French Retirement Reforms and Intragenerational Equity in Retirement Duration

Patrick Aubert (CREST-DREES), Cindy Duc (DREES) and Bruno Ducoudré (DREES) [1]

Preliminary draft – do not cite, quote or circulate

May 2011

Abstract:

The French retirement reform of 1983 has created a particular framework where the age at which an individual can retire and receive a full-rate pension is conditional to both a legal minimum age and a required insurance duration. This framework may be seen as a way to compensate inequalities as regards retirement duration by allowing low-life expectancy workers to retire earlier. Indeed, life expectancy increases with education and the level of earnings. Low-educated workers, who entered the labor market earlier than high-educated workers, may reach the required insurance duration, and thus retire, earlier. However, the extent with which the framework of the pension system may allow compensating inequalities might have changed due to the 1993, 2003 and 2010 reforms, which modified either the insurance duration or the minimum age criteria.

In this paper, we address empirically the extent of redistribution as regards retirement duration across social groups using a singular modeling of professional career and retirement decision based on a large administrative datasets: the so-called PROMESS model. We show that increasing the required duration criterion as was done by the 1993 and 2003 reforms seems to have redistributive impact, as far as retirement duration is concerned. For instance, theses two reforms increase the average retirement age in 2030 by 17 months for male workers in the higher wage quartile, but by 11 months only for male workers in the lower wage quartile.

Key words: retirement behavior, pensions, microsimulation

JEL code: H55, J26

[1] DREES, sous-direction Observation de la solidarité, bureau Retraites.
Contact : patrick.aubert@sante.gouv.fr;
cindy.duc@sante.gouv.fr; bruno.ducoudre@sante.gouv.fr

Introduction

Compared with other OECD countries, the French retirement reforms (1983, 1993, 2003 and 2010) have created a particular legislative framework where the age at which an individual can go into retirement and receive a full-rate pension is conditional to both a legal minimum age and a required insurance duration.

The insurance criterion may have a redistributive impact relatively to the retirement duration or to the ratio between the time passed in retirement and the time passed on the labor market. Indeed, since Low-educated workers usually leave the education system earlier than high-educated workers, they should enter the labor market earlier, and thus they may reach the required insurance duration sooner, which in the end should lead them to retire earlier. Hence the French framework may be a way to address inequalities stemming from differential mortality, *i.e.* the fact that high-income people usually take profit from the pension system thanks to their higher life expectancy.

However several empirical issues remain. First, is the redistribution theoretical argument really funded, i.e. do the required duration criterion really enables low-skill workers to retire earlier? The question behind is the empirics of the alleged correlations between the level of earnings and the age at entering the labor market, and between the latter and the number of quarters that have been validated before age 60. Second, does redistribution hold within all generations? Third, how has it evolved over time and how has it been changed by reforms?

Age at entering the labor market and unemployment rates have varied a lot among cohorts. Moreover the French retirement reforms have modified one or both of the minimum age and required duration parameters. These changes must be taken into account in order to address the three previous questions. We attempt to do so in this paper using a singular modeling of professional career and retirement decision based on a large administrative dataset: the so-called PROMESS model.

We show that increasing the required duration criterion as was done by the 1993 and 2003 reforms seems to have redistributive impact, as far as retirement duration is concerned. For instance, theses two reforms increase the average retirement age in 2030 by 17 months for male workers in the higher wage quartile, but by 11 months only for male workers in the lower e309quartele,

■ Life Expectancy and Inequalities in Retirement Duration: a Brief Review

Intragenerational inequalities as regards life expectancy across social groups can be important. Social differences of life expectancy in France have been estimated using different data sources (see table 1). They show that managers face a longer life expectancy compared with blue collars -scheme samples (*échantillon interrégimes de retraités* EIR) of 1993, 1997, 2001 and 2004, Aubert and Christel-Andrieux find that at age 55, male managers live on average 3.7 years longer than male blue collars. The gap is 2.8 years for women. This result confirms that of Mesrine *& alii* (2000) using the Ined Mortality Sample of 1982, Cambois and Robine (2001) using Insee decadal surveys and longitudinal surveys of health mortality and Desplanques (1993) using Census and Marital Status data[2] on life expectancy gaps at age 60. The extent of the life expectancy gap varies across studies, but it is never lower than 3 years for men. Comparing education groups rather than social groups, Aubert and Christel Andrieux also find that high-skilled people live longer than low-skilled people. The gap in life expectancy at age 55 between higher education retirees and non-graduate retirees is about more than 4 years for men and 2 years for women.

Table 1. Summary of recent estimations of the life expectancy gap across social groups in France

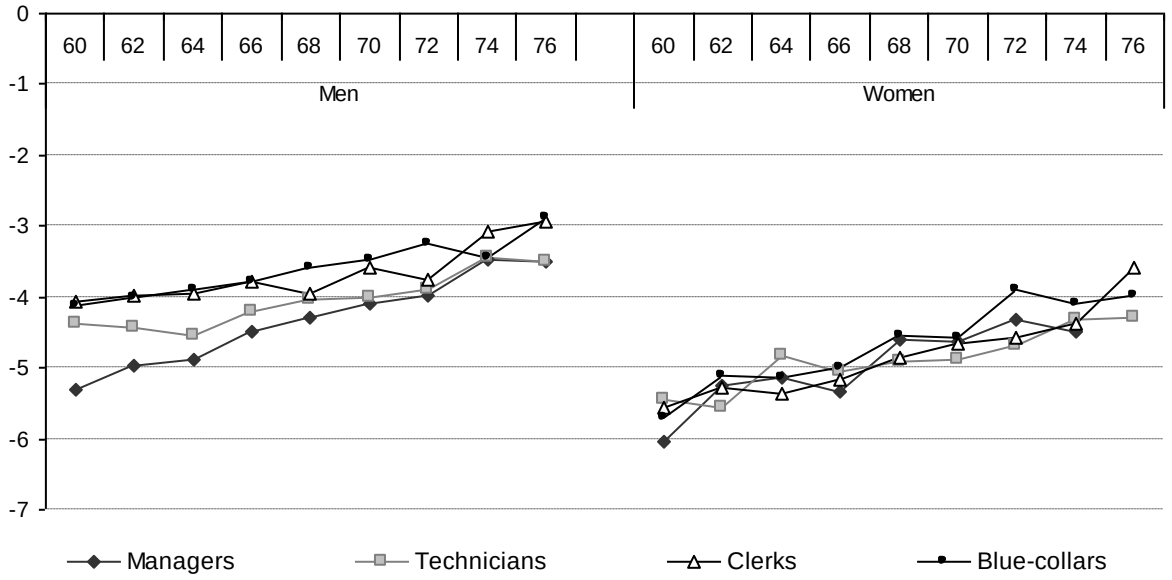
Author	Cambois, Laborde & Robine, 2008	Aubert & Christel Andrieux, 2010	Mesrine, 1999	Cambois & Robine, 2001	Desplanques, 1993
Gap	Managers / blue-collar workers: +6 years for men +2 years for women	Managers / blue-collar workers: +3.7 years for men +2.8 years for women	Managers and liberal professions /blue-collar workers: +5.5 years for men +3.5 years for women	Managers / blue-collar workers: +3.1 years	Teachers, professors of literature and science / body repairmen: +3.8 years for men
Life expectancy	At age 35, 1999-2003 period	At age 55	At age 60, 1982-1996 period	At age 60, in 1991	At age 60, 1980-1989 period
Source	Permanent demographic sample (EDP)	Pensioners' Inter-scheme samples (EIR) of 1993, 1997, 2001 and 2004	Mortality sample of 1982	Insee, decadal surveys and longitudinal surveys of health mortality	Census / Marital Status

Using the EIR to look at death-rate gaps by age according to the social level, we see that managers clearly have a smaller death-rate than blue-collars workers at all ages until the age of 72 (see chart 1). It is less clear for women, but most of the time, the death-rate curve for female managers is under that of female blue-collar workers. The result is also striking for men when we look at death rate curves according to pension deciles. At all ages, retirees in the upper deciles of pension have a death-rate curve that is always below that of retirees in the lower deciles of pension (see chart 2). On the opposite, differences in death-rate are much smaller for women.

[2] See also Cambois & Robin (2008) for life expectancy gap measures at age 35.

Chart 1. Death-rate gaps according to social category

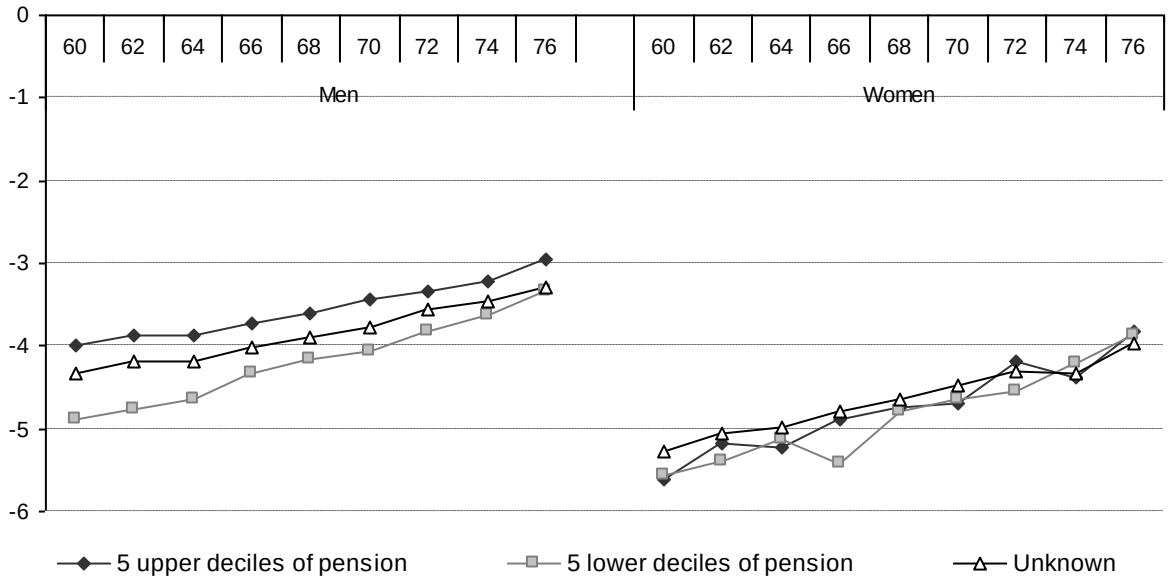
Log(-log(death-rate))



-scheme samples

Chart 2. Death-rate gaps according to pension level

Log(-log(death-rate))



Inter-scheme sample

The French Pension System

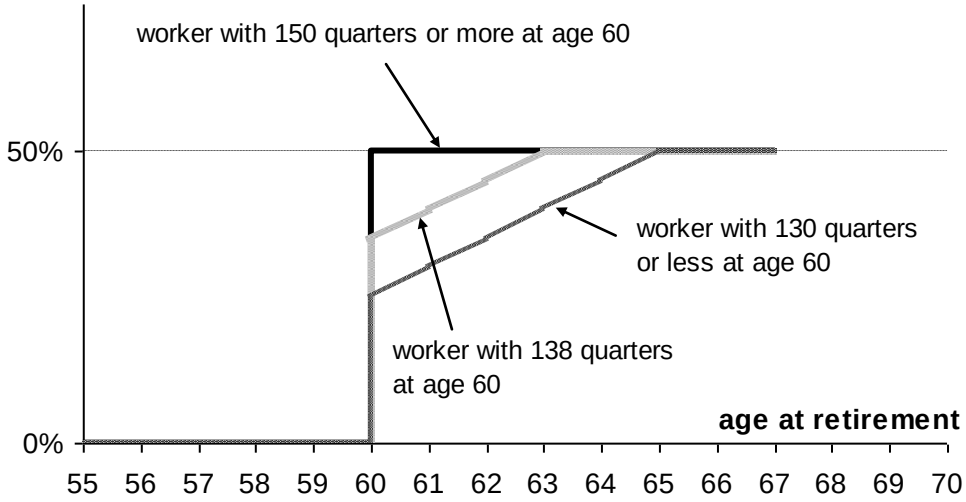
The 1983 pension system reform has provided France with a unique framework, in which the reference age for going into retirement depends on both age and the duration of career. More precisely, retirement with a full-rate pension is possible starting age 60, provided you have validated a sufficient number of quarters during your career[3]. For workers with a too small

[3] Retirement at full-rate at age 60 is also possible for disabled people.

number of quarters at age 60, retirement at full-rate becomes possible at any age between 60 and 65 as soon as the worker fulfills the required number of quarters criterion. Below that age, a cut in the amount of pension is applied, which depends on the missing number of quarters to the required duration or to age 65. In all cases, retirement at full-rate is possible at age 65 and higher (chart 3) [4].

Chart 3. Amount of pension, as a percentage of a worker's reference wage, after the 1983 reform

Required number of quarters = 150



Note: workers are assumed to be working up to their retirement age

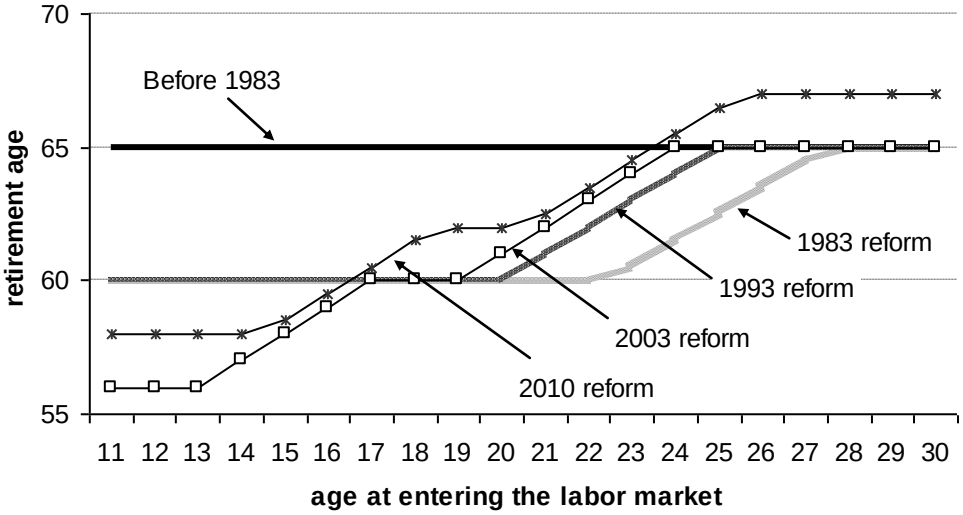
This framework was initially implemented as a way to enable workers with a long duration of career to retire at age 60, while not increasing too much the burden of expenses by allowing *all* workers to retire at that age. Though it was not explicitly devised as a redistribution tool at the beginning, the framework can also be seen as a way to address inequalities in life expectancy. This goal could be achieved thanks to the correlation between age at entering the labor market and life expectancy. Indeed, high life expectancy retirees are higher-educated individuals, who entered the labor market lately due to the length of their primary education. On the opposite, blue-collars workers usually have lower education, and thus should have entered the labor market younger. Since an earlier entry into the labor market implies longer duration of career before age 60, lower life expectancy workers may reach the required duration criterion earlier and thus, thanks to the framework of the pension system, retire earlier[5].

[4] Of course, workers can go into retirement at another age than the earliest age at which they can get a full-rate pension. However, since we are dealing with a normative issue, we believe that it is relevant to focus on the reference ages of retirement among workers, rather than on effective ages of retirement. Whenever a worker retires earlier than his own reference age, the deviation is penalized by a cut in the amount of pension. Moreover, most workers do actually retire at the age when they can get full-rate pension, though this has seemed to become less and less true in recent years.

[5] At the same time, the disabled people, who also have lower life expectancy, can also retire earlier thanks to the fact that they are allowed a full rate pension at age 60, regardless of the number of quarters they have validated.

The extent of redistribution depends on the values of the parameters of the pension system (required duration, minimal age, age of full-rate) and on the distribution of age at entering the labor market. The initial parameters after the 1983 reform were 150 quarters (37.5 years) for the required duration, 60 for minimal age and 65 for age of full-rate. Since people born in the even high-education ones usually entered the labor market before age 22.5, this implied low potential redistribution. The extent of redistribution may have increased and after, due to the increase in the duration of primary education. The 1993 and 2003 reforms also increased the potential redistribution by increasing the required duration[6]. Under the new value for the criterion, a larger share of the population falls into the bracket where the earliest retirement age with full-rate pension increases in age at entering the labor market (chart 4). The 2003 reform moreover decreased the minimum age for workers who entered the labor market before age 17 (under an additional, more binding required duration criterion).

Chart 4. Earliest retirement age with full-rate pension for non-disabled workers



Note: workers are assumed to be working continuously from their age at entering the labor market up to their retirement age. The required number of quarters is 150 for the 1983 reform, 160 for the 1993 reform, 164 for the 2003 reform (or 172 for retirement before age 60) and 166 for the 2010 reform (or 174 for retirement before age 62).

Nonetheless, the theoretical redistribution-increasing framework of the French pension system heavily relies on the assumption that the number of quarters validated before age 60 is strongly correlated with age at entering the labor market. In other words, workers are supposed to be continuously working or validating quarters from the time they enter the labor market up to their old age, without any interruption. The rationale for this assumption is that the pension system enables workers to validate some quarters in a fairly large amount of non-employment situations: unemployment while receiving unemployment insurance benefits, long-term illness, maternity leave, education of younger children (before age 3), etc. However, stylized facts show that this might not have been sufficient. Indeed, descriptive statistics show that a fairly large share of workers do not continuously validate all quarters at arly

[6] The increase is performed step by step, thus the required duration is distinct across generations.

Baraton and Croguennec, 2009). Moreover, most young workers fail to validate all quarters starting from their first entry on the labor market. The number of years between the first validation of a quarter and the first time a worker validates 4 quarters within a single year is greater than 2 for more than 20% of

for those born in 1970 (Rapoport, 2009).

Since non-employment spells during the career and thus failures to validate quarters arise more frequently for less educated workers, the correlation between the age at entering the labor market and the number of quarters validated at age 60 might eventually be low. Moreover, due to the high unemployment rate among younger uneducated workers, the age at entering the labor market might itself be a poor indicator of social group or level of earnings, regardless of the age at leaving the education system. For instance, Rapoport (2009) shows that workers within the lowest deciles of wage at age 30 validated a first quarter on average 1.5 years *later* than the workers within intermediate deciles.

Such stylized facts cast doubt on the (theoretical) ability of the French pension system to reduce inequalities in retirement duration, and thus perform redistribution. Yet, given the complexity of the pension system characteristics, we can not conclude from mere non-quantitative comments. Moreover, the length and frequency of non-employment spells have evolved over time, as well as the parameters of the pension system, which may lead to different conclusions from one cohort to another. In the following parts, we try to address those issues by providing a quantitative analysis based on simulations using the PROMESS model.

PROMESS: the Model

PROMESS (MESO Projection of the Retirement System) is a cell-based projection model developed by the DREES[7] to prepare the 2010 reform of the French pension system[8]. It estimates probability distributions for the age at leaving the labor market, the age at last validating quarters for retirement and the age of retirement.

PROMESS takes into account the legislation applied to each generation as regards the required insurance duration for full-rate pension, the minimum legal age of retirement and the legal age of full-rate. The modeling permits to easily estimate consequences of reforms affecting one or several of these dimensions.

PROMESS deals with all retirement schemes and all generations: it covers the entire population born in France or abroad, without distinguishing people according to their pension scheme during their professional career (*e.g.* private sector wage earners, civil servant, non-wage earners, *etc.*). PROMESS model is called "meso" due to its cell-based framework. Cells are defined as categories of people defined by their generation, gender, country of birth (France / abroad), their insurance duration validated at age 54, their quartile level of wage and

[7] *Direction de la Recherche, de l'Évaluation, des Études et des Statistiques', i.e.* the statistics and economic studies unit of the French social affairs Ministry.
[8] See Aubert, Duc and Ducoudré, 2010 for a detailed presentation of PROMESS.

their pension scheme at retirement[9]. It therefore differs from a "macro" model due to the large number of cells (several thousands for each cohort). It also differs from a "micro" model since it aggregates in homogeneous categories all individuals whose characteristics relevant to retirement behavior are similar. Moreover, PROMESS differs from a simulation model (or "mesosimulation") in that it is not intended to simulate a fixed age of retirement for each category of the model depending on a hazard. Instead, it models the entire probabilities distribution of age of retirement for each block. This modeling choice implies smoother results than those of most microsimulation models, as there is no noise associated with a random simulation here[10].
In the following parts, we focus on the private sector block of the modeling, *i.e*. on categories of individuals who terminated
scheme. They represent close to 80% of the whole population.

The Data

PROMESS is based on two statistical databases extracted in administrative files from almost all French pension schemes: the -scheme sample (*échantillon interrégimes de cotisants* EIC) and the -scheme sample (*échantillon interrégimes de retraités* EIR). EIC contains individual data on careers and entitlements regarding future pensions, especially data on insurance duration already validated[11] by individuals and their annual income (if they are in employment). EIR contains individual data on pensions for retirees. The two databases can be combined to trace the whole career of a retiree. The starting year is defined by the vintage of last EIC, that is, the 2005 EIC, which covers generations born from 1942 until 1974[12]. Only one out of 4 cohorts is included in the sample.

The model

The base component, or cell, of PROMESS is category *c* at age *a* (up to age 54) for generation (*i.e.* year of birth, *i.e.* cohort) *g*. Each category is compounded of individuals born

[9] That is the last pension scheme in which quarters have been validated before age 54, grouped into three categories that have different rules to compute pensions: Service and CNRACL), (SNCF, RATP, CNIEG, FSPOEIE, ENIM and CANSSM) (CNAV *i.e.* the general regime, covering the largest share of the population by far and MSA for wage-earners, and RSI, CNAVPL, CAVIMAC and CNBF for non-wage earners). We assume that individuals keep on the same pension scheme after 54 years old.

[10] It remains at least the hazard sampling: PROMESS parameters are based on statistical data of the 2004 EIR and the 2005 EIC, which are samples from the entire population of retirees and contributors.

[11] It contains quarters validated during employment spells, but also all quarters validated during some kind of non-employment spells (the so-
unemployment spells while receiving Unemployment Insurance benefits, illness interruption and maternity period with an allocation (AVPF), ...

[12] The EIC 2005 dataset also includes data for the 1934 and 1938 cohorts. However, due to quality issues for the earlier part of the career of those generations, they are not included in the scope of the PROMESS model. EIC for cohorts 1934 and 1938 will nonetheless be used to estimates probability of leaving the labor market and of going into retirement after age 54 (cf. infra).

in the same year and sharing the same characteristics, defined by cross-section of several variables:

- Sociodemographic variables: gender s_c and country of birth (France vs. Abroad) cb_c
- Variables summing up career until age a: insurance duration validated until age a: $NbQ_{c,a}$, quartile of median wage between age $a-4$ and age a: $w_{c,a}$ (with a specific value $w_{c,a}=5$ for individuals who have already left the labor market at theses ages), pension scheme to which the individual is affiliated at the end of his career (private, public or special): $sect_{c,a}$

$$c(g,a) = \left\{ individuals\ i \;\middle|\; \begin{array}{l} g(i) = g; \\ s(i) = s_c; \\ cb(i) = cb_c; \\ NbQ(i|age\ a) = NbQ_{c,a}; \\ w(i|age\ a) = w_{c,a}; \\ \sec t(i|age\ a) = \sec t_{c,a} \end{array} \right\}$$

An important input of the model is legislation ℓ that applies to individuals in category c. In the French pension system, legislation can only vary across some of the dimensions, namely generation g and pension scheme $sect_c$. The main legislation parameters are the required insurance duration *ReqNbQ*, the legal minimum age of retirement *MinAge*, and the legal age of full-rate (i.e. the age at which all individuals are entitled to a full-rate pension regardless of the fact that the required insurance duration is fulfilled or not) *LegAgeFR*.

$$\ell[c,g] = \ell[\sec t_c, g] = \{\mathrm{Re}\, qNbQ(c,g); MinAge(c,g); LegAgeFR(c,g)\} \quad \forall c,g$$

Note that *MinAge* nor *LegAgeFR* are not completely binding, since possibilities to retire before the legal minimum age or to be entitled a full-rate pension before the legal age of full-rate are offered to some subcategories of the population (*e.g.* disabled, individuals affiliated to some specific pension schemes, individuals with very long duration of career).

The main outputs of the model are the following:

- number of individuals within all categories c at age 54:

$$N_{c,g}(54) = \sum_i 1\{i \in c(g,54)\} \qquad \forall c,g$$

- number of individuals still in life at age a, for all age a above 54 and within all categories c at age 54:

$$N_{c,g}(a) = \sum_i 1\{i \in c(g,54)\} * \Pr(i\ not\ dead | a) \qquad \forall c,g;\ \forall a \geq 54$$

- probability that an individual i within category $c(54)$ has left the labor market before age a, for all quarterly age a above 54 and for all categories $c(54)$, under legislation ℓ:

$$P^e_{c,g}(a) = \Pr\left(Max\{a' | employment\ at\ age\ a'\} \leq a \;\middle|\; \begin{array}{l} c(g,54); \\ \ell[c(54),g] \end{array} \right) \qquad \forall c,g;\ \forall a \geq 54$$

- probability that an individual *i* within category *c(54)* has ended validating quarters before age *a*, for all quarterly age *a* above 54 and for all categories *c(54)*, under legislation ℓ :

$$P^{v}_{c,g}(a) = \Pr\left(Max\left\{a' \middle| validating\ quarters\ at\ age\ a'\right\} \le a \middle| \begin{matrix} c(g,54); \\ \ell\left[c(54), g\right] \end{matrix} \right) \qquad \forall c, g;\ \forall a \ge 54$$

- probability that an individual *i* within category *c(54)* has ***not yet*** retired at age *a*, for all quarterly age *a* above 54 and for all categories *c(54)*, under legislation ℓ :

$$P^{r}_{c,g}(a) = \Pr\left(Min\left\{a' \middle| retired\ at\ age\ a'\right\} > a \middle| \begin{matrix} c(g,54) \\ \ell\left[c(54), g\right] \end{matrix} \right) \qquad \forall c, g;\ \forall a \ge 54$$

Note that average probabilities over the whole population can be easily estimated by combining the $N_{c,g}(a)$ and $P_{c,g}(a)$ over all cells *c*.

In practice, the model results from the articulation of several independent steps. These steps depend on age: before 54 year old, the model estimates all $N_{c,g}(a)$, as individuals accumulate insurance duration and change quartile of wage and sector of activity. After age 54, probabilities $P_{c,g}(a)$ are estimated differently according to whether age is below or above the minimum legal retirement age.

Before 54 years old

For cohorts born after 1950, category at age 54 cannot be directly observed in the EIC data. Categories are only observed up to some age *a<54*: age 50 for the 1954 cohort, age 46 for the 1958 cohort, *etc.* This allows us to estimate $N_{c,1954}(50)$, $N_{c,1958}(46)$, *etc.* from simple descriptive statistics within the EIC.

EIC data also allows estimating transition probabilities between categories, *i.e.* probabilities of moving from one category to another with a four-year step until age 54. We use a four-year step because only one cohort among four is observed in EIC (cf. *supra*). Note that only three elements among those defining a category *c* may change: insurance duration validated *NbQ*, wage quartile *w* and/or sector *sect*.

$$\Pr_{c \to c',g}(a \to a+4) = \frac{\sum_i 1\left\{i \in c(g,a) \cap c'(g,a+4)\right\}}{\sum_i 1\left\{i \in c(g,a)\right\}} \qquad \forall c$$

To compute quadrennial transitions, we use the most recent generation available. For instance we use data for the cohort born in 1970 to compute transition probabilities between 30 and 34 year old, data for the cohort born in 1966 to compute transition probabilities between 34 and 38 year old and so on. This choice implies that all empirical probabilities correspond to transitions between 2000 and 2004. Implicitly, in PROMESS we assume that in projection, the labor market will keep the average characteristics of the period 2000-2004. The weight of all categories at age 54 for all generations can be projected by chaining the weight of each category at age *a* observed in EIC with transition probabilities between corresponding

categories on a four-year step. For instance, for the 1974 generation $N_{c,1974}(30)$ is observed in the EIC data. Then we have:

$$N_{c,1974}(34) = \sum_{c'} N_{c',1974}(30) * \Pr_{c' \to c,1970}(30 \to 34)$$

then

$$N_{c,1974}(38) = \sum_{c'} N_{c',1974}(34) * \Pr_{c' \to c,1966}(34 \to 38)$$

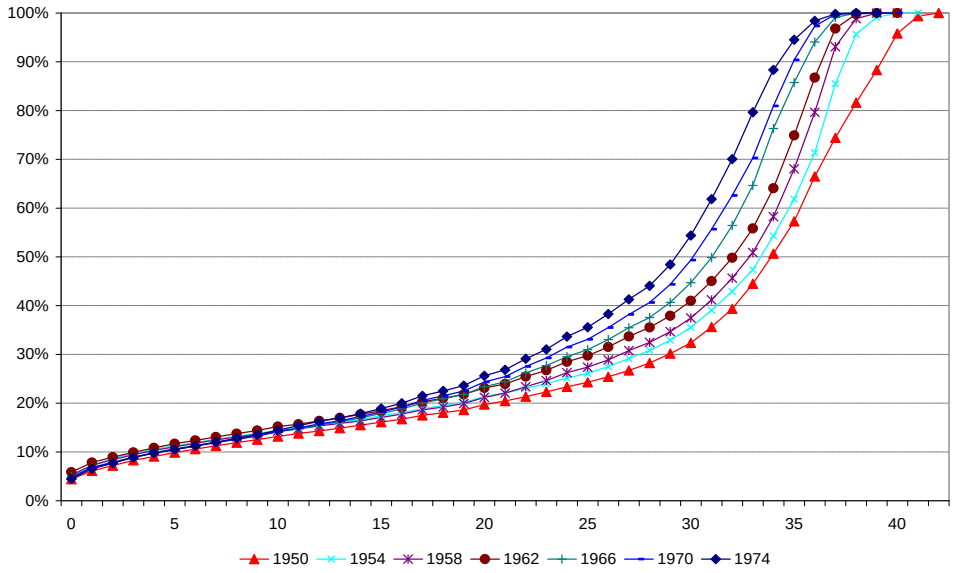
and so on.

We finally obtain, for all generations at age 54, population distributions according to categories defined by generation, gender, country of birth (France / abroad), insurance duration until that age, quartile wage level[13] and the last pension scheme affiliation.

The following charts represent distributions of insurance duration validated at age 54. For men, we project similar distributions from one cohort to another for short durations, but the weight of longest durations decrease in the same time. It comes from later entries on the labor market
schooling until age 16 for cohorts born after 1953. Among women, the same result occurs for longest durations validated at age 54. On the contrary, the weight of short durations is significantly decreasing for women compared with men, stemming from rising participation of women on the labor market. An important result of distributions by quartile is that, on average, the first quartile includes workers with shorter insurance duration validated at age 54 than other quartiles.

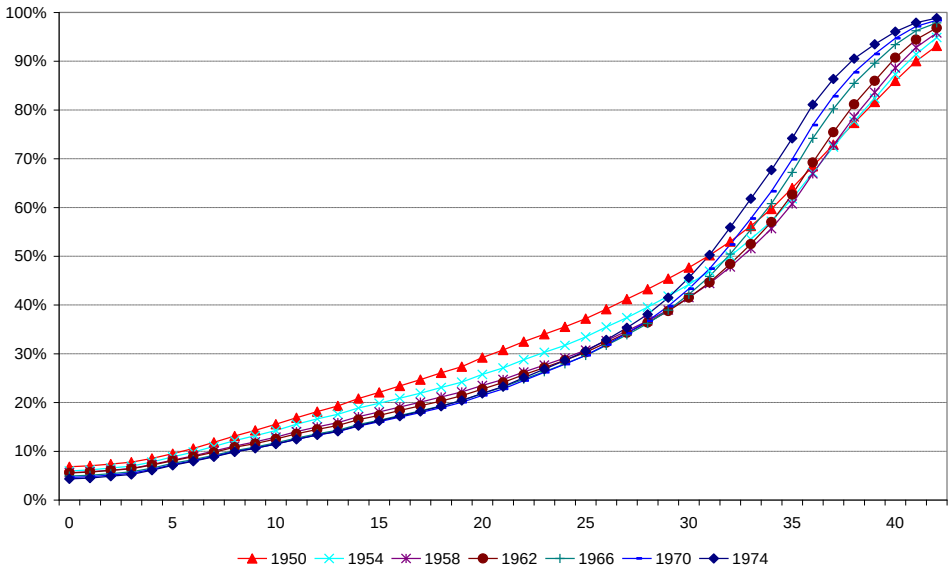
Chart 5. Projected distribution of insurance duration validated at age 54 by generation, in number of year

Men



[13] In fact, quartiles at age 54 are observed wage quartiles only for generation 1950. For younger generations, quartiles at age 54 result from transition matrices and should better be interpreted as indicators of income level, and not as statistical quartiles.

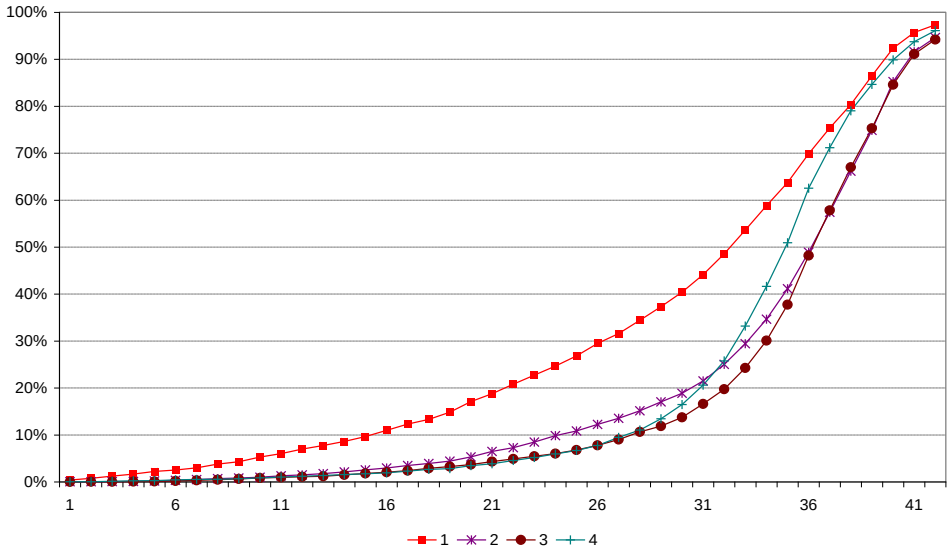
Women



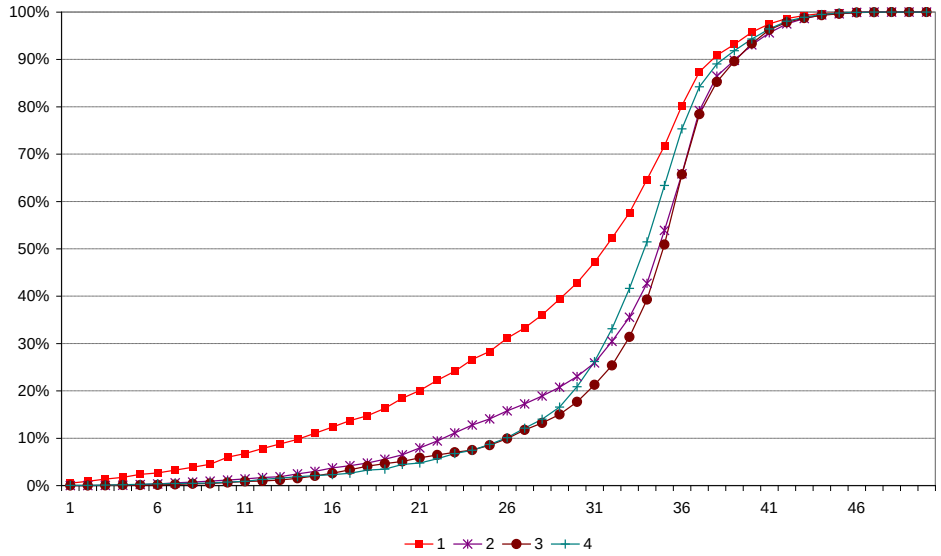
Source: PROMESS, Drees

Chart 6. Projected distribution of insurance duration validated at age 54 by quartile, in number of year

Generation born in 1950



Generation born in 1962



Source: PROMESS, Drees

Between 54 years old and the minimum legal age of retirement

In PROMESS, the age of 54 was selected as the threshold age from which we model the end of activity, that is, both the labor market leaving and the first retirement departure within the last pension scheme. This choice is based on the observation of employment rates by age. They remain roughly stable at a high level until the age of 54, and then begin to decline for men and women. This stylized fact corroborates the idea that it is mainly during the five years preceding the minimum legal age of retirement that the transition from employment to inactivity takes place.

For simplicity reason, we only present the method for the age of leaving the labor market. The method is similar for other ages (age at last validating quarters for retirement and age at retiring). We restrict here to private sector workers still in employment after age 50[14]. Thus we have $P^{e}_{c,g}(50)=1,\ \forall c,g$. We also consider that all transition between 50 and 54 occur at some arbitrary age (=52). For age a $(54 \le a \le MinAge(c,g))$, probabilities are computed as follows:

$$P_{c,g}(a) = P_{c,g}(52) * \prod_{a'=54}^{a} \Pr^{inst}_{c,g}(a')$$

where $\Pr^{inst}_{c,g}(a')$ are the instantaneous probabilities that a worker who is still in employment at age *a'* leaves the labor market at that age:

$$\Pr^{inst}_{c,g}(a') = \Pr\left(Max\left\{a'' \middle| employment\ at\ age\ a''\right\} = a' \middle| c,g\right)$$

They are estimated through a Logit regression on EIC and EIR data for the 1934, 1938 and 1942 cohorts. Separate estimations for all genders and ages are run. Explanatory variables are

[14] See Aubert, Duc and Ducoudré (2010) for a presentation of the model as regards civil servants and workers already out of the labor market before age 50.

dummies for all wage quartiles, plus a dummy $1\{NbQ_c(54) + 4*(a'-54) \geq \text{Re}\,qNbQ(c,g)\}$ which equals 1 when the required insurance duration is reached[15].

After the minimum legal age of retirement

Just before the minimum age of retirement (*i.e.* at age $MinAge^-$), individuals within a category *c* can be divided into 4 subgroups: $P^e_{c,g}(MinAge^-)$ of them are still in employment (subgroup *c1)*, $\left[P^v_{c,g}(MinAge^-) - P^e_{c,g}(MinAge^-)\right]$ have left the labor market but are still validating quarters[16] (*c2*), $\left[P^r_{c,g}(MinAge^-) - P^v_{c,g}(MinAge^-)\right]$ are no more validating quarters but not yet retired (*c3*), and $1 - P^r_{c,g}(MinAge^-)$ are already retired[17] (*c4*). Note that the model considers that retired people never work nor validate quarters, so inequality $P^r_{c,g}(MinAge^-) \geq P^v_{c,g}(MinAge^-) \geq P^e_{c,g}(MinAge^-)$ is always fulfilled.

For each subcategory and each age *a* such as $MinAge(c,g) \leq a \leq LegAgeFR(c,g)$, we estimate probability $\Pr\text{Re}\,tire^{ci}_{c,g}(a)$ that retirement occurs at age *a*. For individuals still in employment, we assume that they leave the labor market and stop validating quarters at the same age. Estimations are run using Logit on EIR and EIC data for generations 1934 and 1938. The specification for the estimations is very simple for individuals already outside of the labor market at the legal minimum age, since retirement mainly occurs at the minimum legal age *MinAge* or at the legal age for full-rate *LegAgeFR*. We therefore do not present them here.

A slightly richer specification is considered for workers who are still in employment when reaching the minimum age. In that case, the specification for the latent variables is as follows:

$$y^* = \sum_{a=MinAge(g,c)}^{LefAgeFR(g,c)+1} \sum_{w\in\{1,2,3,4\}} \left(\tilde{\alpha}.a + \alpha_0.1_{a=MinAge}(a) + \alpha_1.1_{MinAge<a<LegAgeFR}(a) + \alpha_2.1_{a=LegAgeFR}(a) + \alpha_3.1_{a>LegAgeFR}(a)\right).1_{w=w(c)}$$
$$+ \sum_{a=MinAge(g,c)}^{LefAgeFR(g,c)+1} \left(\tilde{\beta}.a + \beta_0.1_{a=MinAge}(a) + \beta_1.1_{MinAge<a<LegAgeFR}(a) + \beta_2.1_{a=LegAgeFR}(a) + \beta_3.1_{a>LegAgeFR}(a)\right).EQUAL(a)$$
$$+ \sum_{a=MinAge(g,c)}^{LefAgeFR(g,c)+1} \left(\gamma_0 + \tilde{\gamma}.a\right).PLUS1(a) + \sum_{a=MinAge(g,c)}^{LefAgeFR(g,c)+1} \left(\delta_0 + \tilde{\delta}.a\right).ABOVE(a)$$
$$+ \varepsilon$$

Explanatory variables are the following (estimations are run separately for men and women):

- age *a*

[15] Workers who are EMC /P 589(Ju)-6 /P 1ters

- dummies $1_{w=w(c)}$ for each wage quartile at age 54
- dummies $1_{a=MinAge}(a)$, $1_{MinAge<a<LegAgeFR}(a)$, $1_{a=LegAgeFR}(a)$, $1_{a>LegAgeFR}(a)$ equalling 1 respectively when *a* equals the minimal age, is strictly between the minimal age and the age of full-rate, equals the age of full-rate, or is above the age of full-rate.
- a dummy *EQUAL(a)*, equalling 1 at age *a* when the required insurance duration *ReqNbQ(g,c)* is reached at age *a* (strictly)
- a dummy *PLUS1(a)*, equalling 1 at age *a* when the required insurance duration *ReqNbQ(g,c)* is reached at age *a-1* (strictly)
- a dummy *ABOVE(a)*, equalling 1 at age *a* when the required insurance duration *ReqNbQ(g,c)* is reached before age *a-1*.

The peak probability of going into retirement occurs when individuals reach the required insurance duration, *i.e.* when *EQUAL(a)=1*. However, the model also takes into account that some individuals retire earlier or later than this age[18].

1993 and 2003 Reforms: some Results

We use the PROMESS model to assess the differential impact of 1993 and 2003 reforms on the projected ages of leaving the labor market and of retiring, by wage quartile and gender. In an ideal world, analyzing inequalities in retirement duration should imply estimating those ages as well as average age at death by wage quartile and gender. However, we have no means to compute the latter with PROMESS. Consequently, we focus here on average ages of labor market leaving and average ages of retirement only. Since life expectancy increases with wage quartile (within a gender group), we assume that any reform that increases retirement age more for higher-wage workers has redistributive effect as regards retirement duration.

The 1993 reform consists in increasing the required duration from 150 quarters for the generation born in 1933 to 160 quarters for the generation born in 1943. Then, the 2003 reform progressively rises the required duration to 164 quarters for generation 1952. It is also planned to raise it again to 166 quarters in 2020 in order to stabilize the average ratio *required duration for full-rate/average expected duration in retirement* from one generation to the other[19]. The 2003 reform also creates a possibility for workers with a long career to retire before the minimum legal age, with eligibility conditions in terms of required insurance duration changing according to the generation.

To assess the impact of the 1993 and 2003 reforms, we first compute average ages of labor market leaving: for a given observation year, it is defined as the annual average labor market leaving age of a generation that would have in each age the same probability of leaving the labor market than that of generations observed that year.

Looking at chart 7, we see that the projected variation of average ages of labor market leaving due to 1993 and 2003 reforms increase with the quartile of revenue for men. The result holds

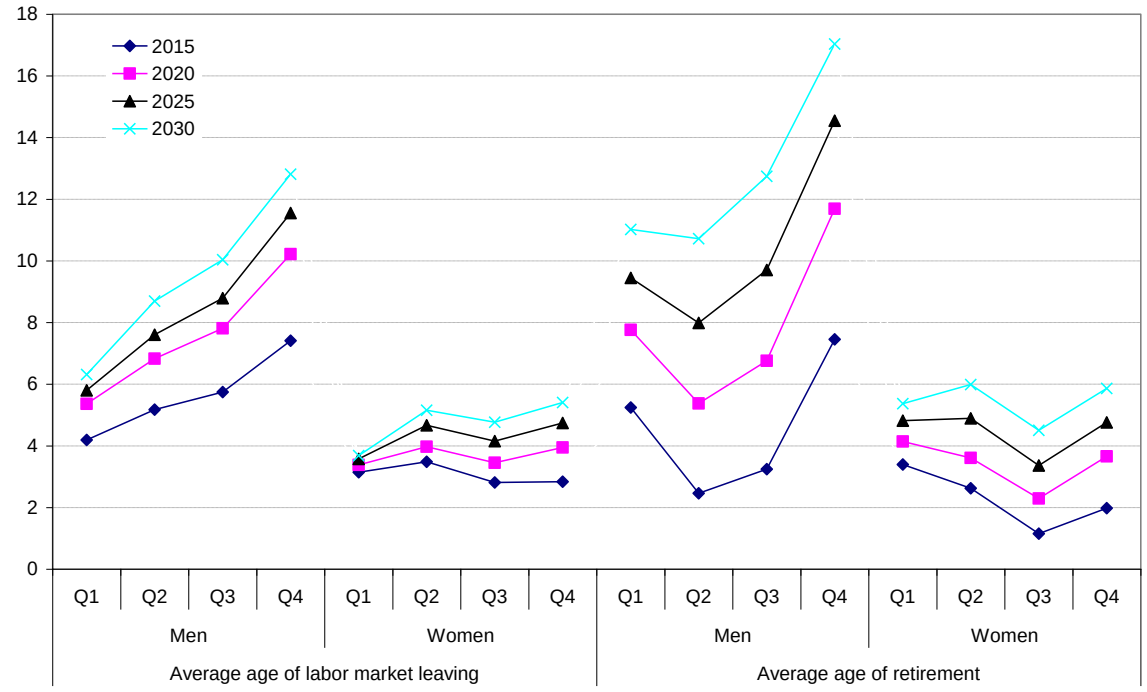
[18] All probabilities are normalized so that they add up to 1.

[19] If the ratio exceeds 1.79 the required duration for full-rate pension has to be increased (COR, 2004; COR 2010). In fact, with the 2010 reform and the minimum legal age increase, the rule is no longer suited to stabilise the ratio.

for the years 2015 to 2030. By 2030, men of the first quartile leave the labor market six month later on average whereas men of the fourth quartile leave it thirteen month later. The mechanisms behind that result are distinct according to whether we consider quartiles 2 to 4 on the one hand and quartile 1 on the other hand. Among quarters 2 to 4, people in the upper quartile have shorter insurance durations validated before age 60 than people in the second and third quartile. Due to reforms, they less and less have a sufficient insurance duration compared to the required duration. Thus their probability to stay in employment rises across generations, and this effect is all the larger as quartile increases. The mechanism is quite different for people in the lower quartile (quartile 1). These people usually have low insurance duration, due to frequent and long non-employment spells along career[20]. They hence often fail to meet the required duration criterion even with pre-1993 values for this parameter which imply that they are less affected by changes in that criterion. Indeed, the fact that they seldom meet the criterion before age 60, whatever the value for this criterion, makes their transition probabilities quite insensitive to reforms. Besides, the fact that they are more often out of employment at age 60 also decreases the impact of the change in required duration on their age at leaving the labor market (see part 2).

Chart 7. Effects of 1993 and 2003 reforms, by gender, quartile and year

In months



Source: PROMESS, Drees

Note: for men in the first wage quartile (Q1) in 2030, the average age at leaving the labor market is 6.3 months higher under the post-2003 legislation than it is under the pre-1993 legislation.

[20] Moreover, a fairly large share of people in the first quartile is made up of immigrants. Most of them entered the French labor market and thus began to validate quarters in French pension schemes lately, which explains their relatively short duration of career from the point of view of French pension schemes.

For women, reforms have a smaller impact than for men: about three months by 2015 for all the quartiles. Beyond that date, average ages of labor market leaving for quartiles two to four continue to increase but not in the first quartile: women of the first quartile seldom reach the full-rate duration before 60 years old, even for older generations. Thus the short run and long run effects are very similar for that quartile.

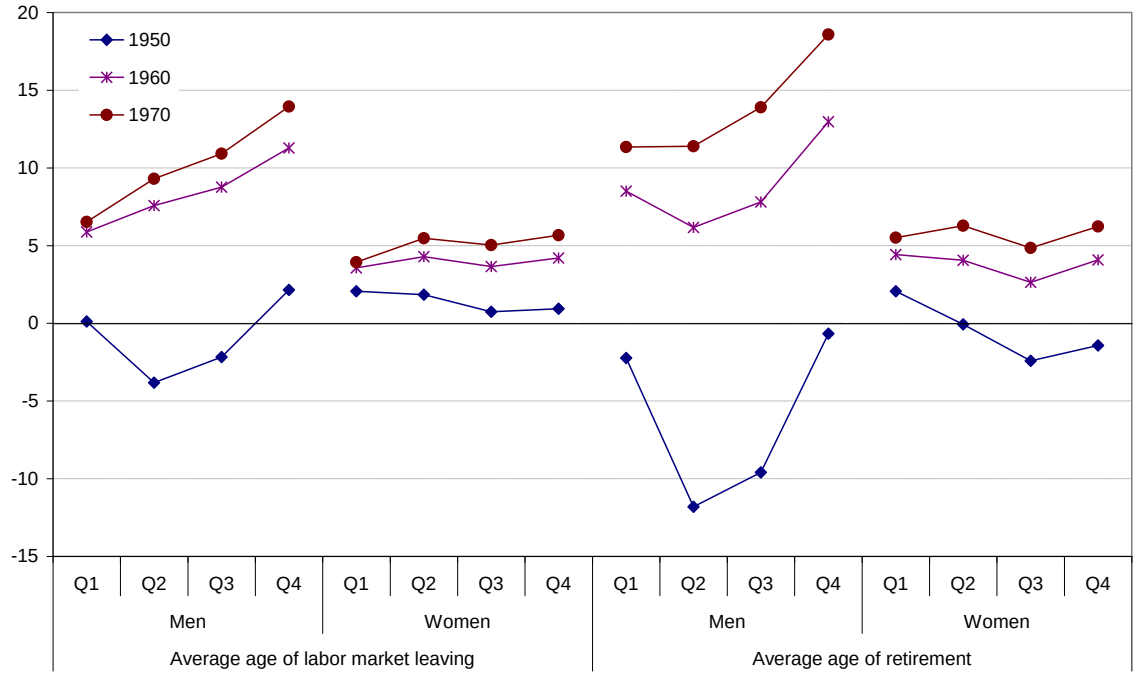
The duration criterion hardening would then have a differential effect on employment between 55 and 59 years old across the quartiles, especially for men. The lower the quartile, the lesser the career would have to be lengthened before leaving the labor market. This effect would be higher in the long run, due to the extinction of retirements for long career.

Comparing the average age of retirement by quartile on chart 7, we also see a differential effect of reforms across quartiles. But the short run and the long run impacts differ. By 2015-2020, reform push up the age of retirement less on average for men of the second and third quartiles (+3 months) than for those of the first and fourth quartiles (respectively +5 months and +7.5 months). It is due to the possibility to retire earlier than the minimal age for people with a long career: for example 7% of the men of the second quartile and 5% of men of the third quartile born in 1960 would retire before 60 years old, against 2% for the first and fourth quartiles. The same explanation holds for women of the first quartile compared to the others. On the contrary, by 2030 the effect is more important for men of the third and fourth quartile.

The difference between impacts on the age of leaving the labor market and on the retirement age might be due to some substitution effect between early exit schemes. Workers who retire below 60 thanks to the 2003 reform should probably also have left the labor market below that age, through preretirement schemes, had the possibility for early retirement not been given to long-career workers. This substitution between the early retirement scheme and preretirement schemes is likely to explain the low negative impact of the 2003 reform on the age at leaving the labor market.

Chart 8. Variation of the average age of retirement, by gender, quartile and generation

In months

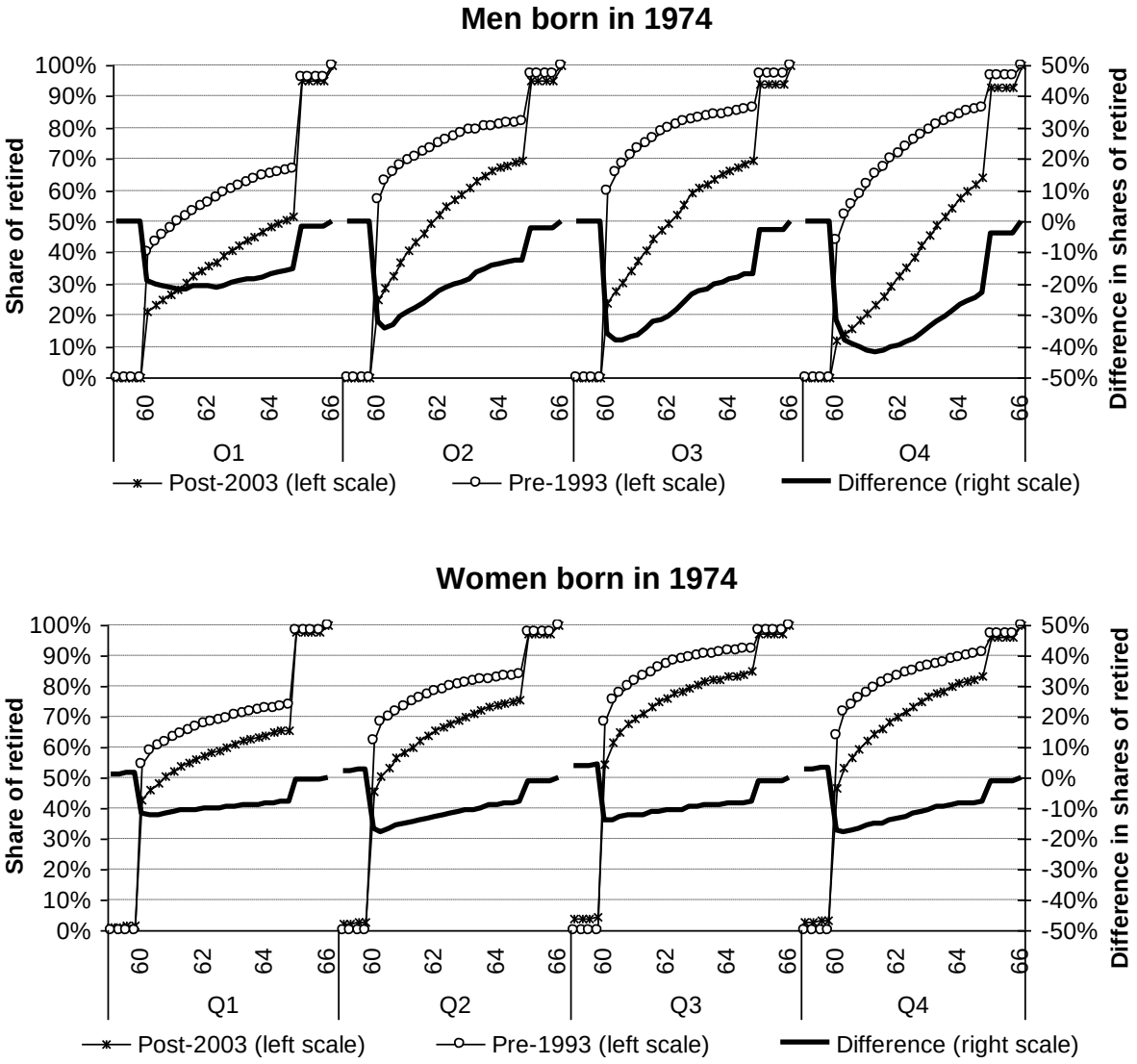


Source: PROMESS, Drees

The result also holds for the average age of retirement by generation (see chart 8). For men born in 1970, the average retirement age would rise by 11 months for the first quartile, while it would increase by 19 months for the fourth quartile. On the contrary, the impact of reforms is almost the same across quartiles for women born in 1970: they postpone their retirement by about 4 to 6 months, whatever the quartile.

Indeed reforms do not have the same impact among quartiles on the distribution of retirement age. For example, the share of men retiring at age 60 or younger decreases by 19% within the first quartile (see chart 9) while it decreases by more than 30% within the other quartiles. This gap is declining with age until the age of full-rate, the slope being larger for quartiles 2 to 4 compared with quartile 1. The lower decrease of the share of people retiring at age 60 in the first quartile is likely to be explained by the larger share of disabled workers. Such workers can retire at 60 with full-rate pension regardless of their number of quarters, which makes them virtually unaffected by reforms. The smaller slope may mean that workers in the first quartile who postpone retirement due to the reforms do it by postponing up to age 65. On the contrary, workers within quartiles 2 to 4 who postpone retirement may more often postpone by a few months only, which explains that the fall in the share of retired people according to age decreases with age up to age 65.

Chart 9. Differences of cumulated distributions of retirement ages before and after 1993 and 2003 reforms, by quartile and gender



Source: PROMESS, Drees

Note: for the first quartile, at 60 years old 40% of the men born in 1974 would have retired if there was no reform, while they would be 21% to have retired at that age with the post 1993-2003 reforms legislation.

Another way to look at the impact of the 1993 and 2003 reforms is to decompose it in the PROMESS model to project retirement ages by gender and quartile simulating only the required insurance duration increase. The computed as the difference between the aggregate

effects are more pronounced for the first and fourth quartiles (see table 2), whereas the possibility to leave before 60 years old for long career-workers benefits to people of the second and third quartile.

Table 2. Decomposition of the 1993 and 2003 reforms into minimum age effects and required duration effects

Effect on retirement age

		Men				Women			
Generation	Reform on:	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
1950	Required duration	5,3	3,7	3,9	6,6	3,5	3,3	2,5	2,7
	Minimum age	-7,9	-16,2	-14,1	-7,6	-1,5	-3,6	-5,2	-4,3
	Total	-2,6	-12,5	-10,2	-1,0	2,0	-0,3	-2,7	-1,6
1960	Required duration	8,8	6,9	8,4	13,3	5,1	5,2	4,1	5,4
	Minimum age	-0,3	-0,8	-0,7	-0,3	-0,7	-1,3	-1,6	-1,4
	Total	8,5	6,1	7,7	12,9	4,4	3,9	2,5	4,0
1970	Required duration	11,3	11,4	13,9	18,6	5,9	6,9	5,7	7,0
	Minimum age	0,0	0,0	0,0	0,0	-0,4	-0,7	-0,9	-0,8
	Total	11,3	11,4	13,9	18,6	5,5	6,2	4,8	6,2

Source: PROMESS, Drees

These results confirm that intragenerational redistributive effects of reforms are not as clear among generations: people with longest careers are not systematically in the lowest quartiles, and especially in the first one. Moreover, for women, the duration criterion would not be redistributive at all. Therefore the duration criterion alone is not a way to automatically correct intragenerational inequalities facing expected life in retirement. Nonetheless, the overall effect of the retirement framework might perform redistribution in retirement duration, thanks to the combination of the required duration criterion and the possibility to retire at the minimum age for the disabled. Moreover, a large share of people in the first quartile of wage has been unaffected by the 1993 to 2003 reforms due to the fact that they already had to wait for the age of full-rate (65), even with pre-reform values of parameters (see table 3). Thus for younger generations, especially for men, the aggregate impact of reforms seem to be redistributing.

In the same way, for older generations, moving the minimum legal age together with the required insurance duration may not have been sufficient to control differences in validated insurance duration among quartiles from an intragenerational point of view: for these generations, it is the second and third quartile that would benefit more from the possibility to retire earlier with a long career.

Table 3. Percentage of people retiring for inability after the 1993 and 2003 reforms

	Men				Women			
Generation	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4
	people retiring for inability							
1950	12.9	6.8	6.2	6.1	19.3	12.9	10.5	9.5
1960	16.5	11.0	10.2	8.1	19.6	14.3	11.7	12.1
1970	18.4	14.4	12.6	8.7	20.9	16.1	13.5	13.6
	people retiring at 65 years old							
1950	23.7	7.9	6.0	10.4	29.5	15.8	8.6	8.2
1960	31.5	11.5	12.0	19.1	28.8	17.1	9.4	10.8
1970	38.9	19.6	19.7	25.7	30.5	19.5	11.1	12.4

Source: PROMESS, Drees

Conclusion

The French retirement reforms (1983, 1993, 2003 and 2010) have created a particular legislative framework where the age at which an individual can go into retirement and receive a full-rate pension is conditional to both a legal minimum age and a required insurance duration. In that framework, the insurance criterion can have a redistributive impact relatively to the retirement duration.

Indeed, we have shown that 1993 and 2003 have an intragenerational redistributive impact for men. That effect seems to be more and more important across generations, due to the

the redistributive effect is not as clear for women, but inequalities stemming from differential mortality also seem to be less important. For older generations

, the redistributive impact of reforms holds for quartiles two to four, but not for the first one.

In fact, the required duration criterion alone does not really enable low-educated workers to retire earlier. Indeed the modeling of careers with PROMESS confirms that first quartile workers face longer non-employment spells during the career, and thus reach the required insurance duration on average later than higher-educated workers. The existence of devices that allow retiring at the minimum legal age without financial penalty, as well as the age when retirement at full-rate is possible regardless of career duration, are playing a key role in the French pension system framework, since a greater part of people using these devices is found in the first wage quartile in PROMESS.

The PROMESS model is useful to study the aggregate impact of reforms on legal ages and required duration. Future work includes studying the projected effect of the 2010 reform on younger generations, to assess the potential redistributive effects of the reform. They also include a decomposition of the impact of reforms, so as to improve our understanding of the mechanisms associated to each parameter of the pension system.

References

Aubert P. and V. Christel-Andrieux, (2010) "La mortalité différentielle des retraités : estimation à partir de l'échantillon interrégimes de retraités et applications", DREES Working Papers .

Aubert P. and V. Christel-
passée en retraite selon la durée validée au *Conseil d'Orientation des Retraites* mimeo (http://www.cor-retraites.fr/IMG/pdf/doc-1321.pdf).

Aubert P., C. Duc and B. Ducoudré (2010), « Le modèle PROMESS : Projection méso des », Document de travail de la DREES séries Études et Recherches, n°102.

Aubert P., C. Duc and B. Ducoudré (2011), «
», forthcoming in *Revue française des affaires sociales.*

Études et Résultats n°692, May.

Cambois E. and J-M. Robine (2001), «
» Société française de santé publique, Santé publique n° 13, 2001/2.

Cambois E., C. Laborde and J-M. Robine (2008), « La double peine des ouvriers : plus
» Population et sociétés n° 441, janvier 2008.

Desplanques G. (1993), « », Insee Données sociales, la société française 1993.

Mesrine A. (1999), « Les différences de mortalité par milieu social restent fortes », Insee Données sociales, la société française 1999.

Rapo
Dossier Solidarité Santé n°10-2009, pp. 24-45.