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Healthier when retiring earlier? Evidence from France[#]

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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 starting from 2004 that substantially increased the proportion of older workers leaving their last job before the legal age of 60 years. We find a positive association between exogenous early retirement and health problems among retirees. However, we fail to evidence any 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 has no influence on our results and occupying a demanding job is harmful to health after retirement regardless of the retirement date.

JEL Classification: I14; J14; J26

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

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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 over the last decade to postpone their legal retirement age (Hofäcker et al., 2016)[1]. In pay-as-you-go pension systems, postponing retirement should have positive effects for 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.

It hence matters to assess the consequences of the retirement timing on health status from an empirical perspective. Obviously, the association 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 entered the labor market during youth will be more likely to retire early because they will have contributed the requested number of years. If those persons have experienced strenuous working conditions during their career, then they are more likely to be 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 pension 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 age for receiving a full pension (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. Starting from 2004, individuals were allowed to retire before the minimum pension claiming age (60 years in France) subject to specific eligibility conditions that include among others birth cohort and starting age of activity. We use eligibility to the program as instrumental variable to control for the 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 focus on respondents born between 1943 and 1950 since the cohorts born from 1945 were the first eligible to the new early retirement scheme introduced in 2004. We further restrict our attention to the case of male retirees having worked in the private sector. We end up with a sample comprising 1,359 retirees for whom we investigate the health consequences of early retirement.

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, a few 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). Conversely, other authors have focused on a single country using temporal changes in pension eligibility as instruments (Bonsang et al., 2012, Eibich, 2015). 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 properly instrument the early retirement decision.

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 (2012) being an exception. 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, 2016). However, country heterogeneity is a serious concern (Motegi et al., 2016). With our data, we find a positive association between exogenous early retirement and health problems among retirees. However, this correlation is not significant for retirees having benefited from the long-career scheme and we fail to evidence any causal effect of early retirement on poor health once we account for the endogeneity of the decision to retire before the legal age.

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 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 concludes.

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) note 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. With respect to the literature on the effect of job loss during activity which is found to have negative consequences on health (Strully, 2009, Browning and Heinesen, 2012, Schaller and Stevens, 2015), a difficulty is that the retirement decision is unlikely to be exogenous. Two main sources of endogeneity have to be taken into account (Dave et al., 2008, Eibich, 2015)[3]. First, both the retirement decision and the health outcomes are likely to be influenced by the same set of individual characteristics (not necessarily unobserved). Fixed effect models are most often estimated to avoid 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 health.

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 variation in retirement ages and consider the early and full statutory retirement ages in each country. However, Bingley and Martinello (2013) show that those variations in pension eligibility are invalid instruments without controlling for level of schooling[4]. The resulting bias is no longer present in studies exploiting panel variation and social security eligibility within one country. Bonsang et al. (2012) and Eibich (2015) consider the key retirement ages as instruments for the retirement decision, i.e. the earliest age at which social security benefits can be claimed and the normal retirement age.

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

[3] Another source of endogeneity is related to measurement errors. A potential drawback is the so-called justification bias such that retirees tend to report more often a poor health as a justification of their retirement status (Bazzoli, 1985, McGarry, 2004).

[4] In that case, 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.

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, 2016). 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 scores[5]. 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. Also, retirement causes an increase in the probability of being obese among men (Godard, 2016).

However, a few other studies have reached the exactly 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 characteristics. Again, the IV estimates switch sign compared to the OLS estimates. With the European SHARE data, Coe and Zamarro (2011) conclude that retirement leads to a 35 percent decrease in the probability of being in fair or poor health. In Germany, Eibich (2015) finds that retirement improves both subjective health and mental health.

The case of France has received little attention to date. France is of course 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, 2016). However, a recent work from Motegi et al. (2016a) 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. To the best of our knowledge, only Blake and Garrouste (2012) have focused on the case of France based on 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.

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

[5] 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).

(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, Motegi et al. (2016b) 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 (2016), concerns the empirical strategy to account for endogenous selection into retirement. The commonly used instruments relate 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 take their decision to retire, for instance due to some expectation effects (Falba, 2009, De Grip et al., 2012)[6].

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

[6] 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.

contribution and the conversion rate[7]. 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 that we will refer to as the Minimum Claiming Age (MCA). 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})[8].

To restore the financial balance of the pension scheme, the French government introduced some changes starting from 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, starting from the 1934 generation (for which the full rate duration was 151 quarters) to 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 that we will refer to as the Normal Retirement Age (NRA) 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 Fillon 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, starting from 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 to contribute to the system very early (at 16) had also to retire at the minimum claiming 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 to work 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). Starting from January 1st 2004, the RACL

[7] 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.

[8] 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.

scheme allowed individuals who started working very young to retire before the minimum claiming age (60 years)[9]. 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 claiming 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) [10]. In particular, the increase in the number of required contribution quarters to retire before 60 increased starting from 2009 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 minimum claiming 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 was gradually phased in with 4 additional months for each cohort from the 1951 one. It also increased the minimum claiming 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 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 took their retirement using the RACL scheme: 114,790 in 2004, 101,462 in 2005, 107,903 in 2006, 114,382 in 2007 and 119,620 in 2008[11]. 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. This explains why we will focus on male retirees in our empirical analysis.

Insert Table 1

[9] See https://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000781627.

[10] Among the other changes, the number of quarters purchased by the 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.

[11] http://dares.travail-emploi.gouv.fr/IMG/xls/series_internet_caa_2003-2014_sexe_age_2015_23_11.xls.

4. Description of the data

We assess the effect of retirement on health in France using the RACL scheme as a quasi-natural experience. 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 contributed 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)[12]. The PRE survey is a complementary module asked to the sample of individuals interviewed in the Employment survey (both surveys are matched by construction) and meeting the two following criteria: they should be aged 50-69 and should have been in the labor market after 50. Its main purpose was to document the circumstances through which people leave the labor market, their motivation to maintain a 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"[13]. 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).

The PRE survey provides a detailed description of the labor force participation history. This includes the age at which the respondent began to work, 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 to receive their pension. We construct an early retirement indicator which is equal to one when the respondent left his last job before the legal age

[12] 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/).
[13] There is no other health indicator (like mental health) in the PRE survey.

of 60. There are also several questions related to the conditions through which respondents retired, for instance with a full-rate pension, a discount ("*décôte"*) or a premium ("*surcôte"*), 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, it is the early departure for long career: did you retire as part of an early retirement for a long career ?", possible answers being "yes" or "no". We will use this self-reported information to identify recipients of the RACL scheme. However, for reasons like 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 eligibility, i.e. birth cohort and starting age of activity.

The PRE survey includes detailed information on working conditions experienced either with the current job (for those who have not yet retired) or with the last job as well as their working conditions when being 50 for those who had a different job at that time. Respondents have to answer 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 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, …)", possible answers to each item being either "yes" or "no". We construct a set of dummy variables associated to each of those working conditions. Finally, the survey contains the usual set of demographic and socio-economic characteristics like year of birth, marital status and education.

We apply the following selections to the original sample. First, we only consider male respondents born, whose current or last job was not in the public sector, and being currently retired. While the last criterion is obvious since we focus on the effect of early retirement, the first two criteria are due to substantial differences in the working history between men and women and in retirement conditions between workers from the private and public sectors. Furthermore, more than 75% of retirees having benefited from the RACL scheme were male. Second, we only keep individuals born between 1943 and 1950 since people born after 1951 have been subject to substantial changes in the RACL scheme[14]. Third, we exclude a small number of respondents (N=16) reporting having worked for

[14] 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.

the first time after 26 years as well as incoherent answers between early retirement and use of RACL scheme[15]. 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 bad working conditions during their last job. The highest proportions are found for the following self-reported conditions: physically demanding work (51.5%), high pace of work (48.8%), exposition to loud noise (44%) 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) of 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 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 likely to be in worse 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 individuals 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, early retirees having used the RACL 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 early retirees, respondents having benefited from the RACL are younger (-1.3 year), they have more often secondary or vocational

[15] 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 report that they retire before 60.

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)[16].

Obviously, several confounding factors are likely to affect the relationship between health and early retirement. For instance, low education or bad 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 susceptible to some justification bias if respondents "justify" their early retirement decision by reporting worse health than actually experienced (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

As emphasized in previous studies (Rohwedder and Willis, 2010, Coe and Zamarro, 2011, Bonsang et al., 2012, Mazzonna and Peracchi, 2012, 2017, Insler, 2014, Eibich, 2015, Motegi et al., 2016a, Hagen, 2016), 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 may 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 decision[17]. More precisely, we 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 early retirees by birth cohort calculated from the PRE survey. For those born in 1943 and 1944, the proportion of 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 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 early retirees results from the introduction of the RACL scheme.

Insert Figure 1

[16] In terms of working conditions, early retirees having benefited from the RACL 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).

[17] 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 potentially 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.

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 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 early retirees due to the RACL scheme to total early retirement. The proportion of RACL recipients among 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 early career scheme.

In Figure 2, we take into account the eligibility status to the RACL scheme. As the numbers of validated and contributed quarters required for full rate duration are not observed in our data, we define eligibility as a function of birth cohort and starting age of activity[18]. With this definition, the eligibility rate for people born from 1945 is equal to 65%. The proportion of 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 12.1 percentage points for the 1945 cohort, 24.4 points for the 1946 cohort, 12.7 points for the 1947 cohort, 28.7 points for the 1948 cohort, 18.8 points for the 1949 cohort and 28.6 points for the 1950 cohort. When considering all birth cohorts, the average gap is equal to 20.9 percentage points.

Insert Figure 2

So, eligibility to the RACL scheme is highly correlated with the increase in the proportion of early retirees. This is the first condition which is needed for eligibility to be a valid instrumental variable. Among the eligibility criteria, the respondent's birth cohort is clearly exogenous. At first sight, the situation sounds different for the starting age of activity 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 are 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 entry age 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

[18] Among those born in 1945, the group of respondents eligible to the RACL scheme comprises individuals with a starting age of activity less than or equal to 17 (they can only retire at 59). For the 1946 birth cohort, the potential recipients of the RACL scheme include people having started their activity at most at 16 for those deciding to retire at 58 years and below and people having started their activity at 17 at most for those deciding to retire at 59 years.

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 starting age of activity. 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 starting age of activity. Once controlling for age and education, there is no reason to observe any correlation between health and the eligibility status of the respondent.

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. Many different reasons like financial incentives, health or family constraints were listed. Overall, more than one 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 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 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 pension when leaving (72.2%) and financial incentives due to early retirement (12.2%)[19]. 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 age when starting work and number of validated quarters.

6. Empirical results

In a first step, we explore the effects of early retirement on the different health outcomes under the assumption that the retirement decision is exogenous. For that purpose, we run simple Probit regressions to assess whether retiring before 60 is associated to health problems in later life

[19] 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.

once we control for individual characteristics[20]. 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 career[21].

We report marginal effects for each health outcome in Panel A of Table 3. In columns (1A), (2A) and (3A), we investigate the influence of early retirement whether 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. It ranges from 7.4 percentage points for health limitation to 10.3 percentage points for chronic problem. Concerning the influence of the other controls (not reported), we find a positive association between bad health and age, but no correlation 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

As discussed in the previous section, the way through which 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 the subsample of non-RACL users. 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: +12.0 points for bad health, +11.9 points for chronic problem and +9.2 points for health limitation. On the other hand, the health outcome of early retirees having benefited from the RACL scheme is not different from that of individuals having retired at the legal age (the reference category) except for chronic problem. 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

[20] We have also estimated a trivariate Probit model explaining the three health outcomes jointly and reach very similar results. As expected, we find large positive significant coefficients of correlation between residuals of each health equation.

[21] We also 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 withdraw from the labor market. These additional covariates have no effect on our empirical results.

not benefit from the RACL scheme. Conversely, for those having retired earlier because of the new eligibility criteria of the RACL scheme, their health has not deteriorated 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 exogenous early retirement on health. Unsurprisingly, individuals who had a physically demanding job before retiring have a much higher probability of being in bad health. Self-reporting bad health is more frequent among respondents claiming that their last job was physically demanding (+12.2 points), that they were exposed to loud noise (+11.6 points) and that they had a high pace of work (+5.9 points). Chronic problem and health limitation are also positively correlated to 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 (+8.9 points), having chronic problem (+10.4 points) and health limitation (+7.2 points). This positive correlation is essentially due to the contribution of early retirees who did not benefit from the RACL.

Next, we investigate the causal effect of early retirement on health using the identification strategy presented in the previous section. Let H^k be a health indicator with $k = b$ for bad health, $k = c$ for chronic problem and $k = l$ for health limitation and R the early retirement decision. The latent outcomes H^{k*} and R^*, which respectively measure the propensity to be in bad health and to retire early, are such that $H^k = 1$ when $H^{k*} > 0$ ($H^k = 0$ otherwise) and $R = 1$ when $R^* > 0$ ($R = 0$ otherwise). They are expressed in the following linear way:

$$H^{k*} = \delta R + X\beta_H + \varepsilon_H \quad (1)$$

$$R^* = X\beta_R + \gamma Z + \varepsilon_R \quad (2)$$

where X is a set of control variables common to the health and retirement equations, Z is the instrument, and ε_H and ε_R are random error terms. We assume that ε_H and ε_R follow a bivariate normal distribution such that $(\varepsilon_H, \varepsilon_R) \sim N(0,0,1,1,\rho)$ with ρ the coefficient of correlation. The early retirement decision R is introduced as control in the right-hand-side of (1) so that the corresponding model is a recursive bivariate Probit model. Identification stems from the fact that eligibility to the RACL scheme is used as instrument in the retirement equation (2), while eligibility is expected to have no direct influence in the health equation (1). Conditional on the observables, the average treatment effect is $\mathrm{E}[\Phi(\delta + X\beta_H) - \Phi(X\beta_H)]$ with Φ the normal cumulative distribution function (Wooldridge, 2002, Angrist and Pischke, 2009)[22].

[22] The treatment effect on the treated is $E\{[\Phi_2(\delta + X\beta_H, X\beta_R + \gamma Z, \rho) - \Phi_2(X\beta_H, X\beta_R + \gamma Z, \rho)]/\Phi(X\beta_R + \gamma Z)\}$, with Φ_2 the bivariate normal cumulative distribution function.

We report the marginal effects obtained from bivariate Probit regressions in 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 more than 11 percentage points higher among eligible respondents compared to non-eligible respondents. Early retirement is also negatively correlated to age and education, especially for those having completed a high school, undergraduate or graduate diploma. Our main result is that once we instrument the endogenous decision of early retirement, we do no longer find any relationship between early retirement and health. This result is consistent with the fact that the marginal effect of early retirement related to the RACL scheme was not significant under exogeneity.

Insert Table 4

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 primarily will depend on the formal criteria required (number of quarters validated for instance) and eligibility to the RACL scheme increases by about 10 percentage points the early retirement decision. Once we account for working conditions, we note some changes in the effect of early retirement which switches of sign for self-reported bad health status and health limitation. However, whatever the health outcome under consideration, the causal effect of early retirement on health is never significant.

The main drawback of the bivariate Probit model is its normality assumption concerning the joint distribution of residuals. Without any distributional assumption, an alternative approach is to estimate a linear probability model using IV. As emphasized in Angrist and Pischke (2009, pp. 197-205), the bivariate Probit and the linear IV models do not provide exactly the same information. While the bivariate Probit regression provides an average causal effect, the linear IV gives a local average causal effect which corresponds to the average treatment effect for compliers (Imbens and Angrist, 1994). The IV results, not reported, confirm the lack of causal effect of early retirement on health. Without working conditions, the LATE estimates are 0.082 for bad health (t=0.31), 0.061 for chronic problem (t=0.22) and 0.235 for health limitation (t=0.99)[23]. With working conditions, the LATE estimates are -0.147 for bad health (t=-0.54), -0.043 for chronic problem (t=-0.16) and 0.062 for health limitation (t=0.26). Overall, our results do not appear sensitive to model specification.

[23] In the first-stage equation, the F-test of excluded instrument gives a statistic equal to 14.8 (p=0.001) which is above the critical value of 10 associated to weak instrument (Staiger and Stock, 1997).

7. Conclusion

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 except through some results based on the cross-national European Share dataset. 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. Starting from 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 starting working age, we use these criteria as instrumental variable 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 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 retirees having benefited from the long-career scheme. This pattern may be explained by some reverse causality such that people retiring early are in worse health compared to those who leaving their job at the legal retirement age. Second, we fail to evidence 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. Fourth, occupying a demanding job is harmful to health after retirement regardless of the retirement date.

As the health outcomes considered in this research refer to self-reported bad health, chronic problem and health limitation, it would be useful to explore the causal effect of early retirement on cognitive abilities with other data. Another issue of interest is to investigate changes in health outcomes over time. Since the 2012 PRE survey is cross-sectional, we are unable to study the dynamic effects of early retirement on health. Our results fail to evidence any long-term (either positive or negative) 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. Clearly, the use of panel data would be useful to look more closely at health trajectories across cohorts and starting age of activity in order to provide a broader picture of the relationship between early retirement and health in France. We leave all these issues for future research.

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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						SAA≤16 VQ=168 CQ=168	SAA≤16 VQ=168 CQ=168
57					SAA≤16 VQ=168 CQ=168	SAA≤16 VQ=168 CQ=168	SAA≤16 VQ=168 CQ=168
58	NOT ELIGIBLE			SAA≤16 VQ=168 CQ=164	SAA≤16 VQ=168 CQ=164	SAA≤16 VQ=168 CQ=164	SAA≤16 VQ=168 CQ=164
59			SAA≤17 VQ=168 CQ=160	SAA≤17 VQ=168 CQ=160	SAA≤17 VQ=168 CQ=160	SAA≤17 VQ=168 CQ=160	SAA≤17 VQ=168 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: SAA = starting age of activity, VQ = validated quarters, CQ = contributed quarters.

Table 2. Descriptive statistics of the sample

Variables	(1) All	(2) Early retirement			(3) Normal
		(2A) All	(2B) RACL	(2C) Other	retirement
Health outcomes					
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
Individual characteristics					
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
Working conditions					
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. Effect of exogenous early retirement on health status (marginal effects from Probit models)

Variables	Bad health		Chronic problem		Health limitation	
	(1A)	(1B)	(2A)	(2B)	(3A)	(3B)
Panel A. Without working conditions						
Early retirement	0.092***		0.103***		0.074***	
	(3.25)		(3.62)		(2.99)	
Early retirement due to RACL		0.036		0.098**		0.037
		(0.88)		(2.38)		(1.00)
Early retirement due to other reasons		0.120***		0.119***		0.092***
		(3.94)		(3.89)		(3.42)
Control variables	YES	YES	YES	YES	YES	YES
Number of observations	1,359	1,359	1,359	1,359	1,359	1,359
Log likelihood	-885.8	-883.0	-922.1	-920.6	-746.5	-745.1
Panel B. With working conditions						
Early retirement	0.089***		0.104***		0.072***	
	(3.08)		(3.59)		(2.91)	
Early retirement – RACL		0.027		0.095**		0.033
		(0.65)		(2.28)		(0.90)
Early retirement – no RACL		0.120***		0.122***		0.091***
		(3.86)		(3.92)		(3.36)
Night working	-0.026	-0.024	0.008	0.010	-0.011	-0.008
	(-0.62)	(-0.58)	(0.19)	(0.24)	(-0.30)	(-0.24)
Shift work	-0.025	-0.032	-0.022	-0.027	-0.018	-0.022
	(-0.56)	(-0.70)	(-0.49)	(-0.58)	(-0.47)	(-0.59)
Short repetitive tasks	0.058	0.063*	0.050	0.051	0.024	0.025
	(1.64)	(1.76)	(1.39)	(1.43)	(0.80)	(0.84)
Work physically demanding	0.122***	0.125***	0.075**	0.076**	0.072**	0.073**
	(3.55)	(3.63)	(2.16)	(2.17)	(2.44)	(2.49)
Exposed to toxic products	0.032	0.031	0.069**	0.068**	0.035	0.033
	(0.99)	(0.95)	(2.12)	(2.07)	(1.26)	(1.22)
Exposed to loud noise	0.116***	0.117***	0.066*	0.068**	0.081***	0.081***
	(3.42)	(3.44)	(1.94)	(1.98)	(2.77)	(2.77)
Exposed to low/high temperatures	-0.027	-0.027	-0.059*	-0.059*	0.036	0.036
	(-0.78)	(-0.78)	(-1.66)	(-1.67)	(1.19)	(1.20)
Supporting tensions with an audience	0.020	0.021	0.106***	0.107***	0.071**	0.072**
	(0.61)	(0.65)	(3.30)	(3.33)	(2.52)	(2.55)
High pace of work	0.059**	0.057*	0.001	0.000	0.018	0.016
	(2.03)	(1.95)	(0.03)	(0.00)	(0.71)	(0.64)
Control variables	YES	YES	YES	YES	YES	YES
Number of observations	1,359	1,359	1,359	1,359	1,359	1,359
Log likelihood	-856.4	-853.2	-905.3	-903.7	-721.6	-720.1

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

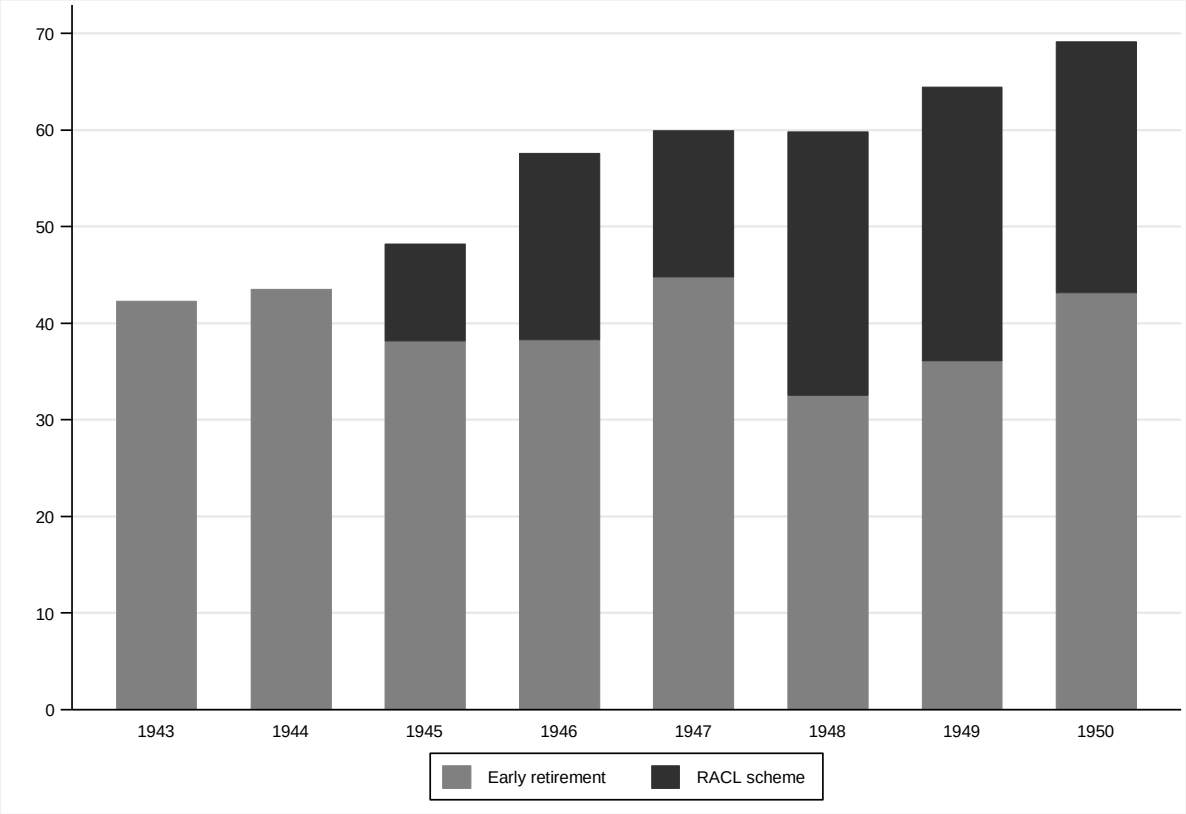
Note: marginal effects from Probit regressions, with t-values in parentheses. Significance levels are p<0.01 (***), p<0.05 (**) and p<0.1 (*).

Table 4. Effect of endogenous early retirement on health status (marginal effects from bivariate Probit models)

Variables	(1)		(2)		(3)	
	Early retirement	Bad health	Early retirement	Chronic problem	Early retirement	Health limitation
Panel A. Without working conditions						
Instrument: eligible to RACL scheme	0.111***		0.112***		0.112***	
	(3.73)		(3.81)		(3.79)	
Early retirement		0.022		0.039		0.093
		(0.08)		(0.14)		(0.47)
Control variables	YES	YES	YES	YES	YES	YES
Number of observations	1,359		1,359		1,359	
Log likelihood	-1752.6		-1788.9		-1613.4	
Panel B. With working conditions						
Instrument: eligible to RACL scheme	0.107***		0.110***		0.106***	
	(3.57)		(3.72)		(3.45)	
Early retirement		-0.173		0.028		-0.066
		(-0.75)		(0.11)		(-0.28)
Night working	0.054	-0.007	0.056	0.012	0.057	-0.002
	(1.36)	(-0.17)	(1.43)	(0.28)	(1.45)	(-0.06)
Shift work	0.071*	-0.006	0.069	-0.017	0.069	-0.009
	(1.66)	(-0.14)	(1.60)	(-0.36)	(1.61)	(-0.22)
Short repetitive tasks	-0.037	0.041	-0.037	0.045	-0.037	0.018
	(-1.12)	(1.16)	(-1.13)	(1.26)	(-1.12)	(0.58)
Work physically demanding	0.025	0.116***	0.026	0.076**	0.026	0.073**
	(0.77)	(3.62)	(0.79)	(2.17)	(0.79)	(2.57)
Exposed to toxic products	0.028	0.034	0.029	0.069**	0.029	0.036
	(0.93)	(1.18)	(0.97)	(2.15)	(0.96)	(1.36)
Exposed to loud noise	-0.038	0.092**	-0.037	0.062*	-0.038	0.072**
	(-1.21)	(2.41)	(-1.17)	(1.80)	(-1.21)	(2.39)
Exposed to low/high temperatures	0.010	-0.020	0.009	-0.056	0.010	0.036
	(0.31)	(-0.63)	(0.28)	(-1.61)	(0.30)	(1.25)
Supporting tensions with an audience	-0.036	0.007	-0.036	0.100***	-0.036	0.060**
	(-1.23)	(0.22)	(-1.21)	(3.01)	(-1.20)	(2.05)
High pace of work	0.036	0.060**	0.034	0.003	0.035	0.021
	(1.31)	(2.29)	(1.27)	(0.10)	(1.30)	(0.86)
Control variables	YES	YES	YES	YES	YES	YES
Number of observations	1,359		1,359		1,359	
Log likelihood	-1714.9		-1764.3		-1580.5	

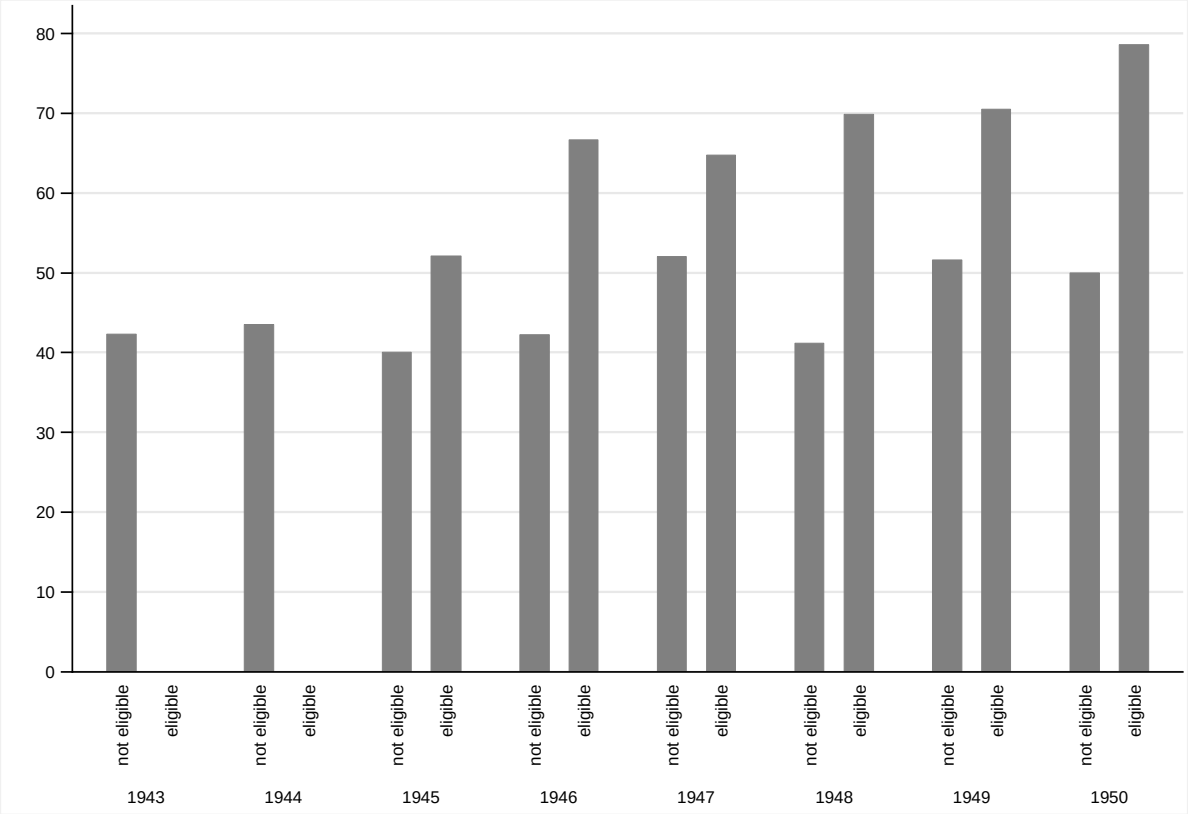
Source: authors' calculations, Passage from Employment to Retirement 2012 survey.
Note: marginal effects from bivariate Probit regressions, with t-values in parentheses. Significance levels are p<0.01 (***), p<0.05 (**) and p<0.1 (*).

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.

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