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Healthier when retiring earlier? Evidence from France[#]

Pierre-Jean Messe* François-Charles Wolff**

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Abstract: This paper contributes to the literature on the health-retirement relationship by looking at the effect of retiring before legal age on health in later life in France. To account for the endogeneity of the early retirement decision, our identification strategy relies on eligibility rules to a long-career early retirement scheme introduced in France in 2004 that substantially increased the proportion of older workers leaving their last job before the legal age of 60 years. We find a positive correlation between early retirement and health problems among male retirees. However, we fail to find any significant causal effect of early retirement on poor health once we account for the endogeneity of the decision to retire before the legal age. Controlling for working conditions does not influence the effect of retirement and occupying a demanding job is harmful to health after retirement regardless of the retirement date. Similar results are found for female retirees.

JEL Classification: I14; J14; J26

Keywords: early retirement; self-assessed health; working conditions

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* Corresponding author. Université du Maine, GAINS-TEPP, LEMNA, CNAM Lirsa CEET, Avenue Olivier Messiaen, 72085 Le Mans Cedex 9. E-mail : pierre-jean.messe@univ-lemans.fr

** LEMNA, Université de Nantes, BP 52231, Chemin de la Censive du Tertre, 44322 Nantes Cedex, France and INED, Paris, France. E-mail: francois.wolff@univ-nantes.fr

1. Introduction

In almost all OECD countries, the retirement age has decreased significantly during the 70s and 80s. With the ageing of their population, most countries have decided to postpone their legal retirement age over the last decade (see Hofäcker et al., 2016)¹. In pay-as-you-go pension systems, postponing retirement should have positive effects on public accounts with a decrease in the total amount of pensions payable to retirees. However, this may also imply additional costs if extending the working period has adverse effects on older workers' health in later life. Therefore, examining the consequences of the retirement timing on health status is a key issue from a public policy perspective.

Obviously, the empirical relationship between retirement and health is subject to endogeneity concern, either in the form of omitted variable bias or reverse causality (Bonsang et al., 2012; Coe et al., 2012; Insler, 2014; Eibich, 2015). For instance, people who started their first job at a young age will be more likely to retire early because they will have contributed to the pension system for the requested number of years to draw a full rate pension. If those persons have experienced strenuous working conditions during their career, then they will be more likely in poor health during their remaining years of retirement. In such setting, being unhealthy would be the motivation – rather than the cause – of early retirement. Conversely, managers and executives in good health and having accumulated enough assets may be tempted to benefit from early retirement since they will be less affected by the reduction in income due to lower pensions once being retired.

In this paper, we study the consequences of early retirement on the health status of retirees in France. In this country, pensions are financed on a pay-as-you-go basis. The average age at which older workers withdraw from the labor market is substantially below the normal retirement age (about 1.5 year)². Early retirement is hence frequently observed, but its impact on health outcomes has not been investigated so far. To estimate a causal effect, our identification strategy relies on the introduction of a specific early retirement scheme whose focus was on long careers. Since 2004, individuals were allowed to retire before the early eligibility age (which is 60 years in France) subject to specific conditions that include among other criteria their birth cohort and the age at which they start working. We use eligibility to the program as an instrumental variable to control for endogeneity of the early retirement decision in various health equations.

Our empirical analysis relies on a unique data set conducted in France in 2012 on a sample of respondents aged between 50 and 69 and interviewed about their passage from employment to retirement. This survey provides information on three health indicators (self-reported health, chronic

¹ See http://www.oecd.org/els/emp/Summary_1970%20values.xls for an overview of time-series data concerning the average effective age of retirement in OECD countries.

² According to OECD (2015), the average effective age of retirement for the 2009-2014 period was 59.4 years for men and 59.8 years for women. The difference with the normal retirement age is 1.8 years for men and 1.4 years for women, respectively.

health problem, limitation in daily life), retirement timing for those having retired and working conditions. We consider respondents born between 1943 and 1950 since the cohorts born in 1945 were the first eligible to the new early retirement scheme introduced in 2004. We first focus on the situation of male retirees having worked in the private sector and end up with a sample of 1,359 retirees for whom we investigate the health consequences of early retirement. We also examine the situation of female retirees (1,078 observations) having worked in the private sector.

Our paper contributes to the recent literature on the health-retirement relationship. Noting that the effect of retirement on health status cannot be signed on a priori grounds, many studies have attempted to assess the causal impact of retirement with different estimation strategies. Considering cross-national household data, some authors have used variations in retirement ages between countries to instrument the retirement decision (Rohwedder and Willis, 2010; Coe and Zamarro, 2011; Mazzonna and Peracchi, 2012). More recent studies exploit panel data combining this identification strategy with fixed-effect models (Hessel, 2016; Heller-Sahlgren, 2017; Mazzonna and Peracchi, 2017). Conversely, other authors have focused on a single country using temporal changes in pension eligibility as instruments (Charles, 2004 ; Neuman, 2008; Behncke, 2012; Bonsang et al., 2012; Eibich, 2015; Gorry et al., 2015; Zhu, 2016; Oshio and Kan, 2017; Atalay and Zhu, 2018). Here, we focus more closely on the health consequences of early retirement and account for the role of working conditions. The early retirement scheme that we consider is a quasi-natural experiment which allows us to instrument the early retirement decision³.

Our empirical analysis provides new results for the case of France. To date, very little work has been conducted on the health-retirement relationship in this country, Blake and Garrouste (2018) or L'Haridon et al. (2018) being recent exceptions. Many studies have analyzed the data provided by the Survey of Health, Ageing and Retirement in Europe for which France is one of the contributing members (Coe and Zamarro, 2011; Mazzonna and Peracchi, 2012, 2017; Heller-Sahlgren, 2017). However, country heterogeneity is a serious concern (Nishimura et al., 2018). With our data, we find a positive correlation between early retirement treated as exogenous and health problems among male retirees. However, this correlation is not statistically significant for retirees having benefited from the long-career scheme. Furthermore, we fail to find any causal effect of early retirement on poor health once we account for the endogeneity of the decision to retire before the legal age. We obtain very similar results for female retirees.

The remainder of our paper is organized as follows. In the next Section, we briefly summarize the existing literature. Section 3 provides a description of the French retirement system with a focus

³ With the exception of Heller-Sahlgren (2017), instruments used to account for endogeneity are constructed using both the early and legal retirement ages in all the aforementioned studies. However, we can expect that early and regular retirement have different effects on health.

on the long career early retirement scheme. We present the data in Section 4 and discuss our identification strategy in Section 5. We describe our results in Section 6 where we show differences in the effect of early retirement depending on whether endogeneity of the retirement decision is taken into account or not. Finally, section 7 provides some concluding comments.

2. The effect of retirement on health: A review

Over the last ten years, a growing number of studies have attempted to investigate the health effects of retirement. Starting from the model of Grossman (1972), Dave et al. (2008) point out that the effect of retirement on health is ambiguous from a theoretical perspective. On the one hand, people invest in health across the lifecycle in order to improve their own productivity and avoid the adverse effect of illness on earnings, but this investment motive is no longer present after retirement (negative effect). On the other hand, health enters as consumption good in the utility function so that retirees still have incentives to invest in health (positive effect). The net effect will depend on the marginal benefits and marginal costs of investing in health and is in particular related to the marginal value of time (Dave et al., 2006). As emphasized in Behncke (2012), the health effect of retirement is expected to be heterogeneous depending on individual preferences.

Identification of the causal effect of retirement on health is thus an empirical issue. A difficulty is that the retirement decision is unlikely to be exogenous. Three main sources of endogeneity have to be taken into account (Dave et al., 2008; Eibich, 2015). First, both the retirement decision and the health outcomes are likely to be influenced by the same set of individual characteristics (not necessarily observed). Fixed effect models are most often estimated to correct the underlying omitted variable bias. Second, there may be a problem of reverse causality (Dwyer and Mitchell, 1999; McGarry, 2004). In particular, even if the retirement decision is expected to be strongly related to rules of the current state pension system, individuals may choose to postpone their retirement decision because they are in good health⁴. Third, a potential drawback is the so-called justification bias related to measurement errors such that retirees tend to report more often a poor health as a justification of their retirement status (Bazzoli, 1985; McGarry, 2004).

Different estimation strategies have been proposed to assess the causal effect of retirement. The most frequent approach is to rely on institutional variation in retirement incentives. Using data from several countries, Rohwedder and Willis (2010), Coe and Zamarro (2011) and Mazzonna and Peracchi (2012) use cross-country variations in retirement ages and consider the early and normal retirement ages in each country. However, Bingley and Martinello (2013) show that those variations

⁴ However, using data from the Health and Retirement Study, Miah and Wilcox-Gök (2007) show the reverse story for chronically ill men and women: they retire later because of lower asset accumulation.

in pension eligibility are invalid instruments without controlling for level of schooling⁵. To overcome this issue, recent studies based on cross-country comparison exploit panel data and estimate models with instrumental variables and fixed effects (Hessel, 2016; Heller-Sahlgren, 2017; Mazzonna and Peracchi, 2017). Other studies looking at the health-retirement relationship in a specific country also exploit panel variation as well as early and normal retirement age (Atalay and Zhu, 2018; Charles, 2004; Neuman, 2008; Behncke, 2012; Bonsang et al., 2012; Eibich, 2015; Gorry et al., 2015; Zhu, 2016; Oshio and Kan, 2017).

In terms of results, empirical evidence is mixed so far. Using cross-country data from the US and Europe, Rohwedder and Willis (2010) report a large negative impact of early retirement on the cognitive ability of people in their early 60s. Using the European SHARE data, Mazzonna and Peracchi (2012) find an increase in the rate of decline of cognitive abilities after retirement. However, it is important to differentiate between short-term and long-term effects of retirement (Heller-Sahlgren, 2017). Using US data from the Health and Retirement Study (HRS), Bonsang et al. (2012) conclude in favor of a substantial negative effect (around 10%) of retirement on cognitive functioning obtained from episodic memory scores⁶. With the same data, Dave et al. (2008) show that the negative effect of retirement concerns the number of mobility difficulties, the number of difficulties in daily activities, the number of illness conditions and depression symptoms. Behncke (2012) finds the same negative effect of retirement on physical and perceived health in England. Also, retirement causes an increase in the probability of being obese among men (Godard, 2016). Using the SHARE data, Heller-Sahlgren (2017) shows that retirement increases the prevalence of depressive symptoms.

However, a few other studies reach the opposite conclusion concerning the retirement-health relationship. Using three different US datasets, Charles (2004) shows that the negative correlation between retirement and well-being is no longer valid once accounting for endogenous variation in retirement probability. Using the HRS data, Coe et al. (2012) report a negative association between retirement duration and cognitive function, but there is no causal effect for white-collar workers and a positive one for blue-collar workers after proper instrumentation. With the same data, Insler (2014) finds that retirement has a beneficial effect on a global health index incorporating both objective and subjective health characteristics⁷. Again, the IV estimates switch sign compared to the OLS estimates. With the SHARE data, Coe and Zamarro (2011) conclude that retirement leads to a 35 percent decrease

⁵ According to Bingley and Martinello (2013), the estimator of the retirement effect is severely biased and the magnitude of the endogeneity bias depends on the correlation between schooling and the retirement instruments.

⁶ In Ireland, the negative effect of retirement on mental health is significant for involuntary or forced retirement, but not for voluntary retirement (Mosca and Barrett, 2016).

⁷ Gorry et al. (2015) find a positive effect of time spent on retirement on mental and physical health (especially several years after the retirement date). They put forward that these benefits are cumulative over the retirement period.

in the probability of being in fair or poor health. In Germany, Eibich (2015) finds that retirement improves both subjective health and mental health. In Australia, Zhu (2016) reports a positive effect of retirement on perceived and physical health, especially several years after the retirement date.

The case of France has received little attention to date. France is one of the countries contributing to the SHARE project from which the causal health-retirement relationship has been empirically investigated in Europe (Coe and Zamarro, 2011; Mazzonna and Peracchi, 2012, 2017; Heller-Sahlgren, 2017). However, a recent work from Nishimura et al. (2018) shows that country heterogeneity has a large influence on the estimated results so cross-country estimation is not appropriate when estimating the health effect of retirement. Recently, Blake and Garrouste (2018) investigated the case of France using the Health Barometer surveys collected in 1999 and 2005. Dealing with causality using the 1993 reform of the French pension system which concerned only private worker employees, they find that retirement leads to an improvement of physical health, especially among men and low-educated individuals. Using the 2013-2016 French Labor Force surveys with a sample of around 13,000 interviewed twice, L'Haridon et al. (2018) show that health tends to improve after retirement using difference-in-differences models.

Very few studies have explored the channels through which retirement may have an influence (either positive or negative) on health outcomes. Focusing on smoking and exercise habits, Insler (2014) observes contrasting post-retirement evolution with a decline in smoking incidence and an increase in exercise levels. For both outcomes, the correlation obtained from fixed effect models is significant especially for long-term retirement. Eibich (2015) provides a detailed analysis of changes in daily life after retirement in Germany. The retirement decision leads to a decrease in smoking probability, an increase in sleep time and an increase in time spent on leisure activities. In all these studies, those changes in post-retirement behavior are mechanisms explaining the positive health effects. At the same time, Eibich (2015) and Mazzonna and Peracchi (2017) report substantial heterogeneity across occupations. They demonstrate that relief from work-related stress and physical strain is important to explain the positive effect of retirement on health.

Understanding why the estimated effect of retirement on health is sometimes negative, sometimes positive remains challenging. In their comprehensive analysis, Nishimura et al. (2018) point out the role of the analysis method and to a lower extent the role of control variables. A central issue, further discussed in Hagen (2018), concerns the empirical strategy to account for endogenous selection into retirement. The commonly used instruments correspond to age-specific retirement incentives (like eligibility age thresholds) which are expected to influence health indirectly, i.e. only through age of retirement. A potential drawback of those instruments is that pension reform may have

an impact on health before individuals make their retirement decision due to some expectation effects (Falba et al., 2009; De Grip et al., 2012)⁸.

3. The French pension system

The French pension system is characterized by many different pension schemes depending on employment status, with specific rules for self-employed, civil servants or workers in special public services. The majority of wage earners in the private sector, representing around 60% of the labor force, contribute to a general mandatory pay-as-you-go pension scheme called general regime ("*régime général*") and receive pensions from the Caisse Nationale d'Assurance Vieillesse (CNAV). For these workers, there is a second pillar that consists of mandatory complementary schemes, ARRCO and AGIRC, respectively for non-executives and executives. These two schemes are also financed in a pay-as-you-go manner.

The basic formula to compute pensions in the general regime is based on the three following parameters: the reference wage corresponding to the 25 best annual earnings, the number of years of contribution and the conversion rate⁹. The latter reaches its maximum, i.e. 50%, when workers draw their pensions at the full rate age (FRA hereafter). The FRA is a complex feature of the French pension system since it depends on both the retirement age and the number of years of contribution (Rabaté and Rochut, 2016). Before 2003, workers covered by the general regime were entitled to a pension once they reached the age of 60 years. They received a pension at a full rate only if they had validated a sufficient number of quarters to the pension system that we will refer to as the full rate duration (D_{FR})¹⁰.

To restore the financial balance of the pension scheme, the French government started introducing some changes in 1993. The main reform consisted in increasing gradually the full rate duration from 150 to 160 quarters. This change was phased in with one additional quarter for each cohort beginning with the 1934 generation (for which the full rate duration was 151 quarters) to end

⁸ Using data from the HRS, Falba et al. (2009) show that divergence between the subjective probability of working full-time at age 62 and actual labor participation at that time affects the risk of depression. Assessing the effect of a Dutch pension system reform, De Grip et al. (2012) find that depression rates increase by about 40% for the 1950 cohort affected by a reduction in pension rights compared to the 1949 cohort.

⁹ The definition of the reference wage for the general regime has changed over time. Before 1993, it was based on the average earnings of the best 10 years. Since then, it has been gradually raised with an increase of one year for each cohort from generation 1933 to generation 1948. For civil servants, the reference wage corresponds to the average earnings of the 6 best months.

¹⁰ A distinction has to be made between two types of quarters, i.e. quarters of contribution and assimilated quarters. A quarter of contribution to the system is validated if the annual earnings are at least equal to 200 hours of minimum wage (1886 euros in 2013). The number of quarters of contribution cannot exceed 4 in one year. Under some conditions, some missing quarters of contribution may be purchased by individuals to compensate incomplete years or high exit age from the schooling system. An assimilated quarter may be validated even though the individual is not employed, for instance due to sickness leaves, unemployment schemes, maternity or disability.

with the 1943 generation (for which full rate duration was 160 quarters). Before 2003, each year of missing validated quarters led to a reduction of 10 percentage points in the replacement rate. However, for workers aged 65 and over, this penalty did not apply and the full pension rate was reached even though individuals had not validated the full rate duration.

In 2003, the government made changes in some rules of the pension system. First, it applied the 1993 changes to the public sector, leading to equality in the full rate duration for private sector employees and civil servants in 2008. Second, since 2009, it prolonged the increase in the full rate duration for both types of workers from 160 quarters for the 1948 cohort to 166 quarters for the 1955 one. It also reduced the penalty for early retirement from 10% to 5% and introduced a bonus for delayed retirement. Another side of the reform introduced social equity. Before 2003, workers having started contributing to the system very early (at 16) had also to retire at the early eligibility age (60 years). In the case of continuous careers, they contributed 44 years (176 quarters) to the system, 4 years more than a worker having started working at 20 or over.

The 2003 reform reduced this inequality by introducing a long-career early retirement scheme (*“retraite anticipée pour carrière longue”*, RACL hereafter). Since January 1st 2004, the RACL scheme allowed individuals who started working very young to retire before 60 years¹¹. The eligibility to the RACL scheme was subject to a triple condition: i) having started working at 17 or before, the age of first contribution to the pension system conditioning the minimum eligibility age (between 56 and 58 if the individual started working at 16 or before, at 59 if he/she started working at 17); ii) having validated 8 quarters more than the full rate duration, while the insurance duration had to be 16 quarters higher before the introduction of this measure (the validated quarters could be made up of short unemployment spells and other types of assimilated quarters); and iii) having a number of quarters of contribution higher than the full rate duration or not depending on age of the first contribution.

In 2009, the conditions to retire before 60 for workers having started working at 17 or earlier were severely tightened in many respects (Denayrolles and Guilain, 2015)¹². In particular, the increase in the number of required contribution quarters to retire before 60 increased in 2009 and afterwards as planned by the 2003 reform. This raised automatically the insurance duration criteria. A last reform was voted in 2010 under the Sarkozy government, which yet came into force in 2011. It increased the early eligibility age from 60 to 62 and the normal retirement age (at which there is no penalty, even though the number of validated quarters is lower than the full rate duration) from 65 to 67. This change

¹¹ See <https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000781627>.

¹² Among the other changes, the number of quarters purchased by workers to compensate incomplete years or high number of schooling years have been excluded since 2009 from the total number of validated quarters required to be entitled to the retirement before 60. Also, the possibilities of overstatement for contributed years have been reduced. Age of the first contribution requires a formal evidence of work since 2009.

was gradually phased in with 4 additional months for each cohort from the 1951 one. It also increased the early eligibility age for workers eligible to the RACL scheme from 56 to 58, but with a delayed implementation (starting from the cohort 1955).

Due to data constraints (we use a survey completed in 2012) and changes in the RACL scheme after 2009, we focus in our paper on the situation of cohorts who were eligible to the RACL scheme between 2004 and 2008. For cohorts born between 1943 and 1949, we describe in Table 1 the eligibility conditions to the RACL scheme as well as changes in the various criteria. Implementation of the RACL scheme led to a high number of demands. According to official statistics, it is estimated that from 2004 to 2008, more than 550,000 individuals used the RACL scheme: 114,790 in 2004, 101,462 in 2005, 107,903 in 2006, 114,382 in 2007 and 119,620 in 2008¹³. In 2009, the number of recipients collapsed to about 24,000 and was around 42,000-43,000 in both 2010 and 2011. All over the period, men were overrepresented among recipients, with proportions equal to 85.7% in 2004, 79.3% in 2006 and 76.5% in 2008.

Insert Table 1

4. Description of the data

We assess the effect of retirement on health in France using the RACL scheme as a quasi-natural experiment. Indeed, this scheme provided exogenous incentives to retire between 2004 and 2008, at least for some specific groups of workers since recipients had to begin their career early and fulfill the requested number of contribution quarters.

Our empirical analysis is based on a unique survey completed in 2012 by the French National Institute of Economics and Statistics (INSEE) entitled Passage from Employment to Retirement ("*Passage de l'Emploi à la Retraite*", PRE)¹⁴. The PRE survey is a complementary module to the French Labor Force Survey (FLFS), a short panel data set of individuals interviewed during six successive quarters, that includes detailed information on labor market participation and type of occupation along with individual demographic and socioeconomic characteristics. The FLFS has a rotating scheme such that for a given quarter the sample includes one sixth of individuals surveyed for the first time, one sixth of individuals surveyed for the second time and so on. The PRE survey was asked to individuals who were interviewed in their sixth and last period in the FLFS and meeting the two following criteria: they should be aged 50-69 and should have been in the labor market after 50. Among those individuals, the response rate is 95.04%. The main purpose of the PRE survey was to document the circumstances through which people left the labor market, their motivation to maintain a

¹³ See http://dares.travail-emploi.gouv.fr/IMG/xls/series_internet_caa_2003-2014_sexe_age_2015_23_11.xls.

¹⁴ The PRE data files are available to researchers using the French portal Réseau Quetelet for data in the humanities and social sciences (<http://www.reseau-quetelet.cnrs.fr/spip/>).

professional activity at old ages as well as their intentions of retiring for those still in the labor market. It was also conducted to better characterize the transition periods separating the end of working life and retirement, with a focus on the use of early retirement schemes.

We rely on three different sets of questions in the PRE survey related to health, retirement and working conditions, respectively. Our dependent variable concerns the respondent's health. We consider the three following indicators: i) a self-reported assessment of health status obtained from the question "how do you currently assess your general health?", possible answers being "very good", "good", "good enough", "bad", "very bad"; ii) an indicator of chronic illness obtained from the question "do you currently have a chronic illness or health problem?", possible answers being "yes" or "no"; iii) an indicator of limitation in daily life from the question "have you been limited, for at least six months, because of a health problem in the activities that people usually do?", possible answers being "yes" or "no"¹⁵. These self-reported outcomes have been widely used in health economics and self-assessed health has been shown to be highly correlated with mortality, disability as well as utilization of health services (Schnittker and Bacak, 2014) or physical and mental health (Bacak and Olafsdottir, 2017).

The PRE survey provides a detailed description of the labor market trajectory. This includes the age at which the respondent started working, the number of working years and the retirement status. Those who have already retired at the date of the survey indicate both when they withdrew from the labor market and when they started receiving their pension. We construct an early retirement indicator which is equal to one when the respondent left his last job before the legal age of 60. There are also several questions related to the circumstances around retirement and on the use of a specific scheme in case of early retirement.

The PRE survey includes a question on the RACL scheme: "you can retire at age 60 or earlier if you start working young and have had a long career, using the RACL scheme: did you benefit from the RACL?", possible answers being "yes" or "no". We will use this self-reported information to identify recipients of the RACL scheme. However, for reasons related to either recall error or reluctance to reveal how they decided to retire, some recipients may deliberately choose not to indicate that they have benefited from the RACL scheme. Thus we will also account for the criteria required for eligibility to the RACL scheme. Due to the lack of information on the number of contributed and validated quarters, we consider only two criteria to construct an indicator of respondents' eligibility, i.e. their birth cohort and the age at which they started working.

The PRE survey includes detailed information on working conditions. Respondents have to answer "yes" or "no" to the nine following assertions: "I had a night-shift work", "I worked with rotating hours", "I did repetitive work or chain work", "my job was physically demanding (heaving loads

¹⁵ There is no other health indicator (like mental health) in the PRE survey.

to carry, strenuous position)", "I was exposed to toxic, harmful or dangerous products", "I worked in a noisy environment", "I worked in high or low temperatures", "I lived tensions with an audience (customers, users, patients, students, travelers, suppliers, ...)". We construct a set of dummy variables associated to each of those working conditions. Finally, the survey contains standard demographic and socio-economic characteristics like year of birth, marital status and education.

We apply the following selections to the original sample. First, we consider for the moment only male respondents, whose current or last job was not in the public sector and being currently retired. The last criterion is obvious since we focus on the effect of early retirement, and we only select respondents in the private sector because of substantial differences in retirement conditions between workers from the private and public sectors. As more than 75% of retirees having benefited from the RACL scheme were male, we present detailed estimates for male retirees. We will conduct as robustness check a separate analysis for female retirees. Second, we restrict our analysis to a subsample of individuals born between 1943 and 1950 since people born after 1951 have been subject to substantial changes in the RACL scheme¹⁶. Third, we exclude a small number of respondents who report having worked for the first time after 26 years as well as incoherent answers between early retirement and use of RACL scheme¹⁷. Overall, our final sample comprises 1,359 respondents.

We provide a description of the sample in column (1) of Table 2. Concerning the health outcomes, 41.7% of respondents report a bad health, 46.0% have chronic health problems and 25.5% face some health limitations in their daily life. The average age of respondents is 64.3 years, 82% of them live in a couple and they have 2.1 children on average. Most respondents (about 80%) have completed less than high school, 18.8% are executives, 25.3% are intermediates, 49.7% are blue-collar workers and 43.7% have experienced at least one unemployment spell. Many retirees have experienced poor working conditions. The largest proportions are found for physically demanding work (51.5%), high pace of work (48.8%), exposition to loud noise (44.0%) and exposition to low/high temperatures (43.5%).

Insert Table 2

In our sample, more than one respondent over two (775/1359=57.0%) have retired before the legal retirement age. As shown by the comparison of columns (2A) and (3) in Table 2, there are substantial differences in the characteristics of people who chose to retire before the legal age and those who did not. Early retirees are slightly younger (-0.8 year), less educated and more often blue-collar workers (+14.6 points). Also, respondents did not report similar working conditions. Early

¹⁶ We exclude the 1942 birth cohort as the number of individuals born in 1942 (N=81) is much lower compared to that of other cohorts. This choice has no effect on our results.

¹⁷ In particular, 21 respondents claim having benefited from the RACL scheme (which means that they retire before the legal age of retirement), but do not indicate in the survey that they retire before 60.

retirees have experienced worse working conditions, in particular for physically demanding work (+12.6 points), exposition to low/high temperatures (+10.5 points), exposition to loud noise (+8.7 points), exposition to toxic products (+8.1 points) and shift work (+7.7 points). Overall, our results suggest a positive association between early retirement and bad health. People who retired early are more likely to be in bad health compared to those who retired at the legal retirement age: +10.4 points for self-reported bad health (46.2% against 35.8%), +11.0 points for chronic health problems (50.7% against 39.7%) and +8.6 points for health limitation (29.2% against 20.5%).

In columns (2B) and (2C), we compare the characteristics of men reporting that they have benefited from the early retirement scheme and those having retired earlier for another reason (or at least not reporting that they have benefited from the RACL). Interestingly, RACL recipients have much better health outcomes than other early retirees: -10.8 points for bad health (38.8% against 49.6%), -3.8 points for chronic health problems (48.5% against 52.3%), and -6.8 points for health limitation (24.5% against 31.3%). Compared to other male early retirees, RACL recipients are younger (-1.3 year), they have more often secondary or vocational education (+8.5 points), they are more likely to have occupied a job as blue-collar worker (+5.6 points) and have less often experienced any unemployment spell (-16.7 points)¹⁸.

Obviously, several confounding factors are likely to affect the relationship between health and early retirement. For instance, low education or poor working conditions are expected to have a negative influence on both the decision to retire early and being in good health. Another difficulty is that the health outcome may be affected by some justification bias if respondents “justify” their early retirement decision by exaggerating their poor health (Dwyer and Mitchell, 1999; McGarry, 2004). In what follows, we explain our empirical strategy to account for the potential endogeneity of the early retirement decision.

5. Identification strategy

Endogeneity is a central concern when investigating the causal effect of retirement on health. In our context, the endogenous selection in early retirement is likely to lead to a positive correlation between bad health and early retirement because of a reverse causality issue. Unhealthy people are expected to have a higher propensity to leave early the labor market. We turn to an instrumental variable strategy to account for the endogeneity of the early retirement decision¹⁹. More precisely, we

¹⁸ In terms of working conditions, RACL recipients report more often having experienced short repetitive tasks (+6.3 points) and physically demanding work (+4.6 points) compared to other early retirees. Conversely, they indicate less often a high pace of work (-5.9 points).

¹⁹ Since we do not have longitudinal data, we are not able to account for unobserved heterogeneity at the individual level. That is why it is important to account for the role of working conditions in our regressions since those covariates may affect both the decision to retire early and the health status.

use the introduction of the RACL scheme which has led to an increase in early retirement rates as a quasi-natural experiment and consider eligibility to the RACL scheme as instrumental variable. In what follows, we investigate the relevance of our identification strategy.

In Figure 1, we present the proportion of male early retirees by birth cohort calculated from the PRE survey. For those born in 1943 and 1944, the proportion of male early retirees is around 42-43%. Then, it increases to 48.2% for the 1945 cohort, 57.6% for the 1946 cohort, 59.8% for the 1948 cohort and 69.1% for the 1950 cohort. On average, the proportion of male early retirees increases by 17.5 percentage points when comparing the situation of the cohorts born in 1943 and 1944 and that of cohorts born from 1945 (from 42.9% to 60.4%). Furthermore, the difference is highly significant according to a mean-comparison test ($p < 0.000$). We argue that this increase in the number of male early retirees results from the introduction of the RACL scheme.

Insert Figure 1

As shown in Table 1, people born either in 1943 or 1944 were not eligible to the RACL scheme. Only cohorts born from 1945 had the opportunity to leave their job before 60 because of the RACL scheme. For those born in 1945 and after, the proportion of respondents reporting that they have used the RACL scheme is equal to 21.6%. Figure 1 shows the contribution of the RACL scheme to total early retirement. The proportion of RACL recipients among male early retirees amounts to 20.9% for the 1945 cohort, 25.2% for the 1947 cohort and 44.0% for the 1949 cohort. Clearly, the increase in early retirement observed among the youngest birth cohorts is strongly related to the introduction of the RACL scheme.

In Figure 2, we take into account the eligibility status to the RACL scheme. As the numbers of validated and contributed quarters required to obtain a full rate pension are not observed in our data, we define eligibility as a function of birth cohort and age at which respondents started their first job. We consider that a man is eligible to the RACL if he is born in 1945 or later and if he started working at 17 or earlier. With this definition, the eligibility rate for people born from 1945 is equal to 70.4%. The proportion of male early retirees who are not eligible to the RACL scheme is around 40% for cohorts born between 1945 and 1948 and 50% for cohorts born either in 1949 or 1950. This proportion appears much higher for respondents eligible to the RACL scheme. The gap is equal to 27.4 percentage points for the 1945 cohort, 37.8 points for the 1946 cohort, 19.5 points for the 1947 cohort, 38.3 points for the 1948 cohort, 26.5 points for the 1949 cohort and 35.9 points for the 1950 cohort. When considering all birth cohorts, the average gap is equal to 30.9 percentage points.

Insert Figure 2

So, eligibility to the RACL scheme is highly correlated with the increase in the proportion of male early retirees. This is the first condition which is required for eligibility to be a valid instrument. Among the eligibility criteria, the respondent's birth cohort is clearly exogenous. At first sight, the

situation sounds different for the age at which respondents started working as less educated people or blue-collar workers have presumably entered earlier the labor market. At the same time, what matters in our context is that respondents were unlikely to have deliberately chosen their date of entry in the labor market (in the sense that they could have manipulated it when being young) while thinking that this age at labor market entry could have more than 40 years later an influence on the possibility to retire early from the labor market.

The second condition for the eligibility variable to be a valid instrument is that it should not be correlated with the various health outcomes. We expect the two criteria considered in the empirical definition of eligibility to be correlated with health. First, it is well acknowledged that health declines with age even though the rate at which health decreases with age is much lower after 60-65 (see for instance Case and Deaton, 2005). Second, there is a large positive association between health and education, which suggests a negative relationship between health and age at which individuals started working. The influence of education increases with years of education, although its magnitude tends to be larger at young ages and declines after 50-60 (Cutler and Lleras-Muney, 2008). However, eligibility to the RACL scheme depends on the combination of specific conditions for both birth cohort and age at labor market entry. Once controlling for age and education, there is no reason to observe any correlation between health and the eligibility status of the respondent²⁰.

Using the RACL scheme as a quasi-natural experiment should allow us to rule out the issue of reverse causality (with people in poor health retiring earlier). In the PRE survey, respondents were asked in what circumstances they left their last job. Several reasons like financial incentives, health or family constraints were listed. Overall, more than one male retiree over two indicated having left their job before 60 because of financial incentives: 44.4% were entitled to a pension when they left and 16.4% benefited from generous financial conditions to leave. Also, 13.6% of male early retirees claimed they left their job because of poor health. Such cases illustrate the aforementioned problem of reverse causality, with poor health potentially influencing the decision to retire earlier.

To assess the relevance of our identification strategy, we choose to compare these self-reported motives depending on whether the male early retirees benefited from the RACL scheme or not. The main result is that a very small number of recipients of the RACL scheme left their job because of poor health (2.0%). Conversely, this proportion is more than nine times higher (18.9%) among respondents who retired earlier for another reason than the RACL scheme. Among those who benefited from the RACL scheme, the most frequent circumstances are related to entitlement to a

²⁰ In our empirical analysis, we will investigate whether our results are robust when considering subsamples of individuals more comparable in terms of age or age at labor market entry.

pension when leaving (72.2%) and financial incentives due to early retirement (12.2%)²¹. These findings clearly show that by construction the RACL scheme rules out the possibility that bad health favors the decision to retire early since the eligibility criteria concern the age at which respondents started their first job and the number of validated quarters.

6. Econometric results

6.1. *The association between early retirement and health for male retirees*

In a first step, we explore the effects of early retirement on the different health outcomes for men under the assumption that the retirement decision is exogenous. For that purpose, we run linear probability regressions to assess whether retiring before 60 is associated with health problems in later life once we control for individual characteristics²². The list of control variables includes age, living in a couple, number of children, level of education (no diploma, secondary-vocational, high school, undergraduate-graduate), and whether the respondent has experienced at least one unemployment spell during his/her career²³.

We report the Ordinary Least Squares estimates for each health outcome in Panel A of Table 3. In columns (1A), (2A) and (3A), we investigate the influence of early retirement whether male retirees have benefited or not from the RACL scheme. Our results show that early retirement is positively associated with a deterioration in retiree's health some years later. The positive correlation is statistically significant at the 1 percent level for the three health indicators and the marginal effect of early retirement is quite substantial : 8.8 percentage points for bad health, 10.3 percentage points for chronic problem and 7.1 percentage points for health limitation. Concerning the influence of the other controls (not reported), we find a positive association between bad health and age, but no influence of age for chronic problem and health limitation. Bad health is negatively correlated with living in a couple and education. People who have experienced at least one unemployment spell over their career are more likely to report bad health, chronic health problem and health limitation.

Insert Table 3

²¹ For respondents who did not benefited from the RACL, only 31.5% received a pension the year they left and 18.3% benefited from generous financial incentives to leave early.

²² We have also estimated Probit models for each health outcome and obtain very similar marginal effects of the various explanatory variables. We have also estimated a trivariate Probit model explaining the three health outcomes jointly. As expected, we find large positive significant coefficients of correlation between residuals of each health equation.

²³ Additionally, we estimated models including industry and region specific fixed effects. The former corresponds to the industry occupied before retirement with the four following categories: primary sector, secondary sector, construction and tertiary sector. We also included the unemployment rate of males working in the private sector in a defined industry-region cell for the year respondents left their last job. This allows controlling for economic conditions at the time individuals withdrew from the labor market. These additional covariates have no effect on our empirical results.

As discussed in the previous section, the way through which male respondents access to early retirement is likely to influence the correlation between early retirement and health. In particular, health may be a cause of the early retirement decision among those who did not benefit from the RACL scheme. In columns (1B), (2B) and (3B) of Table 3, we split the early retirement variable in two by making a distinction between early retirees who have benefited from the RACL scheme and early retirees for other reasons. The new estimates are particularly interesting.

On the one hand, the correlation between poor health and early retirement for other reasons is always statistically significant: +11.5 points for bad health, +11.8 points for chronic problem and +8.8 points for health limitation. On the other hand, the health outcome of RACL recipients is not different from that of individuals having retired at the legal age except for chronic problem (with +9.7 additional percentage points). These contrasted results suggest that being in poor health may be a cause rather than a consequence of the early retirement decision for those who did not benefit from the RACL scheme. Conversely, health has not deteriorated for RACL recipients compared to individuals retiring at the legal age.

In panel B of Table 3, we further account for past working conditions and investigate whether they have an influence on the effect of early retirement on health. Unsurprisingly, men who had a physically demanding job before retiring have a much higher probability of being unhealthy. Bad health is more frequent among respondents claiming that their last job was physically demanding (+11.9 points), that they were exposed to loud noise (+11.1 points) and that they had a high pace of work (+5.6 points). Chronic problem and health limitation are also positively correlated with physically demanding work, exposure to loud noise and supporting tensions with an audience. Also, controlling for working conditions has little influence on the correlation between early retirement and health. Early retirees report more frequently being in bad health (+8.1 points), having chronic problem (+10.1 points) and health limitation (+6.6 points). This positive correlation is observed only for male early retirees who did not benefit from the RACL scheme.

6.2. Endogeneity of early retirement and health for male retirees

Next, we investigate the causal effect of early retirement on health using the identification strategy described earlier. For that purpose, we run a linear model with instrumental variable (IV) so that we estimate a Local Average Treatment Effect (LATE) (Imbens and Angrist, 1994). Our instrument is given by the interaction term between the dummy indicating whether the respondent is born in 1945 or later and the dummy equal to one if the individual has started working at 17 or earlier²⁴. By

²⁴ We have also estimated bivariate Probit models to estimate a non-localized treatment effect exploiting the functional form as an additional source of identification. These additional estimates, available upon request, lead to very similar results compared to those obtained with the linear IV regressions.

construction, the instrument will be highly correlated with the decision to retire early (in connection with the RACL scheme) while there is no reason that this interaction term has a direct influence on the health outcome of the male respondents. We report the coefficients obtained from the IV regressions as well as the first-stage effect of the instrument in Table 4.

Insert Table 4

In panel A, we do not account for the role of working conditions. As expected, we find a strong impact of eligibility to the RACL scheme on the decision to retire early. The probability to retire before the legal age is about 20 percentage points higher among male eligible respondents compared to non-eligible ones. Early retirement is also negatively correlated with age and education, especially for those having completed a high school, undergraduate or graduate diploma. Results related to the health indicators are more mixed. First, we do no longer find any significant relationship between early retirement and health in later life. Second, the LATE effects are quite substantial, at least for chronic problem and health limitation, with the standard errors having inflated by a factor of about 5 with respect to the OLS estimates²⁵. This could suggest a problem of weak instrument, but the F-test in the first-stage is around 40 which is far above the rule-of-thumb of 10 (Staiger and Stock, 1997). In addition, a weak IV test indicates that this value of 40 is much higher than the weak IV test critical value (equal to 16) at a 10% maximal IV size (Stock and Yogo, 2005).

In panel B, we present similar results with working conditions as additional controls. It is interesting to note that we never find any significant correlation (at the 5 percent level) between the early retirement decision and each working condition. This suggests that respondents were not able to leave earlier the labor market because of the specific job conditions they faced during their last occupation. Instead, the decision to retire early will depend on the formal criteria required (number of quarters validated for instance) and eligibility to the RACL scheme increases by 19.4 percentage points the early retirement decision. Once we account for working conditions, we note some changes in the effect of early retirement: it becomes negative for self-reported bad health status and falls for health limitation. However, whatever the health outcome under consideration, the causal effect of early retirement on health is never significant.

In what follows, we perform some robustness checks to confirm that the causal effect of early retirement on health is non-significant. To improve the power of our IV estimates, we decide to follow an alternative empirical strategy. Table 1 suggests that individuals born in 1948 or 1949 and who have entered the labor market at 16 or earlier would be eligible to retire at age 56, while those born in 1945 and who started working at 17 or earlier could have retired at least at 59. This allows us to identify the

²⁵ The standard errors are 0.161, 0.166 and 0.144 when considering subjective bad health, having chronic problems and health limitations as dependent variable, respectively. Under exogeneity, the standard errors were equal to 0.027, 0.028 and 0.025.

health effect not only of early retirement, but also of the distance between the legal retirement age and the effective exit age (i.e. the extra years of retirement before the legal age of 60). In our sample, the exit age is 60 for 42.97% of individuals, 59 for 9.2%, 58 for 11.85%, 57 for 12.8%, 56 for 9.2% and 55 or below for 13.98%. So, for a significant number of men in our sample, the intensity of the treatment effect may be 4 or 5 extra years of retirement with respect to the legal retirement age.

We now look at the effect of the distance between the legal retirement age and the effective exit age on different health outcomes once controlling for the endogeneity of the retirement decision. To construct our new instrument, we interact the distance between the birth year of an individual i denoted by Y_i and 1944 (a non-treated cohort) and the distance between the age at which he started his first job SA_i and 18, which is the minimal age at which non-eligible workers started working. So the new instrument is given by $\max\{0, Y_i - 1944\} * \max\{0, 18 - SA_i\}$. In Table 5, we report the coefficients obtained from the new IV regressions as well as the first-stage effects of this new instrument on the endogenous variable corresponding to the extra years of retirement before 60. In panel A, without controlling for working conditions, we see that the RACL eligibility condition predicts well the male retirement decisions. The F-test in the first-stage is around 47, which is again far above the Stock-Yogo critical value at a 10% maximal IV size (16.38). The effect of extra years of retirement on the probability of reporting a bad health at later ages turns out to be very small, negative and non-significant.

Insert Table 5

In addition, the standard errors of our second-stage estimates concerning the effects of early retirement on the probability of having chronic problems or health limitations are smaller (0.040 for chronic problems, 0.037 for health limitations) compared to those obtained with the LATE estimates (0.066 for chronic problems, 0.085 for health limitations). This means that the precision of our estimates has increased compared to Table 4. Without controlling for the influence of working conditions, the local effect of extra years of retirement at a given age turns out to be positive and significant at a 5% level on the probability of having health limitations and positive and almost significant at a 10% level ($t=1.64$) on the probability of having chronic illnesses. When introducing the set of working conditions in the IV regressions (panel B), the local effect of extra years of retirement before 60 on the probability of having chronic illnesses decreases to 0.052 and becomes non-significant. The coefficient found for the probability of having health limitations slightly falls to 0.064, but it remains significant at the 10% level²⁶. This suggests that working conditions play a crucial role in the relationship between health and retirement (Eibich, 2015; Mazzona and Peracchi, 2017).

²⁶ We note that the standard errors remain quite stable, respectively equal to 0.041 and 0.036 for chronic problems and health limitations.

This insignificant effect of early retirement on health at later ages may be driven by the fact that we identify a localized effect on a selected subsample of men who started working prior to 16 or 17 years and who were induced to retire earlier. These individuals may strongly differ from non-treated ones, especially in terms of working conditions experienced in their past job. For instance, while 26.9% of people having started working at 18 or later had a physically demanding work, this proportion is 61.9% for those who started working at 17 or earlier. Furthermore, this non-significant effect of early exit on retirees' health may result from a potential selection bias due to mortality. Indeed, the cohorts not concerned by the introduction of the RACL (born in 1944 or earlier) are subject to a higher mortality risk as they turn 68-69 years old in 2012. Since we only observe those respondents who are alive at the date of the survey, this may lead us to overestimate the average health status of males not affected by the 2004 reform.

To overcome these two issues, we narrow down our sample to make treated and not treated individuals more comparable in terms of age and age at labor market entry. Specifically, we restrict our sample to men born in 1946 or after and who started their first job at 18 or earlier (774 respondents). In Panel A of Table 6, we first show the OLS estimates of extra years of retirement before the legal age on health. Even after controlling for working conditions of past activity, we find that extra years of retirement at a given age are positively associated with a deterioration in health in later life (at the 1 percent level). The marginal effects are 3.3 percentage points for bad health, 4.6 points for chronic problems and 3.1 points for health limitations. However, once we control for the endogeneity of the retirement behavior using the same instrument as in Table 5 (Panel B), the effect of extra years of retirement on health is never significant at conventional level²⁷.

Insert Table 6 here

6.3. Results for female retirees

We now wonder whether the same effect of retirement on health is found for women. As emphasized earlier, around three-quarters of RACL recipients were men so that women having decided to retire earlier may have different motivations as well as observable characteristics compared to men. We replicate our previous analysis by selecting the subsample of women having worked in the private sector, being retired at the date of the survey and born between 1943 and 1950. After data cleaning, we end up with a sample of 1,078 retired women. There are fewer women than men in our sample due to the lower participation of women in the labor market for those specific cohorts. Among those women, 50.5% of them have retired before the legal retirement age.

²⁷ The marginal effects are -7.6 percentage points for poor subjective health, +0.5 points for chronic health problems and +1.2 points for health limitations.

As a preliminary step, we look at differences in health status between women who retire early and those who retire at the legal age. Among female early retirees, the proportion of respondents in poor health is 52.6% for bad self-reported health, 49.6% for chronic problems and 33.5% for health limitation. Those health outcomes are significantly higher than those found for women having retired at the legal age, with a differential of 8.6 points for bad health (44.0%), 9.4 points for chronic problems (40.3%) and 9.3 points for health limitation (24.2%). When splitting the sample in two to compare the situation of those having benefited from the RACL scheme (60 observations) and those having retired earlier for another reason (484 observations), we find that female recipients of the RACL scheme tend to be in better health : -19.8 points for bad health (35.0% against 54.8%), -25.8 points for chronic problems (26.7% against 52.5%), and -17.0 points for health limitation (18.3% against 35.3%).

In panel A of Table 7, we report linear estimates explaining the probability for retired women of being unhealthy. Net of the influence of individual characteristics, we find a positive correlation between early retirement and poor health: +6.8 points for bad health, +7.9 points for chronic problems and +7.6 points for health limitation. When accounting for the motive explaining early retirement (either RACL or other reasons), we observe that the correlation between bad health and early retirement due to RACL becomes negative and is no longer significant (panel B). The same pattern was found for men. The fact that bad health remains positively associated with early retirement for other reasons may be explained by some reverse causality such that unhealthy women have stronger preferences to leave earlier the labor market. Also, the magnitude of the positive correlation between bad health and early retirement is very similar for men and women when the early retirement decision is treated as exogenous.

Insert Table 7 here

Next, we turn to the IV estimator to assess whether there is any causal effect of early retirement on women's health. As shown in panel C, a difference between the male and female estimates is that in the first-stage equation the F-test associated to the excluded instrument is much lower (but still above 10). This is not very surprising as most recipients of the RACL scheme were men, but this implies that the results obtained for women are potentially subject to the criticism of weak instrument. When considering the second-stage estimates, we observe that the coefficient of early retirement is no longer significant in the various health equations. The same pattern is found once the regressions account for the influence of working conditions. So, we conclude that early retirement does not affect health both for men and women in the selected cohorts.

7. Discussion and concluding comments

In this paper, we have investigated the relationship between retirement and health in France, a country in which this relationship has received little attention so far with a few exceptions (Blake and

Garrouste, 2018; L'Haridon et al., 2018). In contrast to the existing literature whose focus is on people retiring around the legal retirement age, we study the causal effect of early retirement on three health outcomes observed during the retirement period. We rely on a quasi-natural experiment with the introduction of an early retirement scheme targeted to individuals who started working early. Since 2004, individuals were allowed to claim their pension age before the legal age of 60 provided that they started working at 17 or before. As eligibility to the program varies across cohorts and age at which individuals start their first job, we turn to an instrumental variable strategy in order to control for the endogeneity of the early retirement decision in health equations.

Our main results can be summarized as follows. First, when the early retirement decision is treated as exogenous, we find a positive correlation between early retirement of men and poor health in later life with a marginal effect ranging from 7 to 10 percentage points. However, this correlation is not statistically significant for male RACL recipients. This pattern may be explained by some reverse causality such that people retiring early are in worse health compared to those who leave their job at the legal retirement age. Second, we fail to find any significant causal effect of early retirement on poor health once we account for the endogeneity of the decision to retire before the legal age. Third, we show that controlling for working conditions has no influence on our results and that occupying a demanding job is harmful to health after retirement regardless of the retirement date. Fourth, we reach very similar conclusions for women.

A limitation of our study is that we have relied on self-reported data to measure the health status of retirees. As a consequence, there may still be some endogeneity in our results as respondents may be reluctant to disclose their health issues. It is hence of interest to know to what extent self-reported health indicators are correlated with more objective outcomes (unavailable in the PRE survey) for the selected cohorts of retirees. For that purpose, we rely on an additional survey conducted in 2012 by the Institute for Research and Information in Health Economics (IRDES). The French Health, Health Care and Insurance Survey (Enquête Santé et Protection Sociale, ESPS) focuses on the measurement of health within the population and includes information on self-perceived health status, visits to a physician, consumption of medical goods and services, care and services administered by clinicians and hospitalization. The ESPS survey offers a unique opportunity to study the correlation between subjective and more objective health indicators²⁸.

We proceed in the following way. Starting from the whole sample (22,981 respondents), we select both male and female respondents born between 1943 and 1950, having worked in the private sector, and being retired at the date of the survey. The corresponding sample includes 919 observations (450 men and 469 women). Using very comparable questions, we find the following

²⁸ However, there is no information on early retirement (as well as on date of retirement) in the ESPS survey.

pattern of self-assessed health in the ESPS survey : 45.8% report a bad health, 53.0% have chronic health problems and 35.3% face some health limitations (these proportions are 41.7%, 46% and 25.5% in the PRE survey)²⁹. Then, for each subjective indicator, we calculate the proportion of respondents suffering from specific diseases by health status. Figure A in Appendix shows a strong correlation between the self-reported assessment of health and the various diseases. The proportion of respondents suffering from illnesses like osteoarthritis, diabetes, lumbago or hypertension is much higher when they report a poor health status. Figure B further shows that respondents in poor health have much higher health expenditures on average than respondents in good health³⁰.

Overall, these results provide suggestive evidence that our conclusions obtained for self-assessed bad health, chronic problem and health limitation may be valid for more objective health indicators as well as health expenditures. Another issue of interest is to investigate changes in health outcomes over time. Since the PRE survey is cross-sectional, we are unable to study the dynamic effects of early retirement on health. Our results fail to evidence any causal long-term effect of early retirement on health, but it may be that people see their health status improve just after retirement and progressively lose these benefits as time goes by. This issue has been very recently investigated in France by Messe and Wolff (2019) using short panel data (six quarters). Drawing on a semi-parametric difference-in-differences approach, they compare the health trajectories of respondents who retire to those of respondents who remain employed. Their results indicate that transition into retirement has a short-term positive effect on respondents' self-assessed health. Clearly, longitudinal data with several years would be useful to provide a broader picture of the relationship between early retirement and health in France.

In terms of policy implications, our results suggest that limited changes in retirement date do not have any harmful effect on health. Nevertheless, our results have to be interpreted with caution as they concern specific cohorts born between 1943 and 1950. It is unclear to what extent these results can be generalized to other cohorts especially as we provide some local treatment effect estimates, i.e. identification of the causal effect of health is based on the situation of compliers. This concerns individuals who started working very early in their life, a very uncommon situation for younger cohorts. Furthermore, many of the working conditions faced by those generations have presumably improved for younger cohorts with machine modernization and better safety standards and more heterogeneity

²⁹ For the third outcome (health limitation), the question is about limitation in activities that people do usually because of any health problem.

³⁰ The ratio is 2.16 for bad health (2931 euros for respondents in bad health against 1360 euros for those in good health), 2.20 for chronic problem (2931 euros for respondents in bad health against 1360 euros for those in good health) and 2.29 for health limitation (2931 euros for respondents in bad health against 1360 euros for those in good health). The average amounts are calculated on a subsample of 566 respondents for whom information on health expenditures is available.

is expected in terms of occupation among younger cohorts of retirees. Finally, postponing retirement may have different effect on health when the legal retirement age is either 60 or 62 (or even 65 like in other European countries).

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Table 1. Description of the RACL scheme (2004-2008 period)

Retirement age	Birth cohort						
	1943	1944	1945	1946	1947	1948	1949
56	NOT ELIGIBLE					ALME≤16	ALME≤16
						VQ=168	VQ=168
						CQ=168	CQ=168
57	NOT ELIGIBLE					ALME≤16	ALME≤16
						VQ=168	VQ=168
						CQ=168	CQ=168
58	NOT ELIGIBLE					ALME≤16	ALME≤16
						VQ=168	VQ=168
						CQ=164	CQ=164
59	NOT ELIGIBLE					ALME≤17	ALME≤17
						VQ=168	VQ=168
						CQ=160	CQ=160
≥60	Legal retirement age						
Full rate duration	160	160	160	160	160	160	161

Source: adapted from Denayrolles and Guilain (2015, p. 156).

Note: ALME = age at labor market entry, VQ = validated quarters, CQ = contributed quarters.

Table 2. Descriptive statistics of the male sample

Variables	(1) All	(2) Early retirement			(3) Normal retirement
		(2A) All	(2B) RAFL	(2C) Other	
<i>Health outcomes</i>					
Self-reported bad health	0.417	0.462	0.388	0.496	0.358
Has chronic health problems	0.460	0.507	0.485	0.523	0.397
Health limitation	0.255	0.292	0.245	0.313	0.205
<i>Individual characteristics</i>					
Age	64.338	64.013	63.110	64.364	64.771
In couple	0.820	0.828	0.865	0.815	0.808
Number of children	2.131	2.093	1.996	2.119	2.182
Education: no diploma	0.416	0.463	0.460	0.457	0.353
Education: secondary/vocational	0.394	0.422	0.485	0.400	0.356
Education: high-school	0.085	0.055	0.030	0.068	0.125
Education: undergraduate/graduate	0.105	0.059	0.025	0.075	0.166
Occupation: executive	0.188	0.137	0.093	0.158	0.257
Occupation: intermediate	0.253	0.246	0.262	0.236	0.262
Occupation: employee	0.060	0.057	0.046	0.062	0.065
Occupation: blue-collar workers	0.497	0.560	0.599	0.543	0.414
At least one unemployment spell	0.437	0.445	0.329	0.496	0.426
<i>Working conditions</i>					
Night working	0.179	0.210	0.203	0.209	0.137
Shift work	0.162	0.195	0.177	0.206	0.118
Short repetitive tasks	0.227	0.248	0.291	0.228	0.199
Work physically demanding	0.515	0.569	0.599	0.553	0.443
Exposed to toxic products	0.346	0.381	0.392	0.379	0.300
Exposed to loud noise	0.440	0.477	0.489	0.470	0.390
Exposed to low/high temperatures	0.435	0.480	0.498	0.472	0.375
Supporting tensions with an audience	0.267	0.248	0.245	0.247	0.293
High pace of work	0.488	0.507	0.464	0.523	0.462
Number of observations	1,359	775	245	530	584

Source: authors' calculations, Passage from Employment to Retirement 2012 survey.

Table 3. Linear probability estimates of early retirement on male health status

Variables	Bad health		Chronic problem		Health limitation	
	(1A)	(1B)	(2A)	(2B)	(3A)	(3B)
<i>Panel A. Without working conditions</i>						
Early retirement	0.088*** (3.21)		0.103*** (3.63)		0.071*** (2.89)	
Early retirement due to RAEL		0.033 (0.83)		0.097** (2.38)		0.032 (0.90)
Early retirement due to other reasons		0.115*** (3.93)		0.118*** (3.91)		0.088*** (3.35)
Control variables	YES	YES	YES	YES	YES	YES
Number of observations	1,359	1,359	1,359	1,359	1,359	1,359
R ²	0.053	0.057	0.023	0.025	0.033	0.036
<i>Panel B. With working conditions</i>						
Early retirement	0.081*** (3.00)		0.101*** (3.59)		0.066*** (2.73)	
Early retirement – RAEL		0.023 (0.58)		0.092** (2.28)		0.024 (0.68)
Early retirement – no RAEL		0.111*** (3.81)		0.118*** (3.93)		0.085*** (3.26)
Night working	-0.026 (-0.65)	-0.024 (-0.60)	0.007 (0.18)	0.009 (0.22)	-0.012 (-0.33)	-0.010 (-0.28)
Shift work	-0.023 (-0.54)	-0.030 (-0.70)	-0.022 (-0.50)	-0.027 (-0.60)	-0.021 (-0.53)	-0.025 (-0.65)
Short repetitive tasks	0.057* (1.70)	0.061* (1.81)	0.049 (1.40)	0.050 (1.44)	0.025 (0.82)	0.027 (0.90)
Work physically demanding	0.119*** (3.62)	0.121*** (3.69)	0.074** (2.17)	0.075** (2.19)	0.068** (2.30)	0.069** (2.36)
Exposed to toxic products	0.031 (1.00)	0.029 (0.96)	0.068** (2.13)	0.066** (2.09)	0.036 (1.31)	0.035 (1.27)
Exposed to loud noise	0.111*** (3.46)	0.111*** (3.48)	0.065* (1.95)	0.066** (1.98)	0.079*** (2.76)	0.080*** (2.77)
Exposed to low/high temperatures	-0.028 (-0.84)	-0.027 (-0.82)	-0.058* (-1.69)	-0.058* (-1.69)	0.038 (1.26)	0.038 (1.28)
Supporting tensions with an audience	0.016 (0.54)	0.018 (0.59)	0.103*** (3.30)	0.104*** (3.34)	0.063** (2.35)	0.064** (2.39)
High pace of work	0.056** (2.05)	0.054** (1.97)	0.000 (0.01)	-0.000 (-0.01)	0.017 (0.67)	0.015 (0.61)
Control variables	YES	YES	YES	YES	YES	YES
Number of observations	1,359	1,359	1,359	1,359	1,359	1,359
R ²	0.094	0.099	0.047	0.049	0.068	0.071

Source: authors' calculations, Passage from Employment to Retirement 2012 survey.

Note: estimates from linear probability regressions, with t-values in parentheses. Significance levels are p<0.01 (***), p<0.05 (**) and p<0.1 (*).

Table 4. IV estimates of early retirement on male health status

Variables	(1)	(2)	(3)
	Bad health	Chronic problem	Health limitation
<i>Panel A. Without working conditions</i>			
<i>First-stage: early retirement</i>			
Instrument: eligible to RAFL scheme	0.198*** (6.37)	0.198*** (6.37)	0.198*** (6.37)
F test of excluded instruments	40.58	40.58	40.58
<i>Second-stage: health outcome</i>			
Early retirement	0.048 (0.30)	0.212 (1.28)	0.173 (1.20)
Control variables	YES	YES	YES
Number of observations	1,359	1,359	1,359
R ²	0.051	0.012	0.021
<i>Panel B. With working conditions</i>			
<i>First-stage: early retirement</i>			
Instrument: eligible to RAFL scheme	0.194*** (6.20)	0.194*** (6.20)	0.194*** (6.20)
F test of excluded instruments	38.46	38.46	38.46
<i>Second-stage: health outcome</i>			
Early retirement	-0.063 (-0.39)	0.180 (1.07)	0.091 (0.63)
Night working	-0.017 (-0.41)	0.003 (0.06)	-0.013 (-0.36)
Shift work	-0.015 (-0.33)	-0.027 (-0.59)	-0.022 (-0.56)
Short repetitive tasks	0.052 (1.51)	0.051 (1.46)	0.025 (0.84)
Work physically demanding	0.124*** (3.71)	0.071** (2.06)	0.067** (2.25)
Exposed to toxic products	0.034 (1.11)	0.066** (2.06)	0.035 (1.28)
Exposed to loud noise	0.106*** (3.25)	0.068** (2.01)	0.080*** (2.77)
Exposed to low/high temperatures	-0.026 (-0.77)	-0.059* (-1.72)	0.037 (1.26)
Supporting tensions with an audience	0.011 (0.35)	0.106*** (3.34)	0.064** (2.35)
High pace of work	0.061** (2.17)	-0.002 (-0.07)	0.016 (0.64)
Control variables	YES	YES	YES
Number of observations	1,359	1,359	1,359
R ²	0.075	0.041	0.068

Source: authors' calculations, Passage from Employment to Retirement 2012 survey.

Note: estimates from IV linear regressions, with t-values in parentheses. Significance levels are $p < 0.01$ (***), $p < 0.05$ (**) and $p < 0.1$ (*).

Table 5. IV estimates of extra years of retirement on health outcomes

Variables	(1)	(2)	(3)
	Bad health	Chronic problem	Health limitation
<i>Panel A. Without working conditions</i>			
<i>First-stage: extra years of retirement before 60</i>			
Instrument	0.057*** (6.87)	0.057*** (6.87)	0.057*** (6.87)
F test of excluded instruments	47.24	47.24	47.24
<i>Second-stage: health outcome</i>			
Extra years of retirement before 60	-0.011 (0.29)	0.066 (1.64)	0.085** (2.38)
Control variables	YES	YES	YES
Number of observations	1,359	1,359	1,359
R ²	0.051	0.012	0.021
<i>Panel B. With working conditions</i>			
<i>First-stage: early retirement</i>			
Instrument	0.055*** (6.60)	0.055*** (6.60)	0.055*** (6.60)
F test of excluded instruments	43.52	43.52	43.52
<i>Second-stage: health outcome</i>			
Extra years of retirement before 60	-0.045 (-1.09)	0.052 (1.26)	0.064* (1.76)
Night working	-0.006 (-0.14)	-0.004 (-0.08)	-0.028 (-0.76)
Shift work	-0.011 (-0.24)	-0.025 (-0.57)	-0.028 (-0.71)
Short repetitive tasks	0.052 (1.52)	0.047 (1.36)	0.024 (0.81)
Work physically demanding	0.130*** (3.76)	0.069** (1.99)	0.059** (1.96)
Exposed to toxic products	0.044 (1.32)	0.058* (1.76)	0.022 (0.77)
Exposed to loud noise	0.108*** (3.28)	0.062* (1.88)	0.077*** (2.69)
Exposed to low/high temperatures	-0.029 (-0.86)	-0.054 (-1.57)	0.042 (1.42)
Supporting tensions with an audience	0.009 (0.30)	0.104*** (3.34)	0.066** (2.44)
High pace of work	0.065** (2.26)	-0.004 (-0.13)	0.010 (0.39)
Control variables	YES	YES	YES
Number of observations	1,359	1,359	1,359
R ²	0.075	0.041	0.068

Source: authors' calculations, Passage from Employment to Retirement 2012 survey.

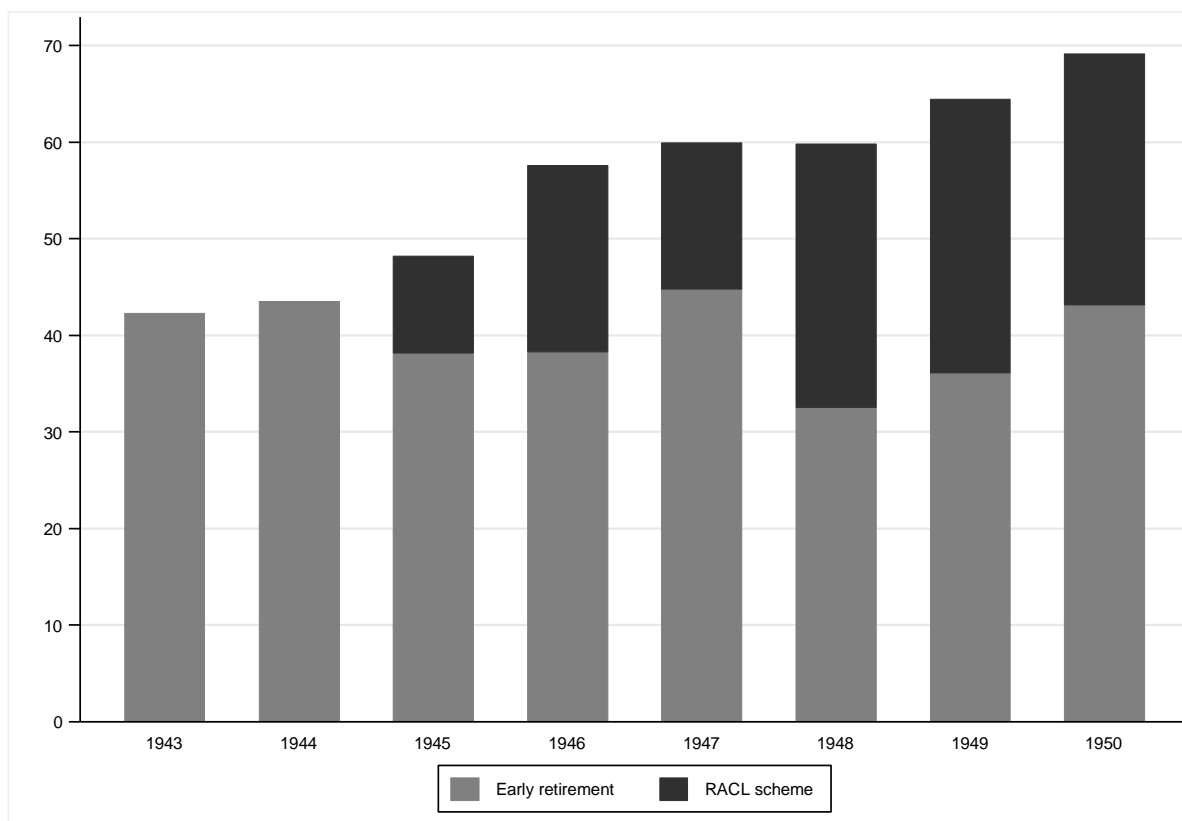
Note: estimates from IV linear regressions, with t-values in parentheses. Significance levels are $p < 0.01$ (***), $p < 0.05$ (**) and $p < 0.1$ (*). The instrument is the interaction of the distance between the birth year of an individual i and 1944 (non-treated cohort) and the distance between age at which this individual starts working and 18.

Table 6. OLS and IV estimates of extra years of retirement on health outcomes, individuals born in 1946 or after and who started their activity at 18 or earlier

Variables	(1)	(2)	(3)
	Bad health	Chronic problem	Health limitation
<i>Panel A. Linear Probability Model (OLS)</i>			
Extra years of retirement before 60	0.033*** (3.49)	0.046*** (4.74)	0.031*** (3.63)
Control variables	YES	YES	YES
Working conditions	YES	YES	YES
Number of observations	774	774	774
R ²	0.099	0.071	0.089
<i>Panel B. IV estimates</i>			
<i>First-stage: extra years of retirement before 60</i>			
Instrument	0.061*** (5.80)	0.061*** (5.80)	0.061*** (5.80)
F test of excluded instruments	33.65	33.65	33.65
<i>Second-stage: health outcome</i>			
Extra years of retirement before 60	-0.076 (-1.55)	0.005 (0.11)	0.012 (0.29)
Control variables	YES	YES	YES
Working conditions	YES	YES	YES
Number of observations	774	774	774

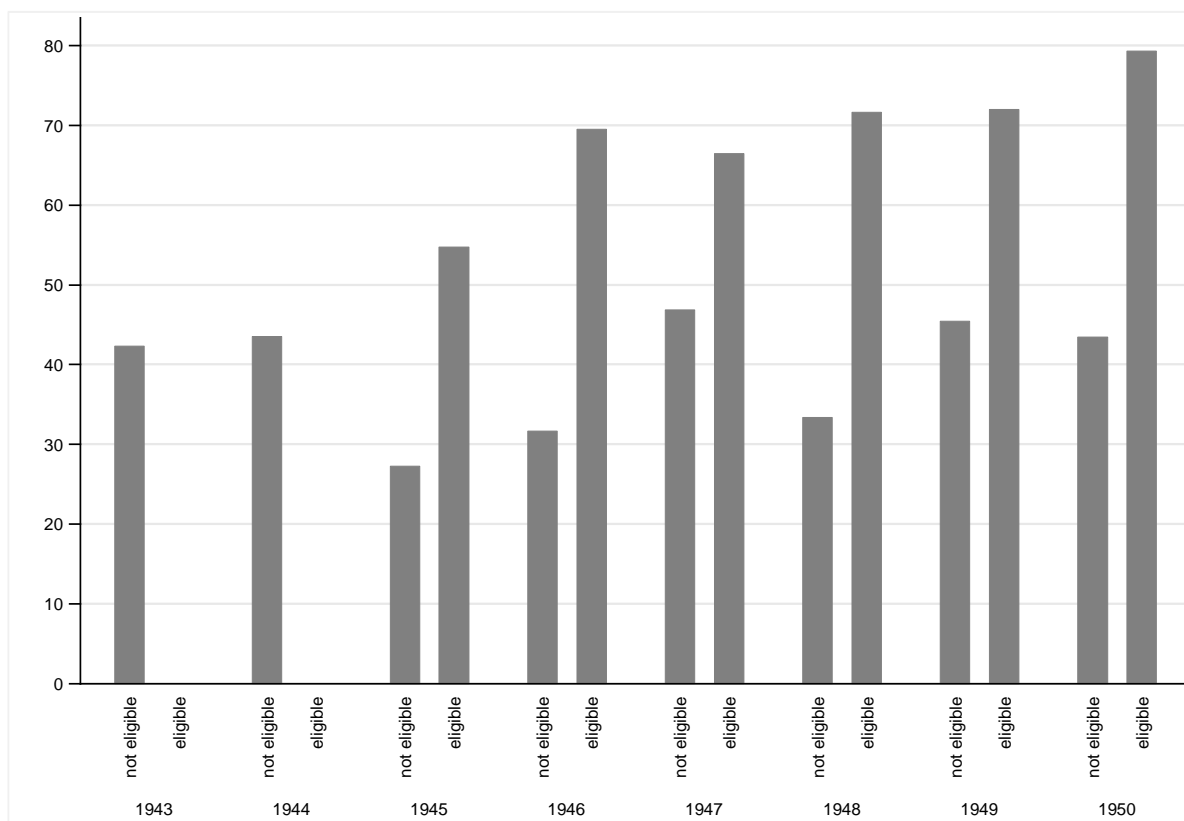
Source: authors' calculations, Passage from Employment to Retirement 2012 survey.

Note: estimates from OLS and IV linear regressions, with t-values in parentheses. Significance levels are $p < 0.01$ (***), $p < 0.05$ (**) and $p < 0.1$ (*). The instrument is the interaction of the distance between the birth year of an individual i and 1944 (non-treated cohort) and the distance between age at which this individual starts working and 18.

Figure 1. Proportion of early retirees, by birth cohort

Source: authors' calculations, Passage from Employment to Retirement 2012 survey.

Figure 2. Proportion of early retirees, by birth cohort and eligibility to the RACL scheme



Source: authors' calculations, Passage from Employment to Retirement 2012 survey.

Table 7. Linear probability estimates of early retirement on female health status

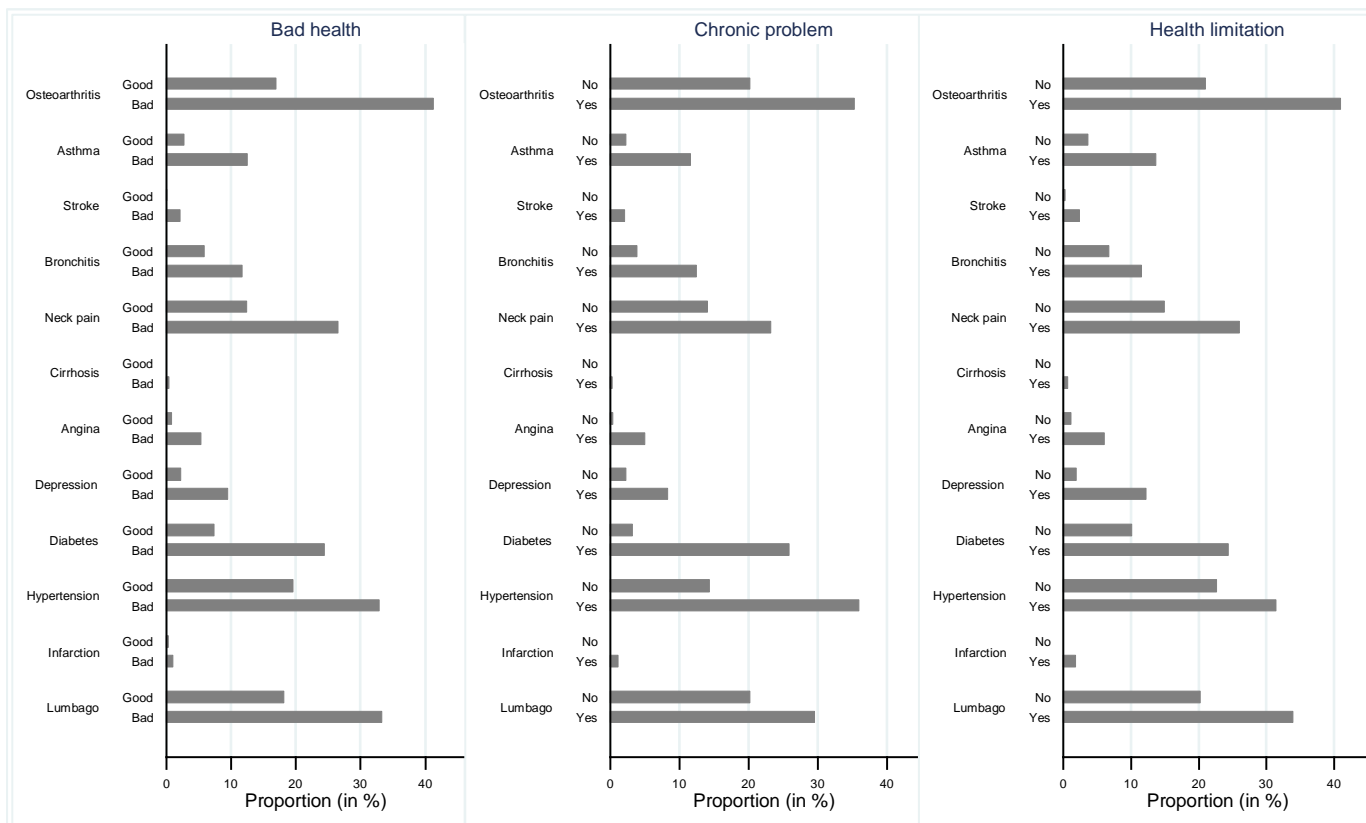
Variables	Bad health		Chronic problem		Health limitation	
	(1A)	(1B)	(2A)	(2B)	(3A)	(3B)
<i>Panel A. Without working conditions (Linear Probability Estimates)</i>						
Early retirement	0.068** (2.26)		0.079*** (2.59)		0.076*** (2.76)	
Early retirement due to RAEL		-0.042 (-0.61)		-0.100 (-1.46)		-0.023 (-0.37)
Early retirement due to other reasons		0.089*** (2.85)		0.108*** (3.41)		0.091*** (3.18)
Control variables	YES	YES	YES	YES	YES	YES
Number of observations	1,078	1,078	1,078	1,078	1,078	1,078
R ²	0.059	0.063	0.032	0.041	0.046	0.049
<i>Panel B. With working conditions (Linear Probability Estimates)</i>						
Early retirement	0.072** (2.43)		0.081*** (2.70)		0.084*** (3.10)	
Early retirement – RAEL		-0.061 (-0.91)		-0.120* (-1.77)		-0.039 (-0.65)
Early retirement – no RAEL		0.095*** (3.09)		0.111*** (3.57)		0.099*** (3.57)
Working conditions	YES	YES	YES	YES	YES	YES
Control variables	YES	YES	YES	YES	YES	YES
Number of observations	1,078	1,078	1,078	1,078	1,078	1,078
R ²	0.105	0.111	0.077	0.087	0.112	0.117
<i>Panel C. Without working conditions (IV Estimates)</i>						
<i>First-stage: early retirement</i>						
Instrument: eligible to RAEL scheme	0.122*** (3.54)		0.122*** (3.54)		0.122*** (3.54)	
F test of excluded instruments	12.53		12.53		12.53	
<i>Second-stage: health outcome</i>						
Early retirement	0.037 (0.13)		0.032 (0.11)		0.068 (0.27)	
Control variables	YES		YES		YES	
Number of observations	1,078		1,078		1,078	
R ²	0.058		0.030		0.046	
<i>Panel D. With working conditions (IV Estimates)</i>						
<i>First-stage: early retirement</i>						
Instrument: eligible to RAEL scheme	0.122*** (3.53)		0.122*** (3.53)		0.122*** (3.53)	
F test of excluded instruments	12.44		12.44		12.44	
<i>Second-stage: health outcome</i>						
Early retirement	-0.119 (-0.42)		-0.113 (-0.40)		-0.086 (-0.34)	
Working conditions	YES		YES		YES	
Control variables	YES		YES		YES	
Number of observations	1,078		1,078		1,078	
R ²	0.071		0.041		0.079	

Source: authors' calculations, Passage from Employment to Retirement 2012 survey.

Note: estimates from linear probability regressions, with t-values in parentheses. Significance levels are p<0.01 (***), p<0.05 (**) and p<0.1 (*).

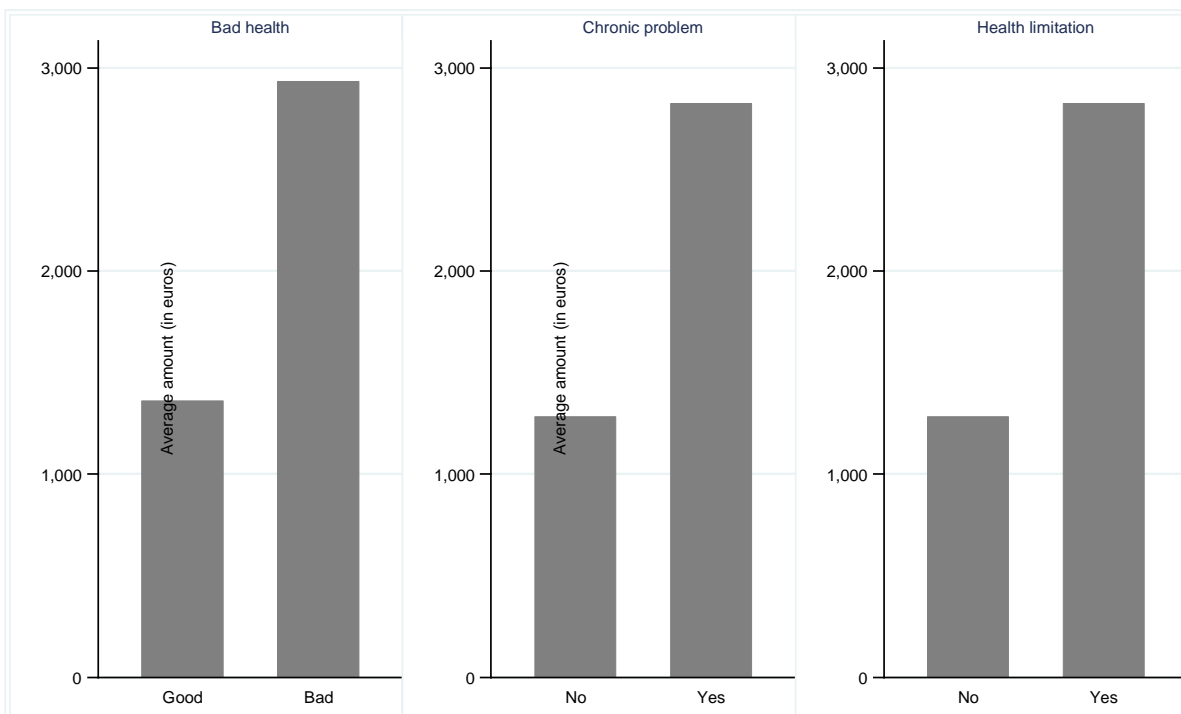
Appendix. Correlation between subjective and objective health indicators

Figure A. Diseases by subjective health



Source: authors' calculations, Health, Health Care and Insurance 2012 survey.

Figure B. Health expenditures by subjective health



Source: authors' calculations, Health, Health Care and Insurance 2012 survey.