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Welfare Effects of Social Security Reforms Across Europe

The Case of France and Italy

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Abstract

This paper uses a calibrated life cycle model to quantify the distributional effects of Social Security reforms. We focus on two countries, Italy and France, because they adopted two different strategies to cope with aging. While France marginally modified its defined benefit pension plan, Italy switched from a defined benefit pension plan to a contributive system. We find both reforms redistribute welfare unevenly: high skilled workers are the primary winners of the French reform and self employed individuals, especially unskilled workers, are the losers under the new Italian Social Security arrangement. Finally, we estimate that the French reform only finances 20% of the expected deficit. This is in sharp contrast with the Italian reform which finances the expected deficit by cutting drastically the generosity of Social Security benefits.

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1 Introduction

All industrialized countries have adopted reforms to support the “Pay as you go” (PAYG) system jeopardized by population aging. The funding of pension systems is one of the major concern in view of the changing demographic trends. However, beyond the solvency issue, it is crucial to quantify the distributional effects of Social Security reforms allowing to identify winners and losers from reforms. Some careers are naturally longer than others and some workers expect to live longer after retirement than others. These facts underline that Social Security (hereafter SS) is not only an individual insurance but also a social insurance. By affecting insurance possibilities as well as savings and labor supply, SS reforms redistribute welfare within and across generations. Redistributive considerations also help understand political support for these reforms.

This paper investigates how changes in Social Security regimes affect workers' welfare. We focus on two countries and their associated reforms that occurred during the nineties: Italy and France, because they adopted very different strategies to cope with aging. While France marginally modified its defined benefit pension plan, a contributive system was introduced in Italy in place of a defined benefit plan. This paper is in direct relation with a large literature, focused primarily on the United States that uses a life cycle framework for the analysis of SS policy reforms (DeNardi, Imrohoroglu & Sargent (1999), Conesa & Krueger (1999), Huggett & Ventura (1999) among others).[1]

We develop a unified theoretical framework in order to quantify the welfare effects of SS reforms. Along the lines of Rust & Phelan (1997), Huggett & Ventura (1999) and Fuster, Imrohoroglu & Imrohoroglu (2003), we use a fully dynamic life-cycle model, in which individuals are heterogeneous with respect to age, wealth and labor status. Our model also allows individuals to differ in skill levels, which permits a rich analysis of intragenerational welfare changes. Retirement and savings decisions are endogenous decisions made under uncertainty, while agents are altruistic (with respect to their offsprings) and face financial constraints. The model is first calibrated to match key features in the data across heterogeneous groups within countries. We then evaluate redistributive effects of policy reforms in steady-state after carefully mapping the "real world" Social Security reforms in France and Italy into the model.

Our results suggest that high-skilled workers were the primary winners of the reform that occurred in France as these workers took advantage of the greater flexibility in pension schemes. However, we estimate that the reform only finances 20% of the expected deficit and as a consequence, no particular group suffered a loss from that reform. Further reforms in the French benefit system are needed to

[1] In a recent literature, some studies use microsimulation models to investigate institutional differences across countries as Gruber & Wise (2004) and Blondal & Scarpetta (1998), Blanchet & Pelé (1997) and Brugiavini (1997) for France and Italy respectively. For want of a complete theoretical setting, such studies can not assess welfare implications of SS reforms.

finance the expected benefit. This is in sharp contrast with the Italian reform which finances the expected deficit by cutting drastically the generosity of Social Security benefits. This strongly and negatively affects the self-employed workers, approximately a third of the working population in Italy, who contribute little to the pension system and have lower earnings than other workers.

We first present the model, then describe pension reforms in France and Italy. This allows us to contrast the French system based on a defined pension system with the Italian contributive system. Third, we solve the model in a benchmark calibration, then check its ability to reproduce the prevailing features of SS and retirement profiles. Finally, we compare welfare effects of SS reforms in both countries.

2 Social Security Reforms

Why is it interesting to compare Italy with France? Both retirement plans are pay-as-you-go systems. In the case of France, the SS reform modified the defined benefit pension plan. In contrast, Italy chose to switch from a defined benefit pension plan to a notional defined contribution system. Descriptions of the French systems and Italian systems can be found in Blanchet & Pelé (1997), Brugiavini (1997) and Brugiavini & Peracchi (2003). In this section, we describe key concepts and formulas of each countries system that will be incorporated in the model.

2.1 France

For French private workers, the pension benefit consists of two elements :

1. a "General Regime". This regime is based on defined pension plans and managed by a State agency (Caisse Nationale d'Assurance Vieillesse, hereafter CNAV). Its US counterpart is the Old Age and Survivors Insurance (OASI).
2. mandatory complementary schemes (AGIRC and ARRCO). The second pillar is managed by trade unions and representatives of employers.

Approximately 70 percent of the labor force falls under this so-called "General Regime". Both retirement plans are pay-as-you-go systems, but they are characterized by separate budgets. Mandatory schemes cannot be discarded when analyzing retirement decisions and computing pension benefits. However, policy debates focus on how the pattern of General Regime benefits could be modified in order to encourage people to postpone retirement. Besides, the General Regime is directly managed by the government, so it constitutes a policy tool, while complementary schemes are managed by non governmental organization. Hence, we focus on changes in the General Regime pensions [2].

Table 1 summarizes the pension formulas that we consider. The difference between the General Regime and Mandatory Complementary Schemes (MCS) lies in the way the contribution rate affects the level of the pension. In the General Regime, the level of the contribution rate, and so the magnitude of the contribution to the pension system, does not affect the level of the pension. The length of contribution and the average annual wage are the only elements of the individual's working life that are included in the pension formula. In contrast, in mandatory complementary schemes, the level of the contribution rate directly determines the level of the pension. The contribution rate enables people to buy points. Each year, a fixed proportion of the wage is devoted to the purchase of these points. The pension paid by mandatory schemes converts the number of points into euros. The General Regime is thus a defined benefit plan while complementary schemes are notional defined contribution plans.

2.1.1 The pre-reform system

The French pension is the sum of the pension paid by the General Regime and the benefits paid by mandatory complementary schemes.

The pension paid by the General regime ($P^{basic}(k)$ for an individual of age k) is the product of three elements :

1. The proratization term $\min\left(1, \frac{d}{40}\right)$ with d the number of contributive years. With 40 contributive years, the individual is entitled to full pension. In case of retirement before 40 contributive years, the proratization term reduces the pension by $\frac{d}{40}$. In case of retirement beyond 40 contributive years, the individual does not gain additional pension.

2. The average wage computed over the 25 best years of each individual's carrier. SS capping (cap_t^{SS}) applies in the computation of the average annual wage for redistributive purposes

3. The pension rate. The full pension rate amounts to 50%. If the individual retires before contributing 40 years, the pension rate is reduced by 5% per missing year. In contrast, the pension rate does not reward additional working years beyond the required 40 years of contribution.

Figure 1 presents the value of the pension rate as a function of the retirement age for an individual who started working at age 23. This agent will have the 40 required contributive years at age 63. Should the individual retire earlier, the pension rate falls by 5% per missing year while continued

[2] To preserve the tractability of the model, we discard French self employed individuals who represent only 10% of the population. Besides, in contrast to Italy, their pension regime greatly differs from the one that prevails in the private sector.

activity is not rewarded (which is not the case in the US pension system). The kinked profile of the pension rate indicates that French agents have little choice in terms of retirement age : they are enticed to retire as soon as they reach the full rate.

This General Regime pension is supplemented by mandatory schemes $P^{ARRCO}(k)$ based on a contributive plan. Pensions paid by mandatory scheme are also reduced (by 4% per missing year captured by $penalty(k)$) in case of retirement before 40 contributive quarters (see table B3, Appendix B). "Points" are purchased by each individual during his career. Each year, a fixed proportion of the wage τw is devoted to the purchase of these points. One euro of earning yields $1/p^{ARRCO}$ points. At the age of retirement, points are converted into euros of pension by multiplying the number of points by a coefficient denoted v_d, the value of each point at the date of retirement. Pension at age k then amounts to $P^{ARRCO}(k)$ where $points(k) = \sum_{i=1}^{k} \frac{\tau w(i)}{p^{ARRCO}}$ denotes the total number of points accumulated throughout the working life. [3]

The complex set of French rules yields a strong implication in terms of retirement age. As underlined by Blanchet & Pelé (1997), the heavy tax on continued activity leaves no freedom as far as retirement age is concerned. An individual retires as soon as he contributes 40 years to the Social Security system. Retiring earlier implies a dramatic fall in his pension, delaying retirement does not yield any significant increase in benefits.

As the number of contributive years is not a state variable in our model, we use a proxy for this variable by considering in both countries the current age k minus the age of end of education for employed individuals (see table A2 in Appendix A). Buffeteau & Godefroy (2005) who develop a microsimulation model for France adopt a similar approach. For unemployed agents, the number of contributive years is given by the difference between the current age and the sum of age of end of education and average number of years of unemployment at this age and skill level, as documented by Labor Force Surveys.

[3] For non executives, contributions are collected by ARRCO. Different contribution rates are applied to the part of the wage below and above the SS cap. For executives, ARRCO (respectively AGIRC) collects the contribution for the part of the wage below (respectively above) the SS cap. Finally, ARRCO and AGIRC introduce a wedge between the contribution rate paid by workers (δ') and the contribution rate that grants them points (δ). In the data, $\delta' > \delta$: by imposing this discrepancy between the tax paid and tax yielding points, complementary schemes anticipate the expected deficit associated with the future demographic change. ARRCO and AGIRC apply different wedges. Let $\frac{\delta'_{ARRCO}}{\delta_{ARRCO}}$ (respectively $\frac{\delta'_{AGIRC}}{\delta_{AGIRC}}$) be the wedge used by ARRCO (respectively AGIRC) for the part of the wage below and above the Social Security cap. Both wedges are endogenously determined at the stationary equilibrium in the pre-reform scenario to balance the budget on complementary schemes. The calibration of parameters of complementary schemes is given by table A1 Appendix A. 60% of contributions to the complementary schemes are paid by employers and 40% by the employee. This sharing rule is left unchanged throughout the paper.

2.1.2 The post reform system (Raffarin Reform, 2003)

The required contributive years to draw full pension is extended from 40 to 42 years. However, in order to make old age pension more actuarially fair, the reduction in pension in reduced in case of early retirement (proratization and decrease in the full rate yield a 2.5% fall in pension per missing year instead of 5% in the pre-regime) and the pension is increased in case of delayed retirement (3% per additional year beyond 42 years). The last elements aim at introducing more freedom in the choice of retirement age.

On figure 1, the agent who started working at age 23 accumulated the required 42 years of contribution at age 65. The kink then appears at this age. Notice that the reform introduces some flexibility in the choice of the retirement age. Indeed, in case of retirement before the age of the full rate (65), the reduction in pension is less dramatic. Besides, additional working years are rewarded with a 3% increase in the whole pension (with a full rate unchanged at 50% beyond 42 years of contribution).

2.2 Italy

Italy pension systems has had different reforms from 1992 until 1997. Before 1992, Italy had a Defined Benefit (DB) system and has now a mandatory notional defined contribution (NDC) system. This system is not exactly a defined contribution scheme. Indeed, it is a pay-as-you-go system where contributions are used to pay current pensions rather than accumulated in a fund. Pension benefits formula depends on economic growth and wages. Both benefits and contributions are individualized and determined by the NDC accounting mechanism (see OECD (2005)). Table 2 summarizes the computation formulas that are considered in our model.

2.2.1 The pre reform system (before 1992)

During the period leading to the reforms, the early retirement age was 60. The pensionable earnings were the average of last 5 years real earnings for private workers (converted to real values through price index) and the last 10 years for self employed individuals. The pension benefit was $\tau^I = 2\%$ of the pensionable earnings by years of tax payments (at most 40 years). Pension benefits were indexed to wages.

2.2.2 The post reform regime (after 1997)

The post reform regime is the result of a series of reforms : in 1992 (Amato), 1995 (Dini) and 1997 (Prodi). In the post reform system, each individual has an account in which contributions equal 33 per cent of earnings for employees and 20 per cent for the self-employed. Contributions for each year are indexed to a five-year moving average of GDP. A conversion coefficient is then applied to total contributions. Pensions are indexed to prices. The conversion coefficient c^I is chosen by Italian authorities and displayed in table A3 of Appendix A. Contributions are capitalized at rate $\gamma^I = 1.5\%$.

The age of end of education differs across skill categories (table A2 in Appendix A). These values are important to compute the workers' years of contribution. In the French and Italian regimes, 2/3 of the SS contribution rate is paid by the employer, leaving 1/3 of the contribution to the employee. In contrast, Italian self - employed workers pay 100% of their contribution rate.

Both reforms aim at increasing labor supply by introducing strong incentives in case to postponed retirement. Our model with endogenous retirement and wealth will be able to capture the possible changes in retirement age that French and Italian governments try to affect through SS reforms.

3 Description of the economy

We assume that labor market status consists of employment and unemployment. Agents cannot completely insure against the idiosyncratic risk of being unemployed.[4] Accordingly, agents in our economy differ with respect to their employment status and their employment history. In both countries, the economy is modelled using an overlapping generation model with stochastic transitions on the labor market. As a result, the working life of each individual affects their saving behavior. Agents also differ in terms of their wealth.

Beyond the heterogeneity arising from uninsurable shock to individual employment opportunities, life cycle features are also considered. Each period, some individuals are born and some individuals die. We take into account different age groups and consider stochastic aging along the lines of Castaneda, Diaz-Gimenez & Rios-Rull (2003). In addition, individuals face borrowing constraints and cannot hold negative assets at any time. We build on Hairault, Langot & Sopraseuth (2005) that extends Rust & Phelan (1997)'s model by introducing wealth accumulation. We analyze a small open economy which implies that interest rate is exogenous. Moreover, we assume that agents are altruistic with respect to future generations, i.e. they have a bequest motive. Our model does not allow for no aggregate uncertainty in order to preserve the tractability of the model.

Finally, retirement behavior is endogenous. In order to analyze retirement decisions we take into account several key features of each country's retirement process

(i) Pensions depend on life-time earnings which is mechanically linked to unemployment spells during the working life. Transitions on the labor market from employment to unemployment is a salient feature of our model. These shocks cannot capture all income risks faced by individuals.

[4] Unemployment insurance leads to incomplete insurance against unemployment risk. There is also a trend toward less unemployment insurance in most of OECD countries. In fact, Italy has not unemployment benefits longer than one year.

Employment shocks are introduced in order to capture differences in the employment rate during the life cycle, with in particular a drastic fall in the employment rate of old workers. We want to take into account the exit from the labor force at the end of working life as labor market status prior to retirement is likely to affect retirement choices. Moreover, taking into account the low labor demand for old workers is necessary to measure the implications of any policy aiming at delaying retirement age (see Hurd (1996)).

(ii) Pensions are assumed indexed on prices. This was used in both countries as a way of reducing SS generosity. The exact pre and post reform pension formulas are used in the model allowing to measure the effect of changes in pension rules on retirement and savings.

(iii) A last important feature of the model is the skill structure. In each country, we distinguish several ability groups defined by different skills. Mortality risk, unemployment transitions, life-time earnings, age of end of education is specific to each skill category. The model accounts for the differential mortality by skill groups. Hence, the model will be able to predict savings and retirement decisions across and within each skill group, allowing each of these group to differ substantially in the incentives they face.

3.1 Population dynamics and endowments

3.1.1 Mortality

Some individuals are born and some individuals die every period. When an individual dies, he gives birth to a single child.[5] Individuals belonging to the same dynasty do not overlap. For sake of simplicity, individuals face a mortality risk from the age of early retirement age on. In order to take into account a typical life-cycle wage profile, we assume that the population can be divided into three age groups: the young, the adult and mature respectively denoted Y, A and M. The mature age group encompasses the ages of early retirement age (ERA) to 70 and more, ($M = \{ERA, 60, ..., 70$ and more$\}$) [6]. From the age of ERA on, each agent chooses to remain in his current state (employed or unemployed) or retire the following period.[7] Each individual is born as a young worker. Following Castaneda, Diaz-Gimenez & Rios-Rull (2003), the stochastic aging process is independent, identically distributed across individuals of the same skill group and follows a finite state Markov chain with conditional transition probabilities given by $\pi_{kk} = \pi(k' \mid k) = \Pr(k_{t+1} = k' \mid k_t = k)$ where k and

[5] In all scenarios, the population is constant ($n = 0$). This assumption is consistent with French data (Aglietta, Blanchet, & Héran (2002)). We choose to retain the same assumption in the Italian case in order to make our results comparable across countries.

[6] Individuals do not die at age 70. The last age group encompasses individuals of 70 years old and more.

[7] The early retirement age is specific to each country. It is 60 years old for France, 60 years old for Italy in the pre-reform scenario and 57 years old in the post - reform period.

$k' \in K = \{Y, A, M\}$. The probability of remaining a young (experienced) worker the next period is π_{YY} (π_{AA}). From the age of ERA on, the individual of age $k \geq ERA$ faces a rising probability to die $(1 - \pi_k)$. The mortality matrix takes into account the inequality in surviving probabilities across skill groups. For example, the Matrix P that governs the age Markov-process in France for a particular skill group is given by:

$$\begin{array}{cc|cccccccc}
 & & & & & & t+1 & & & \\
 & & \begin{array}{c}Y\\ \text{(20 - 34 years old)}\end{array} & \begin{array}{c}A\\ \text{(35 - 58 years old)}\end{array} & 59 & 60 & 61 & \cdots & 69 & \text{70 and more} \\
\hline
 & Y & \pi_{YY} & 1-\pi_{YY} & 0 & 0 & 0 & \cdots & 0 & 0 \\
 & A & 0 & \pi_{AA} & 1-\pi_{AA} & 0 & 0 & \cdots & 0 & 0 \\
 & 59 & 1-\pi_{59} & 0 & 0 & \pi_{59} & 0 & \cdots & 0 & 0 \\
t & 60 & 1-\pi_{60} & 0 & 0 & 0 & \pi_{60} & \cdots & 0 & 0 \\
 & 61 & 1-\pi_{61} & 0 & 0 & 0 & 0 & \cdots & 0 & 0 \\
 & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \ddots & \vdots & \vdots \\
 & 69 & 1-\pi_{69} & 0 & 0 & 0 & 0 & \cdots & 0 & \pi_{69} \\
 & R & 1-\pi_{RR} & 0 & 0 & 0 & 0 & \cdots & 0 & \pi_{RR}
\end{array}$$

3.1.2 Wages

There are two components in the real wage : a deterministic exogenous productivity trend growing at rate γ and the experience component allowing for an upward sloping wage profile with age. As a worker accumulates experience during his life-cycle, we assume that the efficiency of the labor input grows with the age of the agents.

3.1.3 Unemployment Risk

At all ages, people face the risk of being unemployed. Transitions to employment and unemployment are determined by exogenous probabilities that are specific to each skill level i and age group k. Every period the individual receives the realization of a random variable $z \in Z = \{e, u\}$ that determines the probability to be employed or unemployed. z is a two-state, first-order Markov process with the transition probability matrix $\pi_{iY} = Pr\{z' = j | z = i\}$ where $\pi_{uu,k}$ is the probability of an unemployed of age k of remaining unemployed at age $k+1$ and $\pi_{ee,k}$ is the probability of an employed of age k of remaining employed at age $k+1$. Transition probabilities at age k and skill level i are given by

$$\Pi_{k,i} = \begin{pmatrix} \pi_{ee,k,i} & \pi_{eu,ki} = 1 - \pi_{ee,k,i} \\ \pi_{ue,k,i} & \pi_{uu,ki} = 1 - \pi_{ue,k,i} \end{pmatrix}$$

3.1.4 Social Mobility

Finally, we assume that a newly-born individual's skill status is determined by his father's. This social mobility Φ is modelled as an exogenous Markov matrix

$$\Phi = \pi(i'|i) = Pr\{i_{t+1} = i'|i_t = i\}$$

where i' is the skill status of the new born in the dynasty, and i denotes the random variable embodying the skill status of the father. It is assumed that, once born with a random skill status (linked to that of his father), an individual's skill status is not modified in his life-time.

3.2 The individual's decisions: retirement choice, consumption and wealth

Individuals derive utility from leisure, consumption as well as from the consumption of their offsprings. The intertemporal utility function of an individual is given by

$$\sum_{t=0}^{\infty} \beta^t \left\{ \sum_{s_t \in \mathcal{V}} \pi(s_t|s_{t-1}) u(C_t, l_t) + \varrho \Phi \beta \sum_{s_t \in S1} \pi(s_{t+1}|s_t) V(A_{t+1}, s_{t+1}) \right\} \tag{1}$$

where the period utility function u is strictly concave, the time-discount factor is $\beta \in]0, 1[$, consumption C_t and leisure l_t are positive. Labor is inelastically supplied by individuals as in Fuster, Imrohoroglu & Imrohoroglu (2003). However, labor participation is endogenous in old age as individuals choose to retire or not. Indeed, we focus on policy reforms aiming at delaying retirement rather than developing part time jobs for old workers. Retirement age is the core issue in the policy reforms we investigate. $s_t \in S$ is a compact notation to denote age, employment status and skill level. This vector follows a finite state Markov chain with conditional transition probability given by

$$\pi(s'|s) = Pr\{s_{t+1} = s'|s_t = s\}$$

Finally, the last term of the intertemporal utility function describes the utility derived by a parent from his bequest. The parameter $\varrho > 0$ captures in a simple way the individual's concern for the welfare of his off-spring. Thus, $V(A_{t+1}, s_{t+1})$ denotes the expected utility of a new-born child who begins his career according to a stochastic productivity ladder linked to that of his father and inherits a stock of wealth A_{t+1}. We adopt a simple altruism specification for computational reasons. We compute endogenous retirement and savings along the life cycle with heterogenous labor status and ability levels for three steady states in each country (before reform with the current life expectancy, after the increase in life expectancy with and without changes in the pension formula). Considering a model with more complex transfers would substantially increase the computational burden.

As in Huggett & Ventura (1999), we assume that the instantaneous utility function u is a CRRA:

$$u(c) = \frac{(c^{1-\eta}(1-l)^{\eta})^{1-\tilde{\sigma}}}{1-\tilde{\sigma}}$$

with $\tilde{\sigma}$ the risk aversion and η the weight of leisure $(1-l)$ in the instantaneous utility. Time endowment is normalized to 1. The utility function is Cobb Douglas in consumption and leisure. The reasons for this choice are that this function is compatible with a balanced growth path and the parameters needed for the calibration have been extensively studied in the literature relying on calibration (Auerbach & Kotlikoff (1987), Prescott (1986), Cooley & Prescott (1995), Hansen & Imrogoroglu (1992), Rios~Rull (1996), Huggett & Ventura (1999)). In addition, the individual faces two sources of capital market inefficiency. The first stems from market incompleteness that prevents them from insuring completely against idiosyncratic risks. The second relies on a borrowing constraint : net asset holding cannot be negative ($A_{t+1} \geq 0$).

In order to define a stationary equilibrium, we divide all variables by the growth rate of technological progress $(1+\gamma)$. We denote stationary consumption and wealth by

$$c_t = C_t/(1+\gamma)^t \quad \text{and} \quad a_t = A_t/(1+\gamma)^t$$

whereas the real wage and the pension are denoted in stationary terms by

$$w_t = W_t/(1+\gamma)^t, \quad \omega_t(s) = \Omega_t(s)/(1+\gamma)^t,$$

3.3 Computation of the Stationary Equilibrium in a Heterogeneous Agent Economy

The economic problem of an individual is to choose a sequence of consumption, asset holdings and retirement age given a set of policies for social insurance and expected life expectancy. The individuals' problem can be formulated recursively with the help of the value function $v(.)$:

$$v(a,s;w,r) = \max_{c,a'} u(c,l) + \varrho\Phi\tilde{\beta}\left\{\sum_{s'} \pi(s'|s)v(a',s';w,r)\right\} \tag{2}$$

subject to the budget constraint

$$\begin{aligned}(1+\gamma)a' &= (1+r)a + y(s) - c\\ a' &\geq 0\end{aligned}$$

where r, $y(s)$ denote the interest rate, the income and the payroll tax. The individual of age k has 2 state variables : the pair (a,s) with s the realization of the individual-specific process (age, employment status and skill level) and a the beginning-of-period financial wealth. We consider a stationary equilibrium where prices w and r are constant. Indeed, in a small open economy framework, the world interest rate is considered as given which translates into an exogenous wage. As c is the consumption per effective units of labor, the discount rate becomes $\tilde{\beta} = \beta^{(1-\eta)(1-\tilde{\sigma})} \in]0,1[$.

Figure 2 summarizes the decision tree faced by each individual.[8] (e.g. 62RU59 is an individual aged 62 who, at age 59, while he was unemployed, decided to retire at age 60). Note that once retired, individuals remain retired which is consistent with French and Italian data. There does not appear to be important un-retirement flows as in the U.S. (Gruber & Wise (1999)). As income depends on labor status and age, we present value functions for each age group and employment status.

Individuals in Young (Y), Adult (A) and Mature (M) age groups make their decisions taking into account future probabilities of being unemployed (or employed) as well as future payoffs from their current actions given their skill level. To illustrate the retirement choice we consider a mature individual. Other value functions are developed in Appendix B.

When mature $(s \in M)$, individuals choose their employment status $x = E$ (employed) or U (unemployed). From the age of 59 on,[9] individuals have the legal right to claim a pension the following year. Each individual compares the future value of being retired to the future value of remaining on the labor market, given the probability of death $(1 - \pi_{kk',i})$.

1. For ages $k = \{59, ..., 68\}$

   Employed individual with skill i : From the age of ERA on, individuals of age $k \geq ERA$ choose whether to retire or not the following year by comparing the expected future value function at age $k+1$ when retired to the future value function at age $k+1$ if he remains on the labor market, taking into account the probabilities of transitions to employment or unemployment

$$\begin{aligned} v(a, k_i^E) &= \max_{c \geq 0,\ a'} u(c,l) \\ &+ \tilde{\beta} \left\{ \begin{array}{l} (1-\pi_{kk',i})\Phi\varrho \left[\pi_{YY,U} v(a', Y_i^U) + (1-\pi_{YY,U})\, v(a', Y_i^E)\right] \\ +\pi_{kk',i} \max[\pi_{ee,k,i'} v(a', k_i'^E) + (1-\pi_{eu,k,i'}) v(a', k_i'^U), v(a', k_i'^{RE})] \end{array} \right\} \\ (1+\gamma)a' &= (1+r)a + w_i^k - \Theta(w_i^k) - c \\ a' &\geq 0 \end{aligned}$$

   k_i^E means that we look at the value function of an individual of age k and skill level i who is currently employed. The future value is composed of two terms, the future value if alive and the bequest value of dead. Each individual can die with probability $1 - \pi_{kk',i}$, in which case a new young individual is born with skill group is determined by the mobility matrix Φ. (This matrix

[8] Based on Labor force data and literature surveys, when individuals are old and unemployed, they have little chance to find a job. Our calibration based on micro-data find this evidence. See section 4.3.

[9] We adjust the first age where retirement is possible depending on the country and the period (pre or post reform). For example, the earliest age an Italian considers retirement in the post-reform period is 56 while it is 59 prior to the reform.

is calibrated from French and Italian data (see Appendix A)). The share of young agents born unemployed $\pi_{YY,U}$. Similarly the following value is derived from being an unemployed individual and a retired individual.

2. Unemployed individual with skill i at age k :

$$\begin{aligned} v(a,k_i^U) &= \max_{c\geq 0,\ a'} u(c,l) \\ &+\tilde{\beta}\left\{\begin{array}{l} (1-\pi_{kk',i})\Phi\varrho\left[\pi_{YY,U}v(a',Y_i^U)+(1-\pi_{YY,U})\,v(a',Y_i^E)\right] \\ +\pi_{kk',i}\max[\pi_{u\,u,k,i'}v(a',k_i'^U)+(1-\pi_{u\,e,k,i'})v(a',k_i'^E),v(a',k_i'^{RU})] \end{array}\right\} \\ (1+\gamma)a' &= (1+r)a+\theta_i^u w_i^k-c \\ a' &\geq 0 \end{aligned}$$

3. Retired individual with skill i at age k :

$$\begin{aligned} v(a,k_i^{Rx}) &= \max_{c\geq 0,\ a'} u(c,l)+\tilde{\beta}\left\{\begin{array}{c} (1-\pi_{kk',i})\Phi\varrho\left[\pi_{YY,U}v(a',Y_i^U)+(1-\pi_{YY,U})\,v(a',Y_i^E)\right] \\ +\pi_{kk',i}v(a',k_i^{Rx}) \end{array}\right\} \\ (1+\gamma)a' &= (1+r)a+\omega_i^{k^{Rx}}-c \\ a' &\geq 0 \end{aligned}$$

where k_i^{Rx} (with $x=E$ or U) denotes that the individual is a retiree of age k and skill level i after being previously E (employed) or U (unemployed). R denotes retirement. The pension denoted $\omega_i^{k^{Rx}}$ depends on age k, skill level i and labor market status before retirement x.

4. Those still employed or unemployed by age 69 are forced to retire in the next year.

$$\begin{aligned} v(a,69_i^x) &= \max_{c\geq 0,\ a'} u(c,l)+\tilde{\beta}\left\{\begin{array}{c} (1-\pi_{kk',i})\Phi\varrho\left[\pi_{MM,U}v(a',M_i^U)+(1-\pi_{MM,U})\,v(a',M_i^E)\right] \\ +\pi_{kk',i}v(a',R_i^x) \end{array}\right\} \\ (1+\gamma)a' &= (1+r)a+y(69_i^x)-c \\ a' &\geq 0 \end{aligned}$$

where $y(69_i^x)=w_i^{69}-\Theta(w_i^{69})$ if employed ($x=E$) or $\theta^u w_i^{69}$ if unemployed ($x=U$). No individuals delay past age 70, which is consistent with the data. In the model, pension benefits will be computed with French and Italian Social Security formulas, respectively.

Stationary Equilibrium Given the vector of prices (r,w), the stationary equilibrium consists of individuals' choices for consumption, savings and retirement $\{c(a,s),a'(a,s),\Psi(a,s)\}$, value functions $v(a,s)$, a stationary distribution of individuals $\lambda(a,s)$ and a set of aggregate variables (P,D) where P (respectively D) refers to expenditures (respectively the revenues) of the retirement scheme. The stationary equilibrium satisfies:

(i) $c(a,s)$ and $a'(a,s)$ are optimal decision rules given the vector of prices (r,w).

(ii) The real interest rate is given, which is consistent with a small open economy hypothesis. This leads to a constant capital to labor ratio, thus making real wages w exogenous.

(iii) Saving decisions $a' = g(a,s)$ and retirement behavior $\psi = \Psi(a,s)$ are solutions to the lifetime maximization program where

$$\Psi(a,s) = \begin{cases} 1 & \text{si} \quad v(a,\{s,k\}) \geq v(a,\{R,k\}) \\ 0 & \text{sinon} \end{cases}$$

for $s = e(\text{employed}), u$ (unemployed). Finally, let $a' \equiv A(a,s)$ be the individuals' policy that depends on his state on the labor market (employed or unemployed). $A(a,s)$ is such that:

$$\mathcal{A}(a,s) = \Psi(a,s)g(a,\widehat{s}) + [1-\Psi(a,s)]g(a,R)$$

where an agent's policy in state $\widehat{s} = e(\text{employed}), u$ (unemployed) is denoted by $a' \equiv g(a,\widehat{s})$.

(iv) The endogenous probability distribution $\lambda(a,s)$ is the stationary distribution associated with $(A(a,s), \pi(s'|s))$ such that:

$$\lambda(a',s') = \sum_{s} \sum_{\{a:a'=\mathcal{A}(a,s)\}} \lambda(a,s)\pi(s'|s)'$$

(v) In the pre-reform scenario, SS budget is balanced:

$$P = D$$

given pension arrangements specific to each country. P denotes the sum of pensions paid by the Social Security system while D refers to the sum of collected payroll taxes. Each variable is computed over the stationary distribution that yields the proportion of employed and retired people.

$$\begin{aligned} P &= \sum_{s}\sum_{i}\sum_{a} \lambda(a,s)\omega_i^s \\ D &= \sum_{s}\sum_{i}\sum_{a} \lambda(a,s)\Theta(w_i^s) \end{aligned}$$

We implement numerical techniques based on a discretization of state variables (Ljungqvist & Sargent (2000)). This study compares steady states that prevail before and after SS reforms. Our life cycle model allows for endogenous retirement and savings with heterogeneity in wealth, labor status and skills, which yields results on distributional effects of SS reforms. As in Huggett

& Ventura (1999) and Fuster, Imrohoroglu & Imrohoroglu (2003), we choose to discard transitional dynamics in order to focus on the impact of reforms after the transition is over, which allows to identify long run welfare consequences of the reforms. The investigation of transitional dynamics is left for future research but is potentially important to understand political support for particular reforms.

4 Data and calibration

We derive information for our calibration based on various sources of information. Values for macroeconomic parameters are based on OECD data. The rest of the calibration relies on micro - data. In the model, time is counted in years. In order to set parameters at their "steady state" values, we average all variables over 1990 - 2002 (depending on data availability). Reforms occur in 2003 in France and from 1992 to 1997 in Italy. Calibration focus on men.[10] We are averaging characteristics of groups between early nineties and early thousands. Some of these individuals are affected by the pre reform, the oldest ones. Our aim is not to reproduce exactly population patterns but adjust the most stylized facts of these two economies. Rather than relying on calibrated replacement rates, we compute pensions based on pension formulas applied today by the SS. The information described in the previous section was used to calibrate the most close possible pension formulas in France and in Italy and their changes after reforms. We use the following country data sources.

- France: Labor Force Survey, LFS (Enquête Emploi, 1993 through 2002). Data on financial assets and bequest are retrieved from 1998 Wealth Survey (Enquête Patrimoine).

- Italy: 1991-1993-1995-1998-2000 and 2002 Survey of Household Income and Wealth. This database from the Bank of Italy Survey of Household Income and Wealth (SHIW) collects information on demographics, labor status, social mobility and individual's income, consumption and wealth. Wages are computed to private and self-employment by education and age group. Social mobility matrix is computed for 1993 through 2002 years. We use the head of family as our unit of analysis. Employment Proportions and unemployment durations are computed using the ISTAT Labor Force Survey from 1992-1993 and 1998-1999. We decompose them by age class and by education.

4.1 Demographics

We describe below the data used to capture the salient features of the French and Italian population

[10]Our model is perhaps better suited to explain men's behavior. Women's retirement behavior is notoriously more difficult to model (see Gustman & Steinmeier (2000))

- In France, we use occupations to create "skill" groups. Since we are interested in the reforms affecting workers of the private system, we retain 4 broad categories: blue collar workers, clerks, white collars and executives [11]. As the model encompasses a large fraction of the labor force (that covers 70% of the labor force), we discard self - employed workers[12] and civil servants.

- In Italy, workers of the private sector constitute only 52% of the labor force. We discard civil servants. In order to include in the model a large fraction of the labor force, self-employed individuals are added to the model (28 % of the labor force). In addition, the harmonization of Social Security rules for self employed and private workers was one of the major concerns of Italian authorities. By including self employed, the model takes into account this policy issue. Due to data availability, 4 educational levels are investigated: no studies and primary studies, Secondary studies, Pre-Superior studies and Superior studies. These categories are defined as in the Labour Force Survey (ISTAT data).[13] The model then takes into account 8 skill groups : 4 educational level for workers of the private sector and 4 educational level for self employed workers.

We suppose that individuals are born when they are 20 years old. We study three stages of the lifetime (youth, adult and mature). First, young workers refer to individuals of age 20 through 34. Secondly, the adult group encompass agents of age 35 until 59 and 56 in the case of Italy after the reform (until one year prior to retirement age). We then examine all ages decisions until retirement.

Life expectancy is heterogeneous across skill groups. For France, we use data from COR (2001). At age 60, life expectancy is 17 years for blue collars , 19 years for clerks, 19.5 years for white collars and 22.5 for Executives (22.5). As repeatedly found in other studies, life expectancy increases with skill group or education. Blanchet & Monfort (1996) provides similar figures for life expectancy at age 65 but only for men. This allows us to compute death probabilities between 60 and 65. We then assume that this drop applies in a uniform way at all ages. Death probabilities (table 3) then display an exponential pattern that is consistent with INSEE (1996). Death probabilities increase with age and decrease when individuals have more skills. In Italy, life expectancy is based on INPS data[14] (table

[11] Skill levels are defined by the French Bureau of statistics (INSEE). Blue collars refer to unskilled workers, clerks deal with unskilled office work in administrations or firms, white collars are involved in skilled work and executives refer to high skilled workers.

[12] For Italy self-employment count for a larger share of the labor force (around a third). In France self-employment's share is around 10%.

[13] Education definitions: (1) Primary and no studies corresponds to primary school and people without studies: i.e. *Licenza elementare, Nessun titolo.* (2) Secondary studies corresponds to high school and professional: *Diploma di qualifica professionale - corso di 2-3 anni che non permette l'accesso all'università, Licenza media inferiore.* (3) Pre-Superior studies corresponds studies before university: *Diploma di maturità.* Finally (4) superior studies correspond to post-degree and degree studies: *Dottorato di ricerca o Specializzazione post-laurea, Laurea, Diploma universitario o Laurea breve.*

[14] INPS - Istituto Nazionale della Previdenza Sociale. Italian Social Security Institution.

4). Because of data limitation on life expectancy disparity across educational groups, we assume that the heterogeneity in life expectancy rates observed in France also applies in Italy.[15] In the new steady state, life expectancy increases by 5 years in Italy (Visco (2001)) and 6 years in France (COR (2001)) [16]. We assume that all skill levels benefit evenly from the higher life expectancy.

4.2 Preferences, technology and real interest rate

Following Charpin (1999)'s report, the technological trend is set to 2% a year for the case of France and 1.92% is computed for the case of Italy following OECD (2000). The discount factor is set to 0.96 for France and 0.985 in Italy (Brugiavini & Peracchi (2003), Amato & Galasso (2002)). The discount rate is set in order to be compatible with the utility choice, that is $\tilde{\beta} = \beta^{(1-\eta)(1-\tilde{\sigma})}$ where $\tilde{\sigma}$ is the risk aversion and η the weight of leisure. The annual real interest rate equals 5% which corresponds to the average value observed in the last 20 years in France and Italy (authors' calculations based on OECD Main Economic Indicator with long term interest rate and GDP deflator).

In the benchmark calibration, altruism is set to $\varrho = 0.9$, which corresponds to the value chosen by Hairault & Langot (2002) so as to replicate the ratio of total bequest to financial asset of 1.4% observed in the French data (Arrondel & Laferrère (1991)). This parameter value for Italy is set to $\varrho = 0.6$ to match the bequest to financial asset ratio of 3% as computed on SHIW 1991 - 2000 microdata. This ratio is matched by the equivalent ratio predicted by the model (total bequest as a fraction of aggregate financial holding). In spite of a lower bequest to financial asset ratio, France is characterized by a higher ϱ, which is counterintuitive. However, the level of bequest also depends on the intergenerational social mobility captured by matrix Φ. Our interpretation is that Italian individuals do not need a high value of ϱ to accumulate savings for altruistic reasons as in France, the descending mobility is greater than in France (see the calibration of Φ in section 4.3). High skilled workers may insure their offspring against such bad risk by saving more. We set $\tilde{\sigma} = 2$, which is consistent with Attanasio, Banks, Meghir & Weber (1999). Assuming that 8 hours are devoted to labor per day of 24 hours, we get $1 - l = 2/3$. Unemployed and retirees enjoy full time leisure ($l = 1$).

The current pension system in France is highly constrained : individuals bear a strong decrease in pension in case of early retirement and little increase in pension in case of continued work. As a result, the current data on retirement behavior does not allow to reveal preferences for leisure. As illustrated by figure 1, whether the agent likes or dislikes working, the individual is enticed to retire as soon the age of full pension ins reached. It is then difficult for us to pin down η the weight of leisure in the utility function. To circumvent this difficulty, we do the following: we know that when η is very low,

[15] The correlation between skill levels and education is high in both countries, i.e., educated workers (non educated agents) have executive jobs (blue collars jobs), which gives support to our approximation.

[16] That decreases the probability to die in the mortality matrix.

individuals retire at very old age. We then set η to the minimum value such that individuals retire at age 60 (which is consistent with the current data in France and Italy). Their values yield the value of 0.84 (for France) and 0.82 (for Italy). Our calibrated value for η are close to the value of 0.77 chosen by Huggett & Ventura (1999) on US data with similar preferences. Because of data limitations, the leisure parameter in each country is similar across skill groups. Hence differences in behavior across skill groups will not be generated by differences in preferences. Table 5 summarizes the calibration.

4.3 Wages, employment risks and social mobility

In order to provide a calibration coherent with a steady state analysis, we seek parameter values that are consistent with micro-evidence over a long period. When possible, calibration of wage profile, unemployment risks, and social mobility is based on averages computed over the last decade in order to capture steady state values.

We have computed the average wages for the period studied in both France and Italy across age groups and skill levels. Table 6 reports average wages in French Francs by skill groups and by age group for the period studied. In the case of Italy, average wages in millions of Liras are displayed in table 7. Because we have different sources of skill definitions in France and Italy we cannot get the same classification in each country. We have wages by occupational skill level in France (LFS data) and by educational skill level in Italy (SHIW data). Because we account for self-employment in the Italian case, we are constraint to use educational definitions. Note that, due to experience, wage profiles are upward sloping with age.[17] However, we assume that wages are rather flat in old age which is consistent with data from the U.S. older ages (see Blau (2004)).

Let θ^u be the replacement ratio associated with French unemployment benefits. Executives (0.50), Middle White Collars (0.49), Clerks (0.52) and Blue Collars (0.50). These ratios are computed from the French LFS as averages within each skill level. As for Italy, there are no unemployment benefits that last longer than a year (the frequency of our model), θ^u is effectively set to zero.

The correlation between the parents' human capital and that of their off-spring is given by the social mobility matrix Φ (we display these in tables A5 and A6 in Appendix B). Micro-data used to calibrate the model (using SHIW data [18] in Italy and LFS data in France) document for each individual his skill level as well as his father's, which allows us to build the social mobility matrix in a direct manner. Notice that in Italy high skill workers bear a stronger risk to have a child of lower ability than in France. French executives in France have a 48% chance to give birth to a high skilled child while in Italy this probability falls to 17% for private workers with superior studies and 7% for

[17] It is difficult to pin down the age profiles in age because selection. Essentially the patter of average wages profiles are flat or upward sloping but rarely found to be downward sloping.

[18] We take as reference the head of the family in SHIW data.

self employed with superior study. Italian high skilled individuals insure their child against this risk by leaving more bequest. As a result, we find that, in order to replicate the bequest to asset holding ratio, the Italian calibration is characterized by a lower altruism parameter ϱ.

The computation of unemployment risk is based on the authors' computations of unemployment duration and unemployment rates using French LFS and Italian micro-data (ISTAT labor Force Survey from 1992-1993 and 2001-2002). Labor market transitions for each age k and each skill group i are given by matrices $\Pi_{k,i}$.See Appendix C for more details.

We use French (Italian) data on unemployment duration and unemployment rates, both elements by age and skill group to compute the series of matrices $\Pi_{k,i}$ for all age k, and all skill group i. In the Italian case, we compute employment risk based on data on workers of the private sector. Income risk of self - employed is then assumed to be the similar to their counterparts of the private sector, which is consistent with Italian data (Guiso, Jappelli & Pistaferri (2002)). In both countries, because of blurred frontiers between inactivity and unemployment for old workers, unemployment rates take into account inactivity rates after the age of 55.

5 Does the model fit the data?

We first check that the theoretical framework is consistent with the French and Italian data. Comparing the dependency ratios, the model matches the demographic structure observed in year 2002. After taking into account the increase in life expectancy predicted by official statistics, the model matches the worsening of the dependency ratio in 2040. We slightly underestimate the dependency ratio, especially in Italy.[19] Finally, the model matches the contribution rates observed in the data [20]. Table 8 summarizes these results.

We then focus on the predictions of the model before the increase in life expectancy. We thereby gauge the ability of the model to replicate key characteristics observed today. We analyze the retirement rate in the data and in our model.

In France, for the pre-reform period, the 1993 Balladur reform is implemented so gradually that its effect on retirement will not fully appear before 2008. Balladur indeed increased the number of

[19] This shortcoming might be due to the particularly low female participation rate in Italy. Our model cannot capture this dimension as it would involve modelling family dimensions in female labor supply choices.

[20] In the French case, the model actually determines a contribution rate for each pension regime : CNAV, ARRCO and AGIRC. The contribution rate t reported in table 8 is defned as

$$t = \frac{t_{ARRCO} \times \text{wage below } \mathrm{SS}^{\mathrm{CAP}} + t_{AGIRC} \times \text{wage above } \mathrm{SS}^{\mathrm{CAP}} + t_{CNAV} \times \text{wage}}{\text{total wage}}$$

This expression takes into account the endogenous wedge in complementary schemes as well as wages of employed individuals only. With endogenous retirement age, the proportion of workers becomes endogenous and is computed thanks to the stationary distribution. Finally, contribution rates in the table are computed before the increase in life expectancy.

contributive years for workers of the private sector from 37.5 to 40 over a long transition period. As a result, the full effect of the current regime is not apparent in the current data. However, we can check that the model is consistent with the data by examining the retirement age just after the Balladur reform in 1993 (figure 3, source : Charpin (1999) report) when the increase in the number of contributive years was only marginally above 37.5. The data shows that the 80% of French individuals retire at age 60, the early retirement age, versus 100% in our model. Individuals retire as soon as they reach the full rate. The pension formula indeed implies a decrease in pension if individuals retire earlier and no significant increase in pension in case of delayed retirement. Women who are prone to incomplete careers retire more at age 65, age at which individuals get the full rate whatever the number of contributive years. Our proxy for the number of number of contributive years tends to underestimate the number of incomplete careers. In addition, since we discard heterogeneity in health status and specific female participation, the model cannot capture the complete distribution of retirement age. Even though the leisure parameter is calibrated to capture the spike at age 60, it is interesting to underline that the model then matches the behavior stressed by Blanchet & Pelé (1997) : individuals retire as soon as they reach the full rate.

In Italy, our calibration of leisure leads to the prediction that all individuals retire at age 60. Retirees before 60 are in the model old unemployed workers, which is consistent with the retirement age observed before 1992, in our pre-reform regime (figure 4). The small fraction of early retirement (before 60) is captured in the model by inactivity and unemployment rate of old workers.

We report replacement rates in table 9. As in real life, the model yields a distribution of replacement rates : indeed, the replacement rate depends on retirement age that is endogenous. Within each skill group, retirement age can be heterogenous as well because retirement age is affected by asset holdings that can differ across individuals of the same skill level. The reported replacement rate is the weighted average of replacements rates computed over the stationary distribution of the model. In pre-reform regimes, a large fraction of agents retire at age 60 in both countries. As a result, replacement rates are mainly the ones that prevail at this age.

In France, replacement rates indicate that SS has distributional effects. Indeed, low skilled workers are characterized by higher replacement rates than high skilled workers whose wage profile is much steeper. This distributional effect stems from the presence of SS cap in the pension formula. The model is able to capture this feature. In Italy, the profile in the replacement rates by educational level is slightly different. More educated workers have a higher replacement rate in spite of SS capping and minimum pension. As pointed out by Borella (2001), the Italian defined benefit plan takes into account only the last wages, which guarantees an overgenerous pension to individuals with steeper earnings profile, namely high skilled workers. By basing the reform on the entire working life, the

Italian governments aim at establishing a more equal distribution of replacement rates.

We also checked that the model is able to approximate Gini coefficients and Theil inequality indicators on earnings, income and wealth computed on the French and Italian microdata (Enquête Patrimoine 1998, labor Force Survey and SHIW 1991 - 2002). However, the model falls short of capturing the upper tail of the distribution. The reasons for this shortcoming are well known. Quadrini (2000) and Cagetti & DeNardi (2005) show that models including only employment risks do not succeed in explaining the creation of large fortunes. Their model of occupational choice with entrepreneurship has succeeded in capturing large amounts of wealth concentration. Our model replicates key features of the wealth distribution, even though it falls short of explaining the top of the distribution. We therefore consider that our model can constitute a relevant tool when analyzing the interaction between retirement and savings.

6 Welfare effect of Social Security reforms?

In order to know whether the reform is able to sustain the PAYG system, we compare two steady states

1. The first one describes what would happen without the reform. Life expectancy increases. The payroll tax is fixed at its equilibrium level computed in the last section (without the increase in life expectancy). Without reform, a SS deficit appears. This case in labelled "2000" in subsequent tables.

2. The second steady state captures what improvements are associated with the reform. Life expectancy increases. We quantify distributional effects of reforms under the scenarios endorsed by each government. We chose again to discard the endogenous adjustment of the contribution rate.

    - In France, the payroll tax is fixed at its equilibrium level computed in the last section (without the increase in life expectancy). The French government relies on optimistic projected growth to argue that the contribution rate shall not change much.
    - The Italian contribution rate is fixed by the reform (33% for workers in the private sector and 20% for self-employed).

    The pension formula is now modified. Is the reform able to finance a large fraction of the deficit computed in the previous steady state? This case in labelled "2040" in subsequent tables.

6.1 France

Following Fuster, Imrohoroglu & Imrohoroglu (2003), the welfare is measured as the welfare of new born defined as

$$W = \int_a V(:,Y)\lambda(:,Y)da$$

Each row in table 10 corresponds to a steady state ex - ante welfare in the pre-reform system (column (1)) and the post - reform regime (column (2)). Table 10 suggests that all skill groups are better off under the post reform regime. A longer life expectancy entices individuals to save more to insure themselves against the risk of outliving their assets. Combined with a constant contribution rate, the increase in financial asset accounts for the higher welfare. In order to assess the magnitude of welfare variations, we convert them into changes in permanent consumption (column (4)). The permanent consumption $\bar{C}$ is computed as

$$W = \int_a V(:,Y)\lambda(:,Y)da = \frac{1}{(1-\tilde{\beta})(1-\sigma)}\bar{C}^{1-\sigma}$$

Table 10 displays $\frac{\bar{C}'-\bar{C}}{\bar{C}}$ with $\bar{C}'$ (respectively $\bar{C}$) the permanent consumption in the post - reform system (respectively in the pre-reform regime).

Executives benefit more from the reform. Figure 5 provides an intuition for this result. Lower skill groups retire as soon as they reach the age of the "full rate": given their age of end of education, white collars, clerks and blue collars claim their benefits as soon as they accumulate the required contributive years. The Raffarin reform that aimed at providing more flexibility in retirement choice fails along this dimension : given the benchmark calibration of leisure, unskilled workers do not take advantage to the more flexible scheme either to retire earlier or to delay retirement.

The retirement age of clerks and blue collars who enter the job market at very young ages (18 and 16 respectively) retire at 60 before and after the reform : they accumulate the required number of contributive quarters at this age before the reform (40 years of contributive quarters) and after the reform (42 years of contributive quarters). White collars have to delay retirement by 2 years but the increase in savings does compensate for this loss in leisure. Interestingly, as displayed in figure 5, only executives take advantage of the more flexible arrangement introduced in the reform. Some of them decide to retire before 64 thus taking advantage of the reduced decrease in pension in case of early retirement. These executives have enough financial income to compensate for the reduced pension, which underlines the role of savings in retirement decisions.

In addition, given the benchmark calibration on leisure, some executives work beyond the age of the full rate, thereby increasing their pension. Indeed, as executives fear that their off-springs might be born in a lower skill group, they are willing to work longer to accumulate more bequest. Again, saving, through altruism, affect retirement decisions [21].

In spite of the increase in welfare for all skill groups, our results do not totally support the Raffarin reform. Our model predicts that the reform alone can finance roughly 20% of the expected SS deficit. For, the contribution rate remains constant. In addition, clerks and blue collars who constitute 55% of the labor force do not delay retirement. The increase in the contribution rate seems inevitable, which would result in a decrease in welfare for all skill groups, especially for low income workers. [22].

6.2 Italy

What welfare effects can we expect from the Italian reform? One the one hand, a longer life expectancy induces individuals to save more. The resulting increase in financial income yields a higher permanent consumption and welfare. However, several elements negatively affect welfare. First, old age pensions are now indexed on prices, not on wages. Secondly, the Italian reform results in a drop in replacement rates. Figure 6 displays replacement rates as a function of retirement age in the post reform regime. The figure must be compared to the pre-reform replacement rates in table 9. Replacement rates reflect the inequality in lifetime wage profiles. Those who want to benefit from generous replacement rates must now delay retirement. The drop in replacement rates is particularly keen for self - employed workers as their contribution rate is fixed to 20% instead of 33% for private workers. The lower contribution rate for self - employed results in this dramatic fall in replacement rates that are now well below those of the private sector. Furthermore, self - employed are characterized by lower earning profiles than workers of the private sector. With the contributive system, the pattern of pensions reflect this wage inequality.

Table 11 summarizes the welfare effects of the Italian reform. With the increase in life expectancy and savings, all agents are better off in the post 1997 regime, except low skilled self - employed. Indeed, their low wage profile results in low savings and low retirement pension.

The model predicts that the reform will be able to finance the expected deficit. This large impact of the reform on the expected deficit is due to the lower generosity of Social Security (indexation on prices rather than wages and the fall in replacements rates). Even though all skill groups, except low skilled private workers, delay retirement (figure 7), their replacement rates remain well below the levels prevailing in the pre reform regime. [23]

[21] Wealth thus affects retirement through two opposite channels : the desire to accumulate bequest results in delayed retirement while, at the steady state equilibirum, wealthy individuals retire earlier. See Hairault, Langot & Sopraseuth (2005) on this point.

[22] We computed the steady state with reform, the increase of life expectancy and an endogenous contribution rate such that Social Security budget is balanced. We find that, in spite of the reform, the contribution rate has to increase, which actually leads to a reduced welfare, especially for low income groups.

[23] We performed sensitivity analysis to check the robustness of our results. We do not report them as this exercize yields very intuitive results. A lower weight on leisure results in more delayed retirements. In addition, a higher degree

7 Conclusion

This article examines the impact of SS reforms on welfare across skill groups in a life cycle model with heterogeneous agents and endogenous retirement and savings. The model is calibrated on French and Italian micro-data because these countries adopted very different strategies to cope with ageing. France marginally modified its defined pension plan while Italy has given up its generous SS system to a system with a strong contributive flavor. The "real world" Social Security reforms in France and Italy are mapped into the model.

Our paper sheds light not only on the welfare implications of opposite reforms but also on their ability to sustain the PAYG system, thereby quantifying the trade-off between preserving a fair sharing of welfare and financing the expected deficit of Social Security systems.

Our results indicate that executives are the only skill group that takes advantage of the more flexible pension arrangement introduced in the French reform. Wealthy high skilled workers retire earlier while the bequest motive entices a fraction of executives to delay retirement. High skilled workers are the primary winners of the reform. Our results also suggest that the change in SS arrangement will finance only 20% of the expected PAYG deficit. Indeed, the payroll tax rate remains constant and the lengthening of the number of contributive quarters does not affect blue collars and clerks that enter the job market at very young ages: before and after the reform, lower skilled workers that constitute 55% of the labor force retire at age 60.

In the wake of the Italian reform, the fall in SS generosity particularly affects self - employed. For, the new Italian system is based on the capitalization of a fraction of earnings. Self - employed contribute less to the pension system and are characterized by lower lifetime earnings. This dramatic decrease in SS generosity accounts for the ability of the reform to finance the expected deficit. By switching to a defined contribution plan, the Italian government hoped to introduce a more equal SS system. Our model suggests that the reform does not do well along this line.

Further reforms in the French benefit system are needed to finance the expected benefit. This illustrates that both countries have adopted opposite routes to deal with SS issues. France adopted a mild approach by modifying its defined benefit plan without harming too much the low skilled workers' welfare. Although, an increase in the contribution rate seems inevitable in the future. In contrast, Italy shifted from to a notinal defined contribution plan thereby ensuring the financial sustainability of its pension system, but to the detriment of welfare equality.

Our analysis provides a first insight about the consequences of two opposite SS reforms. However, we abstract from important elements. We discarded multimember households so we cannot address issues regarding retirement decision within families, with a specific look at female labor participation

of altruism tends to make high skilled individuals delay more retirement in order to accumulate bequests.

and distributional effects between parents and children. We focus our analysis on steady state profiles, which allows us to make the implications of reforms more transparent but prevented us from having any conclusion about intergenerational welfare effects. We leave these topics for future research.

Table 1: Social Security Reforms in France		
	Pre-reform	Post reform
Early Retirement Age	60	idem
Pension indexation	prices	idem
Pension Formula	$P(k) = P^{basic}(k) + P^{ARRCO}(k)$	idem
	Defined pension plan :	
	$P^{basic}(k) = \min\left(1, \frac{d}{40}\right)$ $\times \frac{1}{25} \sum_{t=1}^{25} Min(w_t, cap_t^{SS})$ $\times \phi$ with $\phi = 0.5$ -0.05 $\times \max\{0, \min[(65-k), 40-d)]\}$ with d = number of contributive years and k = age in years	$P^{basic}(k) = (1 + 0.03 \max\{0, d-42\})$ $\times \min\left(1, \frac{d}{42}\right)$ $\times \frac{1}{25} \sum_{t=1}^{25} Min(w_t, cap_t^{SS}) \times \phi$ with $\phi = 0.5$ $-\frac{0.05}{2}$ $\times \max\{0, \min[(65-k), 42-d)]\}$
	Defined contribution plan :	
	$P^{ARRCO}(k) = points(k) \times v_d \times penalty(k)$	idem

Table 2: Social Security Reforms in Italy		
Pension	Pre-1992 regime	Post-regime
Early Retirement Age	60	from 57 years old on
Pension Private	$P(d) = \left(\frac{1}{5} \sum_{t=1}^{5} w_{age-t}\right) \times Min(d, 40) \times \tau^I$ with d number of contributive years	$P(k) = c^I \times \sum_{t=1}^{d} 0.33 \times w_t (1+\gamma^I)^{k-t}$ with k retirement age
Pension Self-employed	$P(d) = \left(\frac{1}{10} \sum_{t=1}^{10} w_{age-t}\right) \times Min(d, 40) \times \tau^I$	$P(k) = c^I \times \sum_{t=1}^{d} 0.20 \times w_t (1+\gamma^I)^{k-t}$
Pension benefits	$\tau^I = 2\%$ of pensionable wages	$\gamma^I = 5$ year moving average of GDP growth c^I = Conversion coefficients
Pension indexation	wages	prices

Table 3: French death probabilities beween 59 and 70

Age	59	60	61	62	63	64	65	66	67	68	69	70 and more
Executives	0.043	0.044	0.046	0.048	0.050	0.052	0.054	0.056	0.059	0.062	0.065	0.068
White collars	0.049	0.051	0.053	0.056	0.058	0.061	0.064	0.068	0.071	0.075	0.080	0.086
Clerks	0.051	0.053	0.055	0.057	0.060	0.063	0.066	0.070	0.074	0.078	0.084	0.089
Blue Collars	0.056	0.059	0.062	0.065	0.068	0.072	0.076	0.081	0.087	0.093	0.100	0.109

Sources: Own computations from COR(2001) and Blanchet&Monfort (1996)

Table 4: Life expectancy by age - Italy

Age	60	61	62	63	64	65	66	67	68	69	70
Italy											and more
Life Expectancy	20.03	19.23	18.43	17.66	16.9	16.16	15.43	14.72	14.03	13.36	12.7

Sources: INPS for Italy

Table 5: Parameters of the model

Parameters		France	Italy
Interest rate	r	5%	
Growth productivity	γ	2%	1.92%
Discount rate	β	0.96	0.985
Risk aversion coefficient	σ	2	
Leisure of worker	$1-l$	2/3	
Weight of leisure in utility	η	0.84	0.82
Altruism	ϱ	0.9	0.6

Table 6: Annual Gross Wage in French Francs
by age group (Y, A, M) and skill level i

	Age Group		
	Y	A	M
Skill group			
Executives	155974	245349	278709
Middle White Collars	103281	140853	129085
Clerks	76613	103066	83606
Blue Collars	79072	96133	85538

source: French Labor Force Survey. Note: Y (Young) A (Adult) M (Mature)

Table7: Lifetime wage in Italy in millions of Liras by age group (Y, A, M) and skill level i

	Age group	Y	A	M
Skill group i				
Self employed	No studies and primary studies	0.914	10.546	16.28
	Secondary studies	12.329	20.908	20.903
	Pre-superior studies	6.108	22.336	24.139
	Diploma, degree and post-degree	3.267	31.728	42.517
Private Sector	No studies and primary studies	6.954	16.694	18.165
	Secondary studies	16.117	19.911	20.439
	Pre-superior studies	17.568	27.551	31.885
	Diploma, degree and post-degree	19.375	39.061	46.08

source: SHIW average 1991-2002. Note: Y (Young) A (Adult) M (Mature)

Table 8: Dependency ratios

	France	Italy
Dependency ratio 2002 Data (%)	27	29
Dependency ratio 2002 Model (%)	30	33
(Expected) Dependency ratio 2040 without reform Data (%)	58	61
Dependency ratio 2040 without reform Model (%)	55	54
Contribution rate (firm + employee) - Data (%)	29.6	25.3
Contribution rate (firm + employee) - Model (%)	21.3	24.8

Data source: Italy-Visco (2001) -Brugiavini and Galasso (2003), OECD (2000)- France COR(2001), Belhaj (2004)

Table 9: Replacement Rates (Data and Model)- France and Italy

	Skill groups	Data	Model
France			
	Executives	59%	50%
	While Collars	64%	62%
	Clerks	72%	78%
	Blue Collars	80%	82%
Italy			
Self employed	No studies and primary studies	66%	67%
	Secondary studies	68%	69%
	Pre-superior studies	80%	86%
	Diploma, degree and post-degree	82%	80%
Private Sector	No studies and primary studies	68%	77%
	Secondary studies	69%	75%
	Pre-superior studies	71%	81%
	Diploma, degree and post-degree	72%	80%
Total		70%	75%

Source:France- Chagny et al. (2001) Italy- SHIW-1991-2001, authours' calculations.

Table 10: Welfare on New Borns -France

	2000	2040	Welfare change	Consumption change
	(1)	(2)	(3)	(4)
Executives	-10.6086	-10.3898	0.0455	0.0476
White Collars	-16.9144	-16.6789	0.0312	0.0322
Clerks	-22.4713	-22.2726	0.0322	0.0333
Blue collars	-23.2987	-23.0206	0.0258	0.0264

Table 11: Welfare of New Born -Italy

		2000	2040	Welfare Change	Consumption Change
		(1)	(2)	(3)	(4)
Self employed	No studies and primary studies	-18.9508	-21.4595	-0.1324	-0.1131
	Secondary studies	-9.6989	-10.5158	-0.0842	-0.0749
	Pre-superior studies	-8.9406	-8.6142	0.0365	0.0401
	Diploma. degree and post-degree	-7.7777	-7.3834	0.0507	0.056
Private Sector	No studies and primary studies	-10.2903	-9.628	0.0644	0.0713
	Secondary studies	-7.2825	-6.8313	0.062	0.068
	Pre-superior studies	-5.9696	-5.2696	0.1173	0.1342
	Diploma. degree and post-degree	-4.82	-4.4745	0.0717	0.0792

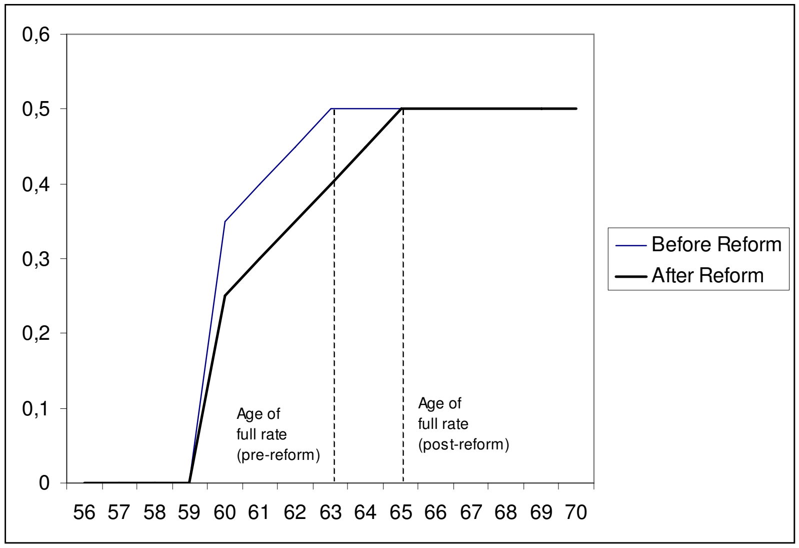


Figure 1: Figure 1: Pension rate of the General Regime for an individual who started working at age 23

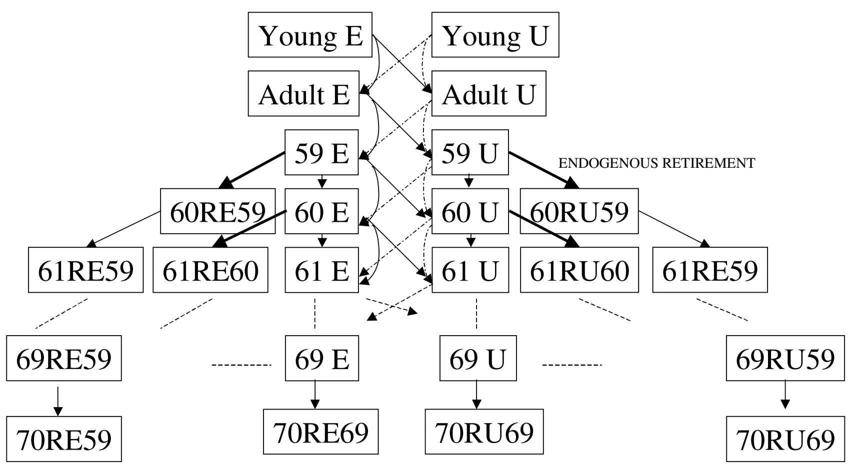
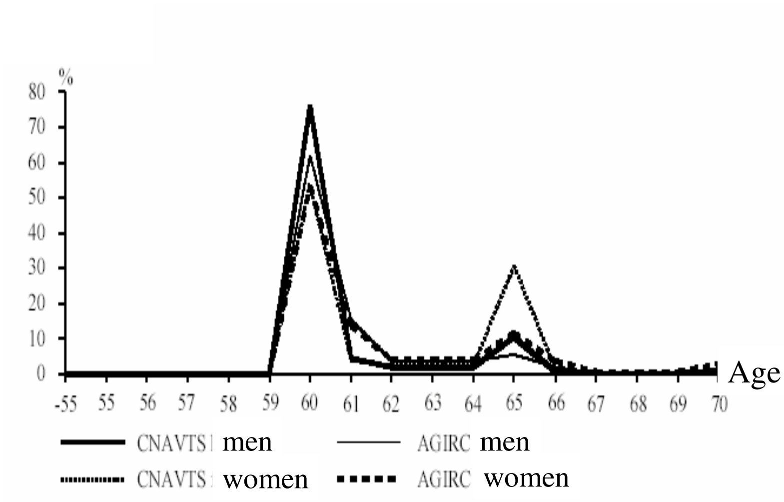


Figure 2: Decision tree faced by each individual in France (Early retirement age is 60 years old)



CNAVTS : Basic General regime
AGIRC : Complementary Schemes

Figure 3 : Retirement age in the French private sector in 1996. Source : Charpin (1999).

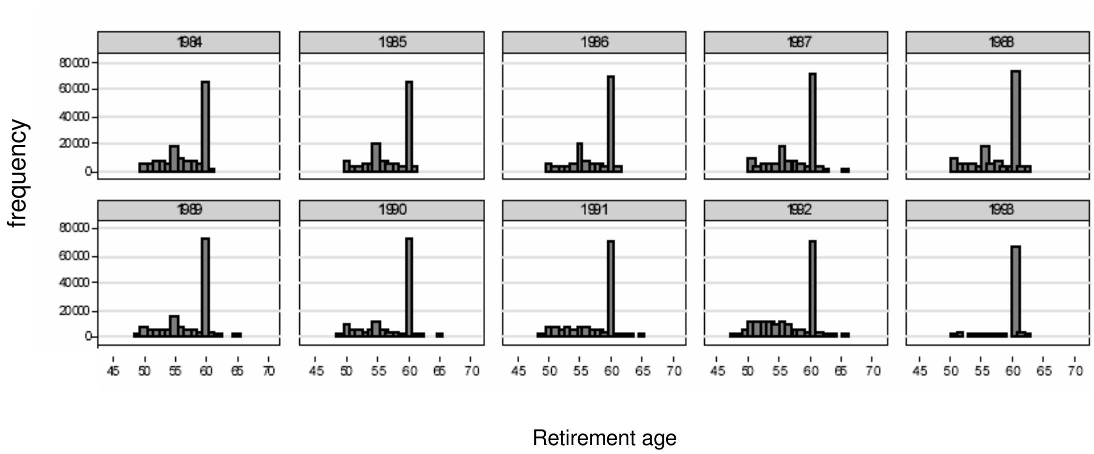


Figure 4: Distribution of retirement age in Italy (INPS data)

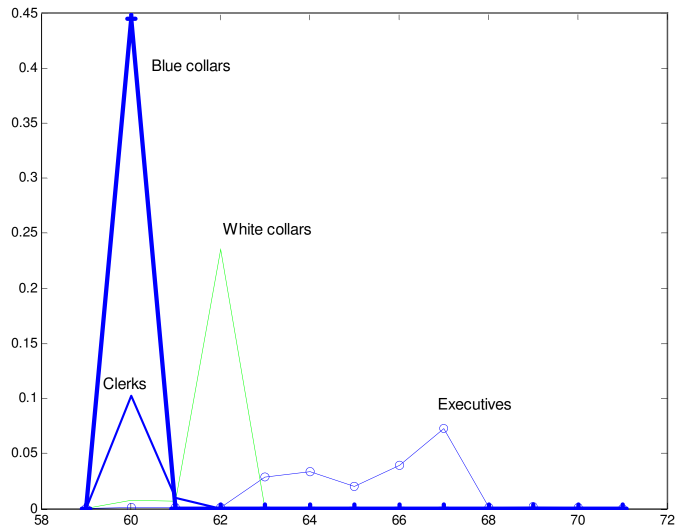


Figure 5: Retirement age in the post-reform regime - France

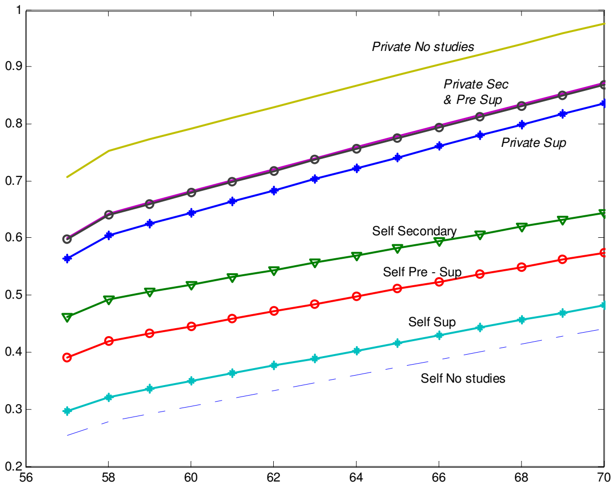


Figure 6: Replacement rates by social group

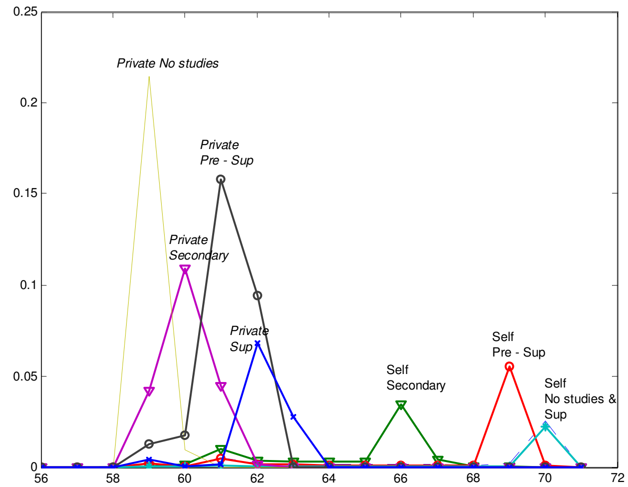


Figure 7: Distribution of retirement age after the reform - Italy

APPENDIX

Appendix A: Tables

Table A1: penalty (k) and Complementary schemes based on 1994 values (French occupational pension system)

Age k	55	56	57	58	59	60	61	62	63	64
$penalty(k)$	0.43	0.50	0.57	0.64	0.71	0.78	0.83	0.88	0.92	0.96

δ_{ARRCO}	p^{ARRCO}	v_d^{ARRCO}	δ_{AGIRC}	p^{AGIRC}	v_d^{AGIRC}
0,04	22,4	2,455	0,12	19,52	2,303

Table A2: Age of end of education -France and Italy (source: LFS and SHIWdata)

France	Executives	Middle White Collars.	Clerks	Blue Collars
k^{eva}	21.7	19	18.2	16.4

Italy	No Studies	Primary	Secondary	Pre-superior	Superior
k^{eva}	16.83	17.14	18.27	20.54	24.59

Table A3: Conversion Coefficients (INSP data)

Age	57	58	59	60	61	62	63	64	65 and more
Conversion Coefficients c^I	4.720%	4.860%	5.006%	5.163%	5.334%	5.514%	5.706%	5.911%	6.136%

Table A4: Social Mobility Matrix in France

		Son's skill group (t+1)			
		Executives	Middle White Collars	Clerks	Blue Collars
Father's	Executives	0.482	0.279	0.101	0.138
skill	Middle White Collars	0.241	0.325	0.120	0.314
group (t)	Clerks	0.153	0.256	0.140	0.451
	Blue Collars	0.067	0.183	0.086	0.664

Source: own computations from LFS, average values

Table A5: Social Mobility Matrix in Italy

Father's status (t)		Son's status (t+1) Self employed no studies	secondary	pre-superior	superior	Private sector no studies	secondary	pre-superior	superior
	no studies	0.2291	0.0456	0.0227	0.0027	0.5346	0.1063	0.0529	0.0062
	secondary	0.0004	0.1422	0.1307	0.0268	0.0008	0.3318	0.3049	0.0625
	pre-superior	0.0240	0.0709	0.1500	0.0551	0.0560	0.1654	0.3500	0.1286
Self employed	superior	0.0820	0.0174	0.1276	0.0730	0.1912	0.0406	0.2978	0.1704
	no studies	0.2291	0.0456	0.0227	0.0027	0.5346	0.1063	0.0529	0.0062
	secondary	0.0004	0.1422	0.1307	0.0268	0.0008	0.3318	0.3049	0.0625
	pre-superior	0.0240	0.0709	0.1500	0.0551	0.0560	0.1654	0.3500	0.1286
Private sector	superior	0.0820	0.0174	0.1276	0.0730	0.1912	0.0406	0.2978	0.1704

Source: own computations from SHIW, average values

Appendix B : Value functions

The mature group's decision is more developed in section 2.3. Here we can follow the young and the adult age group decisions.

Individuals choose when young ($s \in Y^x$) with $x = E$ (Employed) or U (Unemployed) taking into account the probability to become adult in the following period, when adult ($s \in A^x$) with $x = E$ or U. For a young individual of skill level i

$$\begin{aligned} v(a, Y_i^E) &= \max_{c \geq 0,\ a'} u(c,l) + \tilde{\beta} \left\{ \begin{array}{c} \pi_{YY} \left[\pi_{ee,\,Y,i} v(a', Y_i^E) + (1 - \pi_{eu,\,Y,i}) v(a', Y_i^U) \right] \\ +(1-\pi_{YY}) \left[\pi_{ee,\,A,i} v(a', A_i^E) + (1 - \pi_{eu,\,A,i}) v(a', A_i^U) \right] \end{array} \right\} \qquad (3) \\ (1+\gamma) a' &= (1+r) a + w_i^Y - \Theta(w_i^Y) - c \\ a' &\geq 0 \end{aligned}$$

with $Y_i^E = Y$ (age group), E (Employed), i (skill level). $\Theta(w_i^Y)$ are taxes used to finance the PAYG system. Only the share of payroll taxes paid by employees is introduced in individuals' budget constraint. Note that transitions on the labor market captured by probabilities $\pi_{ee,\,Y,i}, \pi_{ee,\,Y,i}, \pi_{ee,\,A,i}$ and $\pi_{eu,\,A,i}$ depend on skill level i.

If unemployed, a fraction of wages is paid as unemployment benefits, $\theta_i^u w_i^Y$ where θ_i^u denotes the replacement ratio associated with unemployment benefits and skill level i. Besides, unemployed individuals do not contribute to the Social Security system.

$$
\begin{aligned}
v(a, Y_i^U) &= \max_{c \geq 0,\ a'} u(c,l) + \tilde{\beta} \left\{ \begin{array}{c} \pi_{YY} \left[\pi_{ue,Y,i} v(a', Y_i^E) + (1-\pi_{ue,Y,i}) v(a', Y_i^U) \right] \\ +(1-\pi_{YY}) \left[\pi_{ue,A,i} v(a', A_i^E) + (1-\pi_{ue,A,i}) v(a', A_i^U) \right] \end{array} \right\} \\
(1+\gamma)a' &= (1+r)a + \theta_i^u w_i^Y - c \\
a' &\geq 0
\end{aligned} \tag{4}
$$

Choice when adult ($s \in A^x$) with $x = E$ or U, taking into account the possibility to be eligible age to take retirement decisions in the next period. For instance, for France, the early retirement age is 60, the threshold to take retirement decision will be 59:

$$
\begin{aligned}
v(a, A_i^E) &= \max_{c \geq 0,\ a'} u(c,l) \\
&\quad + \tilde{\beta} \left\{ \begin{array}{l} \pi_{AA} \left[\pi_{ee,A,i} v(a', A_i^E) + (1-\pi_{eu,A,i}) v(a', A_i^U) \right] \\ +(1-\pi_{AA}) \left[\pi_{ee,59,i} v\left(a', 59_i^E\right) + (1-\pi_{eu,59,i}) v\left(a', 59_i^U\right) \right] \end{array} \right\} \\
(1+\gamma)a' &= (1+r)a + w_i^A - \Theta(w_i^A) - c \\
a' &\geq 0
\end{aligned}
$$

with $A_i^E = A$ (age group)$, E$ (Employed)$, i$ (skill level).

$$
\begin{aligned}
v(a, A_i^U) &= \max_{c \geq 0,\ a'} u(c,l) \\
&\quad + \tilde{\beta} \left\{ \begin{array}{l} \pi_{AA} \left[\pi_{ue,A,i} v(a', A_i^E) + (1-\pi_{uu,A,i}) v(a', A_i^U) \right] \\ +(1-\pi_{AA}) \left[\pi_{ue,59,i} v\left(a', 59_i^E\right) + (1-\pi_{ue,59,i}) v\left(a', 59_i^U\right) \right] \end{array} \right\} \\
(1+\gamma)a' &= (1+r)a + \theta^u w_i^A - c \\
a' &\geq 0
\end{aligned}
$$

with with $A_i^U = A$ (age group)$, U$ (unemployed)$, i$ (skill level).

Appendix C: Labor market transitions

The computation of unemployment risk is based on the authors' computations of unemployment duration and unemployment rates using French LFS and Italian micro-data (ISTAT labor Force Survey from 1992-1993 and 2001-2002). Labor market transitions for each age k and each skill group i are given by

$$
\Pi_{k,i} = \begin{pmatrix} \pi_{ee,k,i} & \pi_{eu,k,i} = 1 - \pi_{ee,k,i} \\ \pi_{ue,k,i} & \pi_{uu,k,i} = 1 - \pi_{ue,k,i} \end{pmatrix}
$$

where $\pi_{ee,k,i}$ ($\pi_{ue,k,i}$ respectively) is the probability of being employed at the subsequent age $k+1$, after being employed (unemployed respectively) at age k. The computation of unemployment risks by age k and by skill group i are based on the following formulas:

$$D_{ki} = \frac{1}{\pi_{eu,k,i}}$$

where D_{ki} denotes the number of years of unemployment, as documented by the micro-data. Besides, given that $E_{ki} = \frac{1}{\pi_{ue,k,i}}$ (with E_{ki} the number of years of employment) and $U_{ki} = \frac{D_{ki}}{E_{ki}+D_{ki}}$ (U_{ki} the unemployment rate of the skill group i of age k), we have

$$\pi_{eu,k,i} = \frac{U_{ki}}{D_{ki}(1-U_{ki})}$$

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