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Simulating Retirement Behavior
The Case of France

Emmanuelle Walraet and Ronan Mahieu

4.1 Introduction

The pension debate in France has essentially focused, until recently, on ways of financing retirement, with a strong opposition between supporters of maintaining the quasi-exclusivity for pay-as-you-go (PAYG) financing and supporters of a progressive introduction of funded pensions, on top of existing PAYG basic and complementary schemes.

Attention has, however, recently shifted toward another variable of adjustment to the new demographic context, which is the age at retirement or, more widely, the age at exit from the labor force. The mean age at retirement in France is in the lower tail of the European distribution, and has been diminishing for the past twenty years for two main reasons:

- The incentive structure of the pension system itself, especially since the introduction of the *retraite à 60 ans:* until 1982, the first age of eligibility to social security (SS) benefits was 65. It was shifted to 60 for all wage earners in 1983. Retirement before reaching a total tenure of 37.5 years remained strongly penalized in the *régime général,* which covers about 65 percent of wage earners, but this constraint did not apply to most older male workers (since they often began to work about age 15) and thus did not prevent a continuous decline in participation rates.
- The relative generosity of unemployment benefits or early retirement provisions before age 60. As unemployment rose in the 1970s, the gen-

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erosity of these schemes was expanded to allow people between 60 and 65 to retire. When the early retirement age was set at 60, unemployment or early retirement provisions were targeted on people aged 55 to 59, whose participation rates also sharply decreased.

Age at retirement appears to be one variable on which there is potential room for large adjustments. Some steps have been made into this direction by one reform of the *régime général,* in 1993, which planned a progressive strengthening of the conditions giving access to normal (full-rate) retirement at age 60: the pre-1993 condition was to totalize at least 150 quarters (or 37.5 years) of contribution to pension schemes. This threshold will progressively increase to reach 160 quarters (i.e., forty years) from 2003. One of the propositions discussed in the Charpin Report (1999), ordered by the current prime minister, is to go further along this same direction, raising this threshold to 170 quarters.

Of course, modifying this state of affairs raises many problems. The low age at retirement or early retirement is itself a response to an employment shortage, and it is often feared that a less permissive policy may result in a worsened situation in the labor market; conversely, policies of early withdrawal from the labor force were never proved to be of any help in mitigating employment problems. The question can also be raised as to what is the best way to induce people to leave the labor force later. One possibility is coercion. The other is to rely (preferably) on incentives, with the idea of compensating the desired increase of the average retirement age by the introduction of more flexibility in this retirement age. This is the option specifically proposed by the Charpin Report, which suggests compensating the strengthening of conditions necessary to get a normal pension by a reduction of penalties associated with either the anticipation or postponing of retirement. The French system is characterized by a strong deviation from marginal actuarial fairness, and the proposition is made to bring it closer to this rule.

This context calls for a closer inspection of what determines retirement behavior, from both demand and supply sides, and also for an assessment of the financial implications of modifications of the retirement incentives. In this respect, the reforms studied in this chapter are not being proposed as feasible reforms for France. They are only chosen in order to illustrate the impact of behavioral effects and, of course, in order to proceed to cross-country comparisons. The following analysis will essentially focus on supply-side effects, although we shall try, systematically, to remind the reader of the importance of the demand side.

This chapter closely follows Mahieu and Blanchet (2002), which provided estimates of the effect of retirement incentives on labor participation. We performed new estimations of similar probit models of the retirement decision, which now include survivor benefits, which was not the case before. We then used these estimates to simulate the effect of possible re-

forms on both participation rates and older workers' net fiscal contributions to retirement income finances. These simulations include the impact of reforms on early retirement and unemployment provisions.

4.2 Basic Facts about the French Pension System

4.2.1 The Different Schemes

The French system is complex, but its structure can nevertheless be summed up quite simply.

- For a large part of the population (wage earners in the private sector), pensions rely on two pillars:

  1. The basic general scheme (Social Security), which offers benefits corresponding to the share of gross wages below a Social Security ceiling (€2,352 per month in 2002). In 1992, 70.5 percent of people over 60 received a pension from this general scheme. On the contributors' side, in the same year, the general scheme gathered 64.8 percent of the labor force.

  2. Complementary schemes, organized on an occupational basis. They consist of a large number (about 180) of specific schemes that are federated in two main organisms, ensuring interscheme demographic compensation: the executives' pension scheme general association (AGIRC) for executive workers and only for the fraction of their wages over the Social Security ceiling, and the wage earners' mandatory complementary pension schemes association (ARRCO) for other workers and executives' wages below the ceiling. In 1972, contributing to a complementary scheme became compulsory. Today, complementary schemes provide 40 percent of retirement pensions for wage earners in the private sector.
- Besides this simple two-pillar structure, the complexity of the French system, in fact, is essentially due to the existence of a large number of exceptions to this general rule of organization. These exceptions are the result of two factors. When Social Security was created, in 1945, people who already benefited from more generous dispositions refused to join the new system (for instance, civil servants or people employed in state-owned companies). Conversely, some categories chose to adopt cheaper systems offering lower protection because they thought that a large part of their retirement needs was likely to be covered by other sources, such as professional capital for the self-employed. Besides the two-pillar system constituted by the general scheme and ARRCO/AGIRC, there are therefore a multiplicity of specific schemes (civil servants, the self-employed) applying specific rules. For instance, there are about 120 first-pillar retirement schemes other than the general scheme. In particular, it must be observed that civil

servants are not really covered by an autonomous pension system, since their pensions are directly paid by the state budget.

For all categories of people, there is a system of old-age minimum allowance (*minimum vieillesse*), which is a means-tested allowance available for people aged 65 or more. The population benefiting from this minimum pension has regularly declined in the past, due to the increasing maturity of normal pensions. It is now slightly below 1 million, against 2.55 million in 1959 (Commissariat Général du Plan 1995).

The following analysis will deal with two subpopulations: wage earners from the private sector and civil servants. We now give more details about the computation of pensions for these two categories.

4.2.2 Wage Earners in the Private Sector

General Regime

The basic general scheme offers contributory benefits corresponding to the share of wages below the Social Security ceiling. The principle is that the pension is proportional to the number of quarters of contribution to the system (truncated to $N_{\max}$ quarters), and to a reference wage, which, until 1993, has been the average wage of the D best years of the pensioners' career (past nominal wages being reevaluated at time of liquidation according to a set of retrospective coefficients). The equation giving the initial pension level is therefore:

$$\text{Pension} = \alpha \times \left(\frac{N \text{ of quarters, truncated to } N_{\max}}{N_{\max}} \right) \times (\text{average wage of the } D \text{ best years}), \tag{1}$$

the proportionality coefficient α being itself modulated. It is maximal when the pensioner leaves at age 60, with a number of quarters of contributions of at least $\overline{N}$ to all pension schemes: in that case, its value is set at 50 percent, and this ensures a replacement rate of the reference wage (not necessarily the last wage) equal to 50 percent. The same value of α also applies whatever the number of contributed years when the individual leaves at age 65. In all other cases, the coefficient is reduced (table 4.1).

1. Either by 1.25 percentage points for each missing quarter to reach the value of $\overline{N}$ quarters.
2. Either by 1.25 percentage points for each missing quarter to reach age 65.

The adjustment actually applied is the one that leads to the most favorable outcome for the pensioner (see table 4.1).

Table 4.1 **Value of α depending on age at receipt of first benefit and *N*, number of quarters of contribution to the general regime (%)**

	Age					
N	60	61	62	63	64	65
32.5	25	30	35	40	45	50
33.5	30	30	35	40	45	50
34.5	35	35	35	40	45	50
35.5	40	40	40	40	45	50
36.5	45	45	45	45	45	50
≥37.5	50	50	50	50	50	50

For cohorts born before 1934, $\overline{N} = N_{max} = 150$.

Access to the full rate is also possible before 65 for people totalizing less than 150 quarters if they are considered disabled or suffer from handicap.

Values of $\overline{N}$ and D are currently changing, while N_{max} remains set to 150. As mentioned in the introduction, the value of $\overline{N}$ should reach 160 quarters when the 1993 reform fully produces its effects (cohorts born after 1943). The same reform also scheduled a progressive increase of D, up to twenty-five years (to be reached for cohorts born after 1948). But for the cohorts we are going to consider here, the rules are those that prevailed between 1983 (when the possibility of retiring at age 60 was generalized) and 1993, that is, $\overline{N} = 150$ (37.5 years) and $D =$ ten years.

This system means that the number of years of contribution affects the pension level in two ways, which may imply, in some cases, a very strong dependency between the age at retirement and the level of the pension. To provide a full understanding of this interaction, table 4.2 shows the consequences of this system, with pre-1993 parameters for three reference cases with individuals arriving at age 60 with, respectively, twenty-five, thirty, and thirty-five years of contribution.

- The first individual had to wait until age 65 to get retirement at a full rate α (50 percent). Even then, however, his or her pension was reduced by the fact that he or she only totalized 120 quarters of contribution at this age. The replacement ratio was therefore only equal to 120/150 of the maximum replacement ratio, which is equal to 50 percent. Note that, at each age lower than 60, the downward adjustment of α is here computed on the basis of the number of years missing to reach age 65 rather than the number of quarters missing to reach a value of *N* equal to 150, since the rule consists of applying the most advantageous of the two adjustments.
- The second individual also had to wait until age 65 to get the full rate α, but benefited at this age of a higher replacement rate, equal to 140/150 of the maximum replacement ratio of 50 percent. In this case, the

Table 4.2 **Replacement rate provided by the general regime and the civil servants regime for three reference cases (%)**

Age	Tenure (years)	α (general regime without complementary schemes) (1)	α (civil servants) (2)	No. of years/37.5 (3)	Replacement ratio, general regime (1) × (3)	Replacement ratio, civil servants (2) × (3)
			Individual A			
60	25	25	75	0.667	16.7	50.0
61	26	30	75	0.693	20.8	52.0
62	27	35	75	0.720	25.2	54.0
63	28	40	75	0.747	29.9	56.0
64	29	45	75	0.773	34.8	58.0
65	30	50	75	0.800	40.0	60.0
			Individual B			
60	30	25	75	0.800	20.0	60.0
61	31	30	75	0.827	24.8	62.0
62	32	35	75	0.853	29.9	64.0
63	33	40	75	0.880	35.2	66.0
64	34	45	75	0.907	40.8	68.0
65	35	50	75	0.933	46.7	70.0
			Individual C			
60	35	37.5	75	0.933	35.0	70.0
61	36	42.5	75	0.960	40.8	72.0
62	37	47.5	75	0.987	46.9	74.0
63	38	50	75	1.000	50.0	75.0
64	39	50	75	1.000	50.0	75.0
65	40	50	75	1.000	50.0	75.0

downward adjustment before age 65 is again based on the number of years missing to reach age 65.

- The third person will not have to wait until age 65. He or she will benefit from the maximum replacement rate as soon as he or she reaches a cumulated number of years of contributions equal to 150, that is, at age 62.5. If he or she decides to leave between age 60 and 62.5, the downward adjustment will now be computed according to the number of years missing to reach the total of 150 contributed years, rather than the number of years missing to reach age 65, since the first rule is now the most generous. Note also that, for this person, working past the age of 62.5 does not bring any further advantage in terms of the basic pension level.

Some additional observations must be added to this presentation of the general scheme:

- Some people were successively affiliated with different schemes, especially in older generations: for instance, people transiting from agriculture or self-employment to the status of wage earner in industry or in services. These people will cumulate two basic pensions, one from their initial scheme and one from the general scheme. The latter one will be proportional to the number of years spent in this scheme, according to equation (1), yet coefficient α will be evaluated taking into account the *total* number of years contributed, whatever the scheme. Reductions of α, furthermore, do not apply in a certain number of cases: veterans, disabled workers, female workers with 24 contributed years, and having raised three children.
- Equation (1) also implies that pensions, at the time they are claimed, are computed in current French francs. They are then reevaluated each year on a discretionary basis. During the 1970s and early 1980s, the general policy was to overindex these pensions (with respect to the average gross wage) in order to make up for the initial gap between standards of living of workers and pensioners. Since the mid-1980s, the practice has rather consisted of an indexation on prices. This practice has been confirmed by the 1993 reform.
- When the average wage (D best years) falls below a floor, it is raised to the level of that floor (about €12,000 in 2000) for individuals who can claim a full-rate pension. These provisions (the *minimum contributif*) mainly concern women who had part-time jobs or whose careers were short and whose annual earnings are thus very low. They involve an additional strong incentive to postpone retirement until the full rate.
- For women, $N_{\max}$ and $N'_{\max}$ are increased by two years for each child they raised. Moreover, people (either men or women) who raised at least three children enjoy a 10 percent increase in their basic pension.

Complementary Schemes

These schemes are almost fully contributory and are organized in a defined-contribution way (although they are not funded). Workers accumulate *points* during their careers, which are the pension's basic unit of calculation:

1. Points are accumulated during workers' careers in proportion to their contributions: the contribution rate is fixed, and 1 franc contributed in year t is considered equivalent to the formal buying of $1/PP_t$ points, where PP_t is the purchase price of one point (the official term for this purchase price is *salaire de référence*).
2. The pension is then equal to the total number of points accumulated over the pensioner's career, multiplied by a coefficient V (*valeur du point*), which is fixed every year.

The pension level at time t can therefore be written for a pensioner who started working at time t_0 and stopped at time t_1 as:

$$\text{pension} = V(t) \cdot \sum_{t'=t_0}^{t_1} \frac{\tau(t')w(t')}{PP(t')}, \tag{2}$$

where $\tau(t')$ and $w(t')$ are, respectively, the contribution rate and the worker's wage at time t'. As explained previously, only a fraction of the wage is taken into account for computing contributions and points accumulated each year:

1. For executives, contributions are collected by ARRCO for the part of the wage below the ceiling, and by AGIRC for the segment of the wage that is comprised between one and four ceilings.
2. For nonexecutives, the wage is truncated to three times the social security ceiling, and contributions are collected by ARRCO.

Concerning retirement age in these complementary schemes—normal retirement theoretically remains at age 65, even after the 1983 reform, which introduced retirement at age 60 in the *general scheme.* For retirement below 65, a quasi-actuarial adjustment is supposed to be applied. But, since the 1983 reform, this adjustment is not applied to people who fulfill the conditions for a basic retirement at full rate (more than 37.5 years of contribution).

4.2.3 Civil Servants

Civil servants have a unique pension scheme, directly financed from the state budget. As a general rule, pension claiming is possible at age 60, if people have at least fifteen years of service. A rather large minority can, however, leave at age 55: primary school teachers, policemen, and prison officers. For women who have raised at least three children, the age condition is completely relaxed. The benefit formula is:

$$\text{Pension} = 0.75 \times \left[\frac{\text{Number of quarters, truncated to } N_{\max}}{N_{\max}} \right] \times (\text{last gross wage, excluding bonuses}) \quad (3)$$

The pension is a proportion of the last gross wage. Note that this gross wage excludes bonuses, which represent, on average, 15 percent of the total net income (and up to 50 percent for some specific categories). These bonuses remain insignificant for most civil servants working for the Education Department, which is the largest employer, but can reach 50 percent of the total net income for some specific categories, those with the highest incomes.

The key variable is the number of years a civil servant worked. Each year entitles him or her to a 2 percent annuity (table 4.2), the sum being truncated to 75 percent. Once this basic annuity is computed, some other periods may be taken into account: the most important provision is the additional year given to women for each child they raised. Each additional year also yields an additional 2 percent annuity, which may increase the basic annuity up to 80 percent. Finally, people (men or women) who raised at least three children enjoy a substantial increase in their pension. This increase is 10 percent if they have raised three children, and an extra 5 percent for every additional child. These provisions are roughly the same as in the private sector.

Note that this system strongly differs from the *general regime* as regards incentives to retire early: let us consider the example of people reaching the legal minimum age of retirement with only 32.5 contributing years, who decide to immediately claim their benefits. The civil servant's replacement rate is 65 percent (instead of 75 percent for a complete career). The private-sector wage earner's replacement rate (basic pension only) is 21.7 percent (instead of 50 percent for a complete career).

4.2.4 Survivor Benefits

Civil servants' as well as private-sector wage earners' widowers or widows may enjoy survivor benefits. The computation of these benefits is rather complex and we will give only their main features here, since our data prevent us from precisely computing these benefits (regarding the lack of information on spouses, see the following).

In the late 80s and early 90s (when our cohorts effectively retired), survivor benefits were far more generous for women than men: a civil servant's widow could enjoy survivor benefits (typically 50 percent of her husband's pension entitlements) whatever her age, whereas a civil servant's widower had to wait until 60. Moreover, benefits were capped at a relatively low level for widowers, which was not the case for widows. In the private sector, women could enjoy spouse benefits from age 55, whereas widowers had to

wait until 65, and benefits were means tested. Gender discrimination was removed from the private sector in the late 90s, but the situation has remained unchanged for civil servants' widows or widowers.

4.2.5 Other Regulations Concerning Age at Retirement: Mandatory Retirement and Eligibility to Early Retirement Benefits

It is only for civil servants or in special schemes that mandatory retirement exists as such. The age for mandatory retirement is generally 65, with some exceptions either below that age (i.e., the armed forces) or above (very limited categories are allowed to work until age 68, such as academics).

In the private sector, a firm is not allowed to lay off a worker according to any age criterion. Yet it is allowed to do so when this worker reaches the conditions to get a full-rate SS pension. Given the employment context of the 1990s—and the relatively large wage gap between elder and younger workers—it is quite likely that firms will quasi-systematically make use of this possibility. A consequence, which will be recalled later when interpreting results, is that decisions to retire at the age when people get the full rate may be interpreted as demand-side as well as supply-side decisions.

Supply- and demand-side aspects are also strongly intertwined for all forms of early retirement. Early retirement developed in several steps in France. We will only describe the rules enacted after the 1983 reform, that is, after the generalization of possibilities to retire at age 60. There are two main paths to early exit from the labor force.

- One is through unemployment insurance. People falling into unemployment are entitled to a compensation for a limited period of time; the level of unemployment benefits, since 1992, is decreasing with the duration of unemployment. But these rules do not apply to people losing their jobs past a certain age (57 until mid-1993, now raised to 58), who can benefit from a full compensation until they are able to benefit from a normal SS pension at a full rate. This system is not officially described as an early retirement system, and people cannot enter into it completely freely: they can do so only if they have been explicitly laid off by their employers. Yet this system is more or less equivalent to an early retirement scheme.
- The second path for early exit is the *Fonds National pour l'Emploi* (FNE [National Fund for Employment]). The level of early retirement benefits is roughly similar to the level of unemployment benefits. People benefiting from this system can leave the labor force at around 58, with benefits maintained until they have access to a full-rate pension in the general regime. The difference from the former path is that this system is under direct control of the state: access to the FNE only concerns workers laid off in the context of a social plan, negotiated between the firm and the state, with some compensations offered by the firm (for instance, a commitment to hire young workers).

4.2.6 Labor Market Participation among Older Workers

Participation of men aged 50 and over sharply decreased over the past twenty years. The share of men employed at ages 55, 60, and 65 decreased from 83.4 percent, 47.0 percent, and 14.7 percent in 1983 to 78.5 percent, 32.1 percent, and 4.9 percent in 1998. The figures are somewhat different for women—52.2 percent, 29.1 percent, and 9.4 percent in 1983, 57.9 percent, 25.9 percent, and 5.9 percent in 1998—since cohort effects (the long-run increase of female labor supply) partly offset the effect of both economic difficulties (with growing exits through unemployment or early retirement) and the decrease to 60 of the minimum age to get SS benefits. Nonetheless, the regular decrease in male participation rates appears to have slowed down since 1997, due to the economic recovery.

In 1998 (table 4.3) employment rates reached 75 percent for people aged 50 to 54, but sharply decreased thereafter: 53 percent for the 55 to 59 age group, and only 12.4 percent (most of them being self-employed) for the 60 to 64 age group. Participation rates are close to zero after 65. Very few self-employed retire before 60. However, exit rates are high from 55 onward for wage earners.

About 8 percent of the population received public benefits (mainly unemployment benefits) between 50 and 54 in 1998 (table 4.4). This figure reaches 23.7 percent between 55 and 59, due to unemployment or early retirement (in the private sector) or SS benefits (for a sizeable minority of

Table 4.3 **Labor market participation by age group**

		Employed			
Age	Cohort	Public sector	Private sector	Self-employed	Not working
50–54	1944–48	22.6	33.4	18.8	25.2
55–59	1939–43	13.3	21.9	18.0	46.8
60–64	1934–38	2.5	3.5	6.4	87.6
65–69	1929–33	0.0	0.3	1.2	98.5

Source: Financial Assets Survey, Insee (1998).

Table 4.4 **Part of the population receiving public benefits by age group**

Age	Cohort	SS benefits	Preretirement benefits	Unemployment benefits	Total
50–54	1944–48	1.3	0.0	7.2	8.5
55–59	1939–43	9.4	6.0	8.3	23.7
60–64	1934–38	68.9	1.4	2.4	72.7
65–59	1929–33	86.2	0.0	0.0	86.2

Source: Financial Assets Survey, Insee (1998).

civil servants). Between 60 and 64, 72.7 percent of the population receive public benefits (now mainly SS benefits).

Research Background

Previous research on retirement behavior in France is relatively scarce, partly because economists lacked appropriate data until the *échantillon inter-régime de retraités* (EIR) was built. Moreover, individuals were so heavily constrained by SS incentives that explaining actual behaviors did not require a sophisticated approach (in econometric terms, for instance). In the first part of this project, Blanchet and Pelé (1999) showed that incentives to retire at the full rate were very strong. Pelé and Ralle (1999), using a life cycle model (based on an intertemporal budget constraint), demonstrated that retiring at the full rate was consistent with a rational utility-maximizing behavior.

Of course, retirement cannot entirely be explained by SS incentives: analyzing early retirement behaviors in France as a three-player game (the firm, the employee, and the government) may be of great interest, but once again, the lack of appropriate, firm data did not allow for a comprehensive analysis of individual behavior concerning early retirement.

4.3 Data Description

4.3.1 The Dataset

Few systematic datasets exist in France concerning the economic situation of retired people. Income surveys only give instantaneous and imperfect pictures of transfer incomes benefiting to retirees: they do not allow the reconstitution of past labor income, which would permit the evaluation of what these transfers would have been if the pensioners had made other choices concerning their age at retirement.

Some other specific surveys were also realized to analyze the transition between activity and retirement (e.g., a questionnaire on this topic was added to the regular Labor Force Survey in 1996). These surveys are especially useful for analyzing the variety of institutional paths from full-time activity to retirement (Caussat and Roth [1997], Burricand and Roth [2000]) and provide some interesting information on standards of living before retirement. But these surveys do not provide precise information on past wages and thus do not allow us to compute financial incentives to retirement.

In practice, the only large-scale survey that is available and that is suited for the current study is a specific panel, the EIR. This permanent survey (whose origin goes back to 1984[1]) matches administrative data collected from all pension schemes that exist in France. This strategy revealed itself

1. The operation has been initially organized by the SESI, the statistical unit within the ministry of social affairs, in connection with the INSEE. Since 1998, the SESI has been absorbed in a new direction within the Ministry of Social Affairs, the *Direction de la Recherche, des Etudes, de l'Evaluation et des Statistiques* (DREES).

to be the only way to overcome problems raised by the multiplicity of pension schemes in France. The other possibility—relying directly on pensioners' declarations—would have been necessarily partial and incomplete (given the limited knowledge these pensioners may themselves have of these various schemes).

The survey was organized as follows. For the first run, in 1988, four cohorts of pensioners were selected: those born in 1906, 1912, 1918, and 1922. A sample totaling 20,000 people belonging to these four cohorts was drawn by the Institut National de la Statistique et des Études (INSEE). Their national identification numbers were transmitted by INSEE to all existing pension schemes (more than 120 basic schemes and about 180 complementary schemes). All these pension schemes then had to search for these individuals in their records. If they were present, the information about their pension entitlements was then transmitted to the statistics, studies and information systems department, ministry of Social Affairs and Solidarity (SESI), who then carried out the matching, for all individuals of the sample, of the information returned by all existing pension schemes. Note that this matching, by the SESI, has been made according to an identification number that was different from the national identification number, in order to preserve the anonymity of final data.

The survey was renewed in 1993 and 1997. Each time, the same samples were redrawn for the cohorts included in the previous studies (and enlarged to compensate for mortality), and new cohorts added to the panel: cohort 1926 in 1993, cohorts 1930, 1932, 1934, 1936, 1938, 1940, and 1942 in 1997 (table 4.5). Since 1990, an additional matching has also been introduced, with information from other administrative sources:

Table 4.5 **Descriptive statistics on the sample**

Variable	Mean value
Sex (Male = 0, Female = 1)	0.439
Age	57.4
Married	0.753
Widowed	0.113
Single	0.125
Wage (euros)	20,095
Executive (private)	0.126
Technician (private)	0.154
Employee (private)	0.215
Skilled blue-collar (private)	0.189
Unskilled blue-collar (private)	0.105
Category A (public)	0.119
Category B (public)	0.055
Category C (public)	0.037
Total tenure (years)	36.4

Note: Sample size = 10,572 observations corresponding to 2,352 individual paths.

1. The Annual Declarations of Social Data (DADS), made each year by firms, which allow one to retrieve wages of people of the sample over the years before retirement, if these people were wage earners in the private sector or employed in state-owned companies.
2. The wage files from the State Service, for former civil servants.
3. Files from the National Professional Union for the Employment in Industry and Trade (UNEDIC), the French system of unemployment insurance, for people in unemployment before retirement (allowing, therefore, for the incorporation of the form of early retirement offered by the UNEDIC and the French National Employment Fund (FNF), as previously discussed).

This matching, however, does not allow a full reconstitution of past careers for these pensioners. DADS, in particular, generally do not go back further than 1985, with one additional missing year in 1990. This matching, for this reason, has not been done for cohorts 1906, 1912, and 1918, for whom it would have been irrelevant.

Given the structure of data available in the panel, our question has been to explore how these data could be best used for the estimation of a model of retirement behavior for France. The choices that have been made resulted from two constraints.

1. The need to have people for whom the situation before retirement has been observed over a significant period, in order to be able to extrapolate what their standard of living would have been in case they would have retired later than they actually did.
2. The need, conversely, to limit ourselves to cohorts for whom entry into retirement can be considered as fully completed. As detailed in the next subsection, our method for reconstructing individual pension entitlements under alternative retirement ages relies essentially on the pension level obtained at the *actual* retirement age. Of course, one possibility would have been, for people not yet retired, to evaluate entitlements on the basis of past working records. But the length of our wage records was too short for such a reconstitution, and for this population our files did not provide any proxy at all for the key variable, which is the number of quarters of past contribution.

The first constraint clearly ruled out cohorts 1906 to 1922. We also considered that wage data were too short, on average, for cohort 1926 (only two years of wages being observed for an individual of this cohort retiring in 1986). The second constraint, at the opposite end, ruled out cohorts 1934 to 1942. Even if a significant share of these cohorts was retired in 1997, we would have missed the fraction retiring at 65, which is precisely the fraction that brings the variance necessary to identify models. We considered that the same problem existed for workers from the private sector

in cohort 1932. So, for this category, we finally restricted ourselves to cohort 1930. For civil servants, however, we decided to use both cohorts 1930 and 1932, in order to increase somewhat the sample size, considering that the selection bias on cohort 1932 was lower than for the private sector, given an average age at retirement that is lower in the public than in the private sector.

Concerning the key question of the definition of retirement, our data provided us with two possible choices: either the age when people definitely leave the labor market, or the age when people claim SS benefits. But this latter definition is not the most interesting from an economic point of view, since a huge majority of people in the private sector claim SS benefits as soon as they reach the full rate. It is more interesting to analyze the impact of SS provisions (and, if possible, early retirement or unemployment provisions) on the decision to definitely leave the labor market. We therefore decided to model the last year of recorded past employment using DADS data. This, of course, implies a restriction to people who are in paid employment in 1985, which limits a bit further our sample.

4.3.2 Reconstructing Wages, Taxes, and Pension Levels

Our data yield net wages (gross wages minus SS contributions) for all wage earners still employed at age 55. We assume that wages then increase, like the Consumer Price Index (CPI), for people employed in the private sector. For civil servants, we assume that wages increase from age 55, like the so-called "civil service point" that has been roughly following the CPI evolutions for more than fifteen years.

We compute income taxes assuming that people in our sample have only wage or pension income or are single (or, equivalently, married with their spouse earning the same income) with no children. This assumption is, of course, excessive, but we lack additional information on nonwage and nonpension income. Concerning indirect taxes, the normal VAT rate in France was 18.6 percent in the late 1980s and early 1990s, but some specific products were taxed at a 5.5 percent reduced rate. We compute an apparent VAT factor based on national accounts. This factor is defined as the share of indirect taxes (VAT, taxes on tobacco and alcohol, etc.) in personal disposable income. We thus assume an apparent VAT rate of 13.9 percent.

Social security payroll taxes do not really exist for civil servants, since pensions are directly paid on the state budget. We therefore compute pseudo-contributions for civil servants by assuming that the total SS payroll tax rate is the same for civil servants as for people employed in the private sector.

4.3.3 Other Data

Computing the actual value of future pension benefits required some additional information: information on people's own mortality risk, and

information on the presence of a spouse and this spouse's mortality risk, assuming that individual evaluations of benefits include the evaluation of survival benefits if the individual dies before his or her spouse.

Mortality rates for people in the sample that was used are differentiated by sex and age but not by socioprofessional group, as in step 2. One point must be noted here: since the sample is conditioned on surviving until age 64 or 66 (depending on the cohort), a selection bias may result if there is a correlation between mortality and the retirement decision. If people with bad health status and a higher mortality risk tend to more frequently anticipate the claiming of their benefits, there will be a tendency to overestimate the actual age at retirement. However, judging from the mortality rates, this phenomenon should have a limited impact, as 14 percent of men and 5.4 percent of women die between 55 and 65.

The final sample consists of 10,572 observations (table 4.5) corresponding to 2,352 individuals still employed at 55 (who are thus observed, on average, between four and five years before they retire). Seventy-five percent of them are employed in the private sector (with a majority being men). Note that the average tenure at 55 is pretty high (over thirty-six years) and close to the tenure required to reach the full rate at 60: this reflects the fact that most people from the sample are entitled to full SS benefits as soon as age 60.

Analyzing pathways to retirement is straightforward for civil servants (they have no other choice than waiting until the minimum age to claim SS benefits, unless they choose to consume their savings). In the private sector (table 4.6), about 60 percent of people still working at 55 do not receive public benefits other than SS benefits. The remaining 40 percent are roughly equally divided between people retiring through unemployment and early retirement schemes.

Table 4.7 provides information on the level of the parameter α. A very tiny minority of men (0.3 percent) claim SS benefits are reduced rate, whereas the figure grows to 4.4 percent for women. About 4 percent of men and women are considered as disabled and are thus allowed to claim full-

Table 4.6 **Pathways to retirement in the sample**

	Retiree category			
	Private sector			Civil servants
Pathway	Men	Women	Total	Total
Directly to SS	57.4	60.8	58.7	100.0
Preretirement then SS	20.7	18.4	19.8	0.0
Unemployment then SS	21.9	20.8	21.5	0.0

Source: EIR, 1930 cohort, people still working at 55.

Table 4.7 **Level of the pension rate (α) when people claim SS benefits (private sector; %)**

	Men	Women
Full rate		
Normal conditions	92.0	81.0
Unfit for a job	3.7	10.7
Disabled	4.0	3.9
Reduced rate	0.3	4.4

rate SS benefits from 60 (even if their tenure is below 150 quarters) is 3.7 percent of men and 10.7 percent of women. The percentage that are unfit to hold a job and thus benefit from a full-rate pension from age 60. Others (over 80 percent of the sample) reach the full rate in normal conditions. In the public sector, there is no such incentive to postpone claiming SS benefits after the minimum age (mostly 60), since α is set to 0.75 whatever the total tenure. Nonetheless, it is worthwhile noting that the retirement rate for civil servants who reach age 60 with 150 quarters or more is 69 percent, whereas it drops to 53 percent for those who reach age 60 with less than 150 quarters. Moreover, the mean wage of civil servants who keep on working after 60 is €32,000 (instead of €23,400 for those who quit at 60). Others (over 80 percent of the sample) reach the full rate in normal conditions. In the public sector, there is no such incentive to postpone claiming SS benefits after the minimum age (mostly 60), since α is set to 0.75 whatever the total tenure. Nonetheless, it is worthwhile noting that the retirement rate for civil servants who reach age 60 with 150 quarters or more is 69 percent, whereas it drops to 53 percent for those who reach age 60 with less than 150 quarters. Moreover, the mean wage of civil servants who keep on working after 60 is €32,000 (instead of €23,400 for those who quit at 60). Remember that highly paid civil servants have—on average—lower replacement rates, since a large part of their wage consists in bonuses. At first glance, civil servants also seem sensitive to SS incentives (despite their weakness). But these preliminary observations must be confirmed by a deeper analysis.

4.3.4 Spouse Issues

This chapter differs from our previous work since we take survivor benefits into account. An ideal solution would have been to calculate an expected survivor benefit for each married individual of the sample, conditioned on the spouse characteristics (particularly his or her SS entitlements). However, we do not have such information. A solution would be to match married males with every married female of the sample or with a typical inactive woman, to compute survivor benefits for each of these would-be couples and deduce an average survivor benefit using appropriate

weights. However, our data provide no relevant information on the way individual characteristics affect the individual process (for example, do educated men marry educated women? Moreover, we have no information on educational achievements). We thus eliminated this time-consuming solution and considered the survivor benefit of an average would-be spouse.

Married women in our sample are arbitrarily matched with a would-be man with average male SS benefits. Married men are matched with a would-be woman with average female SS benefits (with weight 0.8) and with zero SS benefits (with weight 0.2). In these elderly cohorts, about 20 percent of women never worked and thus cannot enjoy SS benefits when they reach age 60. We assume an age difference of two years between the spouses, which matches what is commonly observed in French data.

4.4 A Descriptive Analysis of Incentives to Retire

4.4.1 Definition of Incentive Variables

Two kinds of model will be applied to the analysis of labor force participation rates of older workers. In a first step, we introduce simple measures of SS incentives to retire in probit models to describe the choice to retire at age t for individuals still in the labor force at this age. For an individual aged t, we first compute social security wealth at age t. The value of this SSW will depend on the age $t' \geq t$ at which this individual will decide to retire. $B_s(t')$ is the probability of surviving up to age s for an individual aged t, and if T, at last, is the maximal age at death, we write:

$$\mathrm{SSW}_{t,t'} = \sum_{s=t'}^{T} \beta^{s-t} \pi\left(\frac{s}{t}\right) B_s(t')$$

If, when he or she is 55, an individual is married and his or her spouse is alive, we add to this value the social security wealth corresponding to the spouse's would-be survivor pension if the spouse outlives the studied individual. In terms of social security wealth, the survivor pension is recorded for the spouse who dies first and is thus at the origin of this survivor benefit. If $SB_s(t')$ is the expected level of survivor pension at age s if the individual retires at age t'; if $\pi_{\text{spouse}}(s/55)$ is the probability that the spouse survives up to age $s \pm 2$ (according to gender) conditioned on being alive at 55, as we assume here an age difference of two years between the spouses. The SSW of the studied individual is:

$$\mathrm{SSW}_{t,t'} = \sum_{s=t'}^{T} \beta^{s-t} \pi\left(\frac{s}{t}\right) B_s(t') + \sum_{s=t'}^{T} \beta^{s-t} \left[1 - \pi\left(\frac{s}{t}\right)\right] \pi_{\text{spouse}}\left(\frac{s}{55}\right) SB_s(t')$$

From this value, we derive the pension accrual at age t, which is the algebraic increase in SSW that results, at age t, from the postponement of retirement by one year, that is,

$$\text{Accrual}_t = \text{SSW}_{t,t+1} - \text{SSW}_{t,t}.$$

The accrual will be our first measure of SS incentives. The tax rate is directly derived from the accrual. It captures the fact that a negative accrual involves an implicit tax on continued work: a part of the expected wage (if the individual postpones retirement) is taxed through the decrease in the SSW. The tax rate thus writes:

$$\text{Tax rate}_t = -\frac{\text{Accrual}_t}{E_t w_{t+1}}$$

An alternative measure is also directly derived from the definition of SSW. This variable is the peak index, which is the difference between the maximum of the SSWs associated to all possible ages at retirement beyond the current year, and SSW in case of an immediate retirement.

$$\text{Peak}_t = \underset{s \geq t+1}{\text{Max}}[\text{SSW}_{t,s}] - \text{SSW}_{t,t}$$

It assumes a less myopic behavior by the individual, who considers not only the potential gain in SSW resulting from delaying retirement by one year, but also gains that may be derived from retiring in any subsequent year. However, as with all measures derived from SSW, a limitation of this index is that it does not take into account the comparison that the individual can make between pension benefits and the level of his or her labor income. It assumes that the retirement decision is only affected by variations of pension entitlements. This limitation will be corrected in the following estimation by the introduction of wages as covariates in probit models, but it is more satisfactory to introduce incentive measures that introduce this comparison between benefit and wage levels in a less ad hoc way.

This is the case if we start from a model that fully includes expected flows of utility derived either from labor or retirement income. The model used will be the Stock and Wise (1990) option value model. Let us consider again an individual still in the labor force at age t. If he or she expects to retire at age r, he or she can expect a flow of labor incomes of $(Y_t, \ldots Y_{r-1})$ until retirement, and then a flow of pension benefits $[B_r(r), B_{r+1}(r), \ldots, B_s(r), \ldots]$. It is assumed that this individual derives an indirect utility U_w from his or her labor income and an indirect utility U_r from pension benefits. Time discounting occurs at rate β. For an age at retirement equal to r, the expected utility at age t is therefore:

$$V_t(r) = \sum_{s=t}^{r-1} \beta^{s-t} E_t[U_w(Y_s)] + \sum_{s=r}^{T} \beta^{s-t} E_t\{U_r[B_s(r)]\},$$

with

$$U_w(Y_s) = Y_s^{\gamma}$$
$$U_w(B_s) = (kB_s)^{\gamma}.$$

Note that this specification does not consider the possibility of smoothing income flows through private savings, an assumption that will essentially be valid for low- or medium-income workers. Given this definition of utility, we assume that the individual decides to retire if the resulting expected utility is higher than the maximum value of utilities expected for all other possible choices $r > t$. If we write

$$G_t(r) = V_t(r) - V_t(t),$$

the individual chooses to remain in the labor force if $G_t(r^*) > 0$, where

$$r^* = Arg \operatorname*{Max}_{r \geq t+1} V_t(r).$$

Therefore, $G_t(r^*) > 0$ is called the option value of postponing retirement to express that, given the irreversibility of retirement, remaining in the labor force offers the option to leave the labor force at a later age under better conditions. Stock and Wise (1990) performed a full maximum-likelihood estimation of the model on American data, which yielded $\beta = 0.97$, $\kappa = 1.25$, and $\gamma = 0.6$. Our own estimation of the model on French data led us to adopt the following parameterization: $\beta = 0.97$, $\kappa = 1.6$, and $\gamma = 0.25$. These values imply some risk aversion and a moderate preference for leisure: in the context of a one-period model, a value of κ equal to 1.6 means that an individual would demand a leisure income equal to 62.5 percent of his or her labor income to accept retirement.

4.4.2 Including Incentives Linked to Unemployment and Early-Retirement Benefits

We performed simulations of retirement decisions based on previous estimations. The main issue raised by our estimation process is the possibility offered to a number of workers to leave the labor market before the minimum age required to claim SS benefits: these workers receive unemployment or early retirement benefits that may *both* be viewed as early retirement benefits. This would not be a critical issue if we controlled for the eligibility to these programs. Unfortunately, this is not the case: this would require firm data providing some information on who had the possibility to get early retirement or unemployment benefits and who decided to retire.

We took account of these possible pathways in the following manner: assume, as a first step, that an individual is actually free to choose one of these means of early exit from the labor force. We can therefore compute three values for the SSW: the one computed earlier on the basis of normal pension entitlements only, the ones if we assume that the individual begins by spending a few years in unemployment or in the early retirement scheme

and then moves on to normal retirement once he or she is entitled to the social security full rate. For instance, for an individual aged 55, we compute the following values, depending on age t, at which he or she will leave the labor force:

$$SSW1_{55,t} = \sum_{s=60}^{T} \beta^{s-t} \pi\left(\frac{s}{t}\right) B_s^{\text{Pension}}(t)$$

if the individual only relies on his or her normal pension;

$$SSW2_{55,t} = \sum_{s=t}^{59} \beta^{s-t} \pi\left(\frac{s}{t}\right) B_s^{\text{une}}(t) + \sum_{s=60}^{T} \beta^{s-t} \pi\left(\frac{s}{t}\right) B_s^{\text{Pension}}(t)$$

for a transition through unemployment insurance;

$$SSW3_{55,t} = \sum_{s=t}^{59} \beta^{s-t} \pi\left(\frac{s}{t}\right) B_s^{\text{pre}}(t) + \sum_{s=60}^{T} \beta^{s-t} \pi\left(\frac{s}{t}\right) B_s^{\text{Pension}}(t)$$

for a transition through early retirement.

Benefits B_s^{une} and B_s^{pre} are computed as a fraction of the last wage by direct application of official rules.

We then compute a weighted average of these three SSWs. Weights are a function of the sector of activity and reflect take-up probabilities. We tested other covariates, like gender or professional status (executives versus blue collar versus white collars), but their coefficients are mostly insignificant if sector dummies are included. This strategy is consistent with the results of previous studies that show that the sector of activity predicts access to early retirement or unemployment schemes far better than job skills or social group (Colin, Iéhlé, and Matieu 2000). As a general rule, the probability of facing a period of unemployment or early retirement at the end of one's career is markedly higher (at least for cohorts born around 1930) in industry. In particular, it is the automobile industry that concentrates the highest risks: at 55, there was a 60 percent probability of entering into unemployment or early retirement for a wage earner in the automobile industry. The reason is that around 1985, some sectors (including the automobile industry) benefited from exceptions, allowing for a lower age at entry in Allocation spéciale du Fonds national de l'emploí (ASFNE; fifty-five years instead of fifty-six years, two months).

These weights are conditional final probabilities: for a worker with a given age (e.g., 57) in a given sector (e.g., industry) we use the observed probability for this worker of this sector to retire through early retirement provisions (either early retirement or unemployment benefits) *conditional on still participating at that age (here 57) and whatever his or her actual age*

of retirement. Note that this dependency on age is crucial, since eligibility to these programs typically changes with age. For the considered cohorts, exit probabilities through early retirement or unemployment benefits were rather high at 55 or 56, and then sharply decreased for those who remained in the labor market (there were types of window plans for workers aged 55 to 56 in the mid-80s in France). We finally compute incentives (Accrual, PV, and OV) with this weighted SSW.

4.4.3 Spouse Issues

The incentive variables are computed here for individuals; they include, nevertheless, survivor benefits. A household SSW would be defined as the sum of the SSW of the two spouses. But as we have explained previously, the only way to generate households is to simulate an average spouse. The spouse characteristics (wages, retirement ages, etc.) depend only on gender, and do not result from any matching criterion. As a consequence, for all the individuals of a given gender, the spouse's SSW is a constant. Therefore, in our case, the household SSW would only differ from the individual SSW by a constant and would not add any information to incentive variables.

4.4.4 Descriptive Results and Econometric Analysis

Descriptive Statistics

Table 4.8 yields the median values of each incentive distinguished by age. The results given here are quite different from those of the second step, but several changes in our simulation method (especially the fact that we include survivor benefits in the computation of incentives) may account for these discrepancies.

The tax rate incentive variable is defined as the opposite of the ratio between the accrual incentive and the expected wage if the worker postpones retirement. It may be considered as a tax rate since, if it is positive, the SSW decreases and part of the expected labor income is lost through social security mechanisms.

Average SSW levels in these tables may differ substantially from those in other country studies. Two main limitations in our data may explain these large figures.

1. We excluded the self-employed from our analysis, which induces an upward bias on SSW, since the self-employed in the aftermath of World War II voluntarily chose less generous pension schemes to avoid paying large social security contributions.
2. Concerning civil servants, our data exclude those employed by local governments or hospitals. Civil servants working for hospitals or local governments are, on average, less skilled and thus lower paid than those

Table 4.8 **Median values of incentives**

Age	NB	SSW	Accrual	Tax	Peak	Option
			A. Men, private sector			
55	1,182	240,585	–3,361	0.23	–1,929	32.22
56	914	233,193	–3,647	0.26	–1,143	29.72
57	755	229,450	–1,399	0.12	3,034	26.26
58	647	232,680	913	–0.05	4,948	20.15
59	547	232,423	3,633	–0.21	3,660	11.61
60	512	235,690	–9,783	0.64	–9,783	–0.11
61	169	227,101	–8,436	0.53	–8,436	0.81
62	109	244,038	–8,308	0.47	–8,308	1.48
63	74	222,876	–9,025	0.52	–9,025	0.71
64	56	203,996	–8,467	0.53	–8,467	0.55
65	41	183,713	–7,966	0.56	–7,966	0.11
			B. Men, civil servants			
55	188	352,388	5,390	–0.25	10,244	55.05
56	160	353,343	3,223	–0.15	8,624	45.41
57	134	352,614	5,182	–0.25	9,132	35.04
58	131	358,863	3,045	–0.15	3,543	23.48
59	129	354,606	450	–0.02	450	12.06
60	125	359,480	–18,792	0.84	–18,942	–1.01
61	48	376,017	–21,324	0.86	–21,323	–1.06
62	35	360,196	–20,457	0.79	–20,457	–0.85
63	24	379,089	–25,094	0.91	–25,094	–1.29
64	19	372,915	–22,437	0.84	–22,437	–1.09
65	13	385,788	–28,404	0.91	–28,404	–14.09
			C. Women, private sector			
55	742	137,989	–2,123	0.18	1,332	37.73
56	584	133,732	–1,829	0.15	3,285	34.26
57	505	130,543	–721	0.06	4,234	30.27
58	427	129,559	19	0.00	4,342	23.59
59	361	129,716	2,819	–0.33	3,356	15.40
60	337	134,022	–3,340	0.30	–3,340	4.01
61	136	103,908	–1,011	0.12	–623	8.78
62	115	103,403	–1,237	0.13	1,316	8.39
63	92	98,107	–747	0.09	3,101	6.90
64	77	102,401	3,833	–0.45	3,909	4.28
65	62	107,266	–3,619	0.39	–3,619	0.76
			D. Women, civil servants			
55	240	331,980	–379	0.03	–379	12.25
56	189	316,266	2,059	–0.14	4,532	41.29
57	159	291,850	3,987	–0.25	9,360	32.63
58	149	286,929	2,727	–0.17	6,283	22.25
59	140	282,897	4,047	–0.27	4,047	11.63
60	135	281,714	–12,133	0.74	–12,133	–0.54
61	43	310,768	–12,865	0.61	–12,865	–0.23
62	32	293,548	–12,520	0.66	–12,520	–0.34
63	18	270,546	–15,484	0.86	–15,484	–1.12
64	11	226,657	–13,239	0.80	–13,239	–0.84
65	6	223,162	–14,359	0.90	–14,359	–11.97

directly employed by the central government. We thus overestimate the average civil servant's pension.

Econometric Analysis

The econometric estimations are performed with two different specifications of age: method S1 is based on a linear specification of the age variable, whereas age dummies (from age 55 to 65) are used with method S3. For each age specification (S1 or S3) two estimations are performed: one with the peak variable (PV) and another with the option variable (OV).

Coefficients on incentives variables are significant at the 5 percent level, with the expected sign in all simulations (see table 4.9). The coefficient is larger with the S1 simulation, since incentives related to ages of first eligibility to (early) retirement programs are better captured by age dummies than by the linear age variable or the incentive variables. The coefficient on SSW is not significant in all estimations and never has the expected (positive) sign: this result may stem from a positive correlation between SS entitlements and employees' productivity. Assume that a firm employs two types of old-age workers: the first group consists of highly paid, highly productive employees, and the second of low-paid workers, whose productivity is declining. Since the firm cannot decrease wages, this second group is overpaid—although paid less than the first group. It is costly to fire these workers, so the firm will wait until they can benefit from early retirement or other retirement programs, and then ask them to leave. As a result, this may create a negative correlation between the level of SSW and the likelihood to retire.

Age dummies are strongly significant. We may distinguish three groups of ages, ordered by increasing coefficients: the first age group contains ages 57 to 59 and 61 to 64. At those ages, very few people decide to claim SS benefits (either they claim benefits as early as possible—60 for the private sector, 55 for some civil servants—or they decide to wait until 65), and very few people leave their job to get early retirement benefits (for most, exits to early-retirement programs occur at ages 55 or 56). The second group contains ages 55 and 56: there are some exits to early retirement or even retirement for a minority of civil servants. The third group contains ages 60 and 65, the age of first eligibility to full-rate SS benefits for the huge majority of people in our sample.

The coefficient on the linear age variable is counterintuitive—since negative—with the OV specification: this may stem from unobserved heterogeneity in the preference for leisure in our sample: consider two populations that differ only in their preference for leisure. Those who have a high preference for leisure quit early, say at 60. At 61, the OV measure of the remaining population is lower than the OV measure of the whole population at 60 (there remain fewer years of potential continued work) but is underestimated (since the computation does not account for the endogenous se-

Table 4.9 **Probit model of retirement**

	Peak S1	Peak S3	Option S1	Option S3
Men				
SSW	–0.012	–0.005	–0.018	–0.013
	0.003	0.002	0.003	0.003
PV/OV	–0.267	–0.094	–0.053	–0.035
	0.020	0.020	0.003	0.003
Wage	0.074	0.020	0.277	0.174
Wage square	0.0025	0.0009	–0.0015	–0.0009
Age linear	0.077		–0.138	
Age				
55		Ref		Ref
56		–0.101		–0.188
57		–0.248		–0.445
58		–0.191		–0.608
59		–0.659		–1.360
60		1.262		0.280
61		0.473		–0.543
62		0.437		–0.621
63		0.171		–0.928
64		0.300		–0.840
65		1.440		0.233
Women				
SSW	–0.002	0.006	–0.019	–0.011
	0.006	0.006	0.006	0.007
PV/OV	–0.319	–0.195	–0.039	–0.028
	0.027	0.026	0.003	0.003
Wage	0.008	–0.169	0.380	0.175
Wage square	0.0053	0.0186	–0.0238	–0.0092
Age linear	0.088		–0.057	
Age				
55		Ref		Ref
56		–0.252		–0.329
57		–0.199		–0.408
58		–0.192		–0.556
59		–0.658		–1.224
60		1.129		0.448
61		–0.028		–0.745
62		0.266		–0.494
63		0.098		–0.703
64		0.188		–0.662
65		2.094		1.201

lection on the preference for leisure). Nonetheless, the observed retirement rate will be lower at 61 than at 60, since the considered population has a low preference for leisure. If the econometrician does not observe the preference for leisure, the coefficients of linear age variables will be significantly negative.

4.5 Methodology of the Simulation of Reforms

In order to assess the financial implications of the retirement incentives and also to proceed to cross-country comparisons, four reforms are simulated.

- Three-Year Reform: the minimum age to claim SS benefits is shifted to 63. The full rate is obtained if people have worked at least 162 quarters (instead of 150) or if they are 68. Access probabilities to unemployment or early retirement schemes are shifted by three years (access to these schemes is therefore impossible before 58).
- Common Reform: people may claim SS benefits from 60 (ERA). Claiming SS benefits at 65 (NRA) provides a 60 percent replacement rate. The pension is decreased (respectively, increased) by 6 percent per year below (respectively above 65). Access to early retirement or unemployment schemes is now impossible. The complementary schemes are also removed.
- Actuarial Reform: full-rate SS benefits may still be claimed from 65[2] or from 60 for persons who have worked at least 150 quarters, as with the current legislation. The early retirement age (ERA) is maintained identical to the current one, that is, at 60. But penalties associated with anticipated retirement are decreased to 6 percent for each year missing to reach 65 or 150 validated quarters (instead of 12 percent), whereas SS benefits are increased by 6 percent for each year worked beyond the full rate *and* after age 60. With our assumptions, the NRA is defined individually as the age when a person reaches the full rate (150 quarters or the age of 65). It thus depends on the number of quarters validated. The level of early benefits is also reduced for persons who start receiving these benefits before the age of 60: the reduction is 6 percent if they leave their job at 59, 12 percent at 58, and so forth.
- Charpin Reform: we assess the impact of the reform proposed in the *Charpin* report in 1999. It consists first in increasing the total number of quarters of contributions required to claim full-rate SS benefits to 170 quarters. Second, this reform would involve a decrease in penalties associated with anticipated retirement for workers in the private sector: in the benefit formula for the general regime, the coefficient α is reduced by 0.6 percentage point missing to reach either 170 quarters or age 65. For civil servants, the reform would simultaneously involve an increase from 150 to 170 in the number of quarters required to claim full-rate SS benefits at age of first eligibility to SS benefits (55 to 60). Penalties associated with anticipated retirement (currently close to zero) would increase: the coefficient α (currently 75 percent for

2. Or from 60, for the civil servants who were entitled to their pension from the age of 55.

everybody) is reduced by 0.9 percentage point missing to reach either 170 quarters or age 65 (respectively, 60) for people whose age of first eligibility to SS benefits is 60 (respectively, 55).

In essence, the Actuarial Reform is a halfway point between the current system and the full Common Reform: the Common Reform is based on a 6 percent actuarial adjustment and a replacement rate of 60 percent at the normal retirement age (NRA), whereas the NRA replacement rate in the Actuarial Reform is the same as with the current system (i.e., larger than 60 percent). A specific difficulty for France (in comparison with other countries) stems from the fact that the NRA is individual specific. For most people (those who have worked at least 150 quarters) the NRA is 60: the NRA is then identical to the ERA. But for a minority with short careers the NRA will be larger (up to 65) and different from the ERA.

We simulate changes in retirement behavior following these reforms and assess their financial impact. This assessment deals with the whole government fiscal impact, not just Social Security. Indeed, the taxes taken into account include payroll taxes, income taxes, and consumption taxes (VAT). We distinguish the *mechanical* impact of reforms from their *behavioral* impact: the mechanical impact is the expected change for public net expenditure if we assume that no one changes his or her retirement behavior. The behavioral impact is the difference between the total financial impact (simulated with the estimates of the previous section) and the mechanical impact.

Concerning the implementation of the Common Reform, the 60 percent replacement rate is applied to an average wage computed over the whole career. This average wage replicates the forty best yearly wages of a worker, including zeros when the worker worked less than forty years. As wages before 55 are not available in our data, we simulate a trend for real wages along a career, taking into account a fixed return per year of seniority, consistent with the magnitude of previous estimates on French data (Lolliver and Payen 1990). We apply this trend to the last known wages, including the effect of the tenure, to get an average of yearly wages for the best forty years. These real lifetime earnings are deflated using the average net wage index.

For these four reforms, we compute the incentives for individuals aged 55 to 66, taking into account possible retirement up to age 68. Since retirement after 66 remains minor, all workers leaving after 66 are gathered with workers leaving at 66.

A key issue in our simulations is how to deal with age dummies in specifications of type S3. Estimated age dummies are likely to capture age of first eligibility effects—eligibility to either early retirement or retirement benefits. Thus, these effects are a serious matter of concern.

- In the Three-Year Reform, the eligibility to all programs is raised by three years.

- In the Actuarial Reform—as well as in the Charpin Reform—ages of eligibility to different programs remain unchanged: we thus keep the same coefficient levels.
- In the Common Reform, people are no longer eligible for early retirement programs.

Our first concern was to determine as precisely as possible the appropriate level of coefficients on age dummies when people are not eligible to any (early) retirement program: a no-eligibility coefficient. We chose the mean of estimated coefficients on age dummies at 58 and 59: in our sample, most exits to early retirement in the private sector occurred at ages 55 and 56, and very few at ages 58 and 59. Moreover, the age of first eligibility to SS benefits is 60 for most people (except 55 for a minority of civil servants [but those who are eligible to SS benefits at 55 usually either quit at 55 or 56, or postpone retirement until they reach age 60]).

In the Three-Year Reform, we multiply the age 58 dummy by the estimated age 55 coefficient (here zero, since age 55 was the reference), the age 59 dummy by the estimated age 56 coefficient, and so on. For ages 55 to 57, since there is no open early retirement program, we multiply the age dummies by the no-eligibility coefficient.

In the Common Reform, we keep the estimated coefficients for ages 60 and 65, since 60 or 65 were already ages of eligibility to normal SS benefits for all workers in the sample. For ages 55 to 59, since there is no open retirement program, we multiply the age dummies by the no-eligibility coefficient. For ages 61 to 64, we also use the no-eligibility coefficient, as it reflects retirement behavior between the early retirement age (55) and the normal retirement age (60 to 65). Eventually, for age 66, we use the average of the estimated coefficients between age 61 and 64, as they stand for retirement after the first normal retirement age.

Expected Effects

The Three-Year Reform should induce a rather large increase in the retirement age, since eligibility to *all* retirement pathways (including early retirement) is postponed by three years. Since the level of annual pensions does not fundamentally change (the average pension should slightly increase, since workers have longer careers), total SS entitlements should decrease by a large amount.

The Actuarial Reform should have a positive effect on the average level of SSW. Its impact on the mean age of retirement is not straightforward: the decrease of penalties should include earlier retirement. But increasing pensions when people claim SS benefits with more than 150 quarters has a priori mixed effects: on the one side, it induces people to postpone their retirement through a price effect; on the other side, it increases the level of people who already leave with more than 150 quarters, and could induce them to anticipate retirement through a wealth effect.

In France, for the cohorts considered, the Common Reform involves a sharp decrease in replacement rates: for a normal career, replacement rates (including complementary schemes for the private sector) were close to 75 percent of the last wage. With the Common Reform, the pension would amount to 60 percent of the real lifetime earnings, as previously defined, which are likely to be smaller than the last wages. Associated with the elimination of early retirement programs (before age 60), this may create an incentive to postpone retirement. However, most of the effect of the reform on total SS entitlements should be more mechanical than behavioral, since the Common Reform dramatically lowers the level of the average pension.

The Charpin Reform should have far smaller effects on retirement behavior and aggregate SS entitlements than the Three-Year Reform or the Common Reform: the tenure required to claim full-rate SS benefits at age 60 increases by five years, but ages of eligibility to retirement programs remain unchanged.

4.6 Results of the Simulations

Tables 4.10 and 4.11, figures 4.1, 4.2, 4.4, and 4.6 yield average SSWs or PDVs of benefits per worker, in euros. Table 4.12 yields total PDV for each quintile in euros. Figure 4.7 yields variations in the total PDV of benefits (with a distinction between mechanical and behavioral effects) in percentage of GDP: we multiplied average amounts per worker (in euros) by the number of retired people we consider here, and then divided by GDP. Our number of retired people excludes people who stopped working before age 55, given our sample restrictions: our figures thus underestimate the total effect of reforms, since these people get reduced (respectively, increased) benefits if the simulated reform consists in a reduction (respectively, an increase) in SS benefits.

4.6.1 PDV of Gross Benefits by Age of Retirement

Figure 4.1 presents the present discounted value (PDV) of the gross social security wealth (SSW) by age of retirement. With the current rules, the values are decreasing with the age of retirement because, when retirement is delayed by one year, the loss of one year of pension is not compensated by a much higher level of pension. The decreasing slope is stronger after 60, as the pension level is far more important than the average replacement income in case of a retirement before 60.

The Three-Year Reform shifts this profile to the right, with a loss in the level of SSW before 63. This loss is much higher between 55 and 57 due to the suppression of the early retirement and unemployment schemes. But, after 63, the difference in the SSW with the current rules and with the three-year shift almost vanishes.

With the Common Reform, the PDV of the gross SSW does not depend on the age of retirement (given the quasi-perfect actuarial adjustment) and

Table 4.10 **Total fiscal impact of reform**

	Present discounted value (in euros)					Total change relative to base (%)			
	Base	Three-Year	Actuarial	Common	Charpin	Three-Year Reform	Actuarial Reform	Common Reform	Charpin Reform
				Peak value—S1					
Benefits	277,488	230,797	316,098	102,175	248,604	–17	14	–63	–10
Taxes									
Payroll	55,794	68,224	43,394	63,378	61,681	22	–22	14	11
Income	38,390	38,334	36,462	17,860	37,017	0	–5	–53	–4
VAT	60,176	53,558	66,313	30,615	55,586	–11	10	–49	–8
Total	154,360	160,117	146,169	111,854	154,285	4	–5	–28	0
				Peak value—S2					
Benefit	278,144	229,697	311,546	99,680	250,884	–17	12	–64	–10
Taxes									
Payroll	54,936	62,041	47,334	56,555	57,954	13	–14	3	5
Income	38,245	36,852	37,826	16,773	35,890	–4	–1	–56	–6
VAT	60,262	52,594	65,488	29,655	55,838	–13	9	–51	–7
Total	153,443	151,486	150,647	102,982	149,681	–1	–2	–33	–2
				Peak value—S3					
Benefits	278,144	226,775	311,546	99,906	250,884	–18	12	–64	–10
Taxes									
Payroll	54,936	72,976	47,334	66,058	57,954	33	–14	20	5
Income	38,245	39,135	37,826	19,214	35,890	2	–1	–50	–6
VAT	60,262	52,700	65,488	30,858	55,838	–13	9	–49	–7
Total	153,443	164,812	150,647	116,130	149,681	7	–2	–24	–2

				Option value—S1					
Benefits	278,147	216,423	310,262	103,365	249,128	–22	12	–63	–10
Taxes									
Payroll	55,720	91,090	49,879	92,752	60,063	63	–10	66	8
Income	38,473	43,736	38,617	27,713	36,088	14	0	–28	–6
VAT	60,323	51,713	65,493	34,023	55,607	–14	9	–44	–8
Total	154,517	186,540	153,989	154,488	151,759	21	0	0	–2
				Option value—S2					
Benefits	278,679	220,370	309,727	100,951	250,674	–21	11	–64	–10
Taxes									
Payroll	54,970	83,199	49,640	81,055	57,722	51	–10	47	5
Income	38,264	42,346	38,786	25,354	35,463	11	1	–34	–7
VAT	60,389	52,069	65,369	32,796	55,791	–14	8	–46	–8
Total	153,622	177,614	153,795	139,206	148,977	16	0	–9	–3
				Option value—S3					
Benefits	278,679	225,116	309,727	101,242	250,674	–19	11	–64	–10
Taxes									
Payroll	54,970	81,380	49,640	86,452	57,722	48	–10	57	5
Income	38,264	42,271	38,786	26,789	35,463	10	1	–30	–7
VAT	60,389	53,076	65,369	33,422	55,791	–12	8	–45	–8
Total	153,622	176,727	153,795	146,663	148,977	15	0	–5	–3

Table 4.11 **Decomposition of the total effect of reform**

	Change in present discounted value											
	Three-Year Reform			Actuarial Reform			Common Reform			Charpin Reform		
	Mechanical	Behavioral	Total	Mechanical	Behavioral	Total	Mechanical	Behavioral	Total	Mechanical	Behavioral	Total
						Peak value—S1						
Benefits	–47,978	1,287	–46,691	29,559	0	38,610	–177,855	2,542	–175,312	–27,429	–1,455	–28,884
Taxes: Total	–13,529	19,285	5,756	9,972	–18,164	–42,507	–51,958	9,451	–42,507	–8,965	8,889	–76
Net change	–34,449	–17,998	–52,447	19,587	18,164	37,751	–125,897	–6,909	–132,805	–18,464	–10,344	–28,808
Change as % of base benefits	–12.4	–6.5	–18.9	7.1	6.5	13.6	–45.4	–2.5	–47.9	–6.7	–3.7	–10.4
						Peak value—S2						
Benefits	–49,850	1,403	–48,447	28,683	4,718	33,402	–179,176	712	–178,464	–26,886	–374	–27,261
Taxes: Total	–13,845	11,888	–1,957	9,686	–12,482	–50,461	–52,115	1,654	–50,461	–8,759	4,997	–3,762
Net change	–36,005	–10,485	–46,490	18,997	17,201	36,198	–127,062	–942	–128,003	–18,127	–5,371	–23,499
Change as % of base benefits	–12.9	–3.8	–16.7	6.8	6.2	13.0	–45.7	–0.3	–46.0	–6.5	–1.9	–8.4
						Peak value—S3						
Benefits	–49,850	–1,519	–51,369	28,683	4,718	33,402	–179,176	938	–178,239	–26,886	–374	–27,261
Taxes: Total	–13,845	25,214	11,368	9,686	–12,482	–37,313	–52,115	14,802	–37,313	–8,759	4,997	–3,762
Net change	–36,005	–26,732	–62,737	18,997	17,201	36,198	–127,062	–13,864	–140,925	–18,127	–5,371	–23,499
Change as % of base benefits	–12.9	–9.6	–22.6	6.8	6.2	13.0	–45.7	–5.0	–50.7	–6.5	–1.9	–8.4

						Option value—S1						
Benefits	–47,844	–13,880	–61,724	28,252	3,863	32,115	–178,918	4,136	–174,782	–27,504	–1,515	–29,019
Taxes: Total	–12,467	44,491	32,024	9,602	–10,129	–29	–51,577	51,548	–29	–8,932	6,174	–2,758
Net change	–35,377	–58,371	–93,748	18,650	13,992	32,642	–127,341	–47,412	–174,753	–18,572	–7,690	–26,261
Change as % of base benefits	–12.7	–21.0	–33.7	6.7	5.0	11.7	–45.8	–17.0	–62.8	–6.7	–2.8	–9.4
						Option value—S2						
Benefits	–49,862	–8,446	–58,308	27,676	3,373	31,049	–179,864	2,136	–177,727	–27,248	–757	–28,005
Taxes: Total	–13,338	37,330	23,992	9,385	–14,416	–51,977	37,561	–14,416	–8,845	4,200	–4,645	
Net change	–36,524	–45,776	–82,300	18,291	12,585	30,876	–127,886	–35,425	–163,311	–18,403	–4,957	–23,360
Change as % of base benefits	–13.1	–16.4	–29.5	6.6	4.5	11.1	–45.9	–12.7	–58.6	–6.6	–1.8	–8.4
						Option value—S3						
Benefits	–49,862	–3,700	–53,562	27,676	3,373	31,049	–179,864	2,427	–177,436	–27,248	–757	–28,005
Taxes: Total	–13,338	36,443	23,105	9,385	–9,212	–6,959	–51,977	45,018	–6,959	–8,845	4,200	–4,645
Net change	–36,524	–40,143	–76,667	18,291	12,585	30,876	–127,886	–42,591	–170,477	–18,403	–4,957	–23,360
Change as % of base benefits	–13.1	–14.4	–27.5	6.6	4.5	11.1	–45.9	–15.3	–61.2	–6.6	–1.8	–8.4

Table 4.12 **Distributional analysis: Option value—linear age (S1)**

	Present discounted value					Change relative to base PDV			
	Base	Three-Year	Actuarial	Common	Charpin	Three-year Reform	Actuarial Reform	Common Reform	Charpin Reform
				Quintile 1 (highest)					
Benefits	209,697,209	164,681,193	238,116,614	93,858,974	188,250,564	–45,016,016	28,419,405	–115,838,235	–21,446,645
Taxes									
Payroll	64,666,928	99,310,017	52,397,681	91,496,876	70,141,689	34,643,089	–12,269,247	26,829,948	5,474,761
Income	59,510,041	68,662,650	54,316,181	46,528,054	57,783,757	9,152,609	–5,193,860	–12,981,987	–1,726,284
VAT	48,763,182	43,253,694	52,826,113	31,748,493	45,454,115	–5,509,488	4,062,931	–17,014,689	–3,218,067
Total	172,940,151	211,226,360	159,539,975	169,773,423	173,470,561	38,286,209	–13,400,176	–3,166,728	530,410
Net change						–83,302,225	41,819,581	–112,671,507	–21,977,055
Change as % of base benefits						–39.7	19.9	–53.7	–10.5
				Quintile 2					
Benefits	162,379,589	126,258,531	172,882,161	55,793,639	138,137,154	–36,121,058	10,502,572	–106,585,960	–24,242,435
Taxes									
Payroll	22,903,156	38,928,440	24,097,844	43,553,482	25,361,407	16,025,285	1,194,688	20,650,327	2,458,251
Income	15,623,047	16,816,461	17,870,200	9,685,589	13,284,928	1,193,415	2,247,153	–5,937,458	–2,338,118
VAT	33,461,519	28,136,932	35,213,870	17,280,449	29,424,117	–5,324,588	1,752,351	–16,181,070	–4,037,403
Total	71,987,722	83,881,834	77,181,914	70,519,520	68,070,452	11,894,112	5,194,192	–1,468,201	–3,917,270
Net change						–48,015,170	5,308,380	–105,117,749	–20,325,165
Change as % of base benefits						–29.6	3.3	–64.7	–12.5

				Quintile 3					
Benefits	122,617,443	93,768,747	134,716,504	40,967,282	111,116,584	–28,848,696	12,099,061	–81,650,160	–11,500,859
Taxes									
Payroll	18,225,934	32,444,348	17,818,879	37,384,039	19,649,651	14,218,414	–407,055	19,158,105	1,423,716
Income	8,548,878	9,622,183	10,012,247	5,506,406	7,713,588	1,073,305	1,463,370	–3,042,471	–835,290
VAT	25,760,864	21,480,676	27,829,737	13,439,247	23,817,753	–4,280,189	2,068,873	–12,321,617	–1,943,111
Total	52,535,676	63,547,206	55,660,864	56,329,692	51,180,991	11,011,530	3,125,188	3,794,016	–1,354,685
Net change						–39,860,225	8,973,874	–85,444,176	–10,146,174
Change as % of base benefits						–32.5	7.3	–69.7	–8.3
				Quintile 4					
Benefits	91,804,600	70,789,365	103,967,661	30,154,320	84,957,965	–21,015,235	12,163,061	–61,650,280	–6,846,636
Taxes									
Payroll	14,268,471	25,203,090	13,125,195	26,919,366	14,974,801	10,934,619	–1,143,276	12,650,895	706,330
Income	4,361,567	5,056,629	5,322,191	2,506,209	3,942,306	695,062	960,624	–1,855,358	–419,262
VAT	19,518,004	16,448,220	21,635,008	10,119,785	18,354,688	–3,069,783	2,117,005	–9,398,218	–1,163,316
Total	38,148,042	46,707,939	40,082,395	39,545,361	37,271,795	8,559,897	1,934,353	1,397,319	–876,247
Net change						–29,575,133	10,228,708	–63,047,599	–5,970,389
Change as % of base benefits						–32.2	11.1	–68.7	–6.5
				Quintile 5 (lowest)					
Benefits	68,259,693	53,962,005	80,674,305	22,547,775	63,984,981	–14,297,689	12,414,612	–45,711,918	–4,274,712
Taxes									
Payroll	11,100,669	18,540,847	9,975,719	18,984,399	11,261,518	7,440,178	–1,124,950	7,883,731	160,849
Income	2,522,767	2,797,651	3,383,266	1,009,954	2,226,321	274,884	860,499	–1,512,813	–296,446
VAT	14,497,153	12,413,752	16,666,654	7,501,556	13,758,378	–2,083,401	2,169,501	–6,995,597	–738,775
Total	28,120,589	33,752,250	30,025,638	27,495,909	27,246,217	5,631,661	1,905,049	–624,679	–874,371
Net change						–19,929,350	10,509,563	–45,087,239	–3,400,340
Change as % of base benefits						–29.2	15.4	–66.1	–5.0

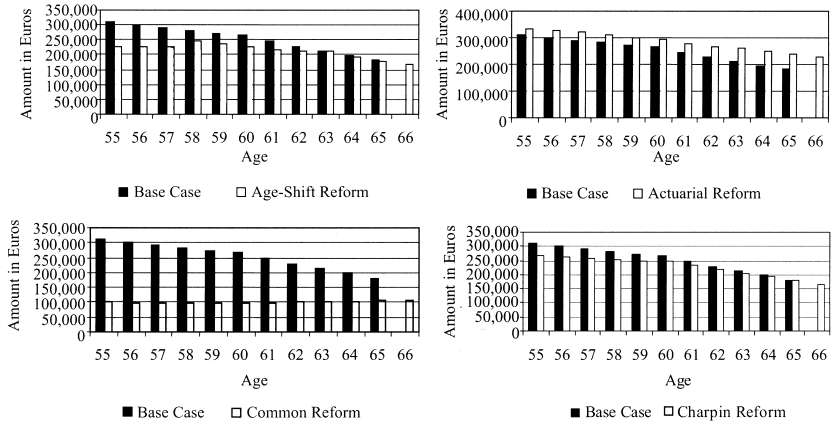

Fig. 4.1 Peak value of social security benefits by age of retirement

the level of SSW is very low compared to the current rules, due to the dramatic decrease in the average replacement rate.

The Actuarial Reform provides higher levels of SSW than the current situation, whatever the age of retirement. The results exhibit a more regular decrease with age than in the base case. However, this case is a halfway point between the current situation (with a strong deviation from actuarial fairness) and pure actuarial provisions. The age profile of SSW is thus not flat (contrary to the Common Reform).

The Charpin Reform induces a small loss in SSW for all ages of retirement. Because the new rules disadvantage early retirement, and also because of the discounting hypothesis, this loss decreases with the age of retirement.

4.6.2 PDV of Taxes by Age of Retirement

Figure 4.2 shows the PDV of the taxes paid by age of retirement. Consistent with our intuition, the PDV of taxes increases with the age of retirement with the current rules. Indeed, working one more year implies paying taxes on one more year of labor income and also earning a better SS pension, which will result in higher taxes for each year of retirement.

For the Three-Year Reform, the strong loss in SSW for retirement before 63 appears through a smaller level of PDV of taxes paid for those ages.

In like manner, for the Actuarial Reform, the better SSW for all ages of retirement appears through a higher level of PDV of taxes paid than with the current rules, particularly for later retirements.

With the Common Reform, the taxes paid remain lower than with the current rules. However, the evolution of the PDV of taxes with the age of retirement is much quicker than with the current rules. Indeed, the gap be-

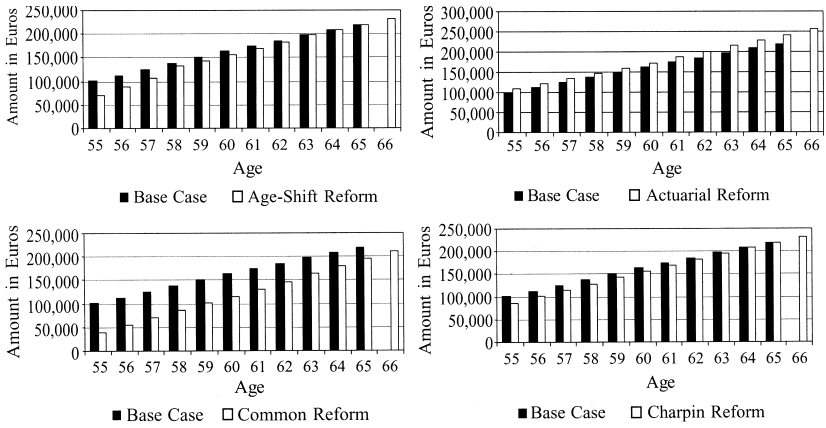

Fig. 4.2 Peak value of taxes by age of retirement

tween taxes paid with the current rules and with the Common Reform is due to the smaller level of pension with the Common Reform. The part of the taxes on pensions in the total of the taxes paid decreases with the age of retirement. As a result, the gap between the PDV of taxes paid with the current rule sand with the Common Reform decreases with the age of retirement.

The Charpin Reform generates slightly smaller levels of PDV of taxes, in particular for early retirement.

4.6.3 Age of Retirement

The results from the OV-S1 method display an average retirement postponement greater than three years, which is doubtful. This may stem from the negative sign for the coefficient on the linear age variable, which contradicts the expected increase of the utility of leisure with age (section 4.4). We shall not comment in detail on the results induced by this method (figures 4.3 and 4.4), but shall concentrate on the OV-S3 results.

Figure 4.5 shows the distributions of the ages at retirement with the OV-S3 modeling. The distributions of the ages at retirement evidence a strong delay in retirement ages with the Three-Year Reform, with an average increase of 2.4 years with the OV-S3 method. The retirement ages profile is close to what is expected, with new retirements before 58 and two peaks at 58 and 63.

Introducing more actuarial fairness hardly changes the distribution of the ages of labor force exit. We observe a slight decrease in the average age at retirement: the decrease in penalties associated with retirement before reaching the full rate are decreased and some people decide to quit earlier.

For the Common Reform, the average delay in the age at retirement is even higher than the one observed with the Three-Year Reform (3.6 years).

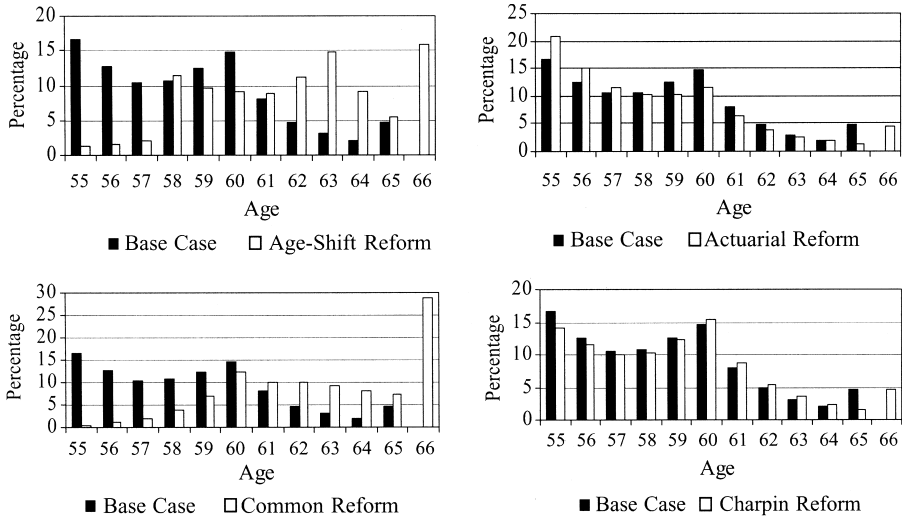

Fig. 4.3 Labor participation effects of reforms—Distribution of the age at retirement, OV-S1 method

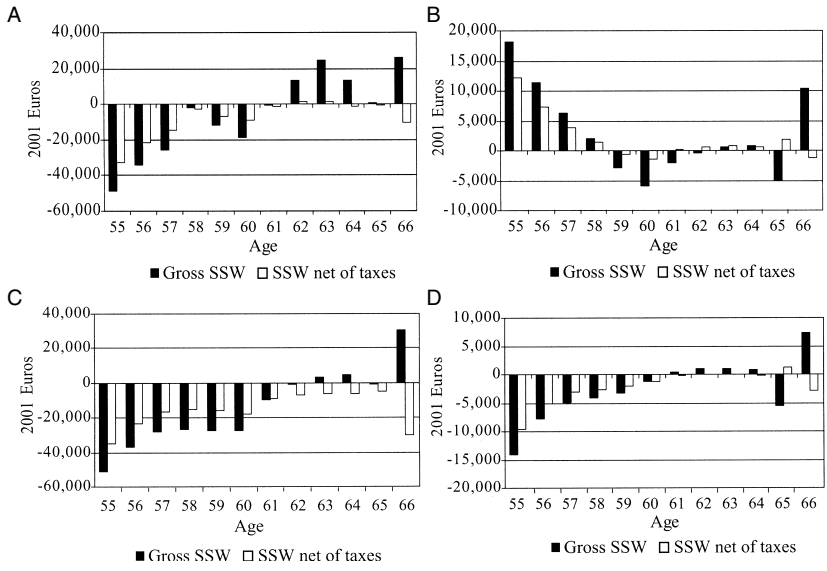

Fig. 4.4 Distribution of total effect, OV-S1 method: Total Effect by Age of Retirement (OV S1 Model); *A,* Age-Shift Reform; *B,* Actuarial Reform; *C,* Common Reform; *D,* Charpin Reform

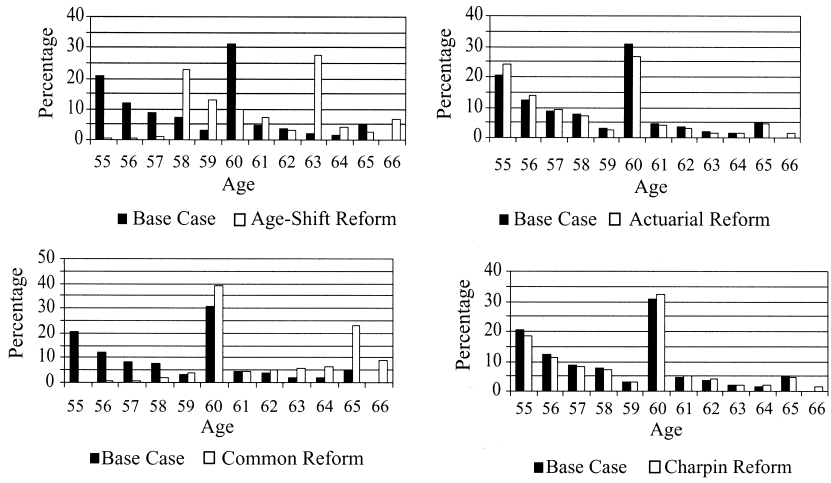

Fig. 4.5 Labor participation effects of reforms—Distribution of the age at retirement, OV-S3 method

The ages profiles show almost no retirement before 60, a large peak at 60, and a smaller one at 65.

For the Charpin Reform, the average delay is smaller (0.3 years). Retirement rates slightly decline before age 60 because fewer people reach the new target of 170 quarters of contributions.

4.6.4 Fiscal Effects: Mechanical versus Behavioral

Figures 4.6 and 4.7 show the impact of the different reforms on the gross and net present discounted value of Social Security benefits and present a decomposition of the total net effect between mechanical and behavioral components.

The Three-Year Reform induces a significant decrease (between 0.5 percent and 0.8 percent of GDP) in the net present discounted value (NPDV) of SS benefits (see figure 4.7). More than 50 percent of this decrease (i.e., 0.4 percent of GDP) results from simulated behavioral effects according to the OV method. Behavioral effects are smaller if we focus on PV simulations, but OV simulations take the future flows of wage income into account better than PV simulations. The future flows of income here are important, since continuing to retire at 60 now means no income until age 63 for people who do not qualify for early retirement benefits. The decrease in the NPDV of SS benefits is especially significant at ages 55 to 57 (see figure 4.6), since the age of first eligibility to early retirement benefits is now 58 and at age 60, since the age of first eligibility to normal SS benefits is now 63.

The Actuarial Reform induces a smaller increase in the NPDV (about 0.3 percent of GDP) and behavioral effects range from 0.1 percent to 0.2

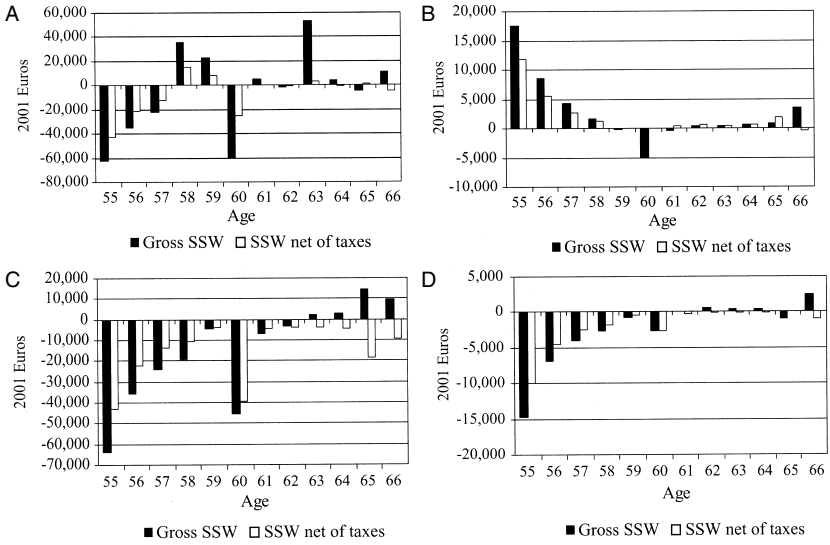

Fig. 4.6 Distribution of total effect by age of retirement, OV-S3 method: *A,* Age-Shift Reform; *B,* Actuarial Reform; *C,* Common Reform; *D,* Charpin Reform

percent of GDP. The increase is the largest at ages 55 and 56, since people who decide to leave at those ages without reaching the full rate face reduced penalties when they claim SS benefits.

The Common Reform exhibits a large decrease in the NPDV of SS benefits: about 1.7 percent of GDP. We prefer, again, OV specifications, since PV simulations (where the behavioral effect is negligible) do not capture the sharp decrease at all in the replacement rate of wage income by SS benefits at each age. The mechanical effect is very large: about 1.3 percent of GDP, and the behavioral effect is estimated to be 0.4 percent of GDP.

The Charpin Reform shows a small decrease in the NPDV of SS benefits (about 0.2 percent of GDP), less than half of which results from behavioral effects. This decrease is sharp at ages 55 to 57: people who qualified for early retirement benefits at these ages, and thus retired before 60, could claim full-rate SS benefits at 60 with the full rate since they had worked 150 quarters or more. This is no more the case for a large part of them because, in the reform, full-rate SS benefits at 60 are only available for those who worked 170 quarters or more.

4.6.5 Distributional Issues

Let us now consider distributional issues (see tables 4.12 and 4.13). The age-shift reform has a negative impact for all quintiles, since the age of first eligibility to SS benefits increases by three years for all people. But this

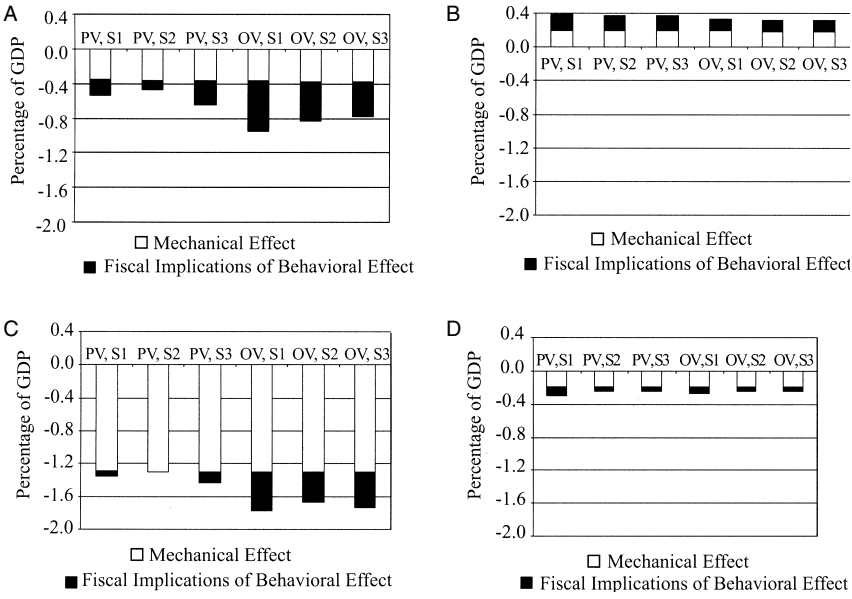

Fig. 4.7 Fiscal implications of reforms (percent of GDP): *A,* 3-year increase in ERA/NRA; *B,* Actuarial Reform; *C,* Common Reform; *D,* Charpin Reform

effect is larger for the highest quintile: this does not stem from the effect of the reform on the gross PDV of SS benefits (the evolution is more or less the same for all quintiles) but on taxes, especially income taxes. Since people retire later and the level of pensions is clearly below the level of wages, people pay higher income taxes. This effect is large on the highest quintile but small for other quintiles (a large majority of people in the third-lowest quintiles pay zero income tax in France).

The Actuarial Reform has a positive impact for all quintiles, but the effect is larger for the extreme quintiles: in the lowest quintile, people often faced liquidity constraints that led a significant number of them to claim reduced benefits at 60, although it would have been better for them to wait until 65, given the strength of penalties. These people take advantage of the decrease of penalties. In the highest quintile, a number of people already worked after 60, although they did not expect any increase in SS benefits (perhaps because their replacement rate was rather low). They take advantage of the possibility to get higher SS benefits for people who postpone retirement after the full rate.

The Common Reform has a negative impact for all quintiles, given the sharp decrease in replacement rates, but the effect is larger for low quintiles: the replacement rate in the base case decreases with wage income and

Table 4.13 **Distributional analysis: Option value—S3**

	Present discounted value					Change relative to base PDV			
	Base	Three-Year	Actuarial	Common	Charpin	Three-Year Reform	Actuarial Reform	Common Reform	Charpin Reform
				Quintile 1 (highest)					
Benefits	210,826,547	173,350,742	237,628,955	91,910,828	190,113,094	–37,475,806	26,802,408	–118,915,719	–20,713,453
Taxes									
Payroll	63,242,882	88,495,737	52,322,038	86,112,825	66,590,386	25,252,855	–10,920,844	22,869,943	3,347,504
Income	58,951,696	66,175,743	54,768,867	45,802,338	56,478,326	7,224,047	–4,182,829	–13,149,358	–2,473,370
VAT	48,893,316	44,446,017	52,726,310	31,253,780	45,719,799	–4,447,298	3,832,995	–17,639,535	–3,173,517
Total	171,087,894	199,117,498	159,817,215	163,168,943	168,788,511	28,029,604	–11,270,678	–7,918,950	–2,299,382
Net change						–65,505,410	38,073,086	–110,996,769	–18,414,071
Change as % of base benefits						–31.1	18.1	–52.6	–8.7
				Quintile 2					
Benefits	161,943,994	129,411,886	172,819,678	54,325,693	138,621,659	–32,532,108	10,875,683	–107,618,301	–23,322,335
Taxes									
Payroll	22,833,029	35,254,768	23,510,317	40,490,503	24,512,929	12,421,740	677,288	17,657,475	1,679,901
Income	15,634,038	16,486,832	17,784,180	9,034,624	13,181,632	852,794	2,150,141	–6,599,414	–2,452,407
VAT	33,377,417	28,636,453	35,164,409	16,941,058	29,469,056	–4,740,964	1,786,992	–16,436,359	–3,908,361
Total	71,844,484	80,378,054	76,458,905	66,466,186	67,163,617	8,533,570	4,614,421	–5,378,298	–4,680,867
Net change						–41,065,678	6,261,262	–102,240,003	–18,641,468
Change as % of base benefits						–25.4	3.9	–63.1	–11.5
				Quintile 3					
Benefits	122,782,770	97,595,711	134,575,925	39,964,806	111,682,445	–25,187,059	11,793,155	–82,817,965	–11,100,325
Taxes									
Payroll	18,067,627	28,530,856	17,657,897	33,692,745	19,000,067	10,463,229	–409,729	15,625,119	932,440
Income	8,564,462	9,281,226	9,993,090	4,952,254	7,655,115	716,764	1,428,628	–3,612,207	–909,347
VAT	25,791,767	22,145,500	27,790,870	13,077,357	23,901,968	–3,646,267	1,999,103	–12,714,411	–1,889,799

Total	52,423,856	59,957,582	55,441,857	51,722,356	50,557,150	7,533,726	3,018,001	–701,499	–1,866,706
Net change						–32,720,785	8,775,153	–82,116,465	–9,233,619
Change as % of base benefits						–26.6	7.1	–66.9	–7.5
				Quintile 4					
Benefits	91,963,844	73,789,282	103,617,373	29,816,676	85,385,849	–18,174,562	11,653,529	–62,147,168	–6,577,995
Taxes									
Payroll	14,156,715	22,275,187	13,230,984	24,931,029	14,586,242	8,118,472	–925,732	10,774,314	429,527
Income	4,373,002	4,830,080	5,344,158	2,298,518	3,925,136	457,078	971,156	–2,074,484	–447,866
VAT	19,546,620	16,970,320	21,569,197	9,957,817	18,422,391	–2,576,300	2,022,576	–9,588,804	–1,124,230
Total	38,076,338	44,075,587	40,144,338	37,187,364	36,933,768	5,999,249	2,068,001	–888,973	–1,142,569
Net change						–24,173,811	9,585,528	–61,258,195	–5,435,425
Change as % of base benefits						–26.3	10.4	–66.6	–5.9
				Quintile 5 (lowest)					
Benefits	68,492,327	55,776,399	80,456,425	22,306,475	–12,715,929	11,964,098	–46,185,852	–4,209,222	
Taxes									
Payroll	11,098,934	17,011,221	10,131,733	18,280,225	11,188,279	5,912,287	–967,201	7,181,291	89,345
Income	2,549,384	2,731,710	3,410,845	973,388	2,240,536	182,326	861,461	–1,575,996	–308,848
VAT	14,545,814	12,743,339	16,628,472	7,446,308	13,819,894	–1,802,475	2,082,658	–7,099,506	–725,919
Total	28,194,132	32,486,270	30,171,050	26,699,921	27,248,710	4,292,138	1,976,919	–1,494,211	–945,422
Net change						–17,008,067	9,987,179	–44,691,642	–3,263,800
Change as % of base benefits						–24.8	14.6	–65.3	–4.8

is 60 percent for all (whatever the level of wage income) in the Common Reform. The loss is thus larger for low-paid people.

With the Charpin Reform the effects are rather small, and nothing appears clear concerning distributional issues.

4.7 Conclusion

This analysis focuses on the steady-state impact of reforms of retirement rules on an age-55 cohort. We rely on a previous assessment of the sensitivity of individual retirement behavior to the structure of Social Security incentives (Mahieu and Blanchet 2002). This enables us to measure the fiscal implications of changes in individual retirement decisions and thus to decompose the financial impacts of simulated reforms between this behavioral component and a mechanical component. However, the analysis does not incorporate any general equilibrium effect that may occur.

We simulate several reforms so as to assess the impact of the behavioral component on the total amount of Social Security benefits paid. The results exhibit a large impact of behavioral responses to modifications in SS provisions. For example, a reform that introduces a unique normal replacement rate of 60 percent at age 65 and a strictly actuarial adjustment involves a sharp increase in the average retirement age. This behavioral component is estimated to reduce the net present discounted value of SS benefits for the 1930 cohort by as much as 0.4 percent of GDP.

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