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**JEL Codes: J14, J26**

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# Employment and Substitution Effects of Raising the Statutory Eligibility Age in France

Simon Rabaté\* and Julie Rochut<sup>†‡</sup>

27th June 2017

## Abstract

Increasing the minimum retirement age is a widespread option chosen by policy makers to reduce spending in financially constrained public pension systems. Yet the effectiveness of such a reform strongly depends on the ability of the impacted individuals to postpone their withdrawal from the labor force. In this paper, we evaluate the effects of the 2010 French pension reform that increased the statutory eligibility age of retirement from 60 to 62. To do so, we use a differences-in-differences methodology, comparing the trajectories from work to retirement for succeeding generations facing a different statutory age. Using a detailed social security administrative database, we provide a global assessment of the effects of the reform, accounting for the potential substitution effects from old-age insurance towards unemployment, sickness or disability insurance schemes. Our findings suggest that despite a sizable effect on the employment rate, the reform also strongly increased unemployment and disability rates. These substitution effects largely reduce the impact of the reform: our estimates suggest that around one fifth in the decrease in public spending is offset by increasing expenses in other public insurance schemes.

**Keywords:** Retirement age · Policy reform · Labor supply · Disability · Unemployment

**JEL:** J14 · J26

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<sup>‡</sup>This paper uses confidential administrative data from the French social security (*Caisse nationale d'assurance vieillesse*). The authors are willing to provide guidance on how to acquire it.

# 1 Introduction

In a context of aging population, ensuring the financial stability of a pay-as-you-go pension system can be realized through three main options: increasing the contribution rates, lowering pension benefits, or extending the working life duration. In France, as in many countries, the third option has prevailed. During the last fifteen years, several reforms aimed at increasing the average retirement age and seemingly had an impact: over the last twenty years employment of older workers has achieved a steady and significant growth, with a sharp acceleration in recent years (Minni , 2015). Yet, the relative contribution of the different reforms to this evolution, as well as underlying labor supply behaviors, are still to be clarified.

In this paper, we focus on one of the most emblematic recent reforms, the increase from 60 to 62 of the statutory eligibility age (SEA), the minimum age at which pension benefits can be claimed.<sup>1</sup> As many countries implemented similar reforms in recent years, there is a growing body of literature evaluating their effects over labor force participation of older workers. In theory, an increase in the statutory eligibility age can have different types of effect.

First, especially when unanticipated, this increase is likely to have a strong impact on employment. Due to credit constraints, individuals may not be able to smooth their consumption without delaying their exit from the labor force. Hence, individuals in employment have strong incentives to postpone retirement when the statutory eligibility age (SEA) increases. This is confirmed by recent evaluations of the employment effects of changes in the SEA, using a differences-in-differences approach (Staubli and Zweilmüller (2013) for Austria, Cribb *et al.* (2013) for the UK, and Dubois and Koubi (2015) for France, Vestad (2013) for Norway). The estimated effects on the employment rate vary from 7 to 33 percentage points, for a change of one or two years in the SEA. Manoli and Weber (2016) extend the evaluation of the Austrian reform, using a regression kink design approach, and find that a one year increase in the SEA leads to a 0.4 year increase in the retirement age.

Besides employment effect, increasing the SEA can also have an impact on other public insurance schemes, such as unemployment insurance, disability insurance or sickpay insurance.

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<sup>1</sup>In the literature, this age is commonly referred to as the early retirement age (ERA). This term, however, is not suitable for the French case since the minimum retirement age is individual-specific and can be set earlier than the SEA.

Those substitution effects may be of two different types. Firstly, individuals already out of employment may not react to the incentives generated by the reform, and just stay longer on the bridge between employment and retirement. The decrease in retirement spending will then be counterbalanced by the increase in spending in other insurance schemes. Secondly, indirect substitution effects can also occur: when access to a given scheme is restricted, the relative “value” of alternative routes increases, and some individuals may manage to fall back on them. Therefore, workers who expected to retire at 60 may use alternative schemes to fill the gap until the new SEA. Those substitution effects are rarely taken into account in evaluations of pension reforms. Among the paper studying changes in the SEA, only Staubli and Zweilmüller (2013) and Vestad (2013) thoroughly estimate the effect of the reform on alternative routes to retirement. They both find evidence of substitution between retirement and unemployment or sick leave. The magnitude of the effect, however, differs substantially: substitution effects equal the employment effect in the case Staubli and Zweilmüller (2013), and represent one third of the effect in Vestad (2013). More generally, substitution effects between public insurance schemes have been largely documented in the literature. For example, Duggan *et al.* (2007) show that the decreasing generosity of social security benefits increases the take up of disability insurance. Karlström *et al.* (2008) study the effect of a tightening of the eligibility rules for disability insurance for the older workers in Sweden. They find no impact over employment, but strong substitution into alternative routes such as unemployment or sickpay insurance system.

Finally, changes in the SEA can have an upstream impact on the labor force participation at earlier ages through the distance to retirement effect (or “horizon effect”). The mechanism has been theorized and tested on French data by Hairault *et al.* (2010) and can be summarized as follows: increasing the distance to retirement has a positive feedback on both labor supply and demand as it increases the return on job-related investments, hence increases the employment rate before the retirement age. This potential upstream effect of pension reforms is rarely accounted for in the literature. This is a highly relevant question though, since the recovery of the employment rate of older workers is partly driven by the 55-59 age group, which is not directly targeted by pension reforms.

In this paper, we investigate these three potential effects by studying the effects of the

2010 reform of the French pension system, which increased the statutory eligibility age from 60 to 62, on the labor force participation of older workers. We implement a differences-in-differences approach, similar to the one used in the literature, and which allows to compare trajectories from work to retirement of cohorts facing different SEAs. To do so, we use the administrative records of the public pension scheme for wage earners of the private sector (*Cnav*). It provides the complete records of working trajectories that are required to isolate the effect of the increase in the SEA from other contemporaneous reforms of the pension system. Since it contains information on periods spent in each public insurance scheme, we are able to make a global assessment of the effect of the reform, taking into account potential substitution effects between different schemes.

We make the following contributions to the literature. We first make a precise evaluation of the French case and confirm the previous findings in other countries on the effect of the increase in the SEA: we find sizable effects on employment but also strong substitution effects. The increase in the employment rate represents only 40% of the decrease in retirement rate induced by the reforms. The remaining part is due to crowding out from retirement to alternative public schemes, mainly unemployment insurance. We then extend this analysis of substitution effects towards two directions. In order to uncover the underlying mechanisms, we first estimate the effect of the reform on sub-populations, according to their pre-SEA labor market status and expected retirement behavior. We show that employment effects are concentrated on individuals (i) who are still employed when reaching the SEA and (ii) who retire at the SEA. On the other hand, substitution effects are more important for individuals who are not able to extend their working lives, either due to early exit from the labor force or health-related limitations. Secondly, we measure the global fiscal impact of the reform, weighting the gains for the pension system against the additional costs in alternative insurance schemes. Crowding out effects are estimated to represent around one fifth of the fiscal gains. More importantly, we explore for the first time, the horizon effect on the increase in the SEA, and do not find any evidence of a distance to retirement effect on employment rates before the SEA. This finding, however, may be partly due to the fact that we measure only short term effects of the reform and focus on a population for which this horizon effect is less likely to play.

The paper proceeds as follows. We present the French institutional context regarding retirement and other insurance schemes in the next section. We then describe the data we use to identify the effects of the reforms (section 3), and detail the empirical strategy in section 4. Sections 5 and 6 display the results. Section 7 concludes.

## 2 Background

### A Overview of the French pension system

The public pension system in France is very large, providing benefits amounting to roughly 14% of GDP (COR, 2015). In this paper, we focus on the *Régime Général* (RG), the main scheme for wage earners of the private sector. It is the most important public pension scheme in France, covering more than two thirds of the working population. Together with its complementary point-based public second pillar, it provides the main source of income during retirement, with a median replacement rate of last earnings of 75% for continuous careers.

In this section, we briefly sketch the computation rules for pensions, focusing on the age parameters of the system.<sup>2</sup> In most pension systems, the computation of benefits depends on two key parameters: the minimum age at which one claim a pension (statutory eligibility age, SEA); and the age at which workers are eligible for full pension benefits (normal retirement age, NRA). The main peculiarity of the French pension system is that both the minimum age and the full pension age are individual-specific, as they do not only depend on age but also on work trajectories.

The age of eligibility for a full pension benefits (full rate age, FRA) can be reached under two conditions: either a working duration condition or a standard age condition. First, when the working duration condition is reached by a working, *ie.* her insurance duration has reached a sufficient number of trimesters, she reaches the full rate age from the statutory eligibility age. Second, if she has not reached the required duration when she reached the normal retirement age, she will be eligible for a full rate pension under the age condition. Otherwise, the full rate duration, and thus the FRA, can be reached between the SEA and the NRA.

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<sup>2</sup>See Mahieu and Blanchet (2004) for a comprehensive description of the French public pension system.

The minimum retirement age also depends on the individual work trajectories. In 2003, the French pension system introduced the opportunity to retire before the statutory eligibility retirement age (SEA), set at 60 at the time, this is what we call the early eligibility age (EEA). Retirement before the SEA is subject to a triple condition of (i) age of first period of work, (ii) number of years validated in the system,  $D$  and (iii) number of years of contribution.<sup>3</sup> Those long-career workers are allowed to claim their pension before the SEA, as summarized in Table 1.

Table 1: Early eligibility age (EEA): summary of the conditions

Age of first contribution	Years validated	Years contributed	<i>EEA</i>
Before 16	42	42	56
Before 16	42	41	58
Before 17	42	40	59

NOTE: EEA stands for Early Eligibility Age.

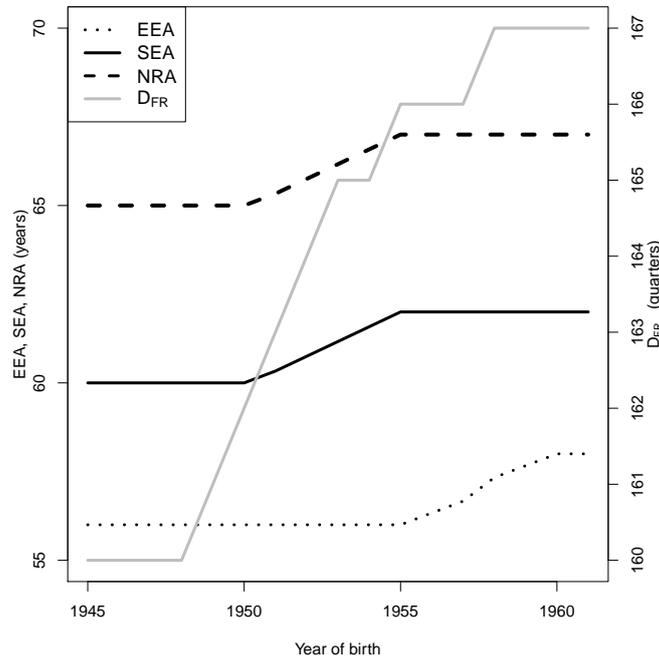
READING: This table presents the condition for retirement before the SEA, in the initial version of the scheme in 2003. A worker can retire at 58 if she started working at 16 and have an insurance duration equal to 42 years, including 41 years of contribution.

## B Recent reforms

We study the 2010 reform of the French pension system, which increased the age parameters of the system: the statutory eligibility age increased from 60 to 62 and the normal retirement age increased from 65 to 67. The implementation of this reform is cohort-based: the parameters gradually increase with the year of birth of the individual. However, over the last decades, several pension reforms have modified the main parameters of the system, and we must carefully take into account these simultaneous changes, as that may interact. First, reforms in 1993, 2003 and 2014 have progressively increased the required full rate duration  $D_{FR}$  from 37.5 years to 43 years, as shown in Figure 1. It presents the evolution of the  $D_{FR}$ , and the age parameters of the system (EEA, SEA and NRA) for cohorts 1945-1960.

<sup>3</sup>The difference between the years validated and the years of contribution is the periods that do not correspond to employment, for example unemployment spells or sickness and maternity leaves.

Figure 1: Evolution of the main parameters of the system  
EEA, SEA and NRA (leftscale) and  $D_{FR}$  (rightscale)



NOTE: This figure presents the evolution of the full rate work duration ( $D_{FR}$ ), the minimum early eligibility age (EEA), the statutory eligibility age (SEA) and the normal retirement age (NRA). See the text for detailed definitions.

READING: Between generation 1950 to 1955, the early retirement age increases from 60 to 62, the normal retirement age increases from 65 to 67 and the full rate work duration increases from 162 to 166 quarters.

Our reform of interest also directly interacts with the change in the eligibility conditions for “long-career”-based early retirement before the statutory eligibility age. The scheme has been frequently reformed in 2009, 2010, 2012 and 2014. The two phases of reforms can be summarized as follows. First, the eligibility conditions were progressively tightened: in 2009, with the increase in the required trimesters validated and contributed; and then in 2010, with the increase in the early eligibility age to match the increase in the statutory eligibility age. Then, conditions were mildly relaxed: the definition of trimesters contributed became less stringent, and more importantly the conditions for early retirement at 60 were strongly relaxed, in order to counterbalance the effect of the 2010 reform of the statutory age. In section 4, we explain how we neutralize the effect of those reforms of early retirement before the statutory age, by constructing treatment and control groups that only differ with respect to the statutory eligibility age they face.

## C Alternative routes to retirement

As we analyze in depth the potential substitutions between the pension scheme and alternative insurance schemes, we briefly present the main features of unemployment insurance (UI), disability insurance (DI) and sickness leaves insurance (SI) in France. We focus on the dimensions that are relevant for substitution effects: eligibility conditions, generosity of the replacement rates and the way periods spent in those schemes are taken into account in the pension system.

Unemployment insurance is sometimes described as an unofficial pre-retirement scheme for older workers (Hairault, 2012). Indeed, the specificity of the unemployment legislation regarding older workers, and its interaction with the pension system, make it a potentially important way of bridging the gap between employment and retirement. A worker becoming unemployed after 50 years can be covered by unemployment benefits up to three years (the maximum duration is two years under age 50). This duration can even be extended to a maximum of eight years.<sup>4</sup> Replacement rates are relatively high, around 70% of the reference wage on average. Finally, periods spent in unemployment generate rights for the computation of pension benefits, as trimesters in unemployment (when registered to the national employment agency, with benefits, or without benefits for older workers) are included in the career duration (50 days of unemployment validate one trimester). Overall, financial incentives to go back to employment are weak for the older unemployed.

The disability scheme in France is complex.<sup>5</sup> One can be considered as disabled after sickness or accident (non-related to working conditions)<sup>6</sup>, if her ability to work is reduced by at least two thirds. Three categories are defined according to the level of seriousness and the ability to work or not, upon which depends the replacement rate (30%, 50% or 70%). The amount of benefits is the product of the replacement rate by the reference wage (average of the 10 best annual earnings), with some maximum and minimum amounts. Periods spent in

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<sup>4</sup>Unemployment benefits cannot be claimed beyond the SEA in the general case. However, individuals who have reached this age and do not have the work duration required to receive a full pension can receive unemployment benefits until they reach the full rate (through age or duration criteria).

<sup>5</sup>See Di Porto 2011 for an extensive presentation of disability insurance schemes. See Behaghel *et al.* 2011 for a shorter description in English language.

<sup>6</sup>If the disability is due to working conditions, the associated benefit is an invalidity compensation equal to the sickness leave benefit.

disability are included in the career duration for the retirement pension benefits' computation. Importantly, when an individual recognized as disabled reaches the statutory eligibility age, she automatically gets a pension benefits at full rate, regardless of the number of trimesters she has validated.

The sickness leaves insurance is divided into two categories: short-term leaves (up to one year) and long-term leaves (up to three years). Replacement rates are equal to 50% of the previous wage. As for unemployment and disability insurance, periods of sickness leaves are included in the computation of pension benefits: a total of 60 days spent in sickness leave during a given year gives the right to an additional trimester for retirement (with a maximum of 4 per year).

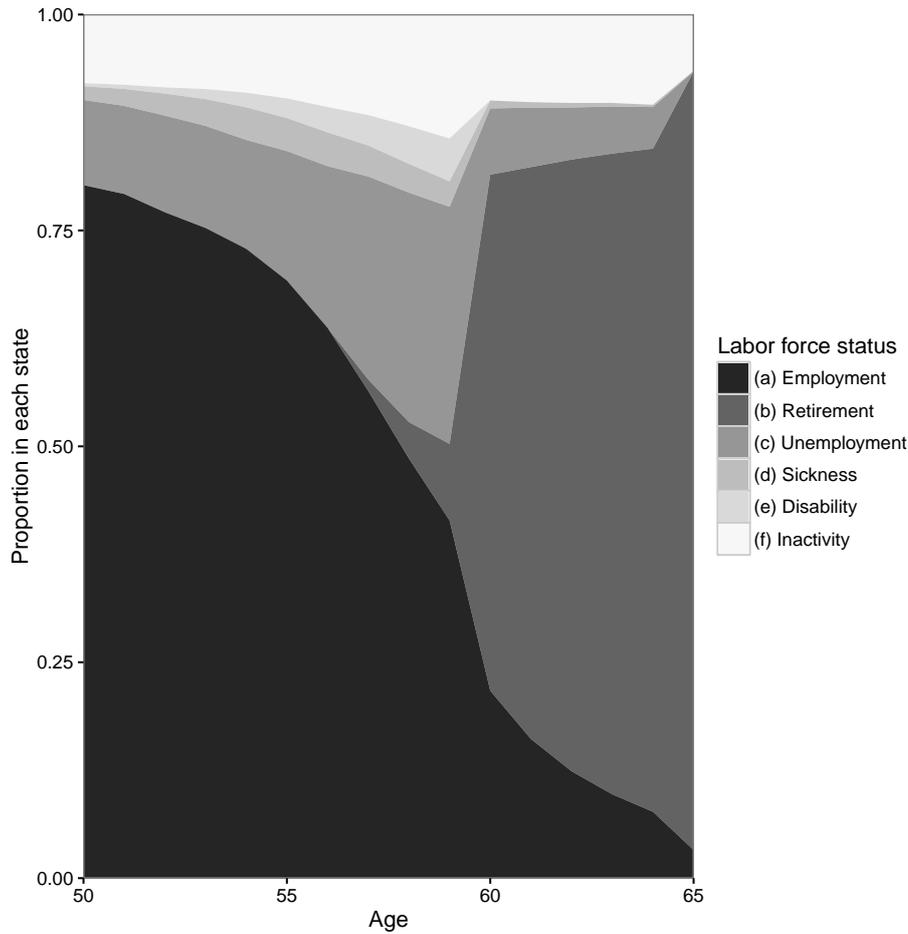
Importantly, the legislative rules concerning the alternative pathways to retirement (unemployment, sickness leave and disability insurance systems) did not change during the period we study. Consequently, most of the substitution effects we observe, come from a tightening on the retirement insurance side.

## **D Trajectories from work to retirement**

A distinctive feature of the transitions between employment and retirement in France is the important gap between the average age of withdrawal from the labor force and the average claiming age. According to Mette (2013), retirees of the *Régime Général* of generation 1944 claimed their pension on average 2 years and 9 month after their withdrawal from the labor force. This raises a question: what happens to workers exiting employment before the statutory eligibility age? The use of alternative routes to retirement in France and its evolution have been largely documented in the literature, for example in Ben Salem *et al.* (2010) or Behaghel *et al.* (2014). Besides mere inactivity, the following pathways can bridge the gap between employment and retirement: unemployment, sickness leave and disability.

The relative importance of each pathway is illustrated in Figure 2, giving a picture of the pre-reform trajectories from work to retirement. We start at age 50 from a situation largely dominated by employment (with high unemployment rates though), and end up in a situation in which almost all the population is retired at the normal retirement age of 65. From age 55,

Figure 2: Transitions to retirement:  
Distribution between different states by age



POPULATION: Retirees of generations 1945 to 1947 with at least one employment spell after 50.  
 READING: At age 55, 70% of the population is employed, 15% is employed, 4% in sickness leave, 2.5% in disability and 8% inactive.  
 NOTE: See section 3 for the definition of the annual workstate in the *Cnav* dataset.  
 SOURCE: *Cnav* 1/20<sup>th</sup> sample

employment declines faster (-28pp/-40% between ages 55 to 59). It does not translate uniquely in retirement as we are under the statutory eligibility age, which is 60 for this population (individuals born before 1951). Some individuals retire through early eligibility retirement scheme, but others use alternative pathways to retirement. It is illustrated by the progressive increase in the share of other status, such as inactivity (+5pp/+60%), disability (+3pp/+120%) and, last but not least, unemployment (+13pp/+60%).

In the rest of the paper, we address the following question: how would the increase in the statutory eligibility age modify the trajectories from work to retirement?

### 3 Data

Our empirical analysis is based on the French Social Security (*Régime Général*) administrative records. We use a  $1/20^{th}$  sample of all workers affiliated at least once to the scheme. The data contain very detailed longitudinal information on each individual career until 2015. For each year, the number of quarters validated in each different labor market status is recorded, namely: employment (in the private sector or in another sector), unemployment, disability, sickness, inactivity and retirement. Earnings are also recorded for every period worked as a wage earner of the private sector. Except for gender and nationality, we do not have any information on demographic variables.

#### A Sample selection

We select individuals who are born in the first quarter of each selected generation. As we only have yearly labor market status, it is the only way we can match a yearly status to the age-based status: labor market outcome of year  $t$  an individual of generation  $g$  will then be assimilated to her outcome at age  $g + t$ . We also focus on a sub-sample of people that are registered to the general retirement scheme at least once after 50 years old. This selection aims at taking out people such as civil servants, the self-employed or farmers that do not belong to the *Régime Général*, but also people that are already out of the labour market at age 50.

#### B Defining a yearly work state

Our data provide an exhaustive record of the individual career, but only give, for each year, the number of trimesters that have been validated for the computation of pension benefits: work in the private sector, unemployment or sickness periods, disability, or period validated in other social security schemes (without distinction between work and other type of validation). Defining a work state for a given year is not straightforward then, as individuals may have validated trimesters of different types during this year. We use the following method:<sup>7</sup> we attribute as yearly workstate the one for which the individual has validated the largest number

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<sup>7</sup>Several alternative methods could be considered, that are presented in Appendix A.

of trimesters for a given year.

Note that the categories we use as work states do not directly match their common use in the literature. It is particularly the case for the unemployment status. In our data, unemployment status corresponds to the report of unemployment trimesters in the pension computation. It is not the same as unemployment status usually used for example in labour force surveys, based on the International Labor Organization (ILO) criteria of job search and availability. Even if our definition of a yearly main states and the minimum of 50 days of unemployment to validate a trimester may lead us to underestimate the unemployment spells in our population, the definition used here is broader than the ILO definition.<sup>8</sup>

## 4 Empirical strategy

### A Identification strategy

In this section, we present and justify our empirical strategy for the identification of the effects of the increase in the statutory eligibility age (SEA) over labor market behavior of older workers. Following recent literature studying the changes in the SEA, our evaluation set-up will be based on a differences-in-differences strategy. As in Vestad (2013), the dynamic dimension of the treatment is not based on time but on age. The treatment is defined as being under the statutory eligibility age. We compare different cohorts who receive the treatment (being under the statutory eligibility age) at different ages. All cohorts are treated at some point, but at some ages (e.g 60) some cohorts are treated and some are not. We restrict our analysis to the early stage of the reform and evaluate the change of the SEA from 60 to 61 years old, since the reform is still currently implemented.

The identifying common trend assumption is then the following: without the increase in the SEA, the control and treated groups would have had the same employment pattern (in evolution, not necessarily in level) at the ages we consider (50 to 61 years old). Hence, the observed differences in the evolution of employment status are only driven by the different SEA age the

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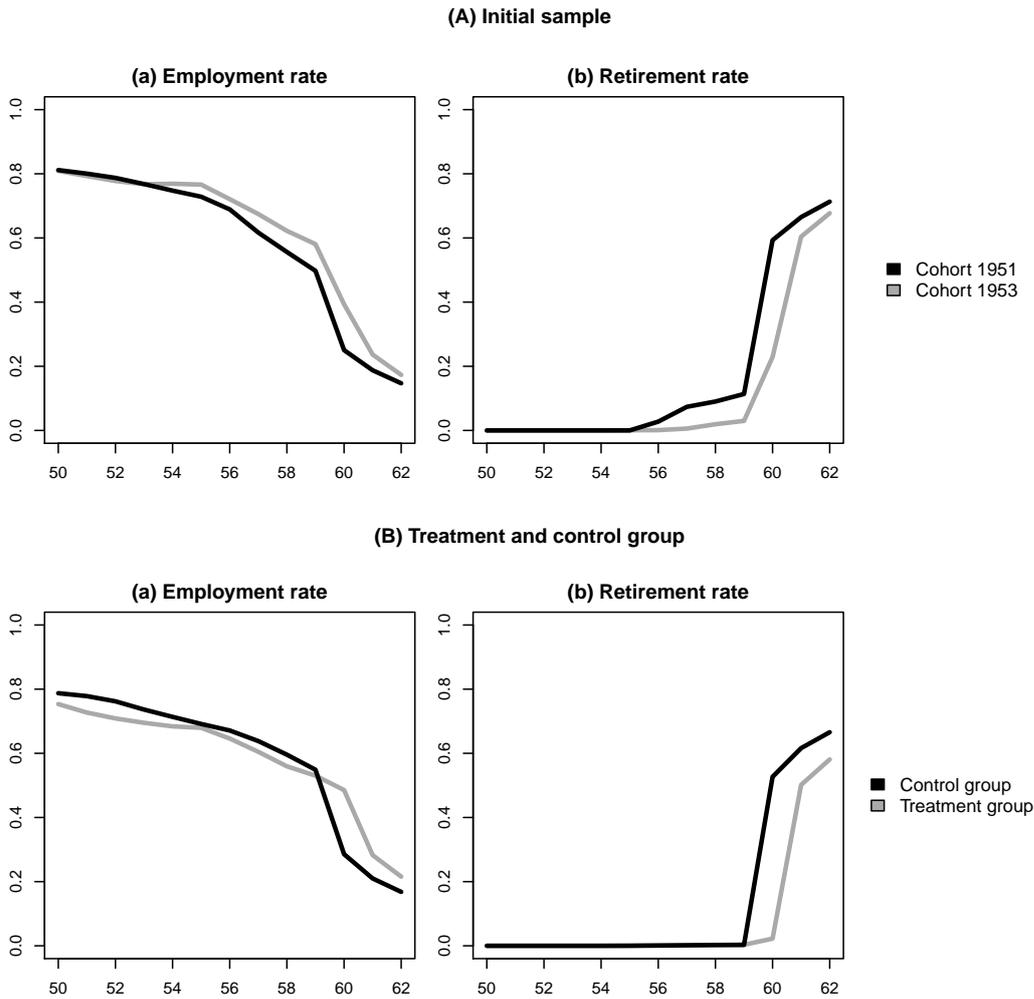
<sup>8</sup>Days of unemployment are recorded on the basis of registration at the unemployment agency or perceived benefits, which can occur without any job search. It is especially the case in France where older unemployed workers were not requested to look for a job in order to get their unemployment benefits until 2012.

two groups faced at given ages. Note that our age-based set-up for differences-in-differences suffers from an immediate limitation: different cohorts reach a given age at a different point in time, so that the macroeconomic context can be an important omitted variable. We discuss the possible ways to deal with this issue in section 4.

As mentioned in section 2, several reforms were implemented simultaneously during the period of interest (2003-2014), which is a potential threat to identification. Picking control and treatment groups is not straightforward in this case: we must restrict our sample to subgroups that are not simultaneously impacted by different reforms. This comes at the cost of a loss in generality and external validity of the results. It is however the only way to properly estimate the effect of the change in the statutory eligibility age.

As we want to study the effect of the change in the SEA on transitions from work to retirement, we first focus on the two main outcomes of interest, namely the employment and retirement rates. The first panel of Figure 3 presents the survival rates in both states, between age 50 and 61 for individuals in our main sample born in 1951 and 1953. Those two cohorts faced different SEA, of 60 for the former and 61 and 2 months for the latter (rounded to 61 with the annual timescale). Our differences-in-differences strategy relies on the hypothesis that the evolution of employment patterns would have been the same in the absence of the increase in the statutory eligibility age. A minimal condition for this hypothesis to be plausible is the pre-treatment parallel trends, which in this case corresponds to a parallel evolution of employment patterns before age 60 in the treated and control group. The first panel of Figure 3 does exhibit a difference in the share of employed (and retired) individuals between the two cohorts. The divergence between the two curves however occurs before the treatment age of 60: we observe an increase in the employment rate for cohort 1953 relative to cohort 1951 as early as age 56. This is a clear violation of the parallel trend assumption.

Figure 3: Defining the treatment and control group



SOURCE: *Cnav* 1/20<sup>th</sup> sample.

NOTE: In panel 1, employment and retirement rates by age are presented for generations 1951 and 1953, which faced different legislation regarding both general and statutory eligibility ages ( $SEA_{gen}$  and  $SEA_{ant}$ ). The second panel presents the same picture for our treatment and control group. See the text and table 3 for the composition of those groups.

The divergence before 60 is linked to the reforms of the early eligibility age conditions. To isolate the effect of the increase in the SEA from 60 to 61, we then neutralize the interactions with the reforms of the early eligibility age in 2009 and 2012. We construct our treatment and control groups as follow. Firstly, the solution we adopt to deal with the interaction between the 2009 and 2010 reforms is to decompose the main sample between individuals eligible for early retirement before 2009 and those who were not. Individuals eligible to the anticipatory retirement scheme represent around 15% of the whole sample. We remove them from the sample of estimation. Secondly, we can consider that individuals born after 1952 and eligible

to early retirement at 60 through the extension of anticipatory retirements are not impacted by the increase of the SEA from 60 to 61. We consequently decide to put them in the control group.

A last question is the choice of the cohorts we include in the control and treatment groups. It strongly depends on data availability, but also on identification. Indeed, another reform potentially interacts with the increase in the statutory eligibility age: the increase in the full rate work duration  $D_{FR}$  (*cf.* section 1). Recall that our differences-in-differences strategy relies on the identifying assumption that, in the absence of reform, different generations would have had the same pattern of transition from work to retirement. Regarding the impact of the 2010 reform, this parallel trend assumption can be restated as follows: in the absence of an increase in the statutory eligibility age, the treated and control groups would have had the same evolution of labor force participation between ages 59 and 60. In particular, this implies that a similar share of the consecutive cohorts would have retired at the statutory age of 60. This may be a rather strong assumption, all the more so for distant cohorts, with different labor market history and legislation. With the triple evolution of a later entrance on the labor market, less linear working trajectories and an increasing required duration for full rate, more recent cohorts will reach age 60 with a working duration ( $D_{60}$ ) further and further from their full rate duration ( $D_{FR}$ ). This in turn could imply a smaller proportion of retirement at age 60, even in the absence of other reforms. For example under the hypothesis of a “full-rate seeking” retirement behavior, the proportion of retirements at 60 would be exactly equal to the proportion of individuals who have validated  $D_{FR}$  trimesters at this age, hence it would decrease over time even without any change in the SEA. Table 2 presents the proportion of individuals reaching 60 with a work duration the  $D_{60}$  above the required duration  $D_{FR}$ , for each generation of our sample. As expected, the proportion of individuals reaching 60 with the requested number of trimesters decreases over time. This implies that the hypothesis of a common trend assumption is less and less likely when we compare more and more remote cohorts. We will then focus on generations as close as possible from each side of the reform: cohorts 1950 to 1953.

Table 2: Work duration at 60 by cohort

	Cohort 1950	Cohort 1951	Cohort 1952	Cohort 1953
Average $D_{60}$	151.4	152.4	151.9	151.7
$D_{FR}$	162	163	164	165
Proportion $D_{60} \geq D_{FR}$	54.3%	55.1%	53.4%	51.9%

SOURCE: *Cnav* 1/20<sup>th</sup> sample.s

Table 3 summarizes the choices made for the elaboration of the control and treatment group. The treated group includes individuals facing a statutory eligibility age of 61. It implies to remove from the treated group individuals of younger generations (1952 and 1953) who can retire before age 61 through the anticipatory retirement schemes.

Table 3: Summary of groups composition

<b>Treatment group (SEA = 61)</b>	<ul style="list-style-type: none"> <li>• Not eligible to retirement before 60: cohorts 1952 and 1953</li> <li>• Eligible to retirement before 61: cohort 1952</li> </ul>
<b>Control group (SEA = 60)</b>	<ul style="list-style-type: none"> <li>• Not eligible to retirement before 60: cohorts 1950 and 1951</li> <li>• Eligible to retirement before 61: cohorts 1950, 1951 and 1953</li> </ul>

As shown in Table 4, the two groups do not have the same characteristics. Individuals of the control group are on average more often male, have longer work duration and higher earnings. This is due to the fact that we include in the control group individuals born in 1953 eligible to early retirement before 61, who have on average a longer work duration. The difference in observable between the two groups is not necessarily an issue in the differences-in-differences setting, as what matters is the plausibility of the common trend assumption. The second panel of Figure 3 suggests that this parallel trend hypothesis is more plausible for the control and treatment group we chose. Trends in employment and retirement rates are parallel until the old statutory eligibility age of 60 is reached.<sup>9</sup> Isolating the population impacted by the increase in the SEA then makes it possible to identify its effects on labor force participation.

<sup>9</sup>Even if a small proportion of the treated group do retire at 60 years old, which may be due to specific program for permanent incapacity to work or asbestos workers.

Table 4: Descriptive statistics

	All	Control group	Treatment group
Men	53.3	56.0	49.7
French	79.7	81.2	77.5
Mean salary under 50	1.57	1.62	1.51
Years worked at 50 (year)	26.89	27.98	25.40
Years validated at 50	30.75	31.50	29.73
Age at first working period	18.66	18.48	18.92
Nb of individuals	25877	15193	10684

SOURCE: *Cnav* 1/20<sup>th</sup> sample.

## B Econometric specification

The goal of the empirical strategy is to estimate the effect of the 2010 reform that increased the statutory eligibility age from 60 to 61 for generation 1952 and 1953. We are not only interested in the effects on employment and retirement behaviors, but also on the impact on potential substitution routes, such as unemployment, disability and sickness leaves. We estimate the following differences-in-differences model:

$$Y_{iact} = \beta_0 + \beta_1 X_{1,ia} + \beta_2 \tau_a + \beta_3 \delta_c + \beta_4 \text{underSEA} + \epsilon_{iac} \quad (1)$$

$Y_{iac}$  is a state dummy equals to 1 if the individual  $i$  from cohort  $c$  is in the relevant state at age  $a$ .  $X_{1,ia}$  includes a set of individuals controls (gender, country of birth, average earning before 50, number of trimesters worked before 50 and number of trimesters contributed before 50).  $\delta_c$  represent the cohort dummies (between 1950 and 1953) and  $\tau_a$  are the age dummies (from 50 to 61). The dummy *underSEA* is equal to one if the individual is below her statutory eligibility age, or zero otherwise. The coefficient before this dummy ( $\beta_4$ ) is the main coefficient of interest, capturing the effect of the 2010 reform over employment behaviors at the ages for which the reform changed the *SEA*, that is only at 60 in this setting as we do not evaluate the further increase from 61 to 62, because the phase-in of the reform is not complete in 2015.

As previously mentioned, two distinct cohorts have the same age at different dates, and we might want to take into account some potential determinants of labor force participation that are period-related. For example if the macroeconomic context is more favorable in 2013 (when

cohort 1953 reaches 60) than in 2011 (when cohort 1951 reaches 60), we will attribute the positive impact of the cycle of the employment rate cohort to the 2010 reform. The reforms under study have impacted different cohorts at different ages, and different cohorts reached a given age at different points in time, which we may want to take into consideration, in order not to attribute to the reform some effects of the macroeconomic context. This is all the more important with the economic crisis of the late 2000s occurring in the middle of period of interest (2004-2014).

Therefore, we want to take into account the three dimensions namely, age, period and cohort (APC). We then face the well-known identification issue:<sup>10</sup> the perfect linearity between age, cohort, period terms makes it impossible to identify the three effects separately without any additional assumptions. One common way to circumvent this issue is to use a different time step (e.g monthly age, quarterly date, yearly cohort) to generate (quite artificially) some non-linearities between the three dimensions. This method is not adapted to our yearly dataset. Three alternative broad types of solution will be tested in the empirical analysis. The first option is to refrain from imposing any additional parametric restriction and to completely omit the time dimension. The second solution is to impose a rather loose constraint on the period dimension, by setting two adjacent coefficients equal (Mason *et al.*, 1973) or normalizing the sum of the coefficients to be equal to zero (Deaton, 1997). Finally, we can include to the main specification a vector of time-varying explanatory variables ( $X_{2,t}$ ), which can potentially capture the macroeconomic cycle effects we want to account for (for example the GDP growth rate or the global unemployment rate).

## 5 Results

### A Graphical evidence

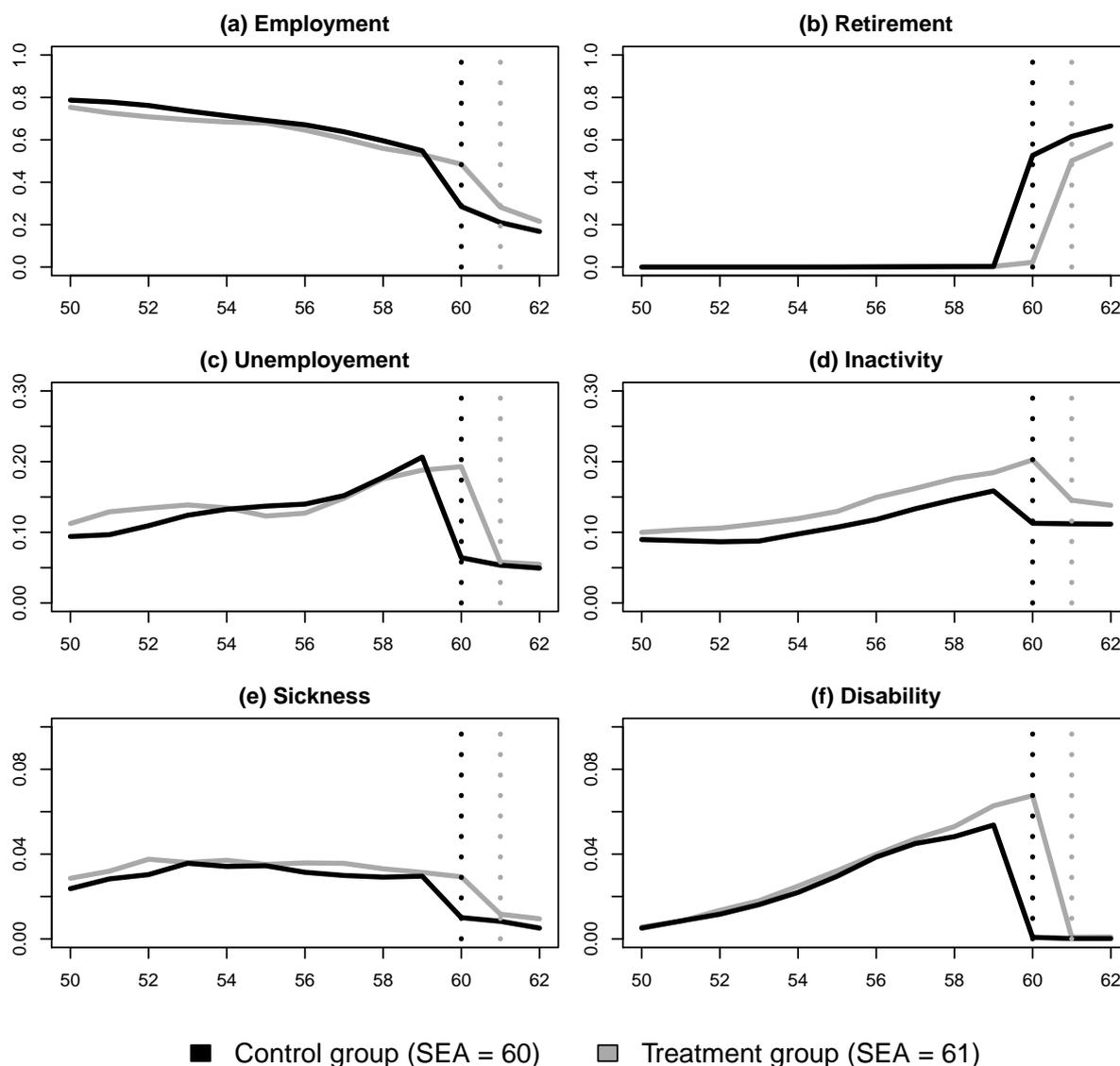
Figure 4 presents the evolution of the proportion of individuals in each possible state (*employment, retirement, unemployment, disability, sick leave, and inactive*) at ages 50 to 61, for the control and treatment group. These two groups faced a different statutory eligibility age,

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<sup>10</sup>See for example Kessler and Masson (1985), Glenn (2005) or Yang and Land (2013).

respectively 60 and 61. In addition to giving an updated picture of the trajectories from work to retirement in France, these graphics give a first idea of the effects we want to measure, as well as an assessment of the validity of the parallel trend assumption at the heart of our identification strategy. We firstly verify that the trends before age 60 are similar in both groups for all the different states we consider. The pattern observed suggest that we do identify an effect of the statutory eligibility age, as the trends sharply change at the group-specific SEA.

Figure 4: Workstates trends by age: Treatment vs. Control group



SOURCE: *Cnav* 1/20<sup>th</sup> sample.

In most cases, the increase in the SEA of one year seems to extend the pre-existing trend by one additional year. Aside from the straightforward substitution between retirement and employment at 60, already presented in figure 3.B, we can observe that the proportion of individuals in unemployment, sickness leave, disability or inactivity also significantly increases at age 60. This is the sum of two distinct effects. Firstly, we can assume that most individuals that were already out of employment before 60 are not going back to employment with the increase in the SEA, and just stay in their previous state one year longer. But there may also be some workers who would have retired at 60 and have fallen back on another state. Interestingly, in the case of disability (panel (f) of figure 4): the hazard rate of entrance into the disability scheme seems to increase with the reform of the statutory eligibility age. It suggests an indirect substitution effect towards disability insurance due to the reform: individual who were not disable and expected to retire at 60 became disable.

## B Main results

Table 5 presents the result of the estimation of equation (1) by OLS, with employment as explained variable, and different specification for the time dimension. We only present the differences-in-differences coefficient.<sup>11</sup> Whatever the specification we use, the 2010 reform is estimated to increase the rate of employment by around 19 percentage points. Reassuringly, estimates are not very sensitive to the specification of time variables.

Table 5: Effect of the increase of SEA on employment rates at age 60

Under SEA	0.199*** (0.006)	0.207*** (0.006)	0.193*** (0.008)	0.193*** (0.008)	0.208*** (0.006)
Observations	282,503	277,030	277,030	277,030	277,030
R-squared	0.147	0.188	0.188	0.188	0.188
Additional					
Controls	No	Yes	Yes	Yes	Yes
Time effect	None	None	Mason	Deaton	Proxy

SOURCE: *Cnav* 1/20<sup>th</sup> sample.

NOTES: This table displays the estimate of the effect of  $SEA_{gen}$  on employment rates ( $\beta_4$  coefficient of Eq. 1). Additional controls in columns (2)(5) are gender, country of birth, average earning before 50, number of trimesters worked before 50 and number of trimesters contributed before 50.

READING: Standard errors in parentheses. Significance level: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

<sup>11</sup>For details estimates on all the coefficients see Appendix Table B.1.

The preferred specification with all the control and time variables is the Deaton specification, which relies on looser assumptions compared to the Mason one. We then estimate the model for all the possible routes (unemployment, sickness, disability, inactivity). Interestingly, the impact on the unemployment rate is almost of same magnitude as the impact on the employment rate (about 14 pp) -Table 6. This confirms that unemployment is a standard route before retiring in France. Disability and sickness play a minor role (comparing to employment and unemployment), however they represent one fifth of the decrease in retirement rate at age 60. Overall, the 47 pp decrease in retirement are distributed as follows: 40% in employment, one third in unemployment, one sixth in disability and sickness leave, and the rest in inactivity.

The results shall also be interpreted in relative terms, comparing the point estimates to the share of the different states at 60. Without the reform the employment rate at 60 in the treated group would have been around 29 pp, which corresponds to an increase in the employment rate of 66% ( $=0.193/0.286$ ).

Overall, it seems that there are large substitution effects from retirement to the relevant previous state: when the statutory eligibility age increases, individuals that would have retired otherwise spend one more year in their current state. This may not be very surprising but it implies that the short term impact of a reform of this kind depends a lot on the impacted population: the bigger the share of non-employed individuals, the smaller the overall effects on employed and the bigger the substitution effects from the retirement scheme to the other public insurance schemes. This is relevant from both the public finance and the individuals' welfare point of view. Firstly, the overall financial gains from the reform are reduced if a large part of the population is already out of the labor force, as it also increases spending in other public insurance schemes. We quantify this crowding out effect in subsection 6.C. Secondly, as retirement pension benefits are on average higher than their counterpart in other schemes, postponing the transition into retirement could have strong negative impacts over the welfare of individuals that are in unemployment, disability or sickness leave. Increasing the statutory eligibility age without any change in other insurance schemes is likely to have antiredistributive effects. Note that the substitution effects may not only be driven by the supply side: going back on the labor force may not be possible for older individuals. As shown in Rabaté(n.d.), the

demand side and firms' choice is an important determinant of the employment of older workers in France.

Table 6: Labor market outcome and DD estimate at age 60

VARIABLES	Employment	Unemployment	Sickness	Disability	Inactivity	Retirement
Under SEA	0.193*** (0.008)	0.141*** (0.006)	0.017*** (0.003)	0.064*** (0.003)	0.064*** (0.005)	-0.478*** (0.004)
Pre-reform mean	.286	.064	.01	.001	.113	.527

SOURCE: *Cnav* 1/20<sup>th</sup> sample.

NOTES: This table displays the estimate of the effect of  $SEA_{gen}$  on different possible outcomes. All specifications include controls (gender, country of birth, average earning before 50, number of trimesters worked before 50 and number of trimesters contributed before 50), and use a Deaton specification for the year dummies. Reported pre-policy means are for individuals of cohorts 1950-1951 at age 60.

READING: Standard errors in parentheses. Significance level: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

## C Effects on transitions

Potential transitions between states are not directly readable from Table 6. Indeed, we estimate substitutions from retirement to other possible routes, but we are not able to differentiate between two types of substitutions. As emphasized in Karlström *et al.* (2008), the tightening of the access to one route can have two type of substitution effects. The reduction of the inflows from different states to the restricted one can be decomposed in (i) direct effects of individuals staying one more year in their current state (ii) indirect effects of individuals who will fall back on alternative scheme to exit or stay out of employment. Table 7 makes it possible to distinguish these effects by comparing the transitions between ages 59 and 60 for the treated and control group. In practice, we estimate equation (1) only for age 59 and 60, and conditioning by the initial state at 59. In Table 7, the rows reflect the initial states, and the columns reflect the final states. We do find a strong absorbing effect of the initial states, that is substitution of type (i) in the previous distinction: the decrease in transition into retirement is mostly translated into continuation in the previous state. This is the case for 85% of the employment transition (0.34/0.40), 86% of the unemployment transition (0.58/0.67), 99% of the disability transition but only 40% for sickness, which is less of an absorbing state.

We do find some evidence of substitution from non-work status to work, especially from sickness leave (23% of individuals in sickness leave go back to employment instead of retiring)

but also from unemployment (6%) and disability (2%). However, we also find non-negligible transition from work to unemployment (7.5% of the decrease in transitions from work to retirement) or to sickness (5%). We also find important substitution of type (ii) for individuals that were in sickness leave at age 59. Even though a non-negligible part come back on employment instead of retiring (23%), many enter unemployment (19%) or disability insurance (14%). Overall, as employment is the main initial state for the population of interest, we have a more negative substitution (from work to other scheme) than positive ones (from other schemes to work).

It should be pointed out however, that we measure very short term effects of the reform. In the long-run, negative substitutions are potentially weaker if individuals have not initially planned to retire at 60. Similarly, positive transitions from non-work to work may be stronger in the long-run with the horizon effect, that we discuss in the next section.

## **6 Complementary results**

### **A Robustness tests**

The causal impact of the 2010 reform over labor market participation can be assessed with two distinct placebo tests. Recall that we study the effect of an increase from 60 to 61 of the statutory eligibility age between generations 1951 to 1953. We estimate the effect of the following counterfactual reforms: (i) an increase in the SEA from 60 to 61 between generations 1949 to 1951 and (ii) an increase in the SEA from 58 to 59 between generations 1951 to 1953. Results are reported in Table 8. Reassuringly, we do not find any impact of the placebo treatments on the main outcome variable.

Note that the second placebo test shows that there is no significant difference between the treated and control group in employment pattern before 60. This seems to contradict the existence of a horizon effect of the statutory eligibility age that would impact working trajectories at previous ages. Indeed, in the presence of an horizon effect, cohorts impacted by a change in their statutory eligibility age should exhibit different employment pattern before age 60, that would be captured by our placebo test. However, for the generations we consider, the reform

Table 7: Effect of the reform on transition

Status in 59	Status at 60					
	Employment	Unemployment	Sickness	Disability	Inactivity	Retirement
<b>Employment</b>						
Under SEA	0.34*** (0.01)	0.03*** (0.00)	0.02*** (0.00)	0.00*** (0.00)	0.01*** (0.00)	-0.40*** (0.01)
Pre-reform mean	.497	.027	.01	0	.018	.448
Nb. Obs	11538	11538	11538	11538	11538	11538
<b>Unemployment</b>						
Under SEA	0.04*** (0.01)	0.58*** (0.01)	0.01*** (0.00)	0.01*** (0.00)	0.03*** (0.01)	-0.67*** (0.01)
Pre-reform mean	.027	.231	.001	0	.027	.714
Nb. Obs	4265	4265	4265	4265	4265	4265
<b>Sickness</b>						
Under SEA	0.16*** (0.02)	0.13*** (0.02)	0.28*** (0.03)	0.10*** (0.02)	0.02 (0.02)	-0.69*** (0.03)
Pre-reform mean	.042	.028	.156	.011	.04	.722
Nb. Obs	655	655	655	655	655	655
<b>Disability</b>						
Under SEA	0.02*** (0.01)	0.01** (0.00)	0.00 (0.00)	0.94*** (0.01)	-0.00 (0.01)	-0.97*** (0.01)
Pre-reform mean	0	.002	0	.003	.02	.975
Nb. Obs	1254	1254	1254	1254	1254	1254

SOURCE: *Cnav* 1/20<sup>th</sup> sample.

NOTES: This table displays the estimate of the effect of  $SEA_{gen}$  on different outcomes. We consider only for ages 59 and 60, and we condition on the initial status at 59.

Pre-reform means give the proportion of individuals in each state at 60 for untreated cohorts.

READING: Standard errors in parentheses. Significance level: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

occurred at relatively late ages (58 for generation 1952 and 57 for generation 1953), maybe too late for the horizon effect to occur.

Table 8: Placebo tests

	Employment	Unemployment	Sickness	Disability	Inactivity	Retirement
Reference	0.19*** (0.01)	0.14*** (0.01)	0.02*** (0.00)	0.06*** (0.00)	0.06*** (0.01)	-0.48*** (0.00)
Placebo 1	0.00 (0.01)	-0.00 (0.01)	0.00 (0.00)	0.00 (0.00)	0.00 (0.01)	-0.01 (0.01)
Placebo 2	-0.01 (0.01)	0.00 (0.01)	-0.00 (0.00)	0.00 (0.00)	0.00 (0.01)	-0.00 (0.00)

SOURCE: *Cnav* 1/20<sup>th</sup> sample.

NOTES: This table displays the estimate of the effect of  $SEA_{gen}$  on different outcomes, using two different placebo tests, that are compared to the reference reproducing the first line of table 6. The second line shows estimates of the effect of a pseudo-increase in the SEA from 60 to 61 between generations 1949 to 1951. The third line shows estimates of the effect of a pseudo-increase in the SEA from 58 to 59 between generations 1951 to 1953

READING: Standard errors in parentheses. Significance level: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

The absence of a detectable horizon effect with the increase in the minimum age can also be explained by the selected population we consider. As we removed individuals with very long work duration, a non-negligible part of our sample would not have retired at 60, even in the absence of reform. As a matter of fact, for individuals reaching their full rate after 60, the reference age may not be the statutory eligibility age but rather the full rate age. For those individuals, the “horizon effect” may occur at older ages, between 60 and 65.

This raises an important point regarding the interpretation of our results: the increase in the statutory eligibility age may not be the only possible explanation for the increase in employment we observe at age 60, between the control and treatment group. In addition to a potential horizon effect of the increase in the normal retirement age, the increase in the full rate duration  $D_{FR}$  also goes in the same direction. So far, we are not able to disentangle between the different potential channels. We come back to this issue of interpretation when estimating the effect on different sub-population according to work duration, in the next subsection.

## B Heterogenous effects

Here, we try to exhibit the underlying mechanisms of the employment and substitution effects of the increase in the statutory eligibility age, by estimating our main model on different subgroups. The rationale for the heterogeneity of the effect is the following: we expect the

effect of the increase in SEA from 60 to 61 to be more important for categories who would have retired at 60 in the absence of reform. For example, a worker who planned to retire at 65 shall not be impacted by the reform we evaluate. We then focus on groups that are likely to retire at the statutory eligibility age: health-constrained individuals, workers who are already eligible for a full rate pension from the SEA, and workers who are still employed at age 55. Results of this heterogeneity analysis are presented in Table 9.

Following our previous analysis on transition, we expect the employment effects to be more important for individuals who are still employed at 55 and may be relatively more able to extend their working life. By contrast, individuals with poor health could be less reactive as they could be physically prevented from working one additional year. We define an individual with a bad health status as a person who has between 1 and 4 trimesters validated as sick between 40 and 55 years old. An individual is said to be in very bad health if she has validated more than 4 trimesters for sickness.<sup>12</sup> Consistently with what we expected, a very large fraction of these subgroups would have retired at 60, as shown by the very large share of retirees at 60 in the control group, and by the very large point estimate on the retirement outcome. However, for persons with very bad health, employment increases only by 8 pp, amounting to less than 13% of the decrease in retirement, suggesting large substitution effect for this group.

Lastly, we split our sample between individuals who have already reached their full rate duration  $D_{FR}$  at age 60 ( $D_{60} \geq D_{FR}$ ), and those who have not ( $D_{60} < D_{FR}$ ). We expect the effects to be more important for the former group. Intuitively, the effect of the increase in the SEA is likely to be more binding for individuals who are eligible for the full rate, as they would have been more willing to retire at 60 without the reform. For this population, a full rate seeking retirement behavior will indeed predict a concentration of pension claiming exactly at the statutory eligibility age, and a translation of this concentration with the increase in this age parameter.<sup>13</sup> For individuals reaching their full rate beyond 61, a full rate seeking behavior will predict no effect of the reform we evaluate. In accordance with those assumptions, we find much bigger impacts of the 2010 reform for the group with relatively high work duration,

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<sup>12</sup>Recall that at least 60 days of sickleaves over a year are required to validate 1 trimester

<sup>13</sup>The literature suggests that this kind of behavior is likely to be widespread for the population of interest. This bunching at full rate may have different complementary explanations, financial incentives of the pension system and norms effect being the main ones (Lumsdaine et al. (1996)).

with a 69pp decrease in the proportion of retirees at age 60. They drive most of the observed employment effect, but we also have important substitution effects.

Table 9: Heterogeneous effects of the reform

	<b>Dependent variables</b>					
	Employment	Unemployment	Sickness	Disability	Inactivity	Retirement
Reference	0.193*** (0.008)	0.141*** (0.006)	0.017*** (0.003)	0.064*** (0.003)	0.064*** (0.005)	-0.478*** (0.004)
Pre-reform mean	.286	.064	.01	.001	.113	.527
<b>Health Status</b>						
<i>Bad Health</i>	0.183*** (0.025)	0.189*** (0.021)	0.028** (0.011)	0.074*** (0.009)	0.057*** (0.017)	-0.531*** (0.012)
Pre-reform mean	.18	.08	.015	.004	.111	.61
<i>Very bad health</i>	0.084*** (0.022)	0.171*** (0.017)	0.023 (0.016)	0.342*** (0.017)	0.036** (0.015)	-0.657*** (0.010)
Pre-reform mean	.083	.028	.015	.001	.139	.734
<b>Duration</b>						
<i>High Duration</i>	0.287*** (0.010)	0.243*** (0.008)	0.022*** (0.004)	0.094*** (0.005)	0.045*** (0.004)	-0.691*** (0.004)
Pre-reform mean	.197	.018	.007	.001	.017	.761
<i>Low Duration</i>	0.047*** (0.012)	0.033*** (0.008)	0.010** (0.004)	0.039*** (0.003)	0.070*** (0.010)	-0.199*** (0.005)
Pre-reform mean	.395	.12	.014	.001	.23	.24
<b>At 55 years old</b>						
<i>Employed</i>	0.257*** (0.008)	0.122*** (0.005)	0.020*** (0.003)	0.023*** (0.001)	0.035*** (0.004)	-0.458*** (0.005)
Pre-reform mean	.368	.06	.012	.001	.05	.508

SOURCE: *Cnav* 1/20<sup>th</sup> sample.

NOTES: This table displays the estimate of the effect of  $SEA_{gen}$  for different populations (in lines) and different outcome variables (in columns). All specifications include controls (gender, country of birth, average earning before 50, number of trimesters worked before 50 and number of trimesters contributed before 50), and use a proxy specification for the year dummies. Reported pre-reform means are for individuals of cohorts 1950-1951 at age 60.

READING: Standard errors in parentheses. Significance level: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

Note that the estimated of the reform is not only weaker for the  $D_{60} < D_{FR}$  group, it is also potentially biased. It is weak because by focusing on individuals with relatively low career duration, we restrict our sample to individuals who reach their full rate at older ages. It implies in return that an increase in the statutory eligibility age has a smaller impact, since an important proportion of this population would have retired beyond the new statutory eligibility age without the reform. It may also be biased because the effect we measure can be the sum of different mechanisms. In addition to the increase in the statutory eligibility age, the (small)

increase in employment we observe can be attributed to the increase in the full rate duration  $D_{FR}$ .<sup>14</sup> This population includes individuals who reach their full rate between the early and normal retirement ages, which have been identified by Bozio (2008) as very elastic to the increase in  $D_{FR}$ . Part of the effect could also be attributed to a distance to retirement effect, related to the increase in the normal retirement age, which can be the reference age for some individuals of this group. Overall, it implies that we are estimating a pure causal effect of the increase in the SEA only for the sub-sample of individuals who have reached their full rate duration at age 60.

### C A fiscal assessment of the reform

A global fiscal assessment of the reform of the increase in the statutory early retirement cannot be limited to its effect on the pension system. As previously underlined, strong substitution effect can occur if some individuals, who would have retired at 60 absent the reform, do not work longer but rather fall back on alternative insurance schemes. Following Staubli and Zweimuller (2013), we can try to quantify how much those substitution effects counterbalance the fiscal gains from the reform. The overall fiscal effect depends on two main components: (i) the labor market effects, that is the effect of the reform on the proportions of individuals in employment, retirement, unemployment, sickness leaves or disability<sup>15</sup> and (ii) the taxes and benefits system, determining the fiscal gains from contribution on earnings and the relative generosity of the insurance schemes. Our objective is to compute as precisely as possible the fiscal impact of the labor market impacts of the reform we previously estimated. To do so, we compute as closely as possible the different benefits associated to periods spent in the disability insurance (DI), sickness insurance (SI) and unemployment insurance (UI) schemes.

We proceed as follows. For each individual, at each point in time, we need to assign a yearly income. For working individuals, it simply corresponds to the observed earnings. Similarly, it is equal to the amount of pension benefits for retirees. Things are less straightforward for other labor market states, as we do not have any information on income. We assign the

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<sup>14</sup> $D_{FR}$  increases by one trimester for every cohort between 1950 and 1954.

<sup>15</sup>We disregard the potential impact of the latter (benefits generosity) and the latter (substitution effects toward alternative schemes).

income variable as follows, trying to reproduce the main rules for benefits computation in each insurance scheme. For unemployed workers, we compute the amount of benefit according to the last earnings recorded in the data base (at most three years ago). For individual in sickness leave or disability, we compute earnings by assigning a replacement rate of 50% for disability and 50% for sickness leave to the last observed earnings. We attribute to all individuals without any labor market status the national basic income (around 500€ per month). We set the social security contribution rate on gross earnings at 65%. For retirement pensions, we attribute the total amount that is to say, the social security pension and the complementary second pillar for almost all retirees in our sample.

The first order effect of the reform is a decrease in spending through (i) the reduction in retirement pension benefits for individuals who postpone retirement and (ii) the increase in fiscal revenue stemming from the additional social security contributions for individuals working an additional year. This reduction in spending is partly offset by the additional spending from other schemes for individuals who do not work.<sup>16</sup>

We proceed as follows: we estimate the DD equations as before, using the different sources of income as dependent variables instead of the work state. It corresponds to the state dummies used in the previous estimations, multiplied by the relevant corresponding income. The average fiscal impact is given by the the additional taxes levied minus the additional benefits paid, which can be approximated by  $(1) - ((2) + (3) + (4) + (5) + (6))$  in Table 10. The average annual fiscal gain from the reform is then 9632 euros per capita. We can also compute the relative size of the counterbalancing effect, comparing the additional spending from other schemes  $((3) + (4) + (5) + (6))$  to the the total surplus generated  $((1) - (2))$ . We then find that it corresponds to roughly 20%. In other words, for 100€ gained from the reform (from additional contributions and saved retirement benefits), 20€ are spent from other social insurance schemes. This confirms that the reform cannot be evaluated solely on the basis of its effects on the pension system.

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<sup>16</sup>Third order effects of additional years of work on the level of pension could also be considered, but would have a very marginal impact.

Table 10: Fiscal effect of the reform

VARIABLES	Employment	Unemployment	Sickness	Disability	Inactivity	Retirement
Under SEA	3,153*** (281.936)	1,048*** (84.758)	160*** (28.616)	667*** (31.668)	419*** (38.135)	-8,772*** (94.938)

SOURCE: *Cnav* 1/20<sup>th</sup> sample.

NOTES: This table displays the estimate of the effect of  $SEA_{gen}$  on income variables, depending on the source of income. All specifications include controls (gender, country of birth, average earning before 50, number of trimesters worked before 50 and number of trimesters contributed before 50), and use a proxy specification for the year dummies. Reported pre-reform means are for individuals of cohorts 1950-1951 at age 60.

READING: Standard errors in parentheses. Significance level: \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$

## 7 Conclusion

In this paper, we studied the effect of an increase in the statutory eligibility age. We find important employment effects of such a reform, but also non negligible substitution effects toward other insurance schemes.

The analysis of the effect of the 2010 reform showed that increasing the statutory eligibility age is logically not efficient for individuals that are already at the margin of the labor force. Very few non-employed individuals do come back to employment. As a result increasing the statutory eligibility age only amounts to extending the length of the bridge between work and retirement for this population. This may still generate some overall spending reduction, as retirement benefits are on average higher than their counterparts in other insurance schemes. The welfare loss for individuals that are maintained additional years in potentially difficult situation, should however be weighted against this reduction in spending. On the other hand, both reforms have shown that increasing the statutory eligibility age is a very efficient way of delaying withdrawal from the labor force for individuals that are still in employment.

The main results of this article can thus be summarized as follows: increasing the statutory eligibility age is very efficient for individuals that are already employed, and not efficient at all for those already withdrawn from the labor force. Two immediate remarks could mitigate this conclusion. First of all, the horizon effect theory predicts that the increase in the statutory eligibility age would have also an impact on individuals with an early exit from the labor force. Even if we do not find any significant effect of this kind, it may be stronger in the long run. Secondly, we find evidence of substitution from work to alternative schemes such as sickness, disability or unemployment. It suggests that some individuals who have a strong disutility for continued work, for example due to health conditions, may not be able to stay in employment when the statutory eligibility age increases. In all likelihood, this kind of phenomenon will be more frequent as individuals age, so that any further increase in the statutory eligibility age could be less efficient, even for employed workers.

# Appendix

## A Choice of a yearly workstate

As the dataset provides with the number of trimesters validated in each state (between work in the private sector, work in other sectors, unemployment, sickness, disability, inactive or retired), we need to set a rule for the attribution of a yearly work status. Several methods are possible. In this appendix, we briefly discuss the pros and cons of each ones. Given the information available in our dataset, there are seven possible states on the labor market: work in the private sector, work in other sectors (with the hypothesis that all periods validated are worked), unemployment, sickness, disability, inactive or retired. Here, are the possible methods for the imputation of a work state:

- (i) Hierarchically order the different states and attribute the main state accordingly. Following the order decided upon, the first state with at least of trimester is set as the main state.
- (ii) Choose the state with the highest number of validated trimesters, and hierarchical order in case of equality)
- (iii) Choose the state with the highest number of validated trimesters (and hierarchical order in case of equality), with additional correction for duration spent in the state when information is available.
- (iv) Defining non-exclusive workstate, using the number of trimesters validated as explained variable. It implies that there is not necessarily one workstate defined for a given year.

Figure [A.1](#) presents the sensitivity of the working status to the adopted definition. We use those four different definitions: a pure hierarchical order (one trimester in the state is enough to attribute it, with the following order: employment, unemployment, sickness, disability, retired and inactive), an imputation based on the number of trimesters (with the same ordering when there is a draw) and the same method with an additional correction for the states for which we have duration-related information (the date of retirement, and the fact that unemployment and sickness periods correspond to a minimum number of days spent in the state make it possible

to assume that the state amounts to at least half of the year). It appears that imputing a state of work as soon as a trimester of work is validated leads to a relatively higher proportion of active *vs.* retired individuals. Many individuals do validate one or two trimesters the year they retire, which tend to give too much weight to employment in the ages of transition from work to retirement.

In the core of the paper, we assign the yearly workstate according to the more accurate definition, which is based on the number of trimesters with the additional correction on duration-related spells. This definition is used for the dependent variables of our estimations. Table A.1 presents the results of our main specification for the different possible definitions of the workstate. Reassuringly, estimates for the alternative definitions (main state, order and non exclusive) are consistent with our main specification.

Figure A.1: Sensitivity to the workstate definition: workstate at 60

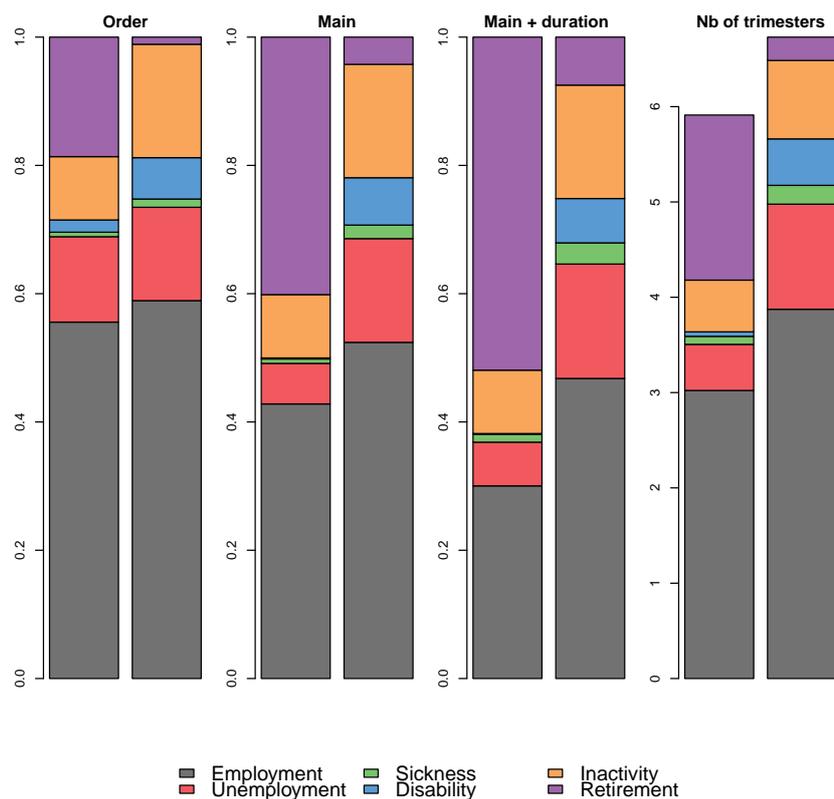


Table A.1: Sensitivity to the workstate definition: estimation results

	<b>Dependent variables</b>					
	Employment	Unemployment	Sickness	Disability	Inactivity	Retirement
<b>Main state + duration</b>						
Under SEA	0.193*** (0.008)	0.141*** (0.006)	0.017*** (0.003)	0.064*** (0.003)	0.064*** (0.005)	-0.478*** (0.004)
prereform	.286	.064	.01	.001	.113	.527
<b>Main state</b>						
Under SEA	0.206*** (0.008)	0.132*** (0.005)	0.010*** (0.002)	0.067*** (0.003)	0.052*** (0.005)	-0.468*** (0.004)
prereform	.307	.06	.006	.001	.098	.528
<b>Order</b>						
Under SEA	0.224*** (0.007)	0.127*** (0.005)	0.007*** (0.002)	0.058*** (0.003)	0.052*** (0.005)	-0.468*** (0.004)
prereform	.319	.051	.003	.001	.098	.528
<b>Non exclusive</b>						
Under SEA	0.846*** (0.064)	0.703*** (0.037)	0.068*** (0.015)	0.364*** (0.015)	0.195*** (0.021)	-1.448*** (0.014)
prereform	2.767	.495	.083	.042	.538	1.744

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

SOURCE: *Cnav* 1/20<sup>th</sup> sample.

## B Complementary results

Table B.1: Effect of  $SEA_{gen}$  on employment rates

VARIABLES	(1)	(2)	(3)	(4)	(5)
age = 51	-0.017*** (0.004)	-0.018*** (0.004)	-0.016** (0.008)	-0.016** (0.008)	-0.018*** (0.004)
age = 52	-0.034*** (0.004)	-0.037*** (0.004)	-0.033** (0.015)	-0.033** (0.015)	-0.035*** (0.004)
age = 53	-0.054*** (0.004)	-0.058*** (0.004)	-0.055** (0.023)	-0.055** (0.023)	-0.055*** (0.004)
age = 54	-0.072*** (0.004)	-0.076*** (0.004)	-0.079*** (0.030)	-0.079*** (0.030)	-0.072*** (0.004)
age = 55	-0.086*** (0.004)	-0.091*** (0.004)	-0.106*** (0.038)	-0.106*** (0.038)	-0.089*** (0.004)
age = 56	-0.112*** (0.004)	-0.118*** (0.004)	-0.147*** (0.046)	-0.147*** (0.046)	-0.117*** (0.004)
age = 57	-0.149*** (0.004)	-0.156*** (0.004)	-0.201*** (0.053)	-0.201*** (0.053)	-0.155*** (0.004)
age = 58	-0.193*** (0.004)	-0.200*** (0.004)	-0.256*** (0.061)	-0.256*** (0.061)	-0.198*** (0.005)
age = 59	-0.232*** (0.004)	-0.239*** (0.004)	-0.307*** (0.069)	-0.307*** (0.069)	-0.234*** (0.005)
age = 60	-0.287*** (0.006)	-0.292*** (0.006)	-0.383*** (0.076)	-0.383*** (0.076)	-0.284*** (0.007)
age = 61	-0.330*** (0.008)	-0.334*** (0.008)	-0.454*** (0.084)	-0.454*** (0.084)	-0.324*** (0.009)
age = 62	-0.383*** (0.008)	-0.387*** (0.008)	-0.533*** (0.092)	-0.533*** (0.092)	-0.375*** (0.009)
generation = 1951	0.015*** (0.002)	0.012*** (0.002)	0.003 (0.008)	0.003 (0.008)	0.012*** (0.002)
generation = 1952	0.007*** (0.002)	0.009*** (0.002)	-0.011 (0.015)	-0.011 (0.015)	0.010*** (0.003)
generation = 1953	0.009*** (0.002)	0.007*** (0.002)	-0.026 (0.023)	-0.026 (0.023)	0.009*** (0.003)
Year = 2002			0.001 (0.011)	0.001 (0.011)	
Year = 2003			-0.005 (0.018)	-0.005 (0.018)	
Year = 2004			-0.007 (0.026)	-0.007 (0.026)	
Year = 2005			-0.007 (0.033)	-0.007 (0.033)	
Year = 2006			0.002 (0.041)	0.002 (0.041)	
Year = 2007			0.024 (0.049)	0.024 (0.049)	
Year = 2008			0.046 (0.056)	0.046 (0.056)	
Year = 2009			0.048 (0.064)	0.048 (0.064)	
Year = 2010			0.061 (0.072)	0.061 (0.072)	
Year = 2011			0.069 (0.079)	0.069 (0.079)	
Year = 2012			0.095 (0.087)	0.095 (0.087)	
Year = 2013			0.108 (0.095)	0.108 (0.095)	
Year = 2014			0.160 (0.102)	0.160 (0.102)	
Year = 2015			0.172 (0.110)	0.172 (0.110)	
Under SEA	0.199*** (0.006)	0.207*** (0.006)	0.193*** (0.008)	0.193*** (0.008)	0.208*** (0.006)
Man		-0.057*** (0.002)	-0.057*** (0.002)	-0.057*** (0.002)	-0.057*** (0.002)
Born in Fr.		-0.004* (0.002)	-0.004* (0.002)	-0.004* (0.002)	-0.004* (0.002)
Av. wage bef.50		0.142*** (0.001)	0.142*** (0.001)	0.142*** (0.001)	0.142*** (0.001)
Years validated bef.50		-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)	-0.002*** (0.000)
rate unemployment					-0.008*** (0.003)
GDP					-0.001 (0.001)
Constant	0.565*** (0.007)	0.453*** (0.008)	0.482*** (0.011)	0.482*** (0.011)	0.496*** (0.016)
Observations	282,503	277,030	277,030	277,030	277,030
R-squared	0.147	0.188	0.188	0.188	0.188
Time effect	None	None	Mason	Deaton	Proxy

Standard errors in parentheses  
 \*\*\* p<0.01, \*\* p<0.05, \* p<0.1

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