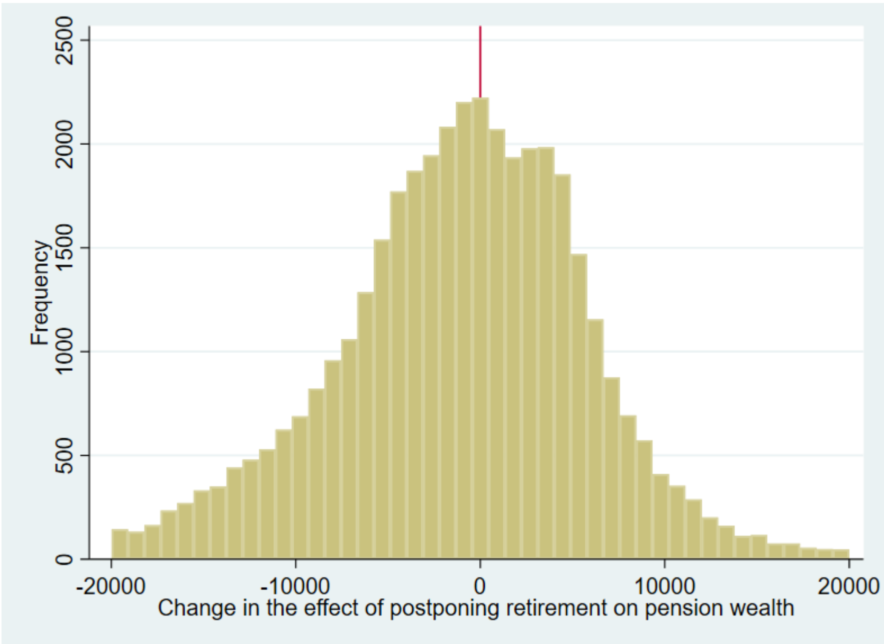


Figure 2: Change in the effect of postponing retirement on pension wealth (in euros)

As was explained above, different age groups were affected differently by the reform. Figure 3 shows the effect of the reform on retirement incentives by age groups (also in euros). According to Figure 3, the reform increased, on average, the incentives to postpone retirement for 62-year-olds. For 63- and 64-year-olds, the incentives worsened on average. For 65-year-olds, the reform was neutral on average.

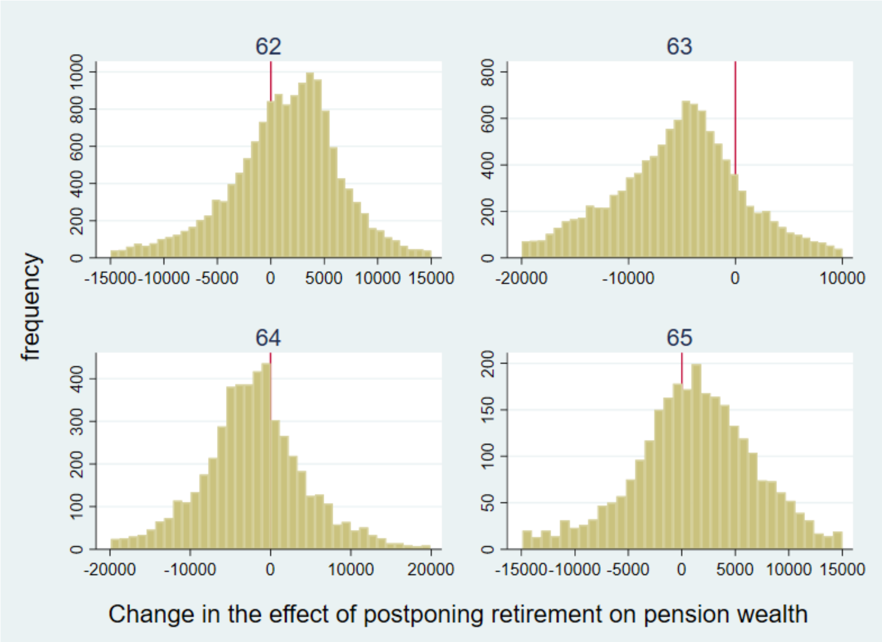


Figure 3: Change in the effect of postponing retirement on pension wealth, by age groups

A similar story emerges from Figure 4, which shows the direct effect of the reform, in percentages, on pension wealth and incentives for those aged 60 to 66. The direct effect on pension wealth is calculated using the 2004 data and the information on total accrued pensions at the end of year 2004. As can be seen from the figure, people under 65 saw an overnight increase in their pension wealth, since eligibility age for old-age pension decreased from 65 to 63 years of age. The effect was highest for individuals aged 63 who saw an increase of around 9% in their pension wealth.[10] The pensions of individuals who were at least 65 years old at the time of the reform were protected. Therefore, the change in pension wealth is zero in the figure for those age groups.

In addition to the overnight effects shown in Figure 4, the reform also had other effects on pension wealth. The larger accrual rate for those aged 53 to 60 years or at least 63 years, the change in the indexation of accrued pensions and the new feature that pensions accruing after the age of 63 did not affect national pensions, all contributed to increase pension wealth. On the other hand, the smaller accrual rate for those aged 60 to 62 years, the change in delayed claiming, and the introduction of the life-expectancy coefficient had a decreasing effect on pension wealth.

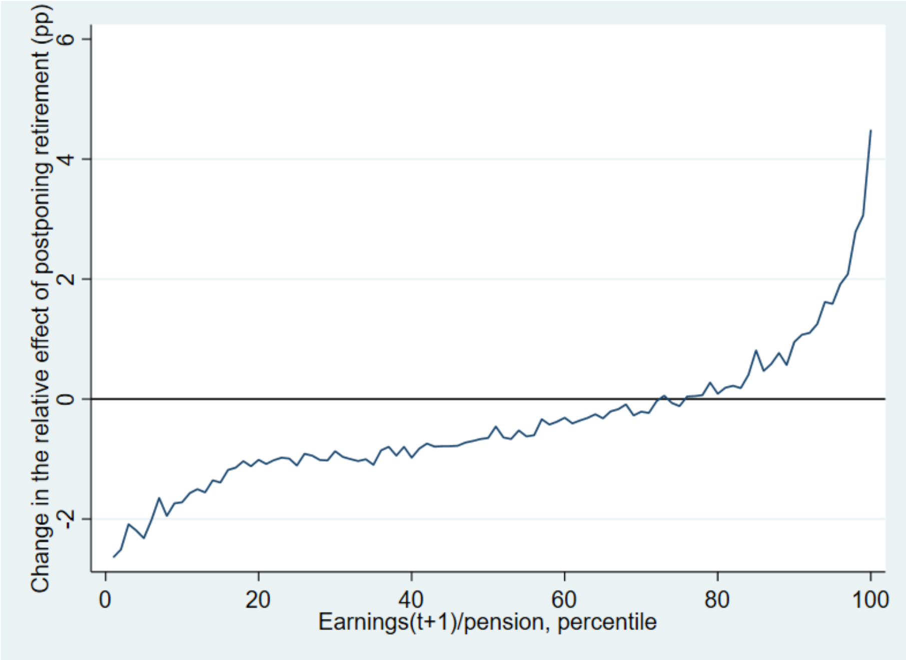
[10]Figure 4 includes national pensions as well. National pensions partly offset the rise in pension wealth, since the statutory ages for full national pension did not change. Those aged 63 and not eligible for national pension saw an increase of around 10% in their pension wealth.

The log-difference of pension wealth (incentives to postpone retirement) changed as well. The reform increased the incentives for those under 62.5 years, weakened incentives for those between 62.5 to 65 years, while the change in incentives was close to zero for those over 65 years of age.

Note: The values are calculated by comparing the levels of pension wealth using the retirement rules before and after the reform. These are calculated as averages within bimonthly bins. The red line is calculated as a percentage point difference in the relative effect on pension wealth when retirement is postponed by 12 months. The blue line is calculated as a percentage change in pension wealth. Change in pension wealth is calculated using the information on total accrued pension at the end of year 2004 and using the 2004 data. Incentives are calculated using the whole sample. Age is age at the end of the year.

Figure 4: Effect of the reform on pension wealth and incentives to postpone retirement

As was mentioned, the reform created variation in incentives according to accrued pension and earnings. This variation in incentives is illustrated in Figure 5. On the x-axis, individuals are divided into percentiles according to the ratio between next-year earnings and current-year total pension. The y-axis shows the difference in the relative effect of postponing retirement between the rules. As can be seen from Figure 5, the incentives to postpone retirement became better for those with high earnings compared to their accrued pension and became worse for those with low earnings compared to their accrued pension. The effect of the reform also clearly increases and is roughly monotonous over the percentiles, but the increase is not linear.



Note: The y-axis shows the difference in the relative effect of postponing retirement on pension wealth between the rules.

Figure 5: Effect of the reform on incentives to postpone retirement by the ratio of future earnings and pension

3.3 Measurement of health

We measure health with several different variables, derived from various national registers containing detailed individual-level information on different aspects of health.[11]

First, we use hospitalisation and treatment information from the hospital discharge records of the Finnish Institute for Health and Welfare. Using this register, we form an indicator of whether or not an individual has been treated in hospital for any reason. We separate cardiovascular diseases and diseases of the musculoskeletal system and connective tissue to their own indicators based on the International Classification of Diseases (ICD-10).[12]

Second, we use medication information from the reimbursement register of the Social Insurance Institution of Finland. We form two variables using data on purchases of prescription medications. The first measure is formed according to total purchases of medication within a year and is divided into three categories (less than 4 purchases, 4 to 7, and 8 or more). For mental health, we use information on

[11] In Appendix B we show how the incentives and the effect of the reform on incentives vary according to health status.

[12] We identify hospitalisations and treatments due to diseases of the circulatory system (I00-I99) and diseases of the musculoskeletal system and connective tissue (M00-M99).

purchases of prescribed psychotropic medication.[13]

Third, we use information on sickness absence from the Social Insurance Institution of Finland. We measure sickness absence as the total length of all sickness absence spells in days within a year. Sickness allowances, however, are paid only after a specified (usually 10 days) waiting period and thus the register only contains information about those sickness absences that are longer than the waiting period. We divide the length of sickness absences (days after the waiting period) into four categories (0 days, 1 to 14 days, 15 to 60 days, and over 60 days). Sickness absences that continue into the next year are allocated to both years according to the respective number of days.

In addition to these measures, we form a more general indicator of ill health, dividing the sample into sub-samples according to overall health status. We describe the formation and rationale behind this measure when we carry out the sub-sample analysis.

Table 1 shows some descriptive statistics for our main sample. Approximately 20–30% of the target group retires each year, and a much larger share (33% instead of 14%) reaches the full retirement age after the reform, due to a lowering of the full retirement age. Individuals have approx. 35 years of work history on average, and the mean pension is close to 15,000 euros a year in comparison to mean annual earnings of around 26,000 euros. When it comes to the measures of health, a small share receive treatment for a specific type of illness. Many individuals (around 20%) have sickness absences and use a large amount of prescription medication. For example, 7–8% of the individuals in the sample used psychotropic medication.

[13]The Anatomical Therapeutic Chemical (ATC) classification codes were used, and purchases of psycholeptics (N05) and psychoanaleptics (N06, excluding anti-dementia drugs N06D) were captured by our variable of psychotropic medication.

Table 1: Means of selected variables before and after the reform

	Before the reform	After the reform
Retirement rate	0.202	0.343
Reaching full retirement age	0.144	0.329
Female	0.430	0.401
Age (at the end of the year)	63.13	63.01
Spouse (share)	0.706	0.704
Working history	34.87	36.84
Earnings	23,354	28,709
Accrued pension (euros)	13,132	17,309
Pension wealth (euros)	279,220	355,854
Pension wealth (logs)	12.43	12.66
$\Delta\ln(PW)$	0.0659	0.0510
$\ln(PW)$	20,379	19,178
Psychotropic medication (t-1)	0.0681	0.0861
Drug purchases (t-1)	5.688	7.960
Any treatment (t-1)	0.106	0.199
Treatment, Cardio (t-1)	0.0228	0.0359
Treatment, Muscular (t-1)	0.0249	0.0402
Sickness absenses days (t-1)	5.170	4.849
Sickness absenses share (t-1)	0.232	0.201

Note: Monetary values are in year 2000 euros. Sickness absences in days refers to the length of sickness absence spells after the waiting period.

3.4 Estimation strategy

Our main question is how financial incentives affect retirement behaviour and whether the reactions vary between individuals with different health status. Our analysis includes the years 2000–2015 and we exploit variation between population groups and across time to study how financial incentives affect retirement. To be precise, we estimate the following regression:

$$R_{i,t} = \theta_1 \Delta\ln(PW_{i,t}) + \theta_2 \ln(PW_{i,t}) + \alpha_g + \gamma_t + \boldsymbol{\beta X} + u_{i,t} \qquad (3)$$

where $R_{i,t}$ is an indicator variable equal to one if individual i retires in year t, conditional on not having retired earlier. α depicts a group fixed effect and γ is the time fixed effect. Groups refer to different population groups, according to gender, age (62–68 years old), and working history ($\leq$ 35 years, 36–40 years, and over 40 years). The age groups 66–68 are combined because the number of individuals who are not yet retired in this age group is small. In total we have 30 population groups. Vector $\boldsymbol{X}$ contains individual-level control variables[14] including spouse controls and health indicators. PW_t is an individual's calculated pension wealth at the end of year t and $\Delta \ln(PW_{i,t})$ captures the incentives to postpone retirement.

The parameter of interest is θ_1, which captures the effect of financial incentives on the retirement probability, while the control variables (including the actual level of pension wealth) capture some of the other determinants of retirement behaviour.

In the second step, we study how the reactions to incentives vary by health status. We choose to present models estimated using different sub-samples, because we want to favour an approach that allows for the varying impact of other determinants on retirement in different population groups. This approach is more flexible and easier to interpret than the alternative of interacting the group indicators with the incentive measures, for example.

In addition to these main analyses, we carry out a wide variety of robustness checks, as outlined in Section 5.

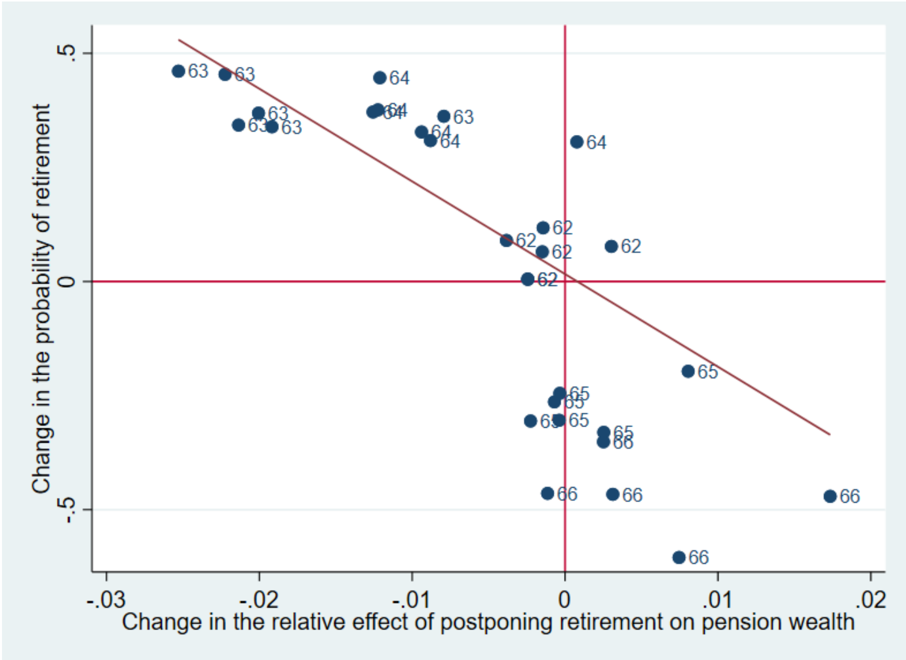
4 Results

4.1 Results for the full sample

We first provide some graphical evidence to illustrate how changes in the incentives to postpone retirement, due to the reform, are related to the corresponding change in the probability of retirement. This is depicted in Figure 6. The x-axis shows how the reform changed the incentives in relative terms among various groups, whereas the y-axis shows how the probability of retirement changed in the same groups around the reform. The groups are formed according to age, gender and work history and the numbers in the graph show the age of each group. Clearly there is a negative connection between the incentives to postpone retirement and the retirement probability.

Next, we report the mean impact of the reform on retirement using a simple OLS setting, corresponding to Equation (3). These results are shown in Table 2. The first column reports results from the regression with group and year fixed effects, while the second column adds the level of pension wealth to the model. The third model contains basic individual-specific control variables, which include also a dummy measuring whether the person has reached the full retirement age. Controlling

[14] A full description of the control variables used in the estimations is presented in Appendix A.



Note: The red line is the regression line, which is weighted according to the group sizes.

Figure 6: Relationship between the change in retirement probability and incentives

for this factor is important, given that the analysis in Gruber et al. (2019) has found reaching the default retirement age to be a crucial determinant of retirement decisions. The fourth model also includes controls for an individual's spouse. In models (5) to (10), the health variables are included separately one at a time, and in model (11) all the individual health variables are included simultaneously.

The signs of the estimates are as expected. The coefficient of the log change in pension wealth, $\Delta \ln(PW)$, is negative, indicating that when incentives to retire later are increased, individuals are indeed less likely to retire during the analysis year. On the other hand, the wealth effect ($\ln(PW)$) increases the likelihood of retirement. These results are stable across the different specifications. With the full set of controls (Column 11), the estimated coefficient indicates that a one percentage point increase in the incentives decreases the risk of retirement by around 2.8 percentage points. A one-unit increase in the level of log of pension wealth, in turn, increases the risk of retirement by 6.4 percentage points (Column 11). Compared to earlier findings from Finland (Uusitalo and Nivalainen, 2013), our estimation results for the effect of incentives have the same sign, but the magnitude is smaller, which may be due for example to the fact that Uusitalo and Nivalainen (2013) conduct the analysis at a group level. In Sweden, Johansson et al. (2014) find rather similar results on the effects of incentives as we do. In sum, individuals respond to retirement incentives as expected, and the estimated wealth effects are consistent with the notion that leisure time is a normal good (higher wealth levels lead to earlier retirement).

Table 2: Baseline OLS estimates

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Dependent variable is retirement decision and mean retirement rate in each model is 0.327											
$\Delta \ln(PW)$	-2.920***	-2.971***	-2.761***	-2.774***	-2.772***	-2.774***	-2.773***	-2.770***	-2.774***	-2.794***	-2.788***
	(0.299)	(0.287)	(0.267)	(0.263)	(0.264)	(0.263)	(0.263)	(0.263)	(0.264)	(0.263)	(0.264)
$\ln(PW)$		0.0466**	0.0660***	0.0647***	0.0646***	0.0647***	0.0645***	0.0651***	0.0629***	0.0646***	0.0636***
		(0.0156)	(0.0156)	(0.0157)	(0.0158)	(0.0157)	(0.0157)	(0.0158)	(0.0157)	(0.0156)	(0.0158)
FRA			0.274***	0.273***	0.273***	0.273***	0.273***	0.273***	0.273***	0.273***	0.273***
			(0.0325)	(0.0327)	(0.0327)	(0.0327)	(0.0327)	(0.0327)	(0.0328)	(0.0327)	(0.0328)
Treatment, cardio (t-1)					0.0521***						0.0407**
					(0.0137)						(0.0130)
Treatment, muscular (t-1)						0.0101					-0.00607
						(0.0153)					(0.0144)
Any treatment (t-1)							0.0118				-0.0112
							(0.00895)				(0.00926)
Psychotropic medication (t-1)								0.0384***			0.0271**
								(0.00981)			(0.00899)
Medication purchases (t-1)											
4 to 7									0.0124		0.00990
									(0.00622)		(0.00622)
8 or more									0.0319***		0.0246**
									(0.00693)		(0.00676)
Sickness absenses (t-1)											
1 to 14 days										0.0239	0.0194
										(0.0159)	(0.0149)
15 to 60 days										0.0247*	0.0212*
										(0.0109)	(0.00919)
Over 60 days										0.0633**	0.0545**
										(0.0191)	(0.0182)
Observations	36,121	36,121	36,121	36,121	36,121	36,121	36,121	36,121	36,121	36,121	36,121
R-squared	0.249	0.250	0.268	0.270	0.271	0.270	0.270	0.271	0.271	0.271	0.272
FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Individual controls	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES	YES
Spouse controls	NO	NO	NO	YES	YES	YES	YES	YES	YES	YES	YES
Health controls t-1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	YES

Note: $\Delta \ln(PW)$ is the relative change in pension wealth when retirement is postponed by one year. Sickness absences indicates days after the waiting period.
Clustered standard errors by group in parentheses
*** p<0.001, ** p<0.01, * p<0.05

As in Gruber et al. (2019), we find that reaching the full retirement age (FRA) is an important determinant of the retirement decision. The estimated coefficient on the dummy indicating that an individual has reached the statutory retirement age is around 0.27 across all specifications.

Regarding the health variables, in many cases worse health is associated with a higher risk of retirement. Psychotropic medication increases the risk of retirement by 3.8 percentage points and having at least 8 prescription medication purchases increases it by around 3.2 percentage points. In addition, a treatment period due to cardiovascular diseases increases the likelihood of retirement by 5.2 percentage points. Sickness absence increases the risk of retirement as well. Having a spell of 15 to 60 sickness absence days (after the waiting period) increases the risk by around 2 percentage points and over 60 sickness days increases it by around 6.7 percentage points. On the other hand, the estimated coefficient for any treatment period, a treatment period due to musculoskeletal issues, less than 8 medical purchases and having a length of sickness absences of 1 to 14 days are not statistically significant. When the health variables are included simultaneously, having a treatment period for cardiovascular diseases, use of psychotropic medication, use of a large amount of other prescription medication and 30 or more sickness absence days (over 60 days) remain statistically significant determinants of retirement behaviour. In particular, long spells of sickness absence are, quite intuitively, important determinants of retirement behaviour.

4.2 Results by subgroups

Next, we analyse how the results vary between different types of individuals with varying health. The heterogeneity analyses are conducted by running regressions using separate sub-samples. The samples are divided according to whether an individual has (i) had any treatment in a hospital; (ii) received treatment for cardiovascular diseases or (iii) musculo-skeletal diseases; (iv) had 8 or more purchases of medication; (v) had medication for mental illnesses; and (vi) had at least one sickness absence day after the waiting period.

Finally, we form an indicator of bad health which utilises information from the different health measures. This combined measure is a complement to the individual measures, and attempts to capture the labour market-relevant aspects of health status more broadly. The indicator gets the value one if the individual has been an inpatient due to cardiovascular diseases in a particular year, has 8 or more purchases of prescription medication, has psychotropic medication or has over 60 days of sickness absence. The rationale behind this indicator is the following: looking at the results from the last column of Table 2, these are the health indicators that have the strongest association with retirement behaviour. Our interest here is in the equity effects of the reform, in particular the interaction between health inequality and economic inequality. We would like to examine whether the reform has a differential effect on those who are prone to retire earlier due to health problems in the baseline. Do those individuals who have a larger risk of retiring early react to incentives - and correspondingly, are they able to utilise the potential financial benefits created by the reform?

The purpose of the subgroup analysis is therefore to detect whether there is a risk that providing high-powered incentives for continuing to work have ramifications in terms of aggravated inequality among older workers. However, it should also be noted that it is not necessarily clear that those with worse health are less inclined to react to incentives: it is also possible that they in fact require stronger financial returns for continuing to work to compensate for the greater opportunity cost of working. The pattern of heterogeneity that we should expect to see is therefore not clear a priori, making the empirical subgroup analysis all the more important and interesting. Further, the link between health and the reaction to work incentives may of course differ depending on the type of the underlying health issues.

The OLS results for the subgroup analysis are reported in Table 3. Overall, those with different types of health problems mostly do react to the incentives and to the level of pension wealth in a similar way as individuals in our sample overall. This is revealed by the test statistics indicating whether the estimated coefficient of the financial incentives differ in a statistically significant way between the two groups studied. This holds for most health indicators, and also for the composite bad health indicator. An important finding, therefore, is that many types of individuals do appear to react to retirement incentives.

Still, we do find some differential reactions to the incentives, pension wealth and reaching the full retirement age. Most importantly, the reactions of individuals with sickness absence spells (exceeding the 10-day deductible period) appear to differ from those of other individuals in our sample: it seems that they react less to the incentives to postpone retirement than others do, and do not react to the level of pension wealth. Furthermore, they react less to reaching the full retirement age. The finding that we see differential reactions for this group in particular is of interest, given that sickness absence is a health indicator with the clearest a priori link to labour market behaviour. Secondly, individuals treated for cardiovascular diseases seem to pay more attention to the incentives when planning whether to retire in the year in question or a year later.

To summarise, the results indicate that economic incentives and the level of pension wealth as well as health status matter for retirement decisions. Many types of individuals, with different health status, do appear to react to incentives. Therefore we do not find evidence of a clear or comprehensive trade-off between providing improved incentives to postpone retirement and avoiding unfair treatment of individuals with differential ability to respond to and therefore benefit from those incentives. One group that does appear to respond differently to the rest of our sample is individuals with sickness absence, which is an indication of health problems that are directly related to an individual's working ability. In addition, individuals with a treatment period for cardio-vascular diseases seem to react more to the incentives to postpone retirement than others do. More generally, there are reasons to interpret our findings cautiously: it is possible, for instance, that the health measures could still hide substantial heterogeneity between people with different severity of morbidity.

Table 3: OLS estimates by population groups

	Treatment, Cardio (t-1)		Treatment, Muscular (t-1)		Any treatment (t-1)		Medication (t-1)		Psychotropic medication (t-1)		Sickness absences (t-1)		Bad health (t-1)	
	Yes	No	Yes	No	Yes	No	8 or more	Less than 8	Yes	No	1 day or more	No	Yes	No
Dependent variable is retirement decision														
$\Delta \ln(PW)$	-3.709***	-2.744***	-2.488***	-2.785***	-2.718***	-2.790***	-2.767***	-2.786***	-2.617***	-2.806***	-1.553***	-2.899***	-2.787***	-2.775***
	(0.448)	(0.265)	(0.398)	(0.269)	(0.315)	(0.272)	(0.304)	(0.253)	(0.356)	(0.263)	(0.295)	(0.273)	(0.304)	(0.246)
$\ln(PW)$	0.0311	0.0664***	0.0448	0.0651***	0.0434*	0.0695***	0.0534**	0.0695***	0.0684*	0.0648***	0.0150	0.0688***	0.0522**	0.0723***
	(0.0364)	(0.0158)	(0.0360)	(0.0158)	(0.0208)	(0.0158)	(0.0191)	(0.0167)	(0.0260)	(0.0156)	(0.0231)	(0.0171)	(0.0187)	(0.0162)
FRA	0.248**	0.273***	0.0702	0.278***	0.230***	0.278***	0.273***	0.272***	0.274***	0.272***	0.231***	0.279***	0.276***	0.270***
	(0.0789)	(0.0330)	(0.0507)	(0.0323)	(0.0424)	(0.0335)	(0.0336)	(0.0354)	(0.0487)	(0.0333)	(0.0381)	(0.0327)	(0.0328)	(0.0366)
p-value $\Delta \ln(PW)$	0.014		0.407		0.771		0.904		0.47		<0.001		0.928	
p-value $\ln(PW)$	0.276		0.536		0.105		0.331		0.867		0.088		0.174	
p-value FRA	0.749		<0.001		0.151		0.974		0.971		0.024		0.83	
Observations	1,243	34,878	1,392	34,729	6,797	29,324	14,592	21,529	3,035	33,086	3,952	32,169	15,885	20,236
R-squared	0.296	0.270	0.308	0.271	0.258	0.274	0.271	0.271	0.293	0.271	0.308	0.269	0.274	0.269
FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Individual controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Spouse controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Health controls t-1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Mean retirement rate	0.413	0.324	0.357	0.326	0.360	0.319	0.355	0.308	0.354	0.325	0.344	0.325	0.354	0.306

Note: The null hypothesis for the p-values is that the difference between the coefficients equals zero. $\Delta \ln(PW)$ is the relative change in pension wealth when retirement is postponed by one year. Sickness absences indicates days after the waiting period.
Clustered standard errors by group in parentheses
*** p<0.001, ** p<0.01, * p<0.05

5 Robustness

5.1 Earnings-related pensions

In the analysis above we included individuals receiving earnings-related pension and/or national pension. However, the reform concerned mostly the earnings-related pension system, and individuals receiving only earnings-related pension were affected more than individuals receiving national pension. In addition, individuals receiving only earnings-related pension have overall higher levels of pension wealth. These two observations together indicate that there might be differences in responses between these two types of individuals.

For this reason, we also examined the recipients of earnings-related pension only, excluding those individuals who received any amount of national pension. The results of the full model (corresponding to the specification reported in the last column of Table 2 for the full sample) are reported in the first column of Table 4. The impact of economic incentives remains significant for this smaller sample as well, but the magnitude of the coefficients rises. This is to be expected, since the changes in the incentives are muted for those receiving national pension. Similarly, the impact of the level of pension wealth remains highly significant, but the magnitude of the coefficient is smaller than in the main sample.

We also conduct the robustness analysis by partitioning the data into subgroups (these are shown in Table C.3). The results tell a similar story as the main analysis. Most subgroups' retirement decisions react to incentives to postpone retirement and also to the level of pension wealth. Furthermore, individuals with sickness absence react differently to incentives than other individuals. The only exception is that individuals treated for cardio-vascular diseases do not react differently to incentives compared to others in this sample.

5.2 IV estimations

One potential worry with the estimations conducted using OLS is that unobserved individual-level characteristics may influence both incentives and retirement: individuals with a greater preference for continuing to work may also have better incentives, for example if their current earnings are high.

Therefore, as a robustness check, we implement an IV (2SLS) analysis. (We explain below why we nevertheless favour the OLS as our main analysis.) In the first stage, we use the reform to generate exogenous variation in incentives between population groups, utilising the fact that the reform changed the incentives to work

Table 4: Robustness of the baseline results

	OLS				IV
	(1)	(2)	(3)	(4)	(5)
Dependent variable is retirement decision					
$\Delta\ln(PW)$ or $\Delta\ln(pension)$	-3.662***	-1.582***	-2.784***	-2.786***	-3.840***
	(0.325)	(0.362)	(0.259)	(0.264)	(0.522)
$\ln(PW)$ or $\ln(pension)$	0.0461**	0.0523**	0.0614***	0.0644***	0.068***
	(0.0165)	(0.0150)	(0.0162)	(0.0158)	(0.007)
FRA	0.292***	0.283***	0.275***	0.274***	0.264***
	(0.0406)	(0.0332)	(0.0308)	(0.0328)	(0.011)
Treatment, cardio (t-1)	0.0273*	0.0321**	0.0426**	0.0408**	0.040**
	(0.0105)	(0.0110)	(0.0135)	(0.0130)	(0.013)
Treatment, muscular (t-1)	-0.0126	-0.00609	-0.0238	-0.00608	-0.007
	(0.0165)	(0.0146)	(0.0149)	(0.0144)	(0.013)
Any treatment (t-1)	-0.0144	-0.00886	-0.0154	-0.0112	-0.014
	(0.00939)	(0.00842)	(0.00850)	(0.00926)	(0.007)
Psychotropic medication (t-1)	0.0337*	0.0287*	0.0364***	0.0272**	0.026**
	(0.0125)	(0.0106)	(0.00854)	(0.00899)	(0.008)
Medication purchases (t-1)					
4 to 7	0.0125	0.00842	0.00952	0.00989	0.010
	(0.00804)	(0.00587)	(0.00649)	(0.00622)	(0.006)
8 or more	0.0307**	0.0192*	0.0278***	0.0246**	0.024***
	(0.00848)	(0.00766)	(0.00682)	(0.00675)	(0.005)
Sickness absenses (t-1)					
1 to 14 days	0.0141	0.0326*	0.0289*	0.0194	0.030*
	(0.0165)	(0.0137)	(0.0137)	(0.0149)	(0.012)
15 to 60 days	0.0282*	0.0341***	0.0557***	0.0211*	0.031**
	(0.0136)	(0.00873)	(0.00837)	(0.00919)	(0.012)
Over 60 days	0.0568**	0.0775***	0.275***	0.0545**	0.060***
	(0.0190)	(0.0175)	(0.0327)	(0.0182)	(0.015)
Mean retirement rate	0.340	0.296	0.338	0.327	0.327
Observations	25,023	31,528	36,713	36,121	36,121
R-squared	0.287	0.278	0.259	0.272	0.268
FE	YES	YES	YES	YES	YES
Individual controls	YES	YES	YES	YES	YES
Spouse controls	YES	YES	YES	YES	YES
Health controls t-1	YES	YES	YES	YES	YES
First stage: Dependent variable is the relative change in pension wealth ($\Delta\ln(PW)$)					
YearXgroup					Yes
Kleibergen-Paap F statistics					4.34
First stage r-squared					0.272
Endogeneity test					0.203

Note: In model (1), individuals entitled to national pension are excluded, in model (2) unemployed in the previous year are excluded, in model (3) disability retirements are included and pension wealth and the incentives calculated according to equation (4), in model (4) $\Delta\ln(pension)$ and $\ln(pension)$, are used to measure the incentives and in model (5) the estimation is conducted using 2SLS with the main sample. OLS is used for the first 4 models, and in all models except model (4) incentives are measured using the relative change in pension wealth and the level of pension wealth. The endogeneity test-column shows the p-value of the endogeneity test. The null hypothesis for the endogeneity test is that the specified endogenous regressor ($\Delta\ln(PW)$) can be treated as exogenous. $\Delta\ln(PW)$ is the relative change in pension wealth when retirement is postponed by one year. Sickness absences indicates days after the waiting period.
For models (1) to (4), clustered standard errors by groups in parentheses. For model (5), robust standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05

in a different way across groups e.g. according to age and length of working career. We use the same groups as in the OLS analysis, and estimate the main equation with 2SLS using group×year interactions as instruments for the retirement incentives, while controlling for group permanent effects and the time period. The exclusion restriction is that group×year dummies affect retirement only via changing economic incentives. The identifying assumption is similar to a parallel trends assumption in difference-in-difference designs, i.e. assuming that the retirement rates of the different groups would have developed in a similar fashion in the absence of the reform.

The instruments, however, seem to be weak and the sizes of some of the group×year interactions are very small.[15] We also test for the endogeneity of the incentives (with given instruments), and find that with the main sample the incentives could be treated as exogenous. For all of these reasons we chose to favour OLS as the main estimation approach, and report the IV results only as a robustness check.

Turning to the results from the IV analysis, in the first stage the dependent variable is the change in pension wealth, $\Delta \ln(PW)$, which is estimated using group×year dummies as instruments. In the second stage, the fitted values of the change in pension wealth with group and year fixed effects and other controls are used to explain retirement decisions. The results from the second stage of the 2SLS estimation are provided in column 5 of Table 4.

The results are qualitatively similar to the OLS results - the signs of the main coefficients of interest are as expected, and the estimated coefficients are also statistically highly significant. The point estimates are larger than with OLS. A one percentage point increase in the incentives decreases the risk of retirement by 3.8 percentage points. A one-unit increase in the log of pension wealth increases the risk of retirement by 6.8 percentage points.

Table C.4 shows the 2SLS estimation results for the different population groups. Qualitatively, the picture that emerges is similar to the main analysis, in that most subgroups appear to react to retirement incentives in a statistically significant way. Again, the differences in the reactions across population groups are typically not statistically significant. Only individuals with a treatment period for musculoskeletal issues seem to differ in their reactions as they do not react to the incentives in a significant manner. However, as in the IV analysis of the mean effect, the F statistic for excluded instruments is low in many specifications.

[15] We also used group×reform interactions as instruments with no significant improvement.

5.3 Excluding unemployed individuals

Unemployed individuals may have different reasons to retire than employed individuals simply because they do not have a job to continue in. Furthermore, there might be differences in the usage of sickness absences between employed and unemployed individuals, which may partly explain our results for sickness absence.[16] Therefore we also run the analysis by excluding unemployed individuals from the sample. We have information about the main type of activity of an individual within a year and use that to identify unemployed individuals.

The baseline estimation results are shown in the second column of Table 4. The estimated coefficients for the incentives and the level of pension wealth are somewhat smaller than with the main specification, but are still highly significant. Also, the majority of the health variables are significant determinants of retirement behaviour.

The population subgroup results are displayed in table C.5. The results are somewhat similar to our main analysis. However, we do not find any statistically significant differences in reactions to financial incentives. This finding has some significance, as it indicates that our results in the baseline analysis might be at least partly driven by differential reactions of unemployed individuals.

5.4 Different measure of incentives

In our main analysis we formed the measure for the incentives using changes in pension wealth, which is the discounted stream of future pensions until age 100. One possible issue with our choice is that the time horizon is too long. To test for the robustness of our results against this choice, we run the analysis using the other extreme, i.e. using annual pension instead of pension wealth, and using the accrual rate of the pension as the measure for the incentives to postpone retirement.

The estimation yields exactly the same coefficients for all the variables as our baseline estimation. These results are shown in column 4 of Table 4. For the subgroup analysis, the results are also very similar (shown in table C.6).

5.5 Disability pensions

In the main analysis, we chose to exclude disability pensions because we wanted to concentrate on retirement that is more directly based on the decision of an individual. This decision may not necessarily be entirely innocuous. We are interested

[16] Both employed and unemployed persons are entitled to sickness allowance in Finland, but because the level of compensation is the same in both benefits, the unemployed may not be motivated to apply for sickness allowance.

in individuals with different health statuses, and one may worry whether excluding individuals with the poorest health affects our results. In this section, however, we argue that the reliability of our results is not compromised by this choice.

First, Table 5 shows that the majority of disability retirements occur before the age of 62 and this share has remained similar after the reform. However, an additional worry is that the reform might have affected the attractiveness of the different retirement pathways. The change in the full retirement age also affected the eligibility ages for disability pensions: after the reform, 63- to 65-year-old individuals could no longer retire due to disability but were able to claim full old-age-pension. The reform also decreased the target age of the projected pension component and changed the accrual rate of the projected pension component from 0.8% to 1.3% and after 2010 it was further increased to 1.5%. Disability pensions were calculated with the new rules for the first time in 2006. In addition, the reform abolished the unemployment pension and this was partly compensated by providing occupational disability criteria for disability retirement.

Table 5: Share of retirements by age and retirement type

	Old-age pensions		Disability pensions	
	2003	2015	2003	2015
62	5 %	8 %	4 %	5 %
63	15 %	51 %	2 %	1 %
64	2 %	13 %	1 %	0 %
65	44 %	17 %	0 %	0 %
66	1 %	3 %		
67	0 %	1 %		
68	0 %	2 %		
Total number of retirements	19,768	55,377	28,056	21,197

Source: Own calculations based on Finnish Centre for Pensions online database
Note: Values include all working sectors. Shares are calculated relative to the total number of retirements of each type and year. Age is at the end of the year.

To account for the role of disability pensions, we carry out a robustness check where we include individuals over the age of 62 who retired due to disability in our sample. This increases the sample size by around 600 observations. However, there is a possible endogeneity problem related to the assignment of different retirement pathways, since the disability pensions are higher and the incentives to postpone retirement are poorer compared with old-age retirement. Therefore, if we were to calculate retirement incentives according to the rules for disability pension, for all individuals who retired due to disability, we would likely end up overestimating the effect of incentives and underestimating the role of pension wealth.

To deal with this potential endogeneity issue, we follow the example of Johansson et al. (2014) and use a probabilistic approach to weight different pathways to retirement. We first calculate the share of individuals aged 62 to 65[17] retiring through old-age-retirement or disability retirement by gender, education and year conditional on not having retired earlier. For this purpose we extended the sample to cover all working sectors (excluding individuals with personal retirement ages), and the descriptive statistics on the shares are shown in the Appendix C. Then these shares are used to form a weighted sum of pension wealth:

$$PW(weighted) = \frac{p(DI)}{p(DI) + p(OLD)} PW(DI) + \frac{p(OLD)}{p(DI) + p(OLD)} PW \qquad (4)$$

Where $p(DI)$ is the mean disability retirement rate and $p(OLD)$ is the mean old-age retirement rate. As mentioned earlier, these rates vary according to gender, age and year. PW is pension wealth with old-age pensions and $PW(DI)$ is pension wealth with disability pensions. This weighted pension wealth is used to form the incentives to postpone retirement, when the possibility to retire due to disability is taken into account.

The baseline estimation results are displayed in the third column of Table 4 and the sub-group results are shown in the Appendix. Not surprisingly, the health variables are much more important determinants of retirement when disability retirement is taken into account. In particular, having a large number of sickness absence days increases the likelihood of retirement substantially (around 27 pp.). However, the coefficients for the level of pension wealth and for the incentives to postpone retirement are almost the same as in the baseline estimation. In addition, the sub-group analysis yields similar results as in the baseline case.

6 Conclusions

The aim of this paper was to study how health modifies the effects of changes in retirement incentives on retirement behaviour. The Finnish pension reform of 2005 changed the incentives to postpone retirement differently for people with different labour market histories, and we exploit the exogenous variation in retirement incentives generated by the reform.

We used rich longitudinal administrative data, combined from the registers of

[17]After the reform only those aged 62 to 63 are included.

Statistics Finland, the Finnish Centre for Pensions, the Finnish Institute for Health and Welfare, and the Social Insurance Institution of Finland. The results indicate that the changes in retirement incentives influenced retirement in an expected manner on average. Improved incentives to continue working induced individuals to postpone retirement, while a higher level of pension wealth led to earlier retirement.

Our second aim was to study how the reactions to incentives vary among different types of people. The main interest here was in how health status may modify the effect of retirement incentives on actual retirement decisions. It could be that older workers who have health problems may find it difficult to postpone retirement despite the financial gain of working longer. On the other hand, the financial gain may be especially important for those with worse health, as greater financial compensation is needed to offset the (mental or physical) costs of working.

To the best of our knowledge, similar analysis of combining quasi-experimental variation in retirement incentives, and focusing on the heterogeneity in the responses to these incentives, has not been offered in the previous literature. While we implement this research in the Finnish context, we would argue that the results have external validity, for example because of the objective health measures used.

Using a wide array of health indicators, including inpatient care (with information on the type of illness) and prescribed medication, we found that individuals with various different types of health issues do respond to incentives to postpone retirement. The only exceptions to this general pattern were that those with a sickness absence period exceeding 10 days appeared not to react to financial incentives to continue working, whereas people with a cardiovascular treatment period reacted more strongly to these incentives than those without such treatment. The statistical significance of these results varies somewhat, however, depending on the sample and the estimation method (OLS vs IV) used. There are reasons to interpret our findings with some caution, as it is possible, for instance, that the health measures could still hide substantial heterogeneity between people with different severity of morbidity. Nevertheless, the results of our paper are important, as they suggest that policy-makers do not necessarily face significant trade-offs in designing policies that improve the incentives to extend working careers and retire later, and treating people with varying health in a fair manner.

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Appendices

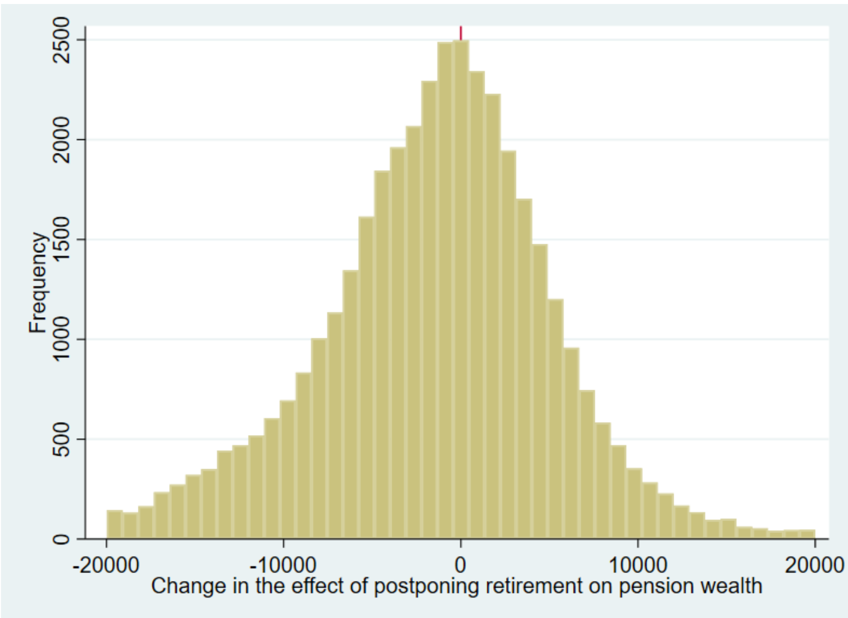
A Variables

The full list of control variables used in the estimations is presented here.

Fixed effects: group and time fixed effects. *Individual controls*: level of education, field of education, region, reached full retirement age (yes or no), reached early retirement age (yes or no) and language. *Spouse controls*: Spouse (yes or no), age of spouse over early retirement age (yes or no) and age of spouse over full retirement age (yes or no). *Health controls*: prescriptive drug purchases (0 to 3, 4 to 7 and 8 or more), purchase of psychotropic medication (yes or no), any treatment period (yes or no), treatment period for circulatory or musculoskeletal diseases (yes or no), sickness absences (1 to 14 days, 15 to 60 days and over 60 days).

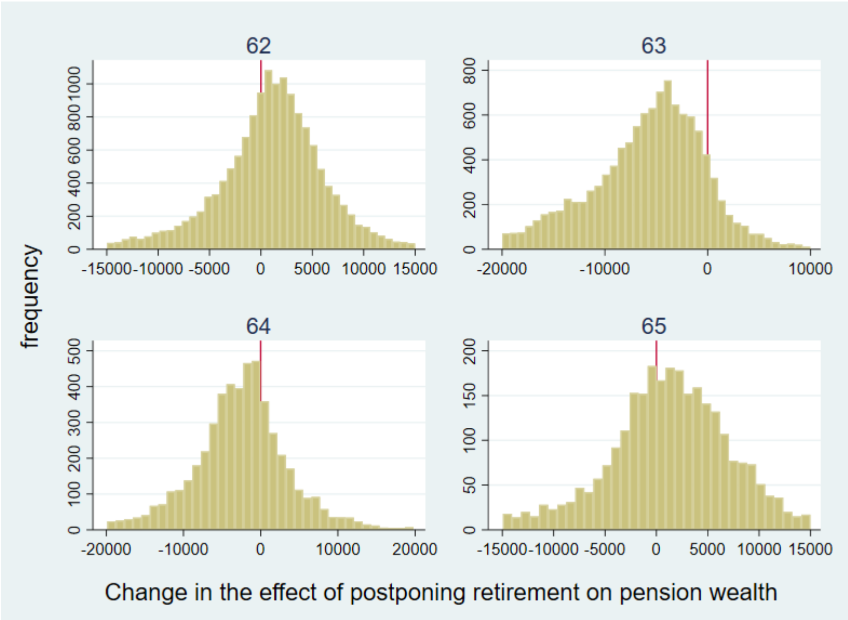
B Additional figures

B.1 The effect of the reform on incentives without national pensions



Note: Pension wealth is calculated without national pensions using the main sample. The sample also comprises those entitled to national pensions.

Figure B.1: Change in the effect of postponing retirement on pension wealth (in euros) without national pensions



Note: Pension wealth is calculated without national pensions using the main sample. The sample also comprises those entitled to national pensions.

Figure B.2: Change in the effect of postponing retirement on pension wealth (in euros), by age groups and without national pensions

B.2 The incentives to postpone retirement according to health statuses

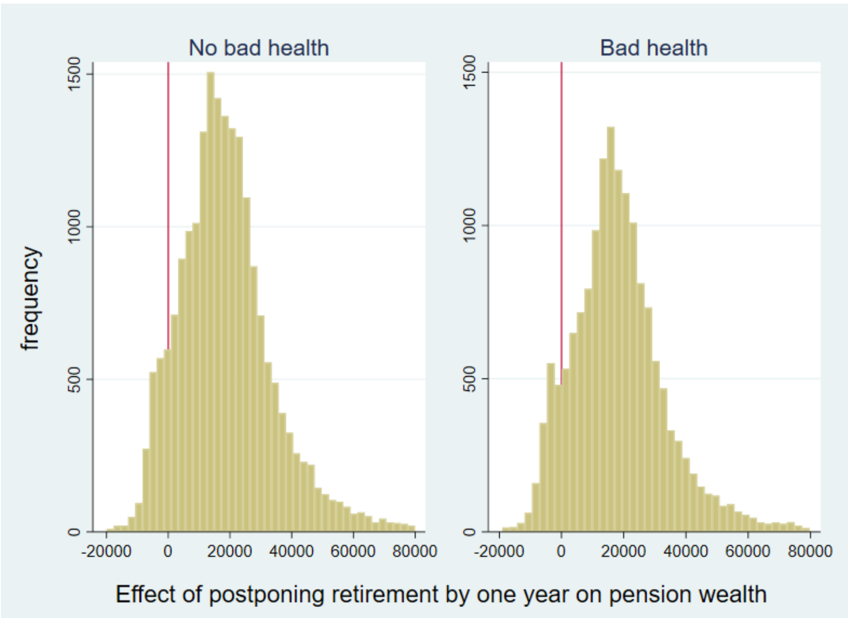


Figure B.3: Effect of postponing retirement on pension wealth (in euros) by bad health

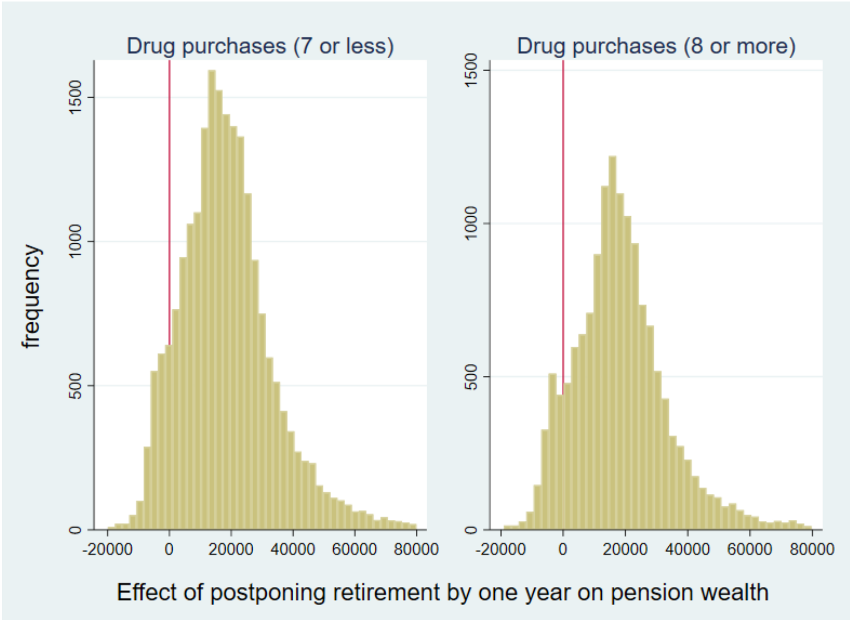


Figure B.4: Effect of postponing retirement on pension wealth (in euros) by medication purchases

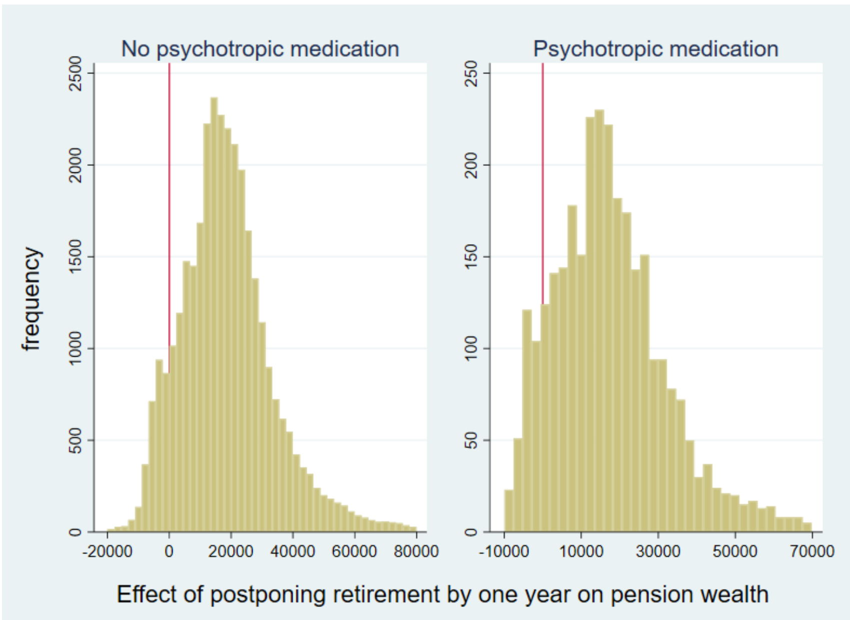


Figure B.5: Effect of postponing retirement on pension wealth (in euros) by psychotropic medication

Figure B.6: Effect of postponing retirement on pension wealth (in euros) by any treatment

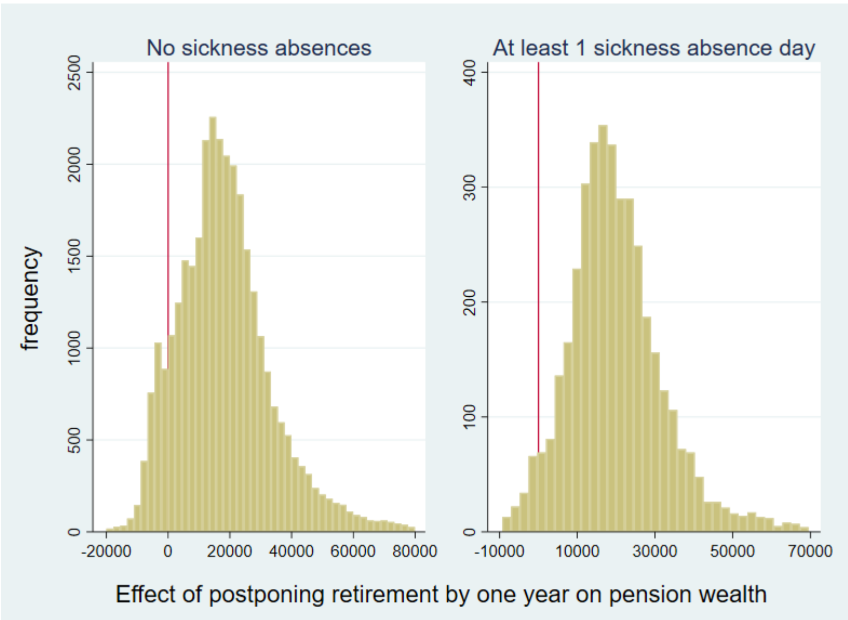


Figure B.7: Effect of postponing retirement on pension wealth (in euros) by any sickness absences

B.3 The effect of the reform on incentives according to health statuses

Figure B.8: Change in the effect of postponing retirement on pension wealth (in euros) by bad health

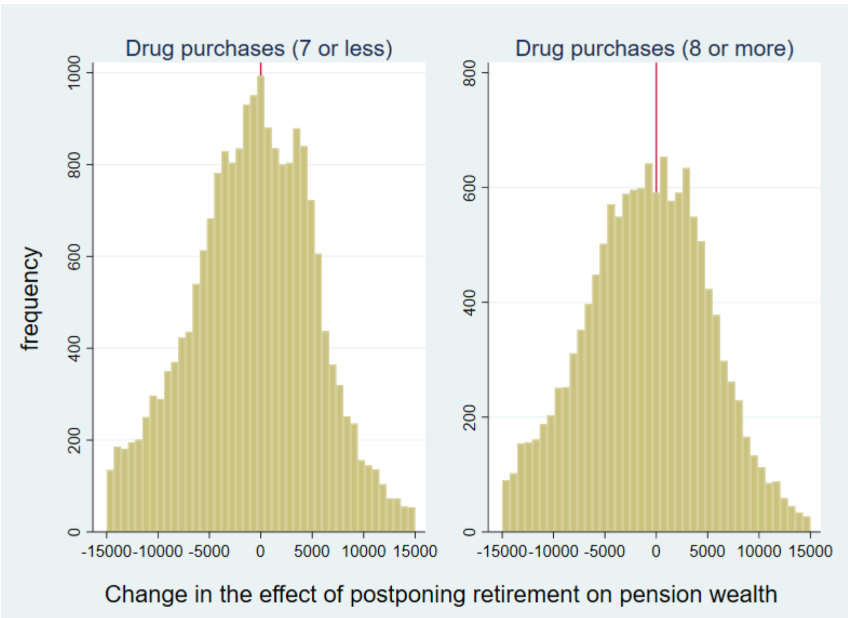


Figure B.9: Change in the effect of postponing retirement on pension wealth (in euros) by medication purchases

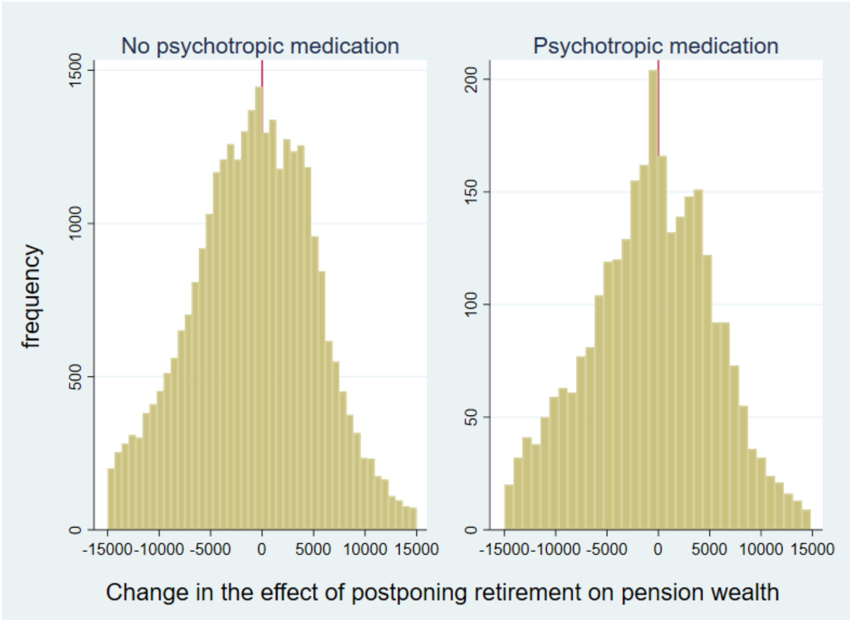


Figure B.10: Change in the effect of postponing retirement on pension wealth (in euros) by psychotropic medication

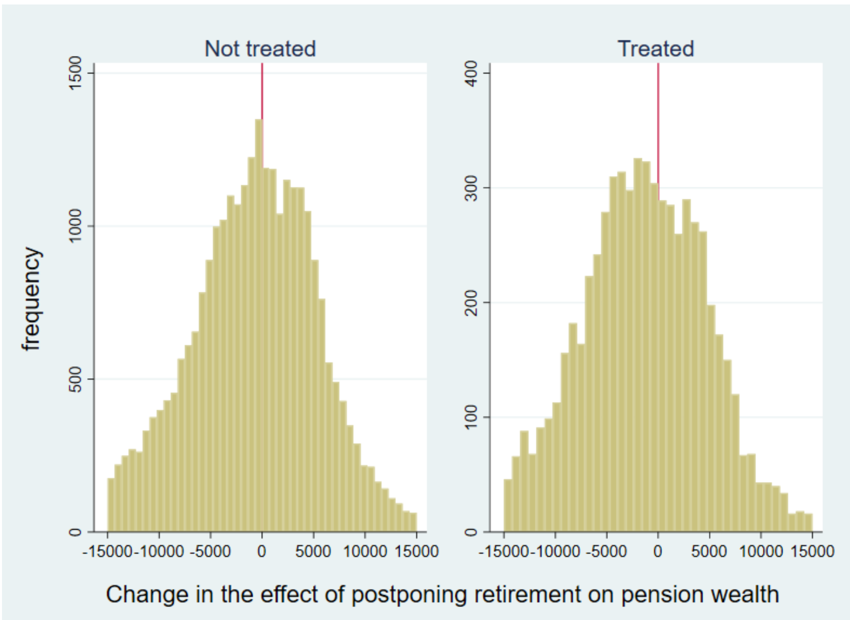


Figure B.11: Change in the effect of postponing retirement on pension wealth (in euros) by any treatment

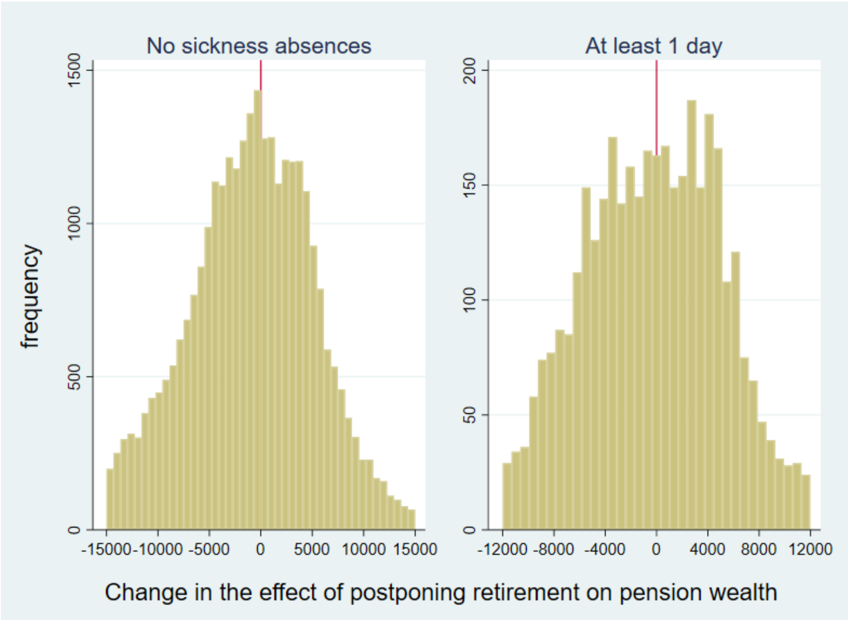


Figure B.12: Change in the effect of postponing retirement on pension wealth (in euros) by sickness absences

C Additional tables

Table C.1: Descriptive statistics on retirement by gender and education

	Men	Women	Low	Middle	High
Risk of DI retirement	1.7%	1.5%	2.1%	1.5%	0.6%
Risk of old-age retirement	29.1%	28.2%	29.5%	28.8%	26.0%
Share of DI retirement	58.1%	42.0%	50.3%	44.8%	5.0%
Share of old-age retirement	56.1%	43.9%	38.9%	48.8%	12.3%
Share of population	55.3%	44.7%	37.9%	48.6%	13.6%

Note: Before the reform individuals aged 62 to 65 are included. After the reform individuals aged 62 to 63 are included. Low, middle and high refer to educational level. All working sectors are included.

Table C.2: Descriptive statistics on retirement by year

Year	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
Old-age retirement	22.1 %	20.6 %	15.1 %	14.8 %	31.0 %	28.2 %	25.3 %	27.9 %	31.1 %	30.5 %	32.2 %	32.1 %	33.2 %	30.1 %
Disability retirement	3.3 %	3.9 %	3.9 %	2.6 %	2.0 %	1.7 %	1.4 %	1.4 %	1.3 %	1.2 %	1.3 %	1.3 %	1.0 %	1.2 %

Note: Before the reform individuals aged 62 to 65 are included. After the reform individuals aged 62 to 63 are included. All working sectors are included.

Table C.3: OLS estimates by population groups, excluding individuals entitled to national pensions

	Treatment, Cardio (t-1)		Treatment, Muscular (t-1)		Any treatment (t-1)		Medication (t-1)		Psychotropic medication (t-1)		Sickness absences (t-1)		Bad health (t-1)	
	Yes	No	Yes	No	Yes	No	8 or more	Less than 8	Yes	No	1 day or more	No	Yes	No
Dependent variable is retirement decision														
$\Delta \ln(PW)$	-4.267***	-3.626***	-2.887***	-3.672***	-3.757***	-3.621***	-3.629***	-3.674***	-3.575***	-3.664***	-2.053***	-3.778***	-3.666***	-3.653***
	(0.480)	(0.323)	(0.456)	(0.326)	(0.347)	(0.331)	(0.373)	(0.303)	(0.276)	(0.329)	(0.496)	(0.323)	(0.357)	(0.305)
$\ln(PW)$	0.0209	0.0495**	0.0233	0.0468**	0.00562	0.0562**	0.0255	0.0584**	0.0313	0.0496**	0.0304	0.0486**	0.0253	0.0621**
	(0.0536)	(0.0164)	(0.0405)	(0.0165)	(0.0265)	(0.0163)	(0.0207)	(0.0186)	(0.0334)	(0.0167)	(0.0296)	(0.0173)	(0.0207)	(0.0183)
FRA	0.231	0.293***	0.153	0.295***	0.258***	0.297***	0.259***	0.302***	0.181**	0.296***	0.264***	0.298***	0.261***	0.304***
	(0.116)	(0.0408)	(0.123)	(0.0391)	(0.0537)	(0.0402)	(0.0446)	(0.0403)	(0.0518)	(0.0401)	(0.0528)	(0.0398)	(0.0442)	(0.0404)
p-value $\Delta \ln(PW)$	0.138		0.057		0.583		0.808		0.629		<0.001		0.932	
p-value $\ln(PW)$	0.546		0.517		0.026		0.12		0.542		0.587		0.07	
p-value FRA	0.599		0.176		0.274		0.12		0.003		0.285		0.134	
Observations	896	24,127	979	24,044	4,823	20,200	10,246	14,777	1,916	23,107	2,764	22,259	11,082	13,941
R-squared	0.303	0.285	0.332	0.285	0.275	0.290	0.287	0.286	0.331	0.284	0.317	0.285	0.290	0.284
FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Individual controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Spouse controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Health controls t-1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Mean retirement rate	0.414	0.337	0.372	0.339	0.371	0.332	0.369	0.320	0.375	0.337	0.357	0.338	0.367	0.318

Note: The null hypothesis for the p-values is that the difference between coefficients equals zero. $\Delta \ln(PW)$ is the relative change in pension wealth when retirement is postponed by one year. Sickness absences indicates days after the waiting period. Those entitled to national pensions are excluded from the analysis.
Clustered standard errors by groups in parentheses
*** $p<0.001$, ** $p<0.01$, * $p<0.05$

Table C.4: 2SLS estimates by population groups (main sample)

	Treatment, Cardio (t-1)		Treatment, Muscular (t-1)		Any treatment (t-1)		Medication (t-1)		Psychotropic medication (t-1)		Sickness absences (t-1)		Bad health (t-1)	
	Yes	No	Yes	No	Yes	No	8 or more	Less than 8	Yes	No	1 day or more	No	Yes	No
Second stage: Dependent variable is the retirement decision														
$\Delta \ln(PW)$	-4.519***	-3.659***	-0.998	-3.834***	-3.252***	-3.863***	-2.596***	-3.671***	-2.317**	-3.993***	-2.823***	-3.794***	-2.799***	-3.745***
	(1.052)	(0.529)	(0.971)	(0.534)	(0.833)	(0.568)	(0.711)	(0.618)	(0.888)	(0.537)	(0.855)	(0.540)	(0.701)	(0.629)
$\ln(PW)$	0.0345	0.0700***	0.0382	0.0693***	0.0468**	0.0732***	0.0529***	0.0737***	0.0670**	0.0694***	0.0233	0.0720***	0.0523***	0.0768***
	(0.0397)	(0.00740)	(0.0386)	(0.00740)	(0.0175)	(0.00794)	(0.0115)	(0.00931)	(0.0241)	(0.00762)	(0.0246)	(0.00756)	(0.0110)	(0.00960)
FRA	0.236**	0.266***	0.0823	0.269***	0.225***	0.269***	0.274***	0.264***	0.277***	0.262***	0.229***	0.271***	0.276***	0.262***
	(0.0722)	(0.0112)	(0.0838)	(0.0112)	(0.0343)	(0.0118)	(0.0188)	(0.0135)	(0.0399)	(0.0115)	(0.0312)	(0.0119)	(0.0179)	(0.0138)
p-value $\Delta \ln(PW)$	0.419		0.016		0.633		0.364		0.151		0.585		0.504	
p-value $\ln(PW)$	0.351		0.329		0.196		0.15		0.974		0.08		0.128	
p-value FRA	0.664		0.026		0.21		0.744		0.831		0.16		0.584	
Observations	1,243	34,878	1,392	34,729	6,797	29,324	14,592	21,529	3,035	33,086	3,952	32,169	15,885	20,236
R-squared	0.294	0.267	0.300	0.266	0.257	0.270	0.270	0.268	0.293	0.265	0.303	0.266	0.274	0.265
Endogeneity test	0.261	0.271	0.045	0.108	Missing	0.197	0.165	0.377	Missing	0.173	Missing	0.208	0.313	0.253
Kleibergen-Paap F statistics	.	4.26	.	4.22	6.79	3.78	8.46	3.18	11.96	4.35	15.13	4.13	9.07	3.16
First stage: Dependent variable is relative change in pension wealth ($\Delta \ln(PW)$)														
First stage r-squared	0.351	0.268	0.368	0.268	0.254	0.275	0.265	0.278	0.316	0.268	0.353	0.268	0.262	0.281
YearXgroup	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Individual controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Spouse controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Health controls t-1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Mean retirement rate	0.413	0.324	0.357	0.326	0.36	0.319	0.355	0.308	0.354	0.325	0.344	0.325	0.354	0.306

Notes: The null hypothesis for the p-values is that the difference between coefficients equals zero. The endogeneity test column shows the p-value of the endogeneity test. The null hypothesis for the endogeneity test is that the specified endogenous regressor ($\Delta \ln(PW)$) can be treated as exogenous. $\Delta \ln(PW)$ is the relative change in pension wealth when retirement is postponed by one year. Sickness absences indicates days after the waiting period.
Robust standard errors in parentheses
*** $p<0.001$, ** $p<0.01$, * $p<0.05$

Table C.5: OLS estimates by population groups, excluding unemployed

	Treatment, Cardio (t-1)		Treatment, Muscular (t-1)		Any treatment (t-1)		Medication (t-1)		Psychotropic medication (t-1)		Sickness absences (t-1)		Bad health (t-1)	
	Yes	No	Yes	No	Yes	No	8 or more	Less than 8	Yes	No	1 day or more	No	Yes	No
Dependent variable is retirement decision														
$\Delta\ln(PW)$	-2.481***	-1.534***	-1.279*	-1.573***	-1.422***	-1.595***	-1.508**	-1.601***	-1.515***	-1.581***	-1.084**	-1.638***	-1.567***	-1.564***
	(0.643)	(0.358)	(0.502)	(0.367)	(0.362)	(0.372)	(0.430)	(0.334)	(0.410)	(0.357)	(0.364)	(0.380)	(0.423)	(0.330)
$\ln(PW)$	0.0227	0.0549**	0.0499	0.0530**	0.0143	0.0616***	0.0426*	0.0578**	0.0435	0.0544**	0.00973	0.0574**	0.0384*	0.0628**
	(0.0401)	(0.0151)	(0.0366)	(0.0152)	(0.0208)	(0.0156)	(0.0177)	(0.0172)	(0.0276)	(0.0149)	(0.0234)	(0.0165)	(0.0170)	(0.0173)
FRA	0.259*	0.283***	0.0873	0.288***	0.232***	0.288***	0.282***	0.280***	0.281***	0.282***	0.230***	0.290***	0.286***	0.279***
	(0.0941)	(0.0333)	(0.0472)	(0.0327)	(0.0437)	(0.0340)	(0.0382)	(0.0350)	(0.0601)	(0.0332)	(0.0411)	(0.0329)	(0.0382)	(0.0360)
p-value $\Delta\ln(PW)$	0.063		0.542		0.415		0.679		0.736		0.148		0.986	
p-value $\ln(PW)$	0.348		0.931		0.015		0.401		0.651		0.115		0.152	
p-value FRA	0.793		<0.001		0.112		0.949		0.981		0.012		0.823	
Observations	1,052	30,476	1,233	30,295	5,796	25,732	12,720	18,808	2,538	28,990	3,762	27,766	13,818	17,710
R-squared	0.319	0.275	0.325	0.276	0.273	0.278	0.282	0.272	0.299	0.276	0.310	0.273	0.285	0.270
FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Individual controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Spouse controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Health controls t-1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Mean retirement rate	0.374	0.294	0.328	0.295	0.327	0.289	0.322	0.279	0.326	0.294	0.337	0.291	0.322	0.276

Note: The null hypothesis for the p-values is that the difference between coefficients equals zero. $\Delta\ln(PW)$ is the relative change in pension wealth when retirement is postponed by one year. Sickness absences indicates days after the waiting period. Individuals who were mainly unemployed in the previous year are excluded from the analysis. Clustered standard errors by groups in parentheses (*** p<0.001, ** p<0.01, * p<0.05)

Table C.6: OLS estimates by population groups with pension and accrual rate of pension

	Treatment, Cardio (t-1)		Treatment, Muscular (t-1)		Any treatment (t-1)		Medication (t-1)		Psychotropic medication (t-1)		Sickness absences (t-1)		Bad health (t-1)	
	Yes	No	Yes	No	Yes	No	8 or more	Less than 8	Yes	No	1 day or more	No	Yes	No
Dependent variable is retirement decision														
$\Delta \ln(pension)$	-3.713***	-2.743***	-2.484***	-2.783***	-2.718***	-2.787***	-2.766***	-2.784***	-2.615***	-2.804***	-1.552***	-2.897***	-2.787***	-2.772***
	(0.447)	(0.265)	(0.399)	(0.269)	(0.315)	(0.272)	(0.305)	(0.253)	(0.356)	(0.263)	(0.296)	(0.273)	(0.304)	(0.246)
$\ln(pension)$	0.0319	0.0672***	0.0459	0.0659***	0.0438*	0.0704***	0.0539**	0.0705***	0.0694*	0.0656***	0.0155	0.0697***	0.0528**	0.0733***
	(0.0363)	(0.0159)	(0.0362)	(0.0158)	(0.0209)	(0.0158)	(0.0192)	(0.0167)	(0.0260)	(0.0157)	(0.0232)	(0.0172)	(0.0187)	(0.0163)
FRA	0.248**	0.274***	0.0704	0.278***	0.230***	0.278***	0.273***	0.272***	0.274***	0.273***	0.231***	0.280***	0.276***	0.270***
	(0.0789)	(0.0330)	(0.0507)	(0.0323)	(0.0424)	(0.0335)	(0.0336)	(0.0354)	(0.0487)	(0.0333)	(0.0381)	(0.0327)	(0.0328)	(0.0366)
p-value $\Delta \ln(pension)$	0.013		0.405		0.778		0.91		0.469		<0.001		0.919	
p-value $\ln(pension)$	0.274		0.545		0.1		0.318		0.859		0.087		0.168	
p-value FRA	0.749		<0.001		0.15		0.974		0.97		0.023		0.831	
Observations	1,243	34,878	1,392	34,729	6,797	29,324	14,592	21,529	3,035	33,086	3,952	32,169	15,885	20,236
R-squared	0.296	0.270	0.308	0.271	0.258	0.274	0.270	0.271	0.293	0.271	0.308	0.269	0.274	0.269
FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Individual controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Spouse controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Health controls t-1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Mean retirement rate	0.413	0.324	0.357	0.326	0.360	0.319	0.355	0.308	0.354	0.325	0.344	0.325	0.354	0.306

Note: The null hypothesis for the p-values is that the difference between coefficients equals zero. $\Delta \ln(pension)$ is the relative change in pension when retirement is postponed by one year. Sickness absences indicates days after the waiting period. Clustered standard errors by groups in parentheses (*** p<0.001, ** p<0.01, * p<0.05)

Table C.7: OLS estimates by population groups including disability retirements

	Treatment, Cardio (t-1)		Treatment, Muscular (t-1)		Any treatment (t-1)		Medication (t-1)		Psychotropic medication (t-1)		Sickness absences (t-1)		Bad health (t-1)	
	Yes	No	Yes	No	Yes	No	8 or more	Less than 8	Yes	No	1 day or more	No	Yes	No
Dependent variable is retirement decision														
$\Delta\ln(PW)$	-3.513***	-2.731***	-2.799***	-2.759***	-2.741***	-2.760***	-2.748***	-2.769***	-2.524***	-2.794***	-2.249***	-2.888***	-2.774***	-2.748***
	(0.490)	(0.263)	(0.390)	(0.270)	(0.324)	(0.271)	(0.313)	(0.246)	(0.359)	(0.264)	(0.324)	(0.269)	(0.312)	(0.240)
$\ln(PW)$	-0.0181	0.0632***	-0.00432	0.0619***	0.0183	0.0692***	0.0434*	0.0684***	0.0590*	0.0610***	-0.0376	0.0699***	0.0409	0.0730***
	(0.0412)	(0.0167)	(0.0410)	(0.0166)	(0.0221)	(0.0166)	(0.0202)	(0.0172)	(0.0283)	(0.0165)	(0.0281)	(0.0173)	(0.0205)	(0.0162)
FRA	0.153*	0.278***	0.0269	0.281***	0.200***	0.284***	0.263***	0.279***	0.264***	0.276***	0.206***	0.288***	0.268***	0.277***
	(0.0662)	(0.0304)	(0.0660)	(0.0299)	(0.0349)	(0.0316)	(0.0288)	(0.0341)	(0.0516)	(0.0310)	(0.0310)	(0.0320)	(0.0271)	(0.0362)
p-value $\Delta\ln(PW)$	0.046		0.914		0.937		0.899		0.322		0.033		0.866	
p-value $\ln(PW)$	0.027		0.075		0.003		0.128		0.93		<0.001		0.036	
p-value FRA	0.08		<0.001		0.009		0.538		0.834		0.006		0.739	
Observations	1,347	35,366	1,500	35,213	7,103	29,610	14,982	21,731	3,178	33,535	4,440	32,273	16,392	20,321
R-squared	0.214	0.248	0.222	0.248	0.207	0.257	0.234	0.255	0.229	0.250	0.175	0.262	0.231	0.260
FE	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Individual controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Spouse controls	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
Health controls t-1	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
Mean retirement rate	0.458	0.333	0.403	0.335	0.387	0.326	0.372	0.314	0.383	0.334	0.416	0.327	0.374	0.309

Notes: The null hypothesis for the p-values is that the difference between coefficients equals zero. $\Delta\ln(PW)$ is the relative change in pension wealth when retirement is postponed by one year. Sickness absences indicates days after the waiting period. Pension wealth and the incentives are calculated according to equation (4).
Clustered standard errors by group in parentheses
*** p<0.001, ** p<0.01, * p<0.05