Collateral effects of a pension reform in France

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October 18, 2013

Abstract

How does retirement affect the physical, mental and social health of seniors? We identify this effect based on the 1993 reform of the French pension system. The French government gradually increased the incentive to work using two tools: the contribution period required for entitlement to a full pension and the number of reference earning years taken to calculate pensions. This created heterogeneity of incentives to work among the population. We use a unique database on health and employment in France in 1999 and 2005, when the cohorts affected by the reform started to retire. Taking the reform as a tool to filter out the potential influence of health on employment choices, we show that retirement improves physical and social health. The more physically impacted are the low-educated individuals.

1 Introduction

The relationship between work and health is a political concern, especially if this link is heterogeneous among the population. It could generate or increase inter and intra-generational health inequalities. Moreover, Social Security accounts may be impacted by workers' health in two possible ways. One the one hand, a bad health decreases life expectancy (all things being equals) and thus the number of people who receive a pension, which increases the benefits of social security. On the other hand, since one constituent of Social Security is the covering of health spending, social security accounts can be deteriorated by a decline of workers' health.

However, the relation between work and health is far from obvious. Work could involve stress and strain detrimental to health, as confirmed by Ekerdt et al. (1983). It

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‡With the support of Health Chair - a joint initiative by PSL, Université Paris-Dauphine, ENSAE and MGEN under the aegis of the Fondation du Risque (FDR). We are very grateful to Arnaud Gautier and François Beck for providing data. We also thank seminar participants at PSE and at Sciences Po. We are particularly grateful to Yann Algan, Andrew Clark, Lucie Gadenne, Thibault Gajdos, Pierre-Yves Geoffard, Jérôme Le, Marion Leturcq, Eric Maurin and Muriel Roger who took some of their time to read the present article and make fruitful suggestions.

could undermine workers' productivity. A number of studies use retirement to measure this impact on the population of seniors. Bound and Waidmann (2008) find evidence that retirement has a positive, albeit temporary, effect on male health in the United Kingdom. Coe and Lindeboom (2008) show that retirement has a positive effect on subjective measurements of health in the United States. Coe and Zamarro (2011) find a similar effect in Europe based on SHARE (Survey of Health, Aging and Retirement in Europe). But, work could also increase activity, income and social networking to make people happier and healthier. The relationship between work and health may foster workers' productivity. Bonsang et al. (2012); Rohwedder and Willis (2010) show that retirement has a negative effect on memory (for comparison studies in the United States and Europe)[1]. To our knowledge, there is no consensus in the literature as to a predominant effect of retirement on health. One of the reason for this lack of consensus is the variety of definitions for health which do not coincide perfectly. An indicator of health at the country level is life expectancy and being in good health is defined as having a weak propensity to die. It is the more objective indicator but not completely sufficient since it allows no precise variation and do not presume good health (as an illustration, firemen who have a high propensity to die compared to the rest of the population still cannot be regarded in bad health). The notion of "healthy life years" developed by the European Union shows that a good health cannot be resumed as a long life. It is defined by the number of disability-free years, which gives a negative and functional definition of health. Another dimension of health is given by the World Health Organization (WHO) which argues for a definition of health as "a state of complete physical, mental and social well-being, and not merely the absence of disease or infirmity". Moreover, beyond the medical dimension, Sen (2002) considers health as a necessary good to thrive. Three dimensions are generally highlighted (Blanchet et al., 2007): the medical dimension which considers health as a physiological or psychical norm; the functional dimension which defines health as a capacity to blossom in a social environment and a subjective measure which focus on the perception of the individual on their health state. We define health using its functional dimension, as life quality. We use a database which contains highly specific questions on well-being and capacity for daily tasks, used to build the Duke Health indicators, based on self-reported, yet accurate information on the state of respondents' physical and mental health. Our definition of health as life quality is thus multidimensional: it includes capacities for daily

[1] Earlier studies argue that retirement may be stressful and associated with mental impacts of feeling older and loneliness (Bradford, 1979; Carp, 1967; Eisdorfer and Wilkie, 1977; Macbride, 1976; Sheppard, 1976).

activities, subjective well-being, self-perception, and social life. This implies that our estimations are based on self-declared information.

The main issue to measure the effects of work on health is that reverse causality may conceal the effect of work on health (less healthy people may be inclined to leave employment more easily, which would create a positive correlation between work and health)[2]. This creates a selection bias[3]. Lindeboom and Kerkhofs (2004) address these problems using rich panel data on Dutch seniors' employment and health (with subjective and objective variables) to study the effect of health on employment[4]. Lindeboom and Kerkhofs (2004) find that health has strong effects on work choices and that health slowly deteriorates when work becomes more strenuous.

In order to investigate how retirement affects the several dimensions of health, we use the 1993 reform, which created heterogeneity in work incentives among seniors. The French pension system is a pay-as-you-go system and its equilibrium depends on the employee-retiree ratio. This balance is in jeopardy as baby boomers leave the labor market and life expectancy lengthens. French governments have been implementing a set of reforms for more than 20 years. One of the main tools used is to increase the incentive to work for individuals nearing retirement age. The 1993 reform reduced the replacement rate, i.e. the average percentage of pre-retirement earnings that the pension system pays, and lengthened the contribution period for private sector employee entitlement to a full rate pension. An increase in the number of years included in the reference wage calculation reduces the total pension amount received. It is then highly likely that people chose to postpone their retirement in order to increase their reference wage or lengthen their contribution period. The length of the contribution period may have the same effect, people may chose to postpone their retirement in order to avoid a decrease in their standard of living[5]. In this environment, we try to identify the effect of retirement on health.

[2]See Blanchet and Debrand (2008), Kalwij and Vermeulen (2008), and Pagan (2011) on part-time work in the case of disability.

[3]There are two other issues to measure this impact. Firstly, health measurements are often self-reported and subjective (one question might be how would you define your health?) or insufficient (there may be some information on sick leave and accidents at the workplace, but it is scarce and does not cover all the symptoms of strenuous work). Secondly, objective data, such as sick leave, are often only available for workers.

[4]Unfortunately, to the best of our knowledge, no such data are available for the French case.

[5]The 1993 reform could have an impact on health through two different ways. Firstly, there may be an income effect. De Grip et al. (2012) show that an unexpected decrease in replacement rates in Dutch pension system implies an increase in depression among seniors. The reform may reduce income, diminishing purchasing power as a consequence and health consumption may in turn decrease. This could have a negative impact on health. Secondly, there may be an activity effect, i.e. an increase in working life has repercussions on health. We are not able to distinguish between these two effects.

We use two different methods to analyze the French case. First, we measure the impact of retirement on health using the 1993 reform as an instrument. Second, we study the impact of the 1993 reform on workers' health using a difference-in-differences estimator. Our first identification strategy consists in taking the number of years used to compute the reference wage (from which pension amounts are calculated) and the number of contribution quarters required for a full pension as instruments to measure the causal effect of retirement on health. The 1993 reform raised the number of years included in the reference wage, which brought down the total pension amount. People work longer since the reform because they anticipate a reduction in their pensions. We take the exogenous reform-driven variation in retirement to estimate the causal effect of retirement on health. We find a positive effect, which is stronger for men and low-skilled seniors. Our second method consists in comparing individuals of similar ages with different incentives to work. We take public sector employees as our control group since the reform did not concern them. We find that workers' health generally improved between 1999 and 2005, but less among those with lower replacement rates.

The paper is structured as follows: Section 2 presents the institutional framework and the 1993 French pension reform. Section 3 presents the data and some descriptive statistics. Section 4 presents the instrumental variable method results and Section 5 the difference-in-differences results.

2 Institutional framework

2.1 Pension schemes in the private sector before the reform

There are various pension systems in France. Private sector workers (60% of the labor force, according to OECD sources) pay into a general mandatory pay-as-you-go pension scheme. Pension amounts depend on the length of time workers contribute to this system hence the length of working life in the private sector and their best-earning years. Before 1993, workers had to contribute for 37.5 years to be entitled to a full pension and the amount paid was proportional to the average wage of the ten high-end contribution years. This amount was calculated as follows:

$$P = \tau \times \omega_r \times \min\left(1, \frac{d}{150}\right) \tag{1}$$

where P denotes the pension level, d the number of contribution quarters, w_r the reference wage and τ is computed as follows:

$$\tau = 0.5 - \delta \times \max[0, \min(4 \times (65 - a), 150 - d)] \tag{2}$$

where δ is the minimization coefficient, equal to 1.25% per quarter of missing contributions (5% per year), and a is the age on drawing the pension (i.e. retirement age). Pension amounts are dictated by contributions not made before the age 65 or before reaching 150 contribution quarters[6]. If a worker retires at 65 or contributes to the general system for more than 37.5 years, there is no pension minimization. In this case, the replacement rate (that is $\frac{P}{w_r}$) is 50%[7].

2.2 The 1993 pension reform

In 1993, the government led by Prime Minister E. Balladur chose to reform the general pension system for the part of the population. This reform did not concern public sector employees[8]. There were three main changes made. We describe the implementation of the first two in Table 1. First, the number of years of contributions required for a full pension was gradually raised from 37.5 to 40 years, cohort by cohort, starting with the 1934 generation. As shown by Table 1, the number of contribution quarters required for a full pension increased by one quarter per year: 150 for the 1933 generation and 151 for the 1934 generation through to 160 for the 1943 generation. In 2003, the number of quarters needed to get a full pension stood at 160 for all cohorts (see Table 1). Second, the reform reduced the reference wage by gradually raising the number of years required for its calculation with each generation from 10 to 25 years. In January 2008, the 25 best years rule was introduced regardless of birth date. The reference wage was the average of the ten best years of earnings prior to 1993 and now stands at the 25 best years. Thus the reform induced an automatic decrease in the pension level. Third, the reference wage is indexed on prices. Equation (2) then becomes:

$$\tau' = 0.5 - \delta \times \max[0, \min(4 \times (65 - a), D - d)] \tag{3}$$

[6]For instance, if the pension drawing age is 61 and the number contribution quarters is 140, then $4 \times (65 - 61) = 16$ and $150 - 140 = 10$. The individual would have to contribute 10 more quarters to reach 150 contribution quarters and 16 more quarters before reaching 65 years old. The pension is computed taking the smallest difference (10) (see Bozio, 2010).

[7]The individual in the previous example has an underestimated pension which corresponds to 1.25% per quarter, i.e. 12.5%, τ is then $0.5 - 0.0125 \times 10 = 0.375 = 37,5\%$ for an individual aged 61 who contributes 140 quarters. This individual's replacement rate is then: $P/\omega_r = \tau \times \min(1, \frac{d}{150}) = 0.375 \times 140/150 = 0.35$.

[8]See the act of 22 July 1993. The reform was implemented by the Balladur's government.

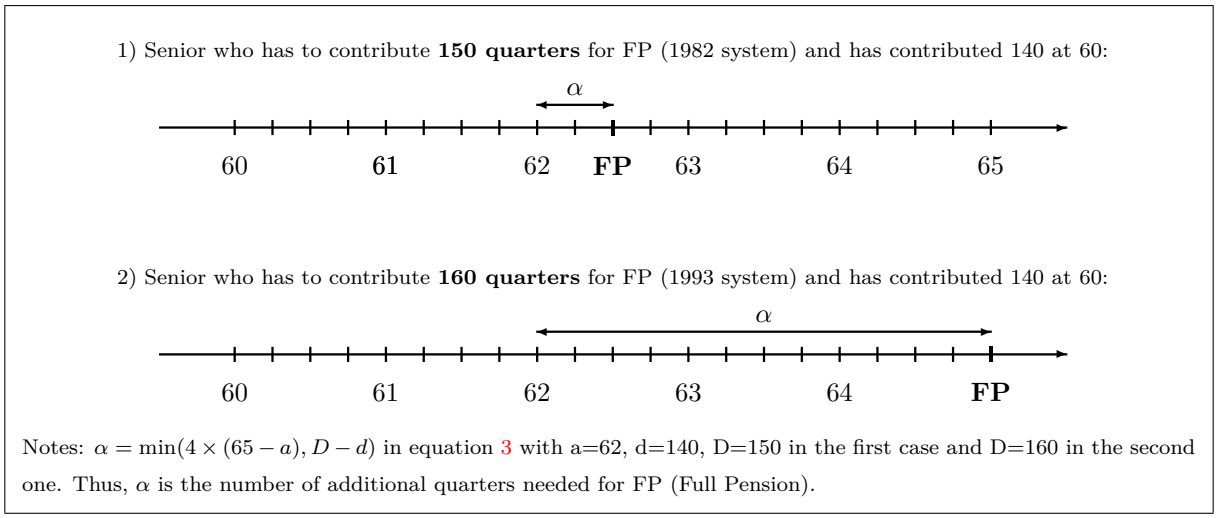


Figure 1: The effect of the 1993 reform for a senior who retires at 62 years old.

where D , the needed quarters required for a full pension, goes from 150 to 160 according to the generation.

Figure 1 shows the effect of the reform as regards incentives to work comparing two seniors who had contributed 140 quarters at age 60: the first one is concerned by the 1982 system (he is born before 1934) and the second by the 1993 reform (he is born between 1942 and 1948). The first one has to contribute ten supplementary quarters (2.5 years) to be entitled to a full pension and if he retires at age 62 his replacement rate is reduced by 2.5 percentage points ($\alpha \times \delta = 2 \times 1.25 = 2.5$). The second senior, affected by the reform has to contribute 20 supplementary quarters for a full pension and if he retires at age 62, his replacement rate is reduced by 15 percentage points ($\alpha \times \delta = 12 \times 1.25 = 15$).

This reform thus raised the incentive to work longer before the age of 65 and reduced the pension level, which reduced the replacement rate[9]. It was implemented gradually, as shown in Table 1, which allows for a detailed evaluation of this reform.

There are also some heterogeneous effects found across generations since public sector employees were not involved in the reform. In 1997, Prime Minister Alain Juppé attempted to implement a similar reform in the public sector, but had to beat a retreat due to a rash of strongly supported strikes all over the country. François Fillon, as Minister of Social Affairs, managed to push through a similar reform in the public sector in 2003 with gradual implementation starting in 2008 to the 1948 generation. The heterogeneity in treatment between and within generations allows for detailed evaluations of this reform.

[9]The replacement rate for the above-studied individual would then be: $P/\omega_r = \tau' \times \min(1, \frac{d}{150}) = (0.5 - 0.0125 \times 12) \times 140/150 = 0.32$ (if we only take into account the required years of contribution).

Table 1: Heterogeneity in treatment for the 1993 reform in the private sector

Generation	Age in 1999	Age in 2005	Nb of requ. quarters	Nb of ref. years
-	-	-	-	-
1932	67	73	150	10
1933	66	72	150	10
1934	65	71	151	11
1935	64	70	152	12
1936	63	69	153	13
1937	62	68	154	14
1938	61	67	155	15
1939	60	66	156	16
1940	59	65	157	17
1941	58	64	158	18
1942	57	63	159	19
1943	56	62	160	20
1944	55	61	160	21
1945	54	60	160	22
1946	53	59	160	23
1947	52	58	160	24
1948	51	57	160	25
1949	50	56	161	25
1950	49	55	162	25
1951	48	54	163	25
-	-	-	-	-

2.3 The impact of the 1993 reform in the literature

Bozio (2008, 2010) estimates the effects of the increase in the number of contribution quarters on working lives by measuring the elasticity of the pension drawing age to the contribution period. This survey was conducted on the Cross-Sample of Pension Scheme Beneficiaries (*Echantillon Interrégime de Retraités*, 2001) and National Pension Fund for Salaried Workers (*Caisse Nationale d'Assurance Vieillesse*) administrative data. As mentioned above, there is heterogeneity in treatment, which enables an estimate of the impact of an increase in the number of contribution quarters on the pension drawing age. Bozio (2008) shows that one extra quarter in contributions (required for full pension entitlement) postpones the retirement age by 1.5 months. This is equivalent to a 0.54 quarter increase in the pension drawing age for one additional contribution quarter.

A survey conducted by Bridenne and Brossard (2008) of National Pension Fund for Salaried Workers (CNAV) administrative data finds that the pension drawn by individuals who retired between 1994 and 2003 was approximately 9% lower than it would have been without the reform. This shortfall widened with each cohort over the reform period. These parameter effects combined with a pension adjustment effect, which increased with each year of pension payment. The 1993 reform made the index-linking of pensions to inflation official. All in all, therefore, pensions fell a total of 8% between 1994 and 2003. The combined parameter and index-linking changes had a significant impact on general scheme pension levels.

In 2003, the French government raised the number of quarters required for a full pension from 40 to 41 years. The reform was to be gradually implemented starting in 2009, i.e. starting with the 1949 generation. Although it had not implemented when our study was launched, we include this reform in our estimates to control for any anticipation effect.

3 Data: *Baromètre Santé* health profiles

3.1 Description

The *Baromètre Santé* is a French study conducted every five years by INPES (*Institut National de Prévention et d'Education pour la Santé*). It contains information on respondents'knowledge of and opinions about their health and behavior that can affect their health. Given that we set out to cover different stages of the pension system reform, we use two cross-sections : the 2000 (people are surveyed in 1999) and 2005 studies with

13,685 and 30,514 observations respectively.

The main focus of this article is how retirement affects health. For this, we need data on people's health from before and after the implementation of the French pension reform. The *Baromètre Santé* produces what is known as the Duke Health Profile (built by Duke University researchers). This indicator, validated by the French health ministry in its research program[10], gives a health profile measuring life quality. The Duke Health Profile is a 17-item generic questionnaire-based self-report instrument containing six health measures (physical, mental, social, general, perceived health, and self-esteem) and four dysfunction measures (anxiety, depression, pain, and disability). The profiles are put together from the questions on self-esteem, physical ability, sleep, social life and depression[11].

People have three possible answers which are coded as 0,1 or 2[12]. Duke health scores are thus continuous variables which we use to compare various health status. This means that:

1. Ordinal answers can be considered as cardinal (the difference between disagreeing and agreeing is the same that the difference between agreeing and strongly agreeing).
2. All questions are equivalent ("I have trouble with sleeping" is equivalent to "I have trouble with walking up a flight of stairs" or even "I have trouble with hurting or aching any part of my body").

Both assumptions are questionable and to clearly answer this objection, we have to study each question one by one. We will use the Duke scores even so for two reasons. First, they bring a global view of people's health by taking into account the multiple dimensions of health. Second, they are widely used by medical schools and medical literature. However, we will check that our results are not biased by the confusion between ordinal and cardinal by rebuilding scores with 0-1 answers to the 17-item questionnaire (0 for very bad health 1 for not so bad and good health) as a robustness check.

3.2 Descriptive data

Average Duke scores are fairly high across the whole sample and highly heterogeneous. The average general health score is 70.6 (on a scale of 100) with a standard deviation

[10] *Programme Hospitalier de Recherche Clinique du Ministère de la Santé.*

[11] Details for the construction of the Duke Health scores are shown in the appendix (Table 18).

[12] Answers are reported as 0,1 or 2 with respect to their increased quality in terms of health (some questions are formulated negatively, the coding takes into account this inversion.)

of 0.15. The average physical health score is 71.2 with a standard deviation of 0.21. The average mental health score is 73.6 with a standard deviation of 0.21. The average depression score is 71.8 (a 100 score means that the individual is not depressed at all[13].) with a standard deviation of 0.21. And the average social health score is 70 with a standard deviation of 0.18. Scores are strongly correlated, as shown by Table 19's correlation matrix, which comes as no surprise given their construction.

Health scores differ between categories. Not surprisingly, physical and general scores decrease with age, as shown in Figure 2, which present average 2005 and 1999 waves scores by age bracket. The decrease in scores is not constant with age: people get better with age between 55 and 62. There is also a change in the way mental health and depression develop in this period of life: after 50, people are less depressed and have a better mental health. If we consider that the average retirement age is 58.8 in France, retiring may generate a peak in good health and satisfaction.

Figure 3 shows the distribution of health score among the population by 6 age quantiles. Physical, mental and depression scores are concentrated in upper values (over 75). This concentration decreases with age regarding physical health. Social health is more normally distributed with small distribution tails and observations concentrated around 60. The mean of age is 19.9 for the first quantile (people aged 12 to 25), 29.7 for the second (people aged 26 to 33), 36.9 for the third (people aged 34 to 40), 45.5 for the fourth quantile (people aged 41 to 50), 55.4 for the 5th (people aged 51 to 60) and 67.4 for the last quantile (people aged 60 to 75). The mean of each health score decreases with age. The mean of general health for the first quantile is 72.0, whereas this mean is 68.8 for the last quantile. The interquantile ratio (Q6/Q1) is 0.96, this ratio is equal to 0.86 for the physical health (mean of physical health for people aged 12 to 25 is 75.7, whereas the same score is equal to 68.1 for people aged 61 to 75). The same ratio is 0.96 for social health (with a mean of social health equal to 69.1 for Q1 and 66.1 for Q6). The ratio is 0.95 and 0.94 for respectively mental health and depression. The health inequality between the first and the last quantile is larger for physical health which decreases around 14% between youngest and oldest people.

Around 18.1% of people in our database are retired in the 1999 wave, 17.9% in the 2005 one[14], this proportion seems stable. Moreover, around 58% of workers are in the

[13] We harmonize this score with others to have the scale: 0 for bad health and 100 for good health

[14] Information differs from one wave of the *Baromètre Santé* to the next and some information in the 2005 dataset is not included in the 1999 dataset. In particular, we do not know the sector in which 1999 wave pensioners used to work. This is a problem when we study people aged 62 to 65, because around 85% of this population are retired (only 20% for people

private sector in both waves. This is consistent with the OCDE statistics.

This paper investigates how the prospect of retirement and retirement itself can affect these scores (i.e. how the prospect of retirement and drawing a pension can affect health). We use two methods to identify the impact of retirement on health scores.

First, we use the reform as an instrument to show that retirement is good for general and physical health and acts as an antidepressant. Then we use a difference-in-differences estimation to show that the working people targeted by this reform are worse off than others, taking the public sector as a control group.

4 The 1993 reform as an instrument

4.1 Strategy

We try to identify the effect of retirement on the Duke Health scores using the reform as a retirement instrument. This method filters out the reverse causality of health on retirement often mentioned in the literature. Since the reform was passed and planned well before our sample respondents had to choose between work and retirement, we can consider that there is no reason why our instrument should be influenced by our sample's employment patterns.

More formally, we estimate the following model:

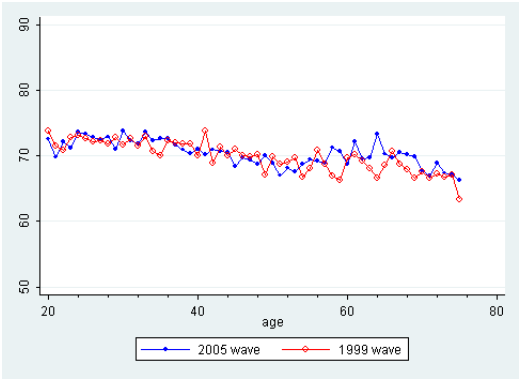
$$Y_i = \alpha_1 + \alpha_2 R_i + \alpha_3 X_i + \varepsilon_i \tag{4}$$

where Y_i is the Duke Health score as defined below, R_i is a dummy for retirement, X_i is a set of controls (including gender, years of education, household size, etc.) and ε_i is an unobserved error term.

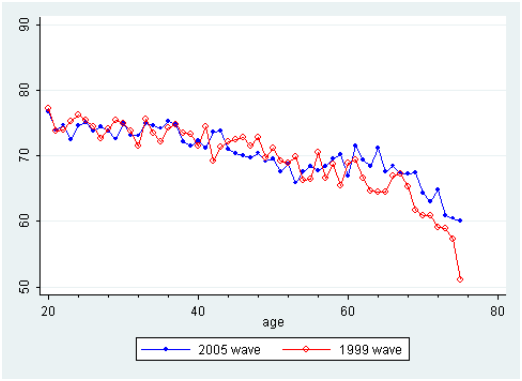
We set out to estimate coefficient α_2, that is the effect of retirement on health. Yet, retirement is very likely to be strongly endogenous, since people may retire because of bad health. This means that $cov(R_{i,}\varepsilon_i) \neq 0$, which means the model is not consistent with an ordinary least square estimation.

We thus introduce an exogenous source of heterogeneity, which can affect retirement, but is not correlated with health. We use the reference wage calculation period and the contribution period required for a full pension as retirement instruments. This variable, which we call F_i depends on the individual's generations as shown in Table 1. It has to

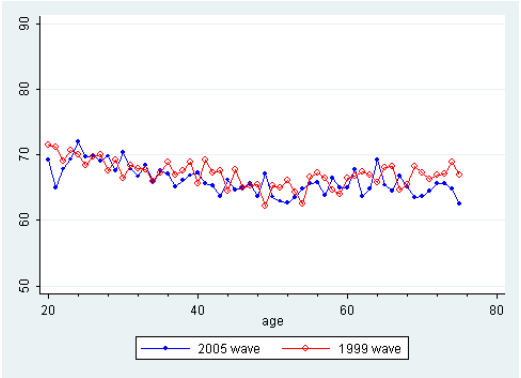
aged 54 to 59). For pensioners surveyed in 1999, we do not know if they were in the private or in the public sector. As we consider they are in the private sector, we under-estimate the reform effect on retirement choices.



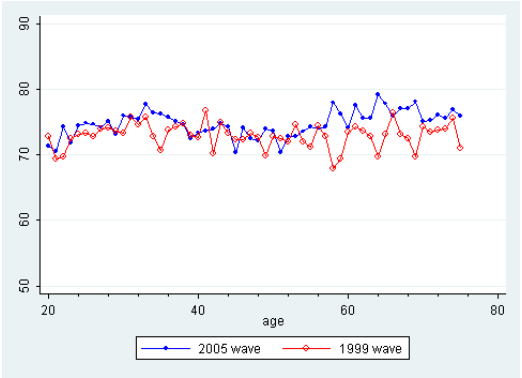
(a) General health



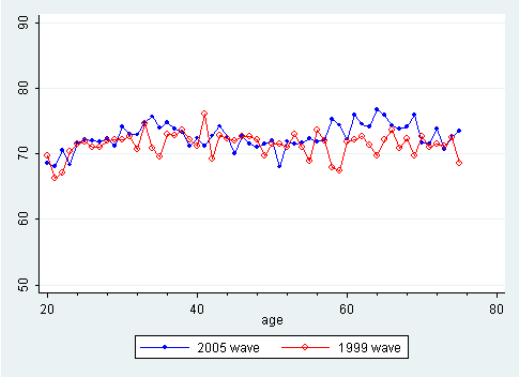
(b) Physical health



(c) Social health

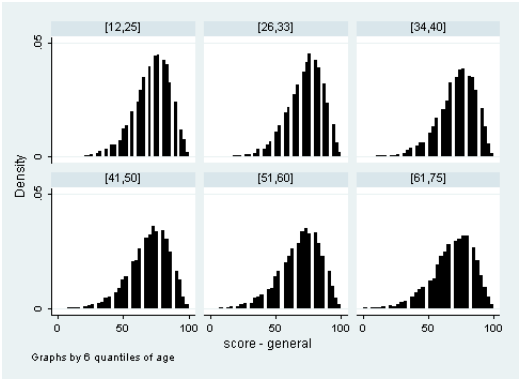


(d) Mental health

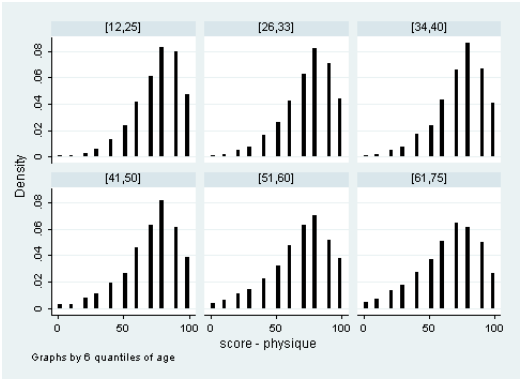


(e) Depression

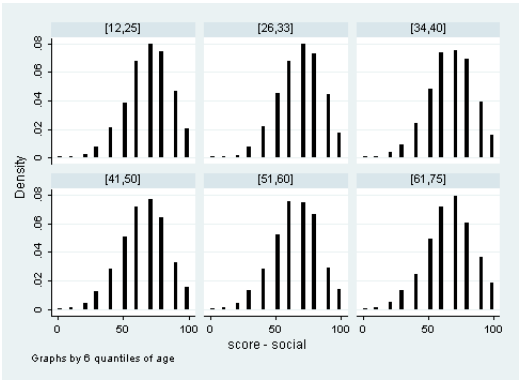
Figure 2: Health scores growth



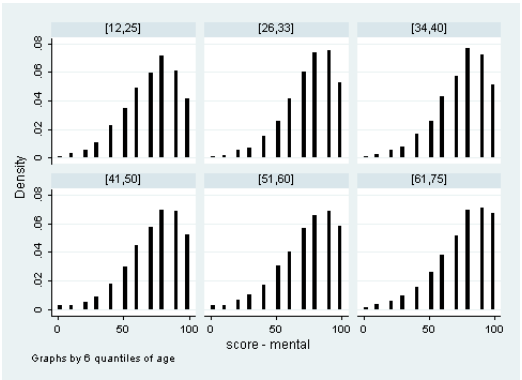
(a) General health



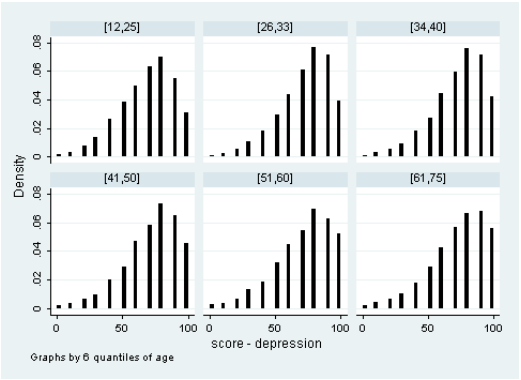
(b) Physical health



(c) Social health



(d) Mental health



(e) Depression

Figure 3: Distribution of health scores by quantiles of age

observe the following hypothesis to be consistent:

$$\begin{cases} cov(F_{i,}\varepsilon_i) = 0 & \text{(order condition)} \\ cov(R_i, F_i) \neq 0 & \text{(rank condition)} \end{cases} \tag{5}$$

Consequently we use instrumental variables (IV) method to estimate the causal effect of retirement on health. The conditions for a good instrument thus become:

- The instrument (F) is correlated with endogenous explanatory variable (i.e. R), other things being equal. This means that the number of years used to compute pensions and contribution period required for a full pension both affect retirement choices. An increase in the number of years included in the reference wage calculation reduces the total pension amount received. It is then highly likely that people chose to postpone their retirement in order to increase their reference wage or lengthen their contribution period. They may also work more to save money, anticipating a decrease in their income in retirement. This will be tested in the first stage equation.
- F is not correlated with the error term ε_i. This means that the only impact of F_i is the endogenous variables and the instrument does not contribute to any hidden factor explaining Y_i. We test this hypothesis using the method implemented by Sargan (1958), a test that finds the non-correlation of residuals and exogenous variables, meaning that the set of exogenous variables does not affect our variable of interest Y_i by any another channel than our endogenous variable R_i.

Conditionally on these assumptions, the first-stage is the following:

$$R_i = \gamma_1 + \gamma_2 Tr_i + \gamma_3 N_i + \gamma_4 X_i + \nu_i \tag{6}$$

with $F_i = [Tr_i; N_i]$ and

$$\begin{cases} Tr_i = & 150.\mathbb{1}[g \leq 1933] + (160 + 1943 - g).\mathbb{1}[(g > 1934) \cap (g \leq 1943)] \\ & +(168 + 1960 - g).\mathbb{1}[(g > 1944) \cap g \leq 1960)] + 168.\mathbb{1}[g \geq 1960] \\ \\ N_i = & 10.\mathbb{1}[g \leq 1933] + (g - 1923).\mathbb{1}[(g > 1934) \cap (g \leq 1948)] \\ & +251\mathbb{1}[g \leq 1948] \end{cases} \tag{7}$$

g is the year of birth, Tr_i and N_i the number of contribution quarters and the number of earning years entering the pension formula, respectively. In this above equation, we

isolate the variation in R due to the increase in the number of reference years and required quarters and obtain $\hat{R}_i$. In the following equation, we estimate the causal effect of retirement on health scores (γ_2') using the variation in R due to the reform (i.e. an exogenous variation in retirement due to the fact that people work longer after the reform, because they anticipate a pension reduction):

$$Y_i = \gamma_1' + \gamma_2' \hat{R}_i + \gamma_4' X_i + \eta_i \tag{8}$$

4.2 Instrumental variables method results

Our sample covers people between 45 and 67 years old in both waves.This large sample was chosen for the following reasons: from 45 years old, more than 1% of the age group is in retirement, and retirement is mandatory in France after 67 years old.

Our identification strategy is based on the heterogeneity of treatment by generation. We remove public sector workers from our sample, since their pensions are based on their wages in the last six months of work. They are thus not affected by a change in reference years.

Table 2 presents the reduced form for people aged 45 to 67. As expected, there is a negative correlation between health indicators and incentives to work which changed in the 1993 reform (i.e. the number of years included in the reference wage calculation and the contributed quarters needed for entitlement to a full pension). In this first approach, the 1993 reform seems to have a direct negative impact on health. An increase in one reference earning year decreases by 0.23 point the general health score, whereas it decreases by around 0.5 the social health score. Tables 20 and 21 (in Appendix) show the same estimations by gender. An increase in one reference year decreases the general health score by 0.3 points and the social health score one by 0.6 point. Table 21 (in Appendix) shows that there is a negative correlation between reference earning years and social health for women aged 45 to 67.

We then estimate this effect by education groups and divide the population into two groups: high school graduates and non-graduates[15]. Our estimations presented in Table 22 (in Appendix) show a negative correlation between reference earning years and general, social and physical health for people without high school degree. The correlation between reference earning years and physical health is the largest one, an increase in one reference year decreases the general health score by 0.4 point the physical health score (respectively

[15] As we do not know the past occupations of retirees, we approximate the skills level of their work from their education.

Table 2: Reduced form for people aged 45 to 67

Dependent variables:	Gen. health	Phys. health	Mental health	Depression	Social health
Ref. years	-0.229**	-0.219	0.0727	-0.0403	-0.494***
	(0.115)	(0.175)	(0.159)	(0.160)	(0.143)
Contributed quarters	0.0495	-0.147	0.259	-0.175	0.0277
	(0.147)	(0.217)	(0.205)	(0.207)	(0.174)
Age	0.0324	-0.248**	0.483***	-0.387***	-0.114
	(0.0797)	(0.119)	(0.113)	(0.113)	(0.102)
Male	5.244***	9.426***	8.079***	-8.895***	-1.664***
	(0.419)	(0.609)	(0.593)	(0.599)	(0.485)
HH size	0.100	-0.0889	0.0734	-0.0510	0.363
	(0.244)	(0.389)	(0.342)	(0.349)	(0.350)
HH child	0.616*	1.041*	0.745	-0.637	0.0498
	(0.342)	(0.545)	(0.468)	(0.473)	(0.444)
Married	2.459***	1.869**	1.609**	-1.477**	3.951***
	(0.534)	(0.790)	(0.749)	(0.750)	(0.660)
Observations	6,519	6,624	6,626	6,629	6,577
R-squared	0.099	0.092	0.073	0.087	0.066

Note : robust standard errors in parentheses. *** P-value<0.01, ** p-value<0.05, * p-value<0.1. Income, education and regions of residence are added as controls, as well as a constant.

0.2 and 0.3 for general and social health scores). There is no significant correlation between reference earning years and physical health for people with HS degree (see Table 23 in Appendix). The impact of the reform on health may be heterogeneous.

Consequently, we have to conduct our estimations by education and by gender in order to estimate the causal impact of an retirement on health. The coefficients are small and sometimes no significant, however we have already age in the regression. Moreover the number of years included in the reference wage calculation and the contributed quarters needed for entitlement to a full pension are correlated (but no colinears).

Table 4 shows the results of the ordinary least squares and instrumental variables regressions to estimate the effects of retirement on the various Duke scores studied (general health, physical health, mental health and depression). The first stage estimation, which validates the rank condition, is shown in Table 3. As expected, there is a strong negative correlation between retirement and the number of years included in the reference wage calculation. The number of quarters needed for a full pension has a positive effect, which may be due to the positive correlation between T_i and N_i (see tables 25 and 24 in Appendix which show that the correlation is negative between retirement and each of our instruments). Considering our coefficients, we calculate that the sum of institutional incentives to retire per generation (that is $.033.T_i - .060.N_i$), other things being equal, is stronger for older generations (4.35 for generations born before 1933, 4.19 for the 1939 generation and 4.01 for the 1955 generation). This means that generations more affected by the reform, that is who have more incentives to work, tend to retire less, which is consistent with the literature. Figure 4 shows the relationship between retirement and generation. The scheme of the pension reform, as an increase in incentives to work, is not obvious. We have to control our regressions by age since the probability of retiring increases with age.

Our estimations presented in Table 4 show that retirement has a positive and significant impact on general and physical health. The instrumental variable effect is much larger than, and sometimes double, the OLS estimator. This was expected since we wanted to rule out the reverse impact of health on employment, which is likely to be positive (healthier people tend to stay in the labor market). So an OLS estimation may underestimate the effects of retirement on health. The increase in our estimator's standard deviations shows that we lose in precision, but the coefficients are still significant. The impact of incentives to work, which are here computed by generation, is highly likely to be hetero-

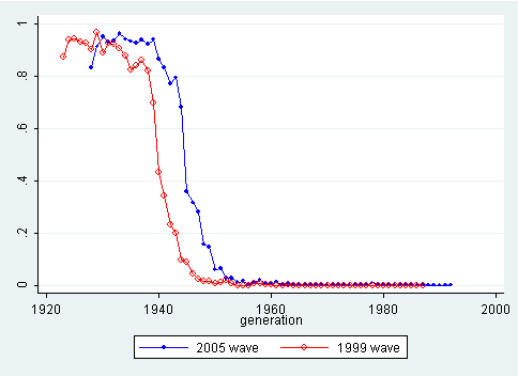


Figure 4: Relationship between Retirement and Generation.

geneous (People who started to work early and had contributed more than 160 quarters at age 60 are not impacted at all by the reform, for instance. Moreover, some people contributed to several pension systems.). However, we cannot be more precise as we lack employment history data. Besides, a loss of precision following a two-step estimation is only natural.

We find that the effect of retirement on general health is positive and equates to an increase of 2.28 points (on a 100 score) when estimated by OLS and 4.25 points when estimated by the instrumental variable method. This increase is due to the effect on two components : physical health and social health. The effect of retirement on physical health is 3.17 points when estimated by a simple OLS and 5.03 points when estimated by the instrumental variable method. Employment among seniors is detrimental to physical health. Moreover, retirement ties in with an improvement in social health - an indicator of social life[16] - totaling 9.54 points if we use an instrumental variable estimation (we find an improvement of 1.9 points with an OLS). Sargan tests validate our instruments for physical and general health scores. Concerning the latter, we find a 54.3% probability of not rejecting that our instruments are not over-identified. That means that retirement is the only channel through which work incentives affect health. The probability is 10% for physical health. Moreover, the Sargan test on social health does not rule out the invalidity of our instruments. It does not allow us to conclude that the positive link between social life and retirement is causal, contrary to physical health.

Concerning physical and social health, the instrumental variable effects are much larger than the OLS estimator. This confirms that the former method screens out the reverse

[16] In France, about 50% of seniors take part in associative activities (Prouteau and Wolff, 2007), and Sirven and Debrand (2008) show that this kind of activity has a positive impact on health. Their analysis reveals that social participation contributes three points to the increase in the share of individuals reporting good or very good health on average.

causality concerning these variables. However, this is not true for mental health and depression. The OLS effect of retirement on mental health is 1.9 points and retirement increases the depression score by 2.2 in this first rough approach. The instrumental variable effect is much smaller than the OLS one. This means that depressed people tend to stay longer on the labor market in France. However, the weakness of the Sargan test may put into question the validity of our instruments for these precise estimations.

To check the validity of our instruments in another way, we consider the consequences on our estimations if we use just one instrument. Table 26 presents the same estimations as before with the reference years being the only instrument. The results are similar and consistent and the coefficients are even stronger: retirement improves general health by 4.7 points, physical health by 6.8 points and social health by 11 points.

It appears that an instrumental estimation identifies the effect of retirement on health for people heterogeneously concerned by the 1993 French pension reform. In the next section, we study the heterogeneous effects of retirement on health by education and gender.

4.3 Detailed answers for physical and social scores

We find that the improvement of general health following retirement is driven by an improvement of physical and social health, and particularly the latter which is improved by 9.5 points. One might ask what are the reasons for a pensioner to have a richer social life than someone working. We thus analyze what drives those scores by estimating the effect of retirement on the most objective questions.

Concerning the social scores, we study the determinants of the following questions:

- *During the past week, how often did you socialize with other people (talk or visit with friends or relatives)?* (answers are between 0 -not at all- and 2-a lot-)
- *During the past week, how often did you take part in social, religious or recreation activities (meetings, church, movies, sports, parties)?* (answers are between 0 -not at all- and 2-a lot-)

We estimate the determinants of the answers using a linear estimation instead of a multi-probit which would have been more appropriate since answers are ordinal. However, since we want to see what drives the Duke scores, which are linear, we stick with it. Columns (1) and (2) of Table 5 show the results of an ordinary least squares and instrumented estimation of the first question. We find that retirement favors relations with

Table 3: First stage regressions on people aged 45 to 67

Dep. variable	Retirement				
	All	Men	Women	Without HSD	With HSD
	(1)	(2)	(3)	(4)	(5)
Contributed quarters needed	0.0325***	0.0333***	0.0308***	0.0340***	0.0266***
	(0.00779)	(0.00825)	(0.00832)	(0.00807)	(0.00780)
Ref. years	-0.0594***	-0.0578***	-0.0619***	-0.0576***	-0.0617***
	(0.00517)	(0.00645)	(0.00490)	(0.00537)	(0.00508)
Age	0.0349***	0.0393***	0.0287***	0.0377***	0.0281***
	(0.00477)	(0.00490)	(0.00534)	(0.00491)	(0.00488)
Male	0.0701***	-	-	0.0856***	0.0417**
	(0.0189)	-	-	(0.0204)	(0.0175)
HH size	-0.00980***	-0.0119**	-0.00617	-0.0151**	-0.00167
	(0.00345)	(0.00490)	(0.00440)	(0.00538)	(0.00784)
HH child	0.0236**	0.0121	0.0446***	0.0250**	0.0187**
	(0.0102)	(0.0129)	(0.0110)	(0.0121)	(0.00892)
Married	0.0100	0.0361**	-0.0171	0.00993	0.0178
	(0.00866)	(0.0171)	(0.0117)	(0.0100)	(0.0156)
Observations	8875	4168	4707	6235	2640
R2	0.601	0.652	0.551	0.612	0.579
F-stat	48.769	30.966	61.836	43.49	41.733
Prob>F	0.000	0.000	0.000	0.000	0.000

Note: robust standard errors in parentheses. *** P-value<0.01, ** p-value<0.05, * p-value<0.1. We use linear regressions. Income, education and regions of residence are added as controls, as well as a constant. F-stat is the Fisher statistic, which tests the overall significance of coefficients in the first-stage regression.

Table 4: The effect of retirement on health: the whole population aged 45 to 67

	General Health		Physical Health		Mental Health		Depression		Social health	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Retirement	2.283***	4.253**	3.169***	5.025**	1.877*	-2.643	2.194**	-1.615	1.902***	9.539***
	(0.724)	(1.812)	(1.122)	(2.384)	(0.919)	(2.682)	(0.970)	(2.676)	(0.624)	(3.198)
Age	0.0291	-0.0718	-0.182**	-0.277**	0.183**	0.413***	0.142*	0.337**	0.0818	-0.309*
	(0.0505)	(0.0932)	(0.0756)	(0.129)	(0.0655)	(0.133)	(0.0798)	(0.140)	(0.0493)	(0.174)
Male	5.081***	4.929***	9.178***	9.031***	7.946***	8.301***	8.731***	9.031***	-1.791***	-2.386***
	(0.434)	(0.450)	(0.833)	(0.850)	(0.635)	(0.734)	(0.684)	(0.763)	(0.300)	(0.457)
HH size	0.185	0.151	0.0291	-0.00287	-0.0740	0.00482	-0.0588	0.00698	0.621	0.487
	(0.265)	(0.267)	(0.311)	(0.321)	(0.362)	(0.352)	(0.326)	(0.319)	(0.381)	(0.412)
HH child	0.454**	0.505**	0.802*	0.850	1.020***	0.902***	0.833**	0.737**	-0.421	-0.223
	(0.199)	(0.219)	(0.456)	(0.501)	(0.325)	(0.306)	(0.350)	(0.351)	(0.404)	(0.445)
Married	2.406***	2.447***	1.866**	1.906**	1.650**	1.552**	1.518**	1.438*	3.783***	3.933***
	(0.462)	(0.466)	(0.737)	(0.741)	(0.671)	(0.645)	(0.711)	(0.697)	(0.623)	(0.670)
Observations	6,519	6,519	6,624	6,624	6,626	6,626	6,629	6,629	6,577	6,577
R2	0.101	0.099	0.093	0.093	0.073	0.069	0.087	0.084	0.064	0.045
TR2	-	0.360	-	2.711	-	3.916	-	1.699	-	2.970
ρ	-	0.543	-	0.100	-	0.048	-	0.192	-	0.085

Note: robust standard errors in parentheses. *** P-value<0.01, ** p-value<0.05, * p-value<0.1. Income, education and regions of residence are added as controls, as well as a constant. Instruments are the number of years for the calculation of the reference wage and the required contributed period (in quarters) for full pension entitlement. ρ is the p-value of a Sargan test (or Hansen test). The Sargan test is a statistical test used to check for over-identifying restrictions in a statistical model. The test statistic is indicated as "TR2" and follows a χ^2 law. Under the null hypothesis the error term is uncorrelated with the instruments.

friends and family, and this effect is underlined by the use of IV estimations. The size of the coefficient is the equivalent in absolute values of being a man (around a quarter of a point, when the value of the variable of interest goes from 0 to 2). Columns (3) and (4) of this table show the results of the same strategy to estimate the impact of retirement on social activities. Once again, retirement improves social activities and the using of IV estimations shows that a reverse causality effect is screened out (some people may have left the labor market because of a weak social life). The coefficient relative to retirement is slightly higher than the coefficient of the previous one (0.296) and significant. This means that the improvement of the social score in the previous subsection is significantly due to objective, though self-declared, questions. Retirement does improve social links in average.

Concerning the score for physical health, we analyze the answers to four questions building these scores the most objective as possible:

- *Today, would you have any physical problem or difficulty walking up a flight of stairs?* (answers are between 0 -a lot- and 2-none)
- *Today, would you have any physical problem or difficulty running the length of a football field?* (answers are between 0 -a lot- and 2-none)
- *During the past week. how much trouble have you had with sleeping?* (answers are between 0 -a lot- and 2-none)
- *During the past week. how much trouble have you had with hurting or aching in any part of your body?* (answers are between 0 -a lot- and 2-none)

Columns (5) and (6) of Table 5 show the determinants of a difficulty walking up a flight of stairs. The coefficient relative to retirement is positive and significant with an IV estimation. It is weaker than for questions building the social scores (0.15), probably because the change of social life is more radical than a change of physical health after retirement. The same applies for the second and the fourth questions which determinants are shown respectively in columns (7), (8), (11) and (12). Determinants underlined by the IV estimations are positive and significant, between 0.1 and 0.2. We find no effect of retirement on the capacity to sleep. However, we find that people who retire sleep more easily. Thus, the improvement of the physical health score due to improvement is explained by a real improvement of physical capacity.

Table 5: The effect of retirement on specific questions: the whole population aged 45 to 67

	Friends/Families		Leisure		Steps		Running		Sleep		No pain	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Retirement	0.0577	0.268***	0.139***	0.292***	0.0350	0.145**	0.0710	0.208***	0.0645**	0.0720	0.152***	0.171**
	(0.0389)	(0.0974)	(0.0339)	(0.0677)	(0.0299)	(0.0601)	(0.0448)	(0.0692)	(0.0271)	(0.0631)	(0.0407)	(0.0858)
Age	0.000113	-0.0105*	-0.00160	-0.00927**	-0.00629***	-0.0117***	-0.0147***	-0.0216***	0.000499	-5.36e-05	-0.0125***	-0.0134***
	(0.00313)	(0.00588)	(0.00223)	(0.00372)	(0.00163)	(0.00339)	(0.00312)	(0.00435)	(0.00220)	(0.00377)	(0.00315)	(0.00494)
Male	-0.216***	-0.230***	0.0159	0.00379	0.0660***	0.0573***	0.255***	0.245***	0.179***	0.180***	0.169***	0.166***
	(0.0251)	(0.0248)	(0.0226)	(0.0236)	(0.0159)	(0.0157)	(0.0293)	(0.0275)	(0.0295)	(0.0299)	(0.0365)	(0.0338)
HH size	-0.0135	-0.0166	-0.00291	-0.00602	-0.0171*	-0.0193*	0.00291	0.000289	0.0190	0.0187	-0.0222	-0.0228*
	(0.0193)	(0.0191)	(0.0159)	(0.0160)	(0.00988)	(0.0101)	(0.0178)	(0.0177)	(0.0167)	(0.0165)	(0.0131)	(0.0126)
HH child	-0.0770*	-0.0765*	0.0133	0.00594	-0.0501	-0.0532*	-0.0281	-0.0228	-0.0204	-0.0127	-0.0673*	-0.0694*
	(0.0418)	(0.0416)	(0.0416)	(0.0372)	(0.0333)	(0.0323)	(0.0360)	(0.0347)	(0.0398)	(0.0375)	(0.0374)	(0.0362)
Married	-0.0362	-0.0338	-0.0181	-0.0166	0.0289	0.0302	0.0128	0.0170	0.0490	0.0512*	0.0200	0.0189
	(0.0343)	(0.0338)	(0.0278)	(0.0282)	(0.0223)	(0.0218)	(0.0402)	(0.0382)	(0.0322)	(0.0311)	(0.0313)	(0.0305)
Observations	3,746	3,746	3,752	3,752	3,752	3,752	3,748	3,748	3,751	3,751	3,753	3,753
R-squared	0.068	0.060	0.093	0.090	0.056	0.052	0.089	0.086	0.043	0.044	0.041	0.041
TR2		0.0825		0.1048		0.4338		0.0006		0.4977		0.2584
ρ		0.774		0.746		0.510		0.980		0.480		0.6112

Note: robust standard errors in parentheses. *** P-value<0.01, ** p-value<0.05, * p-value<0.1. Income, education and regions of residence are added as controls, as well as a constant. Instruments are the number of years for the calculation of the reference wage and the required contributed period (in quarters) for full pension entitlement. ρ is the p-value of a Sargan test (or Hansen test). The Sargan test is a statistical test used to check for over-identifying restrictions in a statistical model. The test statistic is indicated as "TR2" and follows a χ^2 law. Under the null hypothesis the error term is uncorrelated with the instruments.

4.4 Heterogeneous effects by gender

The effects we find here are likely to be heterogeneous, primarily because of the difference between male and female employment patterns. In particular, in 1968, less than 50% of French women worked[17]. The results of our estimations by gender are shown in Tables 6 and 7. First stage estimations shown in Table 3 (see regressions (2) and (3)) and Sargan tests confirm the validity of the instrument for both populations: disincentives to work decrease for both men and women in the younger generations.

Table 6 indicates how retirement affects French men. Retirement raises general health by 6.4 points (estimated by the instrumental method and 3.0 by OLS). This is due to the 6.9 points increase in physical health (estimated by the instrumental method and 4.0 points by OLS), 0.3 points decrease in mental health (estimated by the instrumental variable and 2.4 points by OLS) and 12.1 points increase in social health (estimated by the instrumental variable and 2.6 by OLS). The IV effect is greater than in the OLS estimation, which is probably due to the fact that the instruments filter out the reverse causality and highlight a greater effect of retirement on health than previously found. All these effects are confirmed by Sargan tests, although this is weaker for social health. An OLS approach finds a significant correlation between retirement and mental health. Retirement goes hand in hand with an increase of 2.4 points in the mental health score and an increase of 2.1 points in the depression score. Men may be "directly" depressed by the announcement of the reform and the fact that they have to work longer to obtain a full pension, especially if they have strenuous jobs.

Table 7 shows that retirement is associated with a positive correlation on women's social health, but no effect on the other health scores. The effect on social health is weaker for women than men. It thus appears that the effects retirement might have on health are concentrated among the men. This is consistent with the literature: women do not have similar incentives to work (Bozio, 2008). Men are more sensitive to a variation to retirement than women (men may work in more strenuous jobs than women).

4.5 Heterogeneous effects by education

We find that retirement improves general and social health. But this impact probably differs with the type of work. In particular, work may be more strenuous for unskilled workers. As we do not know the past occupations of retirees, we approximate the skills

[17] Source: INSEE.

Table 6: The effect of retirement on health for men aged 45 to 67

	General Health		Physical Health		Mental Health		Depression		Social health	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Retirement	2.992***	6.423**	4.018***	6.884*	2.381**	-0.335	2.126*	-1.130	2.555***	12.10**
	(0.708)	(2.689)	(1.481)	(5.190)	(1.054)	(3.755)	(1.095)	(4.315)	(0.709)	(4.517)
Age	-0.00147	-0.187	-0.177	-0.331	0.182*	0.328	0.177	0.353	-0.000414	-0.516*
	(0.0730)	(0.152)	(0.137)	(0.309)	(0.0893)	(0.209)	(0.104)	(0.244)	(0.0651)	(0.263)
HH size	0.320	0.283	0.0414	0.0108	0.186	0.216	0.241	0.277	0.746	0.643
	(0.379)	(0.382)	(0.481)	(0.490)	(0.475)	(0.469)	(0.450)	(0.443)	(0.609)	(0.649)
HH child	0.622**	0.724**	1.276*	1.357*	0.995**	0.913**	0.826	0.733	-0.339	-0.0661
	(0.284)	(0.304)	(0.709)	(0.772)	(0.376)	(0.360)	(0.502)	(0.536)	(0.451)	(0.543)
Married	3.173***	3.104***	2.374**	2.313**	1.664*	1.719*	1.923**	1.991**	5.795***	5.595***
	(0.605)	(0.622)	(0.982)	(0.975)	(0.906)	(0.923)	(0.854)	(0.860)	(1.019)	(1.052)
Observations	3,013	3,013	3,052	3,052	3,052	3,052	3,054	3,054	3,036	3,036
R2	0.076	0.071	0.057	0.056	0.042	0.040	0.053	0.050	0.077	0.051
TR2	-	0.669	-	7.056	-	1.524	-	0.073	-	0.121
ρ	-	0.414	-	0.008	-	0.217	-	0.787	-	0.728

Note: robust standard errors in parentheses. *** P-value<0.01, ** p-value<0.05, * p-value<0.1. Income, education and regions of residence are added as controls, as well as a constant. Instruments are the number of years for the calculation of the reference wage and the required contributed period (in quarters) for full pension entitlement. ρ is the p-value of a Sargan test (or Hansen test). The Sargan test is a statistical test used to check for over-identifying restrictions in a statistical model. The test statistic is indicated as TR2 and follows a χ^2 law. Under the null hypothesis the error term is uncorrelated with the instruments.

Table 7: The effect of retirement on health for women aged 45 to 67

	General Health		Physical Health		Mental Health		Depression		Social health	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Retirement	1.634**	2.052	2.373*	2.903	1.138	-4.998	1.998	-2.051	1.581*	7.253**
	(0.830)	(2.704)	(1.278)	(4.128)	(1.196)	(3.721)	(1.217)	(3.864)	(0.941)	(3.042)
Age	0.037	0.017	-0.221**	-0.246	0.178*	0.469**	0.109	0.301	0.140*	-0.131
	(0.065)	(0.138)	(0.098)	(0.210)	(0.091)	(0.189)	(0.096)	(0.197)	(0.076)	(0.159)
HH size	0.004	-0.007	0.072	0.058	-0.388	-0.225	-0.400	-0.294	0.398	0.243
	(0.352)	(0.360)	(0.501)	(0.517)	(0.507)	(0.516)	(0.556)	(0.568)	(0.409)	(0.419)
HH child	0.166	0.175	-0.058	-0.046	1.040	0.911	0.759	0.676	-0.469	-0.344
	(0.497)	(0.498)	(0.724)	(0.725)	(0.716)	(0.714)	(0.734)	(0.736)	(0.555)	(0.565)
Married	1.786**	1.812**	1.426	1.459	1.668	1.292	1.271	1.027	2.143***	2.477***
	(0.751)	(0.761)	(1.075)	(1.102)	(1.063)	(1.084)	(1.073)	(1.097)	(0.822)	(0.847)
Observations	3,506	3,506	3,572	3,572	3,574	3,574	3,575	3,575	3,541	3,541
R2	0.057	0.057	0.041	0.041	0.032	0.024	0.036	0.032	0.069	0.059
TR2	-	0.002	-	0.157	-	1.610	-	1.869	-	4.024
ρ	-	0.96	-	0.691	-	0.204	-	0.172	-	0.045

Note: robust standard errors in parentheses. *** P-value<0.01, ** p-value<0.05, * p-value<0.1. Income, education and regions of residence are added as controls, as well as a constant. Instruments are the number of years for the calculation of the reference wage and the required contributed period (in quarters) for full pension entitlement. ρ is the p-value of a Sargan test (or Hansen test). The Sargan test is a statistical test used to check for over-identifying restrictions in a statistical model. The test statistic is indicated as TR2 and follows a χ^2 law. Under the null hypothesis the error term is uncorrelated with the instruments.

level of their work from their education. We divide the population into two groups: high school graduates and non-graduates. The results of our estimations are shown in Table 8 and 9.

We notice first of all that high school graduates over 40 years old are a minority in France, accounting for just 38.39% of the whole sample. This is consistent with the *Enquête Emploi* survey conducted by the French National Institute of Statistics and Economic Studies (INSEE) in 2009, in which about 20% to 40% of people in the 1936 to 1965 generations were high school graduates, i.e. had qualifications equal to or higher than the *baccalauréat* (Clerc et al., 2011). The main trend found by the instrumental estimation in Section 4 is thus probably due to this population. The determinants of retirement according to education are shown in Table 3. Sargan tests confirm the validity of the instrument for both populations. Incentives to work are still stronger for the younger generations for both high school graduates and non-graduates.

First of all, which is not surprising, lower educated people are less healthy. The average general health score is 67.7 for less-educated people (with a standard deviation of 0.22), compared to 71.9 for higher-educated people (with a standard deviation of 0.31). Table 8 presents the regression for people without high school degree. Retirement increases general health by 5.3 points (virtually equivalent to the effect of being a man) and physical health increases by 8.6 points. The effect of retirement on physical health is hence concentrated among the low educated. There is also a significant positive correlation between the depression scores and retirement and a significant positive correlation between social health and retirement. We are unable to draw any causality conclusions from the Sargan tests. Low-educated individuals may be "directly" depressed by the announcement of the reform and the fact that they have to work longer to obtain a full pension, especially if they have strenuous jobs.

The concentration of the positive effect of retirement on physical and general health among the less educated is confirmed when we study people who graduated from high school. The results, shown in Table 8, find a significant correlation between retirement and health. However, this effect is canceled out by the use of instruments. Since we consider that the number of reference years and required quarters are proper instruments, which is confirmed by our tests, we suppose that this is due to reverse causality: non-graduates in bad health tend to retire earlier. We can conclude that the more sensitive populations in terms of physical health are also the less educated. However, we also find

that retirement improves social health by 12.2 points, a causal effect that is confirmed by a Sargan test. We identify this effect only among more well-educated people. The effects of retirement are thus highly diverse depending on education. The positive impact on physical health is concentrated among high school non-graduates and the positive impact on social life is concentrated among the better educated.

4.6 A robustness check: new health scores

As mentioned above, the building of health scores assume that ordinal answers can be used to build continuous scores. We accept this assumption in order to have the most complete and global information on people's health. But we have to check that this does not bias our results. We build new scores with 0-1 possible answers to the 17-item questionnaire[18] (1 being the two best answers for health, 0 being the bad one[19]).

Results are consistent with preceding results concerning physical health: the use of an IV estimation increases coefficients related to retirement, which shows reverse causality has been screened out. Thus, our first estimations are robust if we consider another way to build health scores.

5 Complements: Difference-in-Differences approach

5.1 Strategy

We look at the change in health scores to identify the reform's effect on workers' health, comparing the evolution in health between the private and public sector since the latter was not affected by the reform. Any significant difference in health score developments between the two sectors can be considered as a consequence of the reform, if we accept three assumptions.

Firstly, seniors in a given sector experienced no other shocks that could affect their health between 1999 and 2005. The only legislation in this period that could have an impact is the act passed in 2003 and implemented in 2008, which gradually increased the number of contribution quarters for full pension entitlement for public sector workers born after 1948. However, we do not think this will undermine our findings. The first reason is that there is still a difference in required quarters between the private and public sector, even though it is smaller for the 1948 cohort and later cohorts. The second reason

[18] Results are available on demand.

[19] We find similar results if we build the scores with the medium answer being coded as 0 instead of 1.

Table 8: The effect of retirement on health for people without high school degree: aged 45 to 67

	General Health		Physical Health		Mental Health		Depression		Social health	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Retirement	2.041***	5.313**	3.114***	8.613**	1.819*	-0.939	2.839***	0.629	1.478*	7.099**
	(0.721)	(2.478)	(1.100)	(3.977)	(1.028)	(3.527)	(1.056)	(3.584)	(0.813)	(2.914)
Age	0.0825	-0.0914	-0.122	-0.413*	0.222***	0.368*	0.187**	0.304	0.127*	-0.172
	(0.0593)	(0.138)	(0.0905)	(0.221)	(0.0834)	(0.196)	(0.0869)	(0.199)	(0.0678)	(0.166)
Male	5.121***	4.807***	8.838***	8.301***	7.896***	8.164***	8.533***	8.748***	-1.164**	-1.708***
	(0.511)	(0.566)	(0.762)	(0.855)	(0.734)	(0.807)	(0.740)	(0.809)	(0.571)	(0.645)
HH size	0.400	0.344	-0.210	-0.303	0.187	0.234	0.0898	0.127	1.200***	1.102***
	(0.314)	(0.318)	(0.516)	(0.528)	(0.455)	(0.464)	(0.453)	(0.460)	(0.346)	(0.354)
HH chid	0.532	0.625	1.379**	1.533**	1.179**	1.101*	1.096*	1.034*	-0.932*	-0.772
	(0.398)	(0.407)	(0.653)	(0.677)	(0.565)	(0.576)	(0.560)	(0.574)	(0.502)	(0.518)
Married	2.506***	2.624***	2.514**	2.710***	1.834*	1.739*	1.771*	1.695*	3.337***	3.531***
	(0.666)	(0.670)	(0.997)	(1.013)	(0.951)	(0.957)	(0.949)	(0.958)	(0.749)	(0.755)
Observations	4,606	4,606	4,677	4,677	4,683	4,683	4,683	4,683	4,647	4,647
R2	0.091	0.086	0.085	0.079	0.069	0.068	0.084	0.083	0.048	0.037
TR2	-	0.356	-	1.427	-	4.079	-	4.018	-	4.586
ρ	-	0.55	-	0.232	-	0.043	-	0.045	-	0.032

Note: robust standard errors in parentheses. *** P-value<0.01, ** p-value<0.05, * p-value<0.1. Income, education and regions of residence are added as controls, as well as a constant. Instruments are the number of years for the calculation of the reference wage and the required contributed period (in quarters) for full pension entitlement. ρ is the p-value of a Sargan test (or Hansen test). The Sargan test is a statistical test used to check for over-identifying restrictions in a statistical model. The test statistic is indicated as TR2 and follows a χ^2 law. Under the null hypothesis the error term is uncorrelated with the instruments.

Table 9: The effect of retirement on health for people with high school degree: aged 45 to 67

	General Health		Physical Health		Mental Health		Depression		Social health	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Retirement	3.065***	0.989	3.344**	-2.467	2.213	-6.865	0.599	-7.123*	3.221**	12.21***
	(1.074)	(3.066)	(1.609)	(4.326)	(1.499)	(4.146)	(1.461)	(4.125)	(1.421)	(4.323)
Age	-0.0934	0.00337	-0.317***	-0.0464	0.0768	0.500**	0.0433	0.403*	-0.0130	-0.432*
	(0.0791)	(0.152)	(0.116)	(0.222)	(0.109)	(0.210)	(0.107)	(0.209)	(0.107)	(0.228)
Homme	5.174***	5.262***	10.09***	10.35***	8.173***	8.578***	9.145***	9.497***	-2.962***	-3.346***
	(0.760)	(0.759)	(1.054)	(1.059)	(1.051)	(1.056)	(1.052)	(1.061)	(0.956)	(0.988)
HH size	-0.245	-0.214	0.340	0.423	-0.617	-0.484	-0.364	-0.254	-0.325	-0.458
	(0.344)	(0.339)	(0.515)	(0.525)	(0.453)	(0.460)	(0.493)	(0.498)	(0.567)	(0.605)
HH child	0.257	0.217	-0.155	-0.260	0.528	0.357	0.298	0.157	0.402	0.577
	(0.518)	(0.515)	(0.735)	(0.738)	(0.697)	(0.690)	(0.732)	(0.728)	(0.634)	(0.644)
Married	2.084**	2.129**	0.618	0.741	1.103	1.269	0.962	1.120	4.420***	4.220***
	(0.898)	(0.887)	(1.329)	(1.298)	(1.225)	(1.240)	(1.218)	(1.212)	(1.212)	(1.220)
Observations	1,913	1,913	1,947	1,947	1,943	1,943	1,946	1,946	1,930	1,930
R2	0.096	0.094	0.095	0.087	0.094	0.075	0.094	0.080	0.068	0.045
TR2	-	0,003	-	2,55	-	0,453	-	1,004	-	0,461
ρ	-	0,956	-	0,11	-	0,501	-	0,046	-	0,497

Note: robust standard errors in parentheses. *** P-value<0.01, ** p-value<0.05, * p-value<0.1. Income, education and regions of residence are added as controls, as well as a constant. Instruments are the number of years for the calculation of the reference wage and the required contributed period (in quarters) for full pension entitlement. ρ is the p-value of a Sargan test (or Hansen test). The Sargan test is a statistical test used to check for over-identifying restrictions in a statistical model. The test statistic is indicated as TR2 and follows a χ^2 law. Under the null hypothesis the error term is uncorrelated with the instruments.

is that the 1948 and later cohorts do not represent the majority of our samples. The third reason is that the 2003 act reduces the difference between the treatment group and the control group, which can only lead us to underestimate the effect of the 1993 reform, and not invalidate it. Moreover, where there were other political reforms targeting a given sector, but not especially seniors, between 1999 and 2005, these reforms did not affect workers' health: we find no significant inter-sector difference in younger workers' health developments.

Secondly, the cohorts are similar, all things considered including age, and their health would have developed similarly had there been no reform. In order to fulfill this pre-requisite, we studied close cohorts no more than six years apart. We checked that there was no difference between cohorts this close by studying health changes among younger cohorts, who were treated similarly by the reform. We did not find any significant results, which supports our hypothesis. Tables 28 and 29 present some descriptive statistics on our target groups (54-59 years old and 62-65 years old). These statistics show that public sector workers are more educated and that this sector attracts more women. The proportion of female workers rose in both sectors between 1999 and 2005. This is due to the arrival of female work in the post-war period and the greater need for teachers and skilled workers in the public sector. In order to prevent the bias this might introduce in our estimations, we control for education, gender, marital status and household size. Private and public sectors in France are structurally different but there are few reasons why seniors health in each sector would evolve differently, which is the key hypothesis of a difference-in-differences estimation. The unemployment rate is higher in the private sector but this rate is stable between the two periods. Figure 7 shows that this rate is around 9-10% between the two periods (Figure 8 shows that this rate is stable for seniors between the two periods). Another difference between these sectors is about pre-retirement which only concerns the private sector[20]. Pre-retirement rules changed a lot before the 1990's, but not after 1998.

Thirdly, people did not move from one sector to the other, so there is no selection bias. Since we study near retirement-age seniors for whom it would serve no purpose to change pension system, we can rule out this eventuality. According the 2005 French Labor Force Survey, only 2.4% of people moved from the private to the public sector among the 54-59

[20] Pre-retirement was created in 1972 with an agreement introducing a guarantee of resources for workers aged 60 to 64 in order to protect them against unemployment. Workers over 60 who lost their job can receive a replacement income (up to 70% of their previous wage) until they reach the age of retirement.

Table 10: Average Y by group

	Private	**Public**
1999	$B = \beta_0 + \beta_2$	$A = \beta_0$
2005	$D = \beta_0 + \beta_1 + \beta_2 + \beta_3$	$C = \beta_0 + \beta_1$

years old (about 3.0% for the 62-65 years old).

Working with these assumptions, we compare people in the same age bracket in two different periods to circumvent the age effect on health. We compare them to people in the same age bracket six years later. We choose small age brackets as we do not want people to appear in both the treatment and the control group.

Given that only people in the private sector are affected by this reform, we have four different groups for each of the samples studied:

- **Group 1 (not treated)**: public sector workers in the 1999 survey.
- **Group 2 (not treated)**: private sector workers in the 1999 survey.
- **Group 3 (not treated)**: public sector workers in the 2005 survey.
- **Group 4 (treated)**: private sector workers in the 2005 survey.

We use the last group as the treatment group in our estimation since it is more affected by the reform. We compare this group to people less affected by the reform (Group 2). To control for the change in environment and generation between 1999 and 2005, we use the public sector as another control group to estimate the impact of the reform on the health of older workers in a difference-in-differences approach.

We thus estimate the equation:

$$Y_i = \beta_0 + \beta_1 T_i + \beta_2 P_i + \beta_3 T_i \times P_i + \beta_4 X_i + u_i \tag{9}$$

where P_i is a dummy for the private sector (the counter-factual is the public sector). T_i is a dummy for the 2005 survey.

So if the average Ys are respectively A, B, C and D for groups 1, 2, 3 and 4, they can be computed as shown in Table 10. Then the difference-in-differences estimator is:

$$\beta_3 = (D - B) - (C - A) \tag{10}$$

β_3 is the difference in changes in Y between private and public sector employees from 1999 to 2005[21]. Figure 5 presents the difference $(D - B)$, i.e. the difference in Ys for private workers between the two waves, and $(C - A)$, i.e. the difference in the public sector. Thus, if we consider the hypothesis that, without any policy change, Y would have developed similarly in the private and public sector, all other things being equal, then β_3 is the effect of the policy change on private sector employees (controlling for individual characteristics X_i). We will test this hypothesis by studying the change in the variables of interest among younger workers, who are not affected by the reform in the short term.

5.2 Our samples

Given that we have two sub-samples built in 1999 and 2005, we take three different age brackets, treated differently as shown in Table 1, in order to identify the reform's causal effect on older workers' health:

- **People between 54 and 59 years old:** we study people born between 1940 and 1945 in the 1999 wave of *Baromètre Santé* and people born between 1946 and 1951 in the 2005 wave. Here, the treatment consists of an increase of up to six years in the pension calculation reference period, depending on the cohort, and a small difference in contribution quarters required for full pension entitlement. The treatment is thus heterogeneous between cohorts and the difference compared with the 1999 wave is stronger for older seniors.

- **People between 62 and 65 years old**, who are born between 1934 and 1937 if they are in the 1999 wave of the *Baromètre Santé* and people born between 1940 and 1943 if they are in the 2005 wave (Table 27). Table 27 shows that the treated group has to work up to six additional semesters to get a full pension and the period of reference to compute pensions is increased by six years. According to what was highlighted in a previous paragraph (see Table 1), this means that everybody in the private sector is impacted by the reform but not in the same way: younger people are more impacted (treated group=T). The heterogeneity of treatment is high if we consider this range of age, which would allow a more precise estimation. However, the average age of retirement is below 60 in France. People working between 62 and 65 are thus a particular population, and we cannot completely extrapolate our results to any other type of population.

[21] This is true if, and only if, individual characteristics X_i are the same across public and private workers.

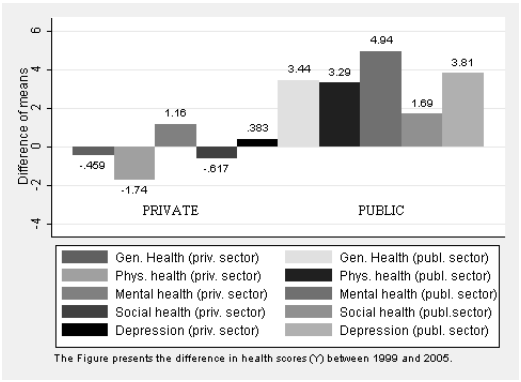
- **People between 40 and 45 years old** are chosen for the robustness check: most people work (around 80% of our sample) in this age bracket and there is no inter-generational pension scheme difference.

5.3 Results for elder age groups

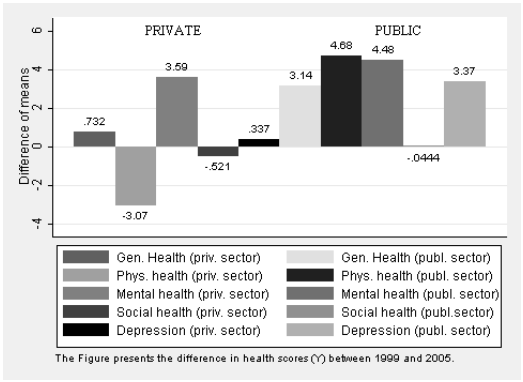
We first study people aged 54 to 59 years old. Differences between 1999 and 2005 are the lengthening of the period required to calculate the reference wage, and hence the pension, and a two-quarter increase in contributions for full pension entitlement for individuals aged 59 and 58. Figure 5 (a) shows the change in health scores in the private and public sectors for people aged 54-59 between 1999 and 2005. The private sector's physical score decreases 1.7 points between 1999 and 2005, whereas the same score increases 3.4 points in the public sector (the difference between the two sectors is about 5 points). The mental health score increases 1.2 points in the private sector, while it increases 4.9 in the public sector. The depression score increases 0.4 point in the private sector and increases 3.8 points in the public sector. The social health score drops 0.6 points in the private sector and rises 1.7 points in the public sector.

The results of a difference-in-differences estimation for this population are shown in Table 12. The physical and general health findings are consistent with the literature: people treated, with a greater incentive to work, are less healthy. There is a general improvement in physical and mental health between 1999 and 2005 and people working in the private sector are by and large healthier. However, the treatment seems to cancel out the general improvement. Significance appears even without any control for age, income, education and gender. Standard errors are similar with and without controls, which shows that the groups are not so different in terms of education, age and income. The effect of the treatment (which is an increase in mandatory contribution quarters for only part of the population and a six-year increase in reference years) is a decrease of some 3 points in the general health score and a decrease of around 5 points in the physical health score. The mental health and depression scores do not seem to be affected by the treatment for this population, but this may be due to the weakness of this treatment. We also study older workers for whom the treatment is stronger, as shown in Table 1.

We present the results of the difference-in-differences estimators described in Equation 9 for the different Duke scores in Table 11 for older workers (between 62 and 65 years old). Figure 5 (b) shows the change in health scores in the private and public sectors for



(a) People aged 54-59



(b) People aged 62-65

Figure 5: Health scores evolution between the 1999 and the 2005 waves.

people aged 62-65 between 1999 and 2005[22].

The physical score decreased 3.1 points in the private sector between 1999 and 2005, whereas it increased 4.7 points in the public sector (the difference between the two sectors is about 7.7 points). The mental health score rises 3.6 points in the private sector, while it increases 4.5 points in the public sectors. The depression score increases 0.3 points in the private sector and increases 3.4 points in the public sector. The social health score drops by 0.5 point in the private sector and falls 0.04 points in the public sector. Thus, this first approach finds that private sector workers' health deteriorates compared with public sector workers between the two periods. The general health score decreases 0.5 points for people aged 54-59 and increases 0.7 points for people aged 62-65 in the private sector, while the same score increases respectively 3.4 and 3.1 in the public sector. The general health decreases around 3 point in the private sector in comparison with the public one.

Rough estimation, without controls, may appear to suggest an improvement in people's health between 1999 and 2005. However, there is a generation change between our first and second sample. If we add controls for age, income, gender and education, this effect diminishes, suggesting that it is more a composition effect than a time effect. Private sector employees are healthier and less depressed on average, if we do not consider the reform. However, there is also less of an increase in health scores between 1999 and 2005.

The difference-in-differences estimator is large and significant for most of our variables of interest. Its size is equivalent to the gender effect. Our estimation finds that people more affected by the reform see their general health score fall 5.8 points and their physical score 11.67 points. Being in the private sector also strongly increases depression, but has no effect on mental health (our estimation does not find any significant result). The

[22]Figure 2.6 in Appendix presents the Duke Health scores for each sector between the two periods.

effect of treatment on depression is strongly positive and significant: treatment raises the depression score by 10.50.

We thus find that people more affected by the reform are more depressed and less healthy. This may be due to a longer working life expectancy and a decrease in expected pensions or to certain composition effects, since some people who would not have stayed on the labor market until that age because of bad health or depression without the reform may be in the treated sample.

However, it is worth pointing out how endogenous the groups can be, particularly as they are defined by the sector in which respondents chose to work. We find that general and mental health deteriorated less in the public sector between 1999 and 2005, but we cannot rule out selection issues since the average retirement age in France is 58.5 for men and 59.2 for women. The population studied (people working between 62 and 65 years old) is thus particular.

If we accept the hypothesis that the only difference between cohorts studied in the 1999 and the 2005 survey is due to a change in retirement incentives, these estimations show that stronger incentives to work and weaker replacement rates for seniors cause a decrease in physical health and even mental health for older seniors. This is likely to be due to the fact that retired people are more healthy. We find the same results than IV estimations by education (see Tables 13, 14, 15 and 16). People the less educated are more affected by the reform, i.e. we find a deterioration in health between the two periods for low-educated people.

5.4 Robustness check

The main hypothesis of the difference-in-differences approach is that the different groups would have evolved similarly if there had been no treatment. Most papers test this hypothesis by studying other periods. In our case, the French pension system has been constantly changing in both the public and private sectors since the first part of the 1990s[23]. People are affected by other policy reforms than the one studied in this paper, so we have no reason to believe the scores would evolve similarly in the private and the public sector in other periods. We thus choose to study people between 40 and 45 years old who did not experience any change in their incentives to work between 1999 and 2005. There should be no β_3 effect, as described in Equation 9 if they evolve similarly.

[23] Moreover, there was the 2001 crisis that may affect more the private than the public sector, in this case we should find degradation in health for younger private workers (40-45 years old).

Table 11: Diff in Diff for elder workers (62-65 years old)

	Gen. health		Phys. health		Mental health		Depression		Social health	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2005	2.285*	-0.637	3.829**	-0.287	3.820**	2.322	2.708	0.525	-1.036	-4.090*
	(1.348)	(1.915)	(1.916)	(2.705)	(1.737)	(2.473)	(1.704)	(2.454)	(1.607)	(2.211)
Private	2.351	4.799	6.814**	10.01**	2.444	5.404	5.474	10.06**	-0.957	0.744
	(2.911)	(3.043)	(3.418)	(4.036)	(4.003)	(4.223)	(3.785)	(4.049)	(3.929)	(4.330)
Treatment	-2.665	-5.800*	-6.859*	-11.67**	-2.163	-6.960	-3.998	-10.50**	0.0388	-0.286
	(3.205)	(3.418)	(3.923)	(4.636)	(4.351)	(4.691)	(4.139)	(4.508)	(4.259)	(4.744)
Controls	N	Y	N	Y	N	Y	N	Y	N	Y
Observations	1404	1223	1428	1241	1421	1235	1423	1238	1419	1236
R2	0.004	0.125	0.008	0.155	0.009	0.111	0.009	0.131	0.003	0.073

Note: robust standard errors in parentheses. * Significant coefficients at the 10% confidence level; ** at the 5% confidence level; *** at the 1% confidence level. Controls are age, income, gender, numbers of children, education, size of the household and marital status.

Table 12: Diff in Diff for senior workers (54-59 years old)

	Gen. health		Phys. health		Mental health		Depression		Social health	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2005	3.374***	2.423**	3.289**	2.317	4.497***	5.768***	3.293**	3.905**	1.975	-1.034
	(0.998)	(1.204)	(1.434)	(1.766)	(1.388)	(1.690)	(1.398)	(1.693)	(1.232)	(1.528)
Private	2.714**	2.183*	5.052***	4.181**	3.163*	2.513	3.135*	2.383	-0.365	-0.282
	(1.156)	(1.167)	(1.630)	(1.676)	(1.627)	(1.690)	(1.644)	(1.719)	(1.297)	(1.411)
Treatment	-3.572**	-2.944**	-5.109**	-4.611**	-2.645	-3.290	-2.291	-2.026	-2.164	-0.254
	(1.421)	(1.454)	(2.042)	(2.090)	(1.983)	(2.089)	(2.011)	(2.125)	(1.699)	(1.808)
Controls	N	Y	N	Y	N	Y	N	Y	N	Y
Observations	2672	2445	2713	2481	2715	2484	2714	2483	2687	2459
R2	0.007	0.107	0.006	0.113	0.009	0.089	0.006	0.106	0.003	0.069

Note: robust standard errors in parentheses. * Significant coefficients at the 10% confidence level; ** at the 5% confidence level; *** at the 1% confidence level. Controls are age, income, gender, numbers of children, education, size of the household and marital status.

Table 13: Diff in Diff for low-educated people (62-65 years old)

	Gen. health		Phys. health		Mental health		Depression		Social health	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2005	0.752	-1.197	1.274	-3.046	2.616	1.354	0.157	-1.745	-1.512	-1.313
	(2.025)	(2.718)	(3.153)	(3.759)	(2.523)	(3.477)	(2.518)	(3.283)	(2.396)	(3.021)
Private	1.902	9.065***	9.326**	18.62***	3.300	12.72***	5.507	14.86***	-4.673	-1.901
	(3.931)	(3.334)	(4.212)	(3.589)	(5.072)	(4.652)	(4.701)	(3.721)	(5.381)	(5.747)
Treatment	-1.191	-9.408**	-7.301	-17.65***	-2.358	-13.81**	-1.496	-12.68***	3.755	0.722
	(4.434)	(4.076)	(5.287)	(4.968)	(5.666)	(5.441)	(5.337)	(4.676)	(5.922)	(6.360)
Controls	N	Y	N	Y	N	Y	N	Y	N	Y
Observations	968	864	985	876	980	871	982	874	978	873
R2	0.002	0.133	0.006	0.174	0.006	0.122	0.009	0.154	0.005	0.056

Note: robust standard errors in parentheses. * Significant coefficients at the 10% confidence level; ** at the 5% confidence level; *** at the 1% confidence level. Controls are age, income, gender, numbers of children, education, size of the household and marital status.

Table 14: Diff in Diff for low-educated people (54-59 years old)

	Gen. health		Phys. health		Mental health		Depression		Social health	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2005	2.876**	2.081	3.120	1.987	4.245**	4.539**	3.055	3.224	0.796	-0.558
	(1.434)	(1.569)	(2.015)	(2.375)	(1.990)	(2.163)	(2.037)	(2.288)	(1.600)	(1.804)
Private	2.475*	2.198	5.094**	4.834**	1.722	1.476	1.541	1.494	-0.0346	-0.303
	(1.446)	(1.367)	(2.061)	(2.004)	(2.073)	(2.024)	(2.124)	(2.111)	(1.503)	(1.594)
Treatement	-2.825	-3.275*	-5.246*	-5.901**	-1.063	-2.373	-0.322	-1.348	-1.033	-0.468
	(1.915)	(1.830)	(2.723)	(2.653)	(2.699)	(2.681)	(2.774)	(2.783)	(2.092)	(2.147)
Controls	N	Y	N	Y	N	Y	N	Y	N	Y
Observations	1,692	1,595	1,714	1,616	1,717	1,619	1,715	1,617	1,701	1,604
R2	0.006	0.123	0.006	0.120	0.009	0.102	0.007	0.116	0.000	0.064

Note: robust standard errors in parentheses. * Significant coefficients at the 10% confidence level; ** at the 5% confidence level; *** at the 1% confidence level. Controls are age, income, gender, numbers of children, education, size of the household and marital status.

Table 15: Diff in Diff for educated people (62-65 years old)

	Gen. health		Phys. health		Mental health		Depression		Social health	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2005	1.260	-0.655	4.277	2.604	3.784	2.569	2.691	2.201	-5.002**	-8.235**
	(2.046)	(2.821)	(2.733)	(3.813)	(2.713)	(4.040)	(2.585)	(3.885)	(2.476)	(3.609)
Private	1.114	1.441	2.759	1.351	0.747	-0.785	4.009	6.166	-0.413	3.206
	(4.358)	(5.184)	(5.564)	(6.561)	(6.485)	(6.797)	(6.179)	(6.773)	(5.158)	(5.779)
Treatment	-0.0626	-2.076	-2.677	-4.281	0.493	-0.0646	-3.147	-8.216	2.910	-0.511
	(4.718)	(5.521)	(6.110)	(7.081)	(6.920)	(7.325)	(6.598)	(7.280)	(5.638)	(6.446)
Controls	N	Y	N	Y	N	Y	N	Y	N	Y
Observations	436	359	443	365	441	364	441	364	441	363
R2	0.005	0.192	0.010	0.225	0.013	0.232	0.007	0.189	0.013	0.143

Note: robust standard errors in parentheses. * Significant coefficients at the 10% confidence level; ** at the 5% confidence level; *** at the 1% confidence level. Controls are age, income, gender, numbers of children, education, size of the household and marital status.

Table 16: Diff in Diff for educated people (54-59 years old)

	Gen. health		Phys. health		Mental health		Depression		Social health	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2005	1.473	2.979	0.781	2.762	3.903*	7.027**	1.604	4.385	-0.188	-0.720
	(1.520)	(1.950)	(2.119)	(2.557)	(2.135)	(2.906)	(2.094)	(2.676)	(1.965)	(2.768)
Private	3.062*	2.155	4.890*	2.458	6.283**	4.462	6.556***	4.350	-1.285	0.449
	(1.857)	(2.273)	(2.565)	(3.120)	(2.489)	(3.110)	(2.328)	(2.930)	(2.445)	(3.007)
Treatment	-2.176	-1.994	-1.973	-1.436	-4.956*	-4.133	-4.397	-3.312	0.159	-0.717
	(2.217)	(2.600)	(3.144)	(3.663)	(2.982)	(3.496)	(2.868)	(3.414)	(2.988)	(3.425)
Controls	N	Y	N	Y	N	Y	N	Y	N	Y
Observations	980	850	999	865	998	865	999	866	986	855
R2	0.005	0.094	0.008	0.118	0.012	0.107	0.011	0.109	0.001	0.084

Note: robust standard errors in parentheses. * Significant coefficients at the 10% confidence level; ** at the 5% confidence level; *** at the 1% confidence level. Controls are age, income, gender, numbers of children, education, size of the household and marital status.

This is confirmed by our estimation, whose results are shown in Table 17. There is hardly any change in the scores studied among workers aged 40-45 between 1999 and 2005 [24], all things being equal. There is thus no score change difference between public and private sector workers. The significant coefficient found in the previous section for older workers is therefore due to heterogeneity specific to older workers, which is most likely down to a change in the pension system.

We hence show with a difference-in-differences approach that the prospect of working longer directly damages workers' health.

[24] We conducted similar robustness checks on a number of different populations. They were all positive (i.e. with a $\beta_3 = 0$) , but we chose to present populations close in age to the older workers studied previously. Tables are available at demand.

Table 17: Diff in Diff for younger workers (40-45 years old)

	Gen. health		Phys. health		Mental health		Depression		Social health	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
2005	3.374***	0.480	3.289**	1.910	4.497***	2.282	3.293**	1.693	1.975	-2.118
	(0.998)	(1.177)	(1.434)	(1.665)	(1.388)	(1.597)	(1.398)	(1.597)	(1.232)	(1.520)
Private	2.714**	1.487	5.052***	2.121	3.163*	3.823**	3.135*	3.711**	-0.365	-1.058
	(1.156)	(1.043)	(1.630)	(1.498)	(1.627)	(1.518)	(1.644)	(1.575)	(1.297)	(1.229)
Treatment	-3.572**	-1.599	-5.109**	-2.571	-2.645	-3.403*	-2.291	-3.243*	-2.164	0.936
	(1.421)	(1.382)	(2.042)	(1.956)	(1.983)	(1.950)	(2.011)	(1.933)	(1.699)	(1.737)
Controls	N	Y	N	Y	N	Y	N	Y	N	Y
Observations	2672	2156	2713	2183	2715	2182	2714	2185	2687	2166
R2	0.007	0.139	0.006	0.124	0.009	0.104	0.006	0.122	0.003	0.093

Note: robust standard errors in parentheses. * Significant coefficients at the 10% confidence level; ** at the 5% confidence level; *** at the 1% confidence level. Controls are age, income, gender, numbers of children, education, size of the household and marital status.

6 Conclusion

This paper uses a unique dataset to show that, other things being equal, retirement fosters physical health, especially for high school non-graduates. Moreover, retirement goes hand in hand with a greater social life, a correlation that can be seen for all categories of the population. Our aim is to identify the many effects of work on seniors' physical and mental health. We take the example of the 1993 French pension reform, which lengthened seniors' working lives, to identify these effects. Our study is conducted using the *Barometre Santé* dataset and two methods to measure this effect: a difference-in-differences estimator and an instrumental variable estimator.

First, we set out to measure the causal effect of retirement on health based on the reform, and more precisely the number of years required to compute the reference wage. The reference wage defines the pension amount. Prior to 1993, it was calculated on the basis of the individual's average wage over the ten best years of earnings and the contribution quarters required for a full pension, as retirement instruments for older workers. The 1993 reform gradually raised the number of reference years from 10 to 25. Thus, an instrumental estimation measures the impact of retirement on health for people heterogeneously affected by the 1993 pension reform. This method rules out the reverse causality of health on employment, because the reform was announced before people had to choose between work and retirement. This estimation shows that retirement has a positive impact on health, which confirms our initial results. The impact on physical health concerns the low-educated individuals only (compared to high-educated people). This is likely to be explain by a harder work. So, the weakest population in terms of income and social risk are also the most sensitive to the impacts work may have on physical health. Moreover, we find a positive effect of retirement on social life for the more well-educated individuals and the men. Consequently, retirement may increase social interactions for this population. Our dataset does not suggest any explanations for this, but it is a point worth keeping in mind when it comes to lengthening people's working lives.

Second, we compare the health changes in two groups, heterogeneously affected by the reform, using the public sector as a control group since public sector workers were less affected by the reform. Our estimations find strongly negative and significant coefficients: the general and physical health indicators are lower for people more affected by the reform. Moreover, the fact of being more affected by the reform also raises the depression score. So the difference-in-differences approach finds that people affected by the reform tend to

be less healthy and more depressed. A number of robustness checks confirm these results.

There are two concerns about this. The first is about equity since this means that the physical weight of the reform is carried by the less-educated which are also the poorer. The second is about market efficiency. There are some negative externalities of work on people's health which can increase health expenses born by the whole society. On the other hand, bad health as defined here may lead to an anticipated mortality and thus lighten social security accounts. We check the link between work and mortality in an upcoming article and endeavor to explain the heterogeneous effects in terms of career history.

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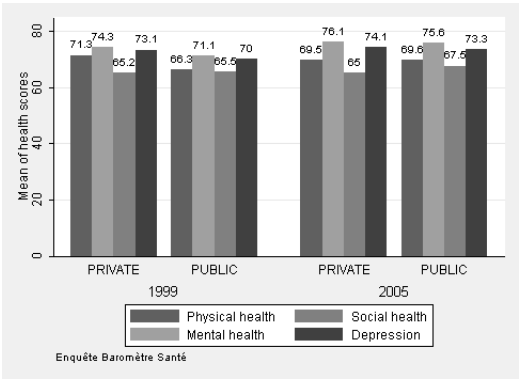
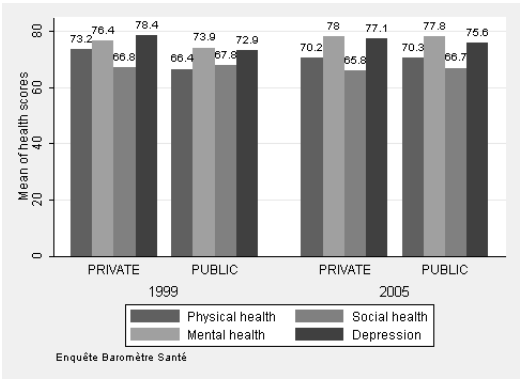
Appendix



(a) People aged 54-59



(b) People aged 62-65

Figure 6: Health scores evolution between the 1999 and the 2005 waves.

Table 18: Weights for the building of the Duke health scores

		Physical	Mental	General	Depression	Social
	Self-description (2 yes exactly.1 somewhat. 0 not at all)					
1	I like who I am	.	10	3.33	.	.
2	I am an easy person to get along with	.	.	3.33	.	10
3	I am basically a healthy person	.	.	.	.	.
4	I give up too easily	.	10	3.33	10	.
5	I have difficulty concentrating	.	10	3.33	10	.
6	I am happy with my family relationships	.	.	3.33	.	10
7	I am comfortable being around people	.	.	3.33	.	10
	Today. would you have any physical problem or difficulty (2 none 1 some 0 a lot)					
8	Walking up a flight of stairs	10	.	3.33	.	.
9	Running the length of a football field	10	.	3.33	.	.
	During the past week. how much trouble have you had with (2 none 1 some 0 a lot):					
10	Sleeping*	10	.	3.33	10	.
11	Hurting or aching in any part of your body	10	.	3.33	.	.
12	Getting tired easily*	10	.	3.33	10	.
13	Feeling depressed or sad *	.	10	3.33	10	.
14	Nervousness	.	10	3.33	.	.
	During the past week. how often did you (2 a lot 1 some 0 none)					
15	Socialize with other people (talk or visit with friends or relatives)	.	.	3.33	.	10
16	Take part in social. religious. or recreation activities (meetings. church. movies. sports. parties)	.	.	3.33	.	10

* 0.1 and 2 are inversed for the depression score,

Health scores are built as the weighted sums of the answers to the questions below.

Table 19: Correlation matrix of the scores studied

	General	Physical	Mental	Depression	Social
General	1	0.769*	0.811*	-0.822*	0.634*
Physical	-	1	0.461*	-0.663*	0.193*
Mental	-	-	1	-0.853*	0.306*
Depression	-	-	-	1	-0.295*
Social	-	-	-	-	1

Table 20: Reduced form for men aged 45 to 67

Dependent variables:	Gen. health	Phys. health	Mental health	Depression	Social health
Ref. years	-0.338**	-0.255	-0.0393	-0.0510	-0.674***
	(0.155)	(0.234)	(0.215)	(0.213)	(0.210)
Contributed quarters	0.0671	-0.409	0.262	-0.0259	0.302
	(0.196)	(0.286)	(0.266)	(0.272)	(0.251)
Age	-0.00721	-0.363**	0.444***	-0.339**	-0.0943
	(0.107)	(0.159)	(0.151)	(0.149)	(0.143)
HH size	0.208	-0.0784	0.225	-0.290	0.503
	(0.320)	(0.539)	(0.432)	(0.421)	(0.503)
HH child	0.807*	1.501**	0.877	-0.714	0.0757
	(0.428)	(0.718)	(0.576)	(0.573)	(0.600)
Married	3.282***	2.239*	1.859*	-1.980*	6.037***
	(0.762)	(1.174)	(1.053)	(1.052)	(1.034)
Observations	3,013	3,052	3,052	3,054	3,036
R-squared	0.075	0.057	0.041	0.052	0.080

Note : robust standard errors in parentheses. *** P-value<0.01, ** p-value<0.05, * p-value<0.1. Income, education and regions of residence are added as controls, as well as a constant.

Table 21: Reduced form for women aged 45 to 67

Dependent variables:	Gen. health	Phys. health	Mental health	Depression	Social health
Ref. years	-0.118	-0.198	0.205	-0.0258	-0.319*
	(0.169)	(0.257)	(0.234)	(0.240)	(0.187)
Contributed quarters	0.0415	0.177	0.208	-0.306	-0.224
	(0.221)	(0.326)	(0.321)	(0.320)	(0.238)
Age	0.0648	-0.126	0.492***	-0.409**	-0.128
	(0.121)	(0.179)	(0.172)	(0.178)	(0.139)
HH size	-0.0248	0.0619	-0.102	0.188	0.0889
	(0.373)	(0.535)	(0.537)	(0.592)	(0.429)
HH child	0.262	0.0107	0.519	-0.389	0.174
	(0.550)	(0.804)	(0.797)	(0.825)	(0.616)
Married	1.766**	1.378	1.377	-1.041	2.360***
	(0.756)	(1.085)	(1.073)	(1.087)	(0.836)
Observations	3,506	3,572	3,574	3,575	3,541
R-squared	0.057	0.040	0.033	0.035	0.071

Note : robust standard errors in parentheses. *** P-value<0.01, ** p-value<0.05, * p-value<0.1. Income, education and regions of residence are added as controls, as well as a constant.

Table 22: Reduced form for people without HS degree aged 45 to 67

Dependent variables:	Gen. health	Phys. health	Mental health	Depression	Social health
Ref. years	-0.275*	-0.413*	-0.0414	0.128	-0.312*
	(0.141)	(0.222)	(0.200)	(0.204)	(0.164)
Contributed quarters	0.0674	-0.0106	0.391	-0.436*	-0.152
	(0.183)	(0.276)	(0.259)	(0.261)	(0.210)
Age	0.0544	-0.232	0.534***	-0.525***	-0.0916
	(0.101)	(0.152)	(0.146)	(0.145)	(0.120)
Male	5.291***	9.106***	8.056***	-8.782***	-1.039*
	(0.507)	(0.749)	(0.725)	(0.731)	(0.565)
HH size	0.252	-0.479	0.346	-0.218	0.925**
	(0.331)	(0.547)	(0.493)	(0.486)	(0.375)
HH child	0.781*	1.839**	0.888	-0.855	-0.451
	(0.435)	(0.724)	(0.630)	(0.627)	(0.552)
Married	2.612***	2.680***	1.770*	-1.727*	3.506***
	(0.671)	(1.008)	(0.960)	(0.962)	(0.761)
Observations	4,606	4,677	4,683	4,683	4,647
R-squared	0.090	0.084	0.069	0.083	0.050

Note : robust standard errors in parentheses. *** P-value<0.01, ** p-value<0.05, * p-value<0.1. Income, education and regions of residence are added as controls, as well as a constant.

Table 23: Reduced form for people with HS degree aged 45 to 67

Dependent variables:	Gen. health	Phys. health	Mental health	Depression	Social health
Ref. years	-0.0576	0.276	0.368	-0.512*	-0.797***
	(0.200)	(0.281)	(0.265)	(0.264)	(0.267)
Contributed quarters	0.0121	-0.537	0.0385	0.458	0.471
	(0.246)	(0.349)	(0.335)	(0.333)	(0.315)
Age	0.0233	-0.322*	0.417**	-0.0941	-0.0437
	(0.132)	(0.194)	(0.185)	(0.182)	(0.181)
Male	5.302***	10.31***	8.273***	-9.234***	-2.892***
	(0.756)	(1.051)	(1.039)	(1.046)	(0.953)
HH size	-0.219	0.445	-0.449	0.209	-0.528
	(0.345)	(0.534)	(0.448)	(0.492)	(0.554)
HH child	0.238	-0.284	0.203	-0.0330	0.801
	(0.536)	(0.763)	(0.719)	(0.751)	(0.662)
Married	2.152**	0.479	1.171	-0.811	4.653***
	(0.905)	(1.344)	(1.235)	(1.228)	(1.206)
Observations	1,913	1,947	1,943	1,946	1,930
R-squared	0.092	0.094	0.095	0.096	0.071

Note : robust standard errors in parentheses. *** P-value<0.01, ** p-value<0.05, * p-value<0.1. Income, education and regions of residence are added as controls, as well as a constant.

Table 24: FS regressions with one instrument (TR_i) on people aged 45 to 67

Dependent variable	Retirement				
	All	Men	Women	With HSD	Without HSD
	(1)	(2)	(3)	(4)	(5)
Quarters needed	-0.041***	-0.037***	-0.046***	-0.050***	-0.036***
	(0.0023)	(0.0030)	(0.0033)	(0.0045)	(0.0027)
Age	0.038***	0.042***	0.033***	0.033***	0.041***
	(0.0010)	(0.0013)	(0.0012)	(0.0018)	(0.0011)
Male	0.075***	-	-	0.047***	0.091***
	(0.0071)	-	-	(0.013)	(0.0086)
HH size	-0.003	-0.006	0.001	0.005	-0.008
	(0.0045)	(0.0063)	(0.0047)	(0.0067)	(0.0052)
HH child	0.010	-0.001	0.030***	0.007	0.011
	(0.0070)	(0.0084)	(0.0101)	(0.0090)	(0.0088)
Married	-0.002	0.023	-0.027**	0.014	-0.004
	(0.0095)	(0.0142)	(0.0120)	(0.0159)	(0.0112)
Observations	8,875	4,168	4,707	2,640	6,235
R-squared	0.572	0.623	0.521	0.548	0.584

Note: robust standard errors in parentheses. *** P-value<0.01, ** p-value<0.05, * p-value<0.1. We use linear regressions. Income, education and regions of residence are added as controls, as well as a constant.

Table 25: FS regressions with one instrument (N_i) on people aged 45 to 67

Dependent variable	Retirement				
	All	Men	Women	With HSD	Without HSD
	(1)	(2)	(3)	(4)	(5)
Reference years	-0.045***	-0.043***	-0.048***	-0.051***	-0.042***
	(0.0018)	(0.0025)	(0.0024)	(0.0033)	(0.0021)
Age	0.024***	0.028***	0.018***	0.018***	0.027***
	(0.0012)	(0.0017)	(0.0014)	(0.0022)	(0.0013)
Male	0.074***	-	-	0.045***	0.089***
	(0.0070)	-	-	(0.0123)	(0.0084)
HH size	-0.009**	-0.010	-0.008*	0.0002	-0.016***
	(0.0043)	(0.0061)	(0.0044)	(0.0071)	(0.0045)
HH child	0.026***	0.010	0.054***	0.017*	0.030***
	(0.0079)	(0.0095)	(0.0104)	(0.0095)	(0.0101)
Married	-0.001	0.018	-0.020*	0.009	-8.27e-05
	(0.0090)	(0.0134)	(0.0115)	(0.0156)	(0.0103)
Observations	8,875	4,168	4,707	2,640	6,235
R-squared	0.592	0.643	0.542	0.572	0.603

Note: robust standard errors in parentheses. *** P-value<0.01, ** p-value<0.05, * p-value<0.1. We use linear regressions. Income, education and regions of residence are added as controls, as well as a constant.

Table 26: Instrumented regressions with one instrument (Ni) on people aged 45 to 67

	General Health		Physical Health		Mental Health		Depression		Social health	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	OLS	IV	OLS	IV	OLS	IV	OLS	IV	OLS	IV
Retirement	2.283***	4.689**	3.169***	6.766**	1.877*	-4.664	2.194**	-2.952	1.902***	11.03***
	(0.724)	(2.159)	(1.122)	(2.771)	(0.919)	(3.097)	(0.970)	(3.075)	(0.624)	(3.676)
Age	0.0291	-0.0941	-0.182**	-0.366**	0.183**	0.517***	0.142*	0.405**	0.0818	-0.386*
	(0.0505)	(0.111)	(0.0756)	(0.141)	(0.0655)	(0.161)	(0.0798)	(0.160)	(0.0493)	(0.205)
Male	5.081***	4.896***	9.178***	8.894***	7.946***	8.460***	8.731***	9.137***	-1.791***	-2.503***
	(0.434)	(0.436)	(0.833)	(0.859)	(0.635)	(0.717)	(0.684)	(0.746)	(0.300)	(0.491)
HH size	0.185	0.143	0.0291	-0.0328	-0.0740	0.0401	-0.0588	0.0301	0.621	0.461
	(0.265)	(0.270)	(0.311)	(0.321)	(0.362)	(0.364)	(0.326)	(0.323)	(0.381)	(0.420)
HH child	0.454**	0.517**	0.802*	0.894*	1.020***	0.850**	0.833**	0.702*	-0.421	-0.184
	(0.199)	(0.226)	(0.456)	(0.521)	(0.325)	(0.322)	(0.350)	(0.361)	(0.404)	(0.444)
Married	2.406***	2.456***	1.866**	1.943**	1.650**	1.509**	1.518**	1.411*	3.783***	3.962***
	(0.462)	(0.468)	(0.737)	(0.746)	(0.671)	(0.646)	(0.711)	(0.698)	(0.623)	(0.679)
Observations	6,519	6,519	6,624	6,624	6,626	6,626	6,629	6,629	6,577	6,577
R2	0.101	0.098	0.093	0.091	0.073	0.064	0.087	0.082	0.064	0.037

Note: robust standard errors in parentheses. *** P-value<0.01, ** p-value<0.05, * p-value<0.1. Income, education and regions of residence are added as controls, as well as a constant. Instruments is the number of years for the calculation of the reference wage.

Table 27: Average in treatment by age in the private sector

	Age=[54-59]			Age=[62-65]		
	2005	1999	Diff.	2005	1999	Diff.
	(1)	(2)	(1)-(2)	(3)	(4)	(3)-(4)
Nb of suppl. contributed quarters	161	159	2	158.6	152.5	6.1
Nb of suppl. reference years	24.4	19.5	4.9	18.6	12.5	6.1

Table 28: Average differences of characteristics of workers (people aged 54-59)

	1999 wave			2005 wave		
	Private	Public	P-value	Private	Public	P-value
Age	56.03	56.41	0.04**	56.33	56.20	0.07*
Male	0.65	0.43	0.00***	0.54	0.40	0.00***
HH size	2.70	2.34	0.03**	2.44	2.40	0.59
HH child	0.84	0.53	0.05*	1.08	1.08	0.97
Maried	0.82	0.80	0.57	0.77	0.70	0.00***
Educated	0.31	0.44	0.02**	0.32	0.59	0.00***

Lecture: In our sample, the average age of people working in the private sector is 56.03 in the 1999 wave and 56.41 in the public sector. The difference of means is not significant at 5% (*** p-value<0.01, ** p-value<0.05, * p-value<0.1). "Educated" corresponds to people who have a degree equal or greater than the *baccalauréat*.

Table 29: Differences in characteristics of workers (people aged 62-65)

	1999 wave			2005 wave		
	Private	Public	P-value	Private	Public	P-value
Age	63.28	63.26	0.94	63.70	63.64	0.52
Male	0.30	0.21	0.61	0.57	0.44	0.00***
HH size	1.93	1.99	0.89	2.08	2.06	0.77
HH child	0.26	0.64	0.37	1.09	1.09	0.71
Married	0.62	0.41	0.35	0.74	0.74	0.82
Educated	0.46	0.23	0.23	0.30	0.61	0.00***

Lecture: In our sample, the average age of people working in the private sector is 63.28 in the 1999 wave and 63.26 in the public sector. The difference of means is not significant at 1% (*** p-value<0.01, ** p-value<0.05, * p-value<0.1).

Table A. **Standardised unemployment rates in 27 OECD countries**

As a percentage of civilian labour force

	1990	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Australia	6.7	9.5	8.2	8.2	8.3	7.7	6.9	6.3	6.8	6.4	6.1	5.5	5.1	4.9
Austria	..	3.9	3.9	4.3	4.4	4.5	4.0	3.7	3.6	4.2	4.3	4.8	5.2	4.8
Belgium	6.6	9.8	9.7	9.5	9.2	9.3	8.5	6.9	6.6	7.5	8.2	8.4	8.4	8.2
Canada	8.1	10.4	9.5	9.6	9.1	8.3	7.6	6.8	7.2	7.7	7.6	7.2	6.8	6.3
Czech Republic	..	4.4	4.1	3.9	4.8	6.4	8.6	8.7	8.0	7.3	7.8	8.3	7.9	7.2
Denmark	7.2	7.7	6.8	6.3	5.2	4.9	5.1	4.3	4.5	4.6	5.4	5.5	4.8	3.9
Finland	3.2	16.9	15.3	14.6	12.7	11.3	10.2	9.8	9.1	9.1	9.0	8.9	8.4	7.8
France	8.5	11.7	11.1	11.6	11.5	11.1	10.5	9.1	8.4	8.7	9.4	9.6	9.7	9.4
Germany[a]	4.8	8.3	8.0	8.6	9.2	8.8	7.9	7.2	7.4	8.2	9.1	9.5	9.5	8.4
Greece	6.3	8.8	9.0	9.7	9.6	11.0	12.0	11.2	10.7	10.3	9.7	10.5	9.9	8.9
Hungary	..	11.0	10.4	9.6	9.0	8.4	6.9	6.4	5.7	5.8	5.9	6.1	7.2	7.5
Ireland	13.4	14.3	12.3	11.7	9.9	7.5	5.7	4.3	4.0	4.5	4.7	4.5	4.4	4.4
Italy	8.9	10.6	11.2	11.2	11.3	11.4	10.9	10.1	9.1	8.6	8.4	8.0	7.7	6.8
Japan	2.1	2.9	3.2	3.4	3.4	4.1	4.7	4.7	5.0	5.4	5.3	4.7	4.4	4.1
Korea	2.4	2.5	2.1	2.0	2.6	7.0	6.6	4.4	4.0	3.3	3.6	3.7	3.7	3.5
Luxembourg	1.7	3.2	2.9	2.9	2.7	2.7	2.4	2.3	2.0	2.7	3.7	5.1	4.5	4.7
Netherlands	5.9	6.8	6.6	6.0	4.9	3.8	3.2	2.9	2.2	2.8	3.7	4.6	4.7	3.9
New Zealand	7.8	8.1	6.3	6.1	6.6	7.4	6.8	6.0	5.3	5.2	4.6	3.9	3.7	3.8
Norway	5.8	6.0	5.5	4.8	4.0	3.2	3.3	3.4	3.6	3.9	4.5	4.4	4.6	3.5
Poland	..	14.4	13.3	12.3	10.9	10.2	13.4	16.1	18.2	19.9	19.6	19.0	17.8	13.8
Portugal	4.8	6.9	7.3	7.3	6.8	5.1	4.5	4.0	4.0	5.0	6.3	6.7	7.6	7.7
Slovak Republic	..	13.7	13.1	11.3	11.9	12.6	16.3	18.8	19.3	18.6	17.6	18.2	16.2	13.4
Spain	13.0	19.5	18.4	17.8	16.7	15.0	12.5	11.1	10.3	11.1	11.1	10.6	9.2	8.6
Sweden	1.7	9.4	8.8	9.6	9.9	8.2	6.7	5.6	4.9	4.9	5.6	6.3	7.3	7.0
Switzerland	..	3.9	3.5	3.9	4.2	3.6	3.0	2.7	2.6	3.2	4.2	4.4	4.5	..
United Kingdom	6.9	9.3	8.5	7.9	6.8	6.1	5.9	5.4	5.0	5.1	4.9	4.7	4.8	5.3
United States	5.6	6.1	5.6	5.4	4.9	4.5	4.2	4.0	4.7	5.8	6.0	5.5	5.1	4.6
EU-15[b]	8.1	10.4	10.0	10.1	9.8	9.2	8.5	7.6	7.2	7.6	7.9	8.0	7.9	7.4
OECD Europe[b]	8.0	10.5	10.0	9.9	9.6	9.1	8.8	8.3	8.1	8.5	8.8	8.9	8.6	7.8
Total OECD[b]	6.1	7.6	7.2	7.2	6.9	6.8	6.6	6.2	6.4	6.9	7.1	6.9	6.6	6.0

a) For 1990, the data refer to western Germany; subsequent data concern the whole of Germany.

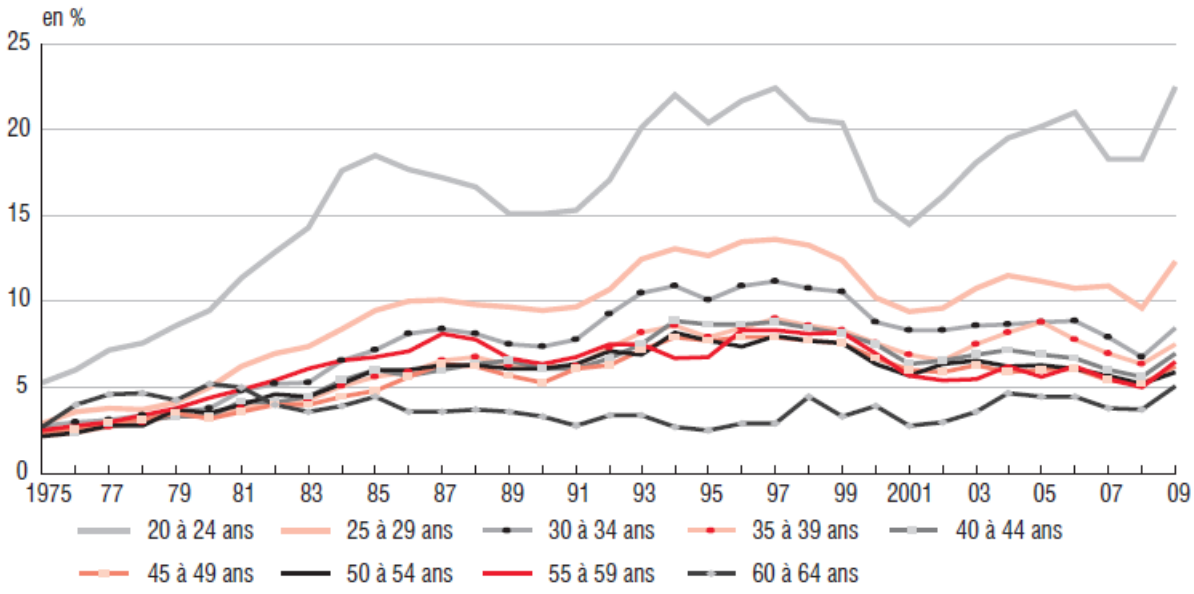
b) For above countries only.

Note: In so far as possible, the data have been adjusted to ensure comparability over time and to conform to the guidelines of the International Labour Office. All series are benchmarked to labour-force-survey-based estimates. In countries with annual surveys, monthly estimates are obtained by interpolation/extrapolation and by incorporating trends in administrative data, where available. The annual figures are then calculated by averaging the monthly estimates (for both unemployed and the labour force). For countries with monthly or quarterly surveys, the annual estimates are obtained by averaging the monthly or quarterly estimates, respectively. For several countries, the adjustment procedure used is similar to that of the Bureau of Labor Statistics, U.S. Department of Labor. For EU countries, the procedures are similar to those used in deriving the Comparable Unemployment Rates of the Statistical Office of the European Communities. Minor differences may appear mainly because of various methods of calculating and applying adjustment factors, and because EU estimates are based on the civilian labour force. For a fuller description, please refer to the following URL: *www.oecd.org/std*.

Source: OECD (2007), *OECD Main Economic Indicators*, April, Paris.

StatLink http://dx.doi.org/10.1787/024830722817

Figure 7: Unemployment rates (OECD)



Champ : France métropolitaine, ensemble des actifs.
Source : Insee, Enquêtes emploi 1975-2009, corrigées des ruptures de série.

Figure 8: Unemployment rates by age groups (INSEE, Clerc et al. (2011)).