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THE TAX ON CONTINUED ACTIVITY AND THE UNEMPLOYMENT OF THE ELDERLY THEORETICAL AND EMPIRICAL INVESTIGATION

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The tax on continued activity and the unemployment of the elderly Theoretical and empirical investigations

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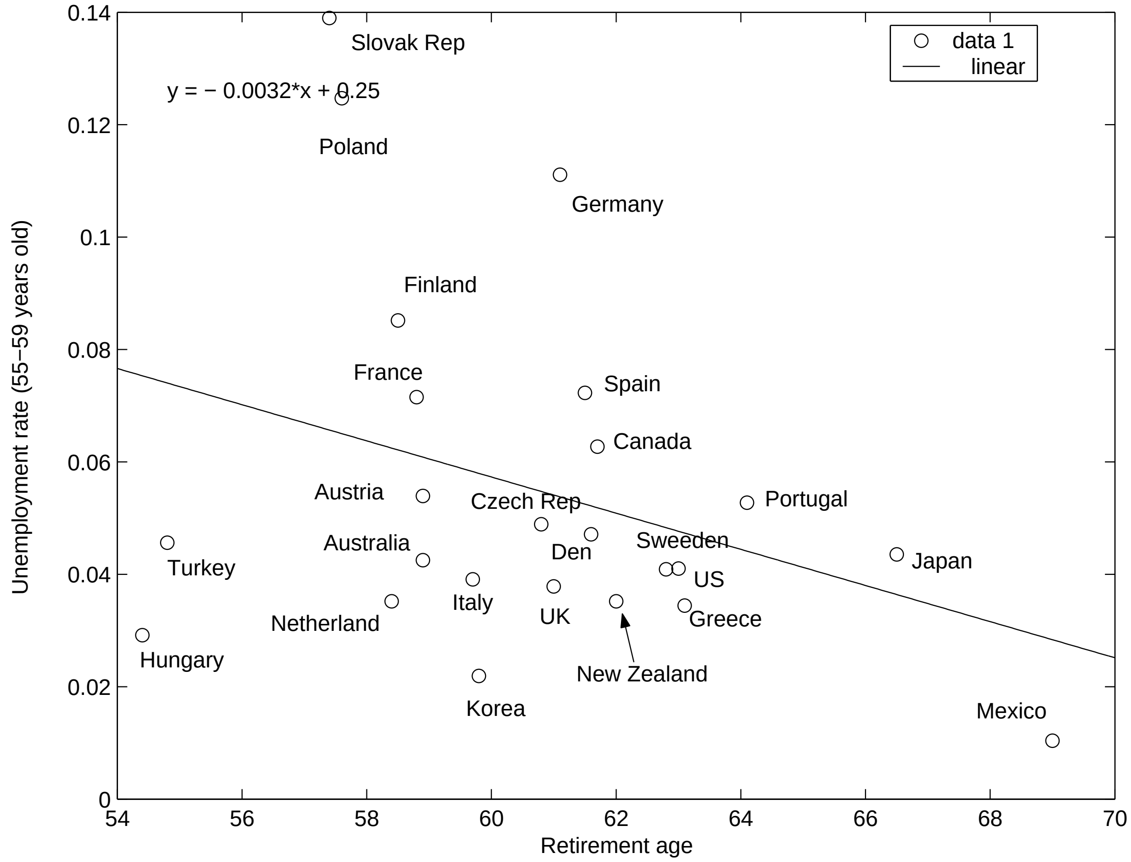
Abstract

This paper presents theoretical foundation and empirical evidence in favor of the view that the tax on continued activity, not only decreases the participation rate by inducing early retirement, but also badly affects the unemployment rate of elder workers. Forward-looking behavior of the elderly actually implies that the tax on continued activity may have strong implications for the participation rate of old workers. Decreasing this tax, thus bringing it closer to the actuarially-fair scheme, can not only increase the activity of workers, but also encourages the search intensity of elder unemployed individuals. Based on the French Labor Force Survey, we show that employment probabilities are significantly affected by the length of time before retirement, in addition to their age and other standard relevant variables. These results yield strong arguments in favor of policies aimed at increasing the employment of the elderly : decreasing the tax on continued activity can not only increase the return of working activity for people still at work but also entice unemployed elder people to find a job.

1 Introduction

We present in this paper both theoretical foundation and empirical evidence in favor of the view that the tax on continued activity, not only decreases the participation rate by inducing early retirement, but also badly affects the unemployment rate of elder workers. Figure 1 displays the unemployment rate of elder workers and the average retirement age across OCDE countries in 2003 (Source : OECD Employment Outlook 2004). A linear regression suggests that the higher the retirement age the higher the unemployment of the elderly: an increase in retirement age by 3 years and 2 months leads to a 1% decline in the unemployment rate of elder workers. We focus on 55 - 59 years old workers who are not entitled yet to retirement. Indeed, we investigate in this paper the forward looking behavior of old workers with regards to their expected working time horizon before retirement. With finite working life horizon, the job value, given by the difference between the value of employment and the value of unemployment, falls to zero. This is why early finite working-life, due to high tax on continued activity, can cause low search intensities for elder unemployed workers. Forward-looking behavior of the elderly actually implies that the tax on continued activity may have strong implications for their participation rate. Decreasing this tax by bringing it closer to the actuarially-fair scheme can not only increase the

Figure 1: Unemployment of elder workers and retirement age



employment of workers, but also encourages the search intensity of elder unemployed people.

We propose in the first section a canonical search model in order to shed light on the interaction between the finite working life horizon and search behavior on the labor market. In the second session, we aim at providing some empirical findings in favor of this interaction. Based on the French Labor Force Survey, we show that employment probabilities are significantly affected by the distance to retirement age, in addition to their age and other standard relevant variables.

These results yield strong arguments in favor of policies aimed at increasing the employment for the elderly. The high observed rate of unemployment can no longer be considered as given; decreasing the tax on continued activity can not only increase the return of working activity for people still at work but also entice unemployed elder people to find a job.

2 Theoretical investigations

The model analyzed in this section is a modified version of the McCall [1970] model where unemployed workers must search for a new job and choose an optimal search intensity which will influence the average length of unemployment spells. Beyond the heterogeneity arising from wage offer distribution, life cycle features are also considered. Following here Castaneda, Diaz-Gimenez and Rios-Rull [1998] or Ljungqvist and Sargent [2002], agents age stochastically. Upon death, households are replaced by other households of the same dynasty and are not altruistic towards them.

2.1 Population dynamics and employment opportunities

In this section, we define the exogenous stochastic variables of the model, namely the age of the households and their employment opportunities. These two stochastic processes are independent.

2.1.1 Population dynamics

Each period, some households are born and some die. We assume that the measure of the newly-born is constant over time. They are born as unemployed workers. Retirement is endogenous. Upon retirement, they can die with a given probability.

In order to take into account a typical wage life-cycle profile and the age-specific unemployment risk, we assume that the worker population can be divided into four age groups, denoted C_1, C_2, C_3 and C_4. We also consider two classes of retirement, denoted C_5 and C_6.

As a worker accumulates experience during its life-cycle, we assume that the efficiency of the labor input grows with the agents' age. Thus, when a worker of age C_1 (C_i, for $i = 2, 3, 4$) becomes a worker of the age C_2 (C_i, for $i = 3, 4$), his efficiency is multiplied by $1 + x_1$ ($1 + x_i$, for $i = 2, 3$, with $x_i < x_{i+1}$). The income of an employed worker is the product of the wage (w) by the amount of human capital (H_i), which is increasing with age: for example, $H_2 = (1 + x_1)H_1$. Given to legal minimum age, only workers in $C5$ and $C6$ may become retired.

Each individual is born young. The probability for a worker of remaining in C_1 (C_i, for $i = 2, 3, 4$) the next period is π_1 (π_i, for $i = 2, 3, 4, 5, 6$). Conversely, the probability of aging $1 - \pi_1$ ($1 - \pi_i$, for $i = 2, 3, 4$).

The matrix $\mathcal{P}$ governing the age Markov-process is given by:

		$t+1$					
		C_1	C_2	C_3	C_4	C_5	C_6
	C_1	π_1	$1-\pi_1$	0	0	0	0
	C_2	0	π_2	$1-\pi_2$	0	0	0
t	C_3	0	0	π_3	$1-\pi_3$	0	0
	C_4	0	0	0	π_4	$1-\pi_4$	0
	C_5	0	0	0	0	π_5	$1-\pi_5$
	C_6	$1-\pi_6$	0	0	0	0	π_6

This matrix yields the stationnary distribution of workers conditionnally to their age groups. Each period, a fraction $1 - \pi_6$ of new workers are born. They replace an equal number of dead workers, so that the measure of the population is constant.

2.1.2 Employment opportunities

An unemployed worker, each period t, chooses a search intensity $s_t \geq 0$. We assume that individuals derive utility from consumption and leisure. Leisure refers to the time not spent on labor or job search. Consequently, the utility of an unemployed worker at time t can be expressed as $u(B, T - s_t)$, where function u satisfies the usual Inada conditions, B denotes unemployment benefits[1] and T the total time endowment. The incentive to increase search intensity is linked to the probability of getting a job offer. This probability $\phi(s_t)$ is an increasing function of s_t, and we assume that $\phi(s_t) \in [0, 1]$, for $s_t \in [0, \infty)$.

[1]Without financial wealth, current income equals consumption at all times.

According to this probability $\phi(s_t)$, an unemployed worker receives a job offer in the next period. This offer is drawn from the wage offer distribution $F(w)$, which denotes the probability of receving a wage offer between the lower wage of the distribution $\underline{w}$ and w_{t+1} ($F(w) = \text{Prob}(w_{t+1} \leq w)$). Accepting a wage offer w_{t+1} implies that the worker earns that wage per unit of human capital (experience) in period t and thereafter for each period he has not been laid off and has not retired. The probability of being laid off at the beginning of the period is $\lambda \in [0, 1]$.

2.2 Behavioral assumptions and optimal solution

A worker observes his new age at the beginning of a period before deciding to accept or reject a new wage offer and chooses a search intensity. The preferences are given by:

$$E_0 \sum_{t=0}^{\infty} \beta^t u(y_t, T - z_t) \quad \text{where } z_t \equiv I^p(As_t - (1 - A)h)$$

where E_0 is the expectation operator conditional at time 0, $\beta \in (0, 1)$ the subjective discount factor and y_t the after-tax income from employment, unemployment compensation and pension. If $I^p = 0$, then the agent is retired, otherwise, the agent participates to the labor market. In the latter case, if $A = 0$, then the worker is at work and has a constant disutility of labor denoted by h, whereas if $A = 1$ the worker is unemployed and has an endogenous disutility of search, denoted by s_t. Let $V_i^e(w)$ be the value of the optimization problem for a worker of age C_i and paid w, V_i^u be the value of the optimization problem for an unemployed worker of age C_i, and V^r be the value of a retiree. The Bellman equations can be written as:

$$\begin{aligned}
& \text{for } i = 1, 2, 3 \\
V_i^e(w) &= u(wH_i, T - h) + \beta \left\{ \pi_i [(1 - \lambda) V_i^e(w) + \lambda V_i^u] \right. \qquad (1) \\
&\quad \left. + (1 - \pi_i)[(1 - \lambda) V_{i+1}^e(w) + \lambda V_{i+1}^u] \right\} \\
V_i^u &= u(bH_i, T - s_i) \qquad (2) \\
&\quad + \beta \left\{ \pi_i \left[\phi(s_i) \int \max\{V_i^e(w), V_i^u\} dF(w) + (1 - \phi(s_i)) V_i^u \right] \right. \\
&\quad \left. + (1 - \pi_i) \left[\phi(s_{i+1}) \int \max\{V_{i+1}^e(w), V_{i+1}^u\} dF(w) + (1 - \phi(s_{i+1})) V_{i+1}^u \right] \right\} \\
& \text{for } i = 4 \\
V_i^e(w) &= u(wH_i, T - h) + \beta \left\{ \pi_i [(1 - \lambda) V_i^e(w) + \lambda V_i^u] \right. \qquad (3)
\end{aligned}$$

$$
\begin{aligned}
& +(1-\pi_i)[(1-\lambda)\max\{V_{i+1}^e(w),V_{i+1}^r\}+\lambda\max\{V_{i+1}^u,V_{i+1}^r\}]\} \\
V_i^u &= u(bH_i,T-s_i) \qquad (4)\\
& +\beta\left\{\pi_i\left[\phi(s_i)\int\max\{V_i^e(w),V_i^u\}dF(w)+(1-\phi(s_i))V_i^u\right]\right. \\
& +(1-\pi_i)\left[\phi(s_{i+1})\int\max\{V_{i+1}^e(w),V_{i+1}^u,V_{i+1}^r\}dF(w)\right. \qquad (5)\\
& \left.\left.+(1-\phi(s_{i+1}))\max\{V_{i+1}^u,V_{i+1}^r\}\right]\right\}
\end{aligned}
$$

for $i=5$

$$
\begin{aligned}
V_i^e(w) &= u(wH_i,T-h) \\
& +\beta\left\{\pi_i[(1-\lambda)\max\{V_{i+1}^e(w),V_{i+1}^r\}+\lambda\max\{V_{i+1}^u,V_{i+1}^r\}]\right. \\
& \left.+(1-\pi_i)V_{i+1}^r\right\} \qquad (6)\\
V_i^u &= u(bH_i,T-s_i) \qquad (7)\\
& +\beta\left\{\pi_i\left[\phi(s_i)\int\max\{V_i^e(w),V_i^u,V_i^r\}dF(w)+(1-\phi(s_i))\max\{V_{i+1}^u,V_{i+1}^r\}\right]\right. \\
& \left.+(1-\pi_i)V_{i+1}^r\right\}
\end{aligned}
$$

and for $i=5$

$$V_i^r = u(p,T)+\beta\left\{\pi_i V_i^r+(1-\pi_i)V_{i+1}^r\right\} \qquad (8)$$

for $i=6$

$$V_i^r = u(p,T)+\beta\left\{\pi_i V_i^r\right\} \qquad (9)$$

where H_i denotes the skill level at age i, and p the retiree's pension. Notice that agents of age C_4 and C_5 endogenously choose retirement.

Associated with equations (2)-(9) are four optimal policy rules $\overline{s}_i$, for $i=1,...,4$ and four reservation wages $\overline{w}_i$. The optimal decision for search intensity is given by

$$u_2'(bH_i,T-s_i) = \phi'(s_i)\beta\left\{\pi_i\left(\left[\int\max[V_i^e(w),V_i^u]dF(w)\right]-V_i^u\right)\right)$$

The marginal disutility of the search activity equals its expected return which is captured by the product between the increase in the probability of getting a contact and the expected surplus of employment.

2.3 Equilibrium unemployment rates

Let $U_{t,i}$, $N_{t,i}$, $R_{i,t}$ and $P_{t,i}$ denote respectively the number of unemployed workers of age i at the beginning of period t, the number of employed workers, the number of retirees, and the total labor force (note that $P_{t,i}=N_{t,i}+U_{t,i}+R_{t,i}$, $\forall t,i$). The unemployment rates at each age obey the following laws of motion:

$$U_{t,1} = \underbrace{(1-\pi_6)P_{t-1,6} + \pi_1\lambda N_{t-1,1}}_{\text{new unemployed workers}} + \underbrace{\pi_1[\phi(\overline{s}_1)F_1(\overline{w}_1) + (1-\phi(\overline{s}_1))]U_{t-1,1}}_{\text{surviving unemployed workers}}$$

and for $i = 2, 3, 4$

$$\begin{aligned} U_{t,i} = & \underbrace{(1-\pi_{i-1})[\phi(\overline{s}_{i-1})F_{i-1}(\overline{w}_{i-1}) + (1-\phi(\overline{s}_{i-1}))]U_{t-1,i-1}}_{\text{new unemployed workers coming from age } i-1} \\ & + \underbrace{(1-\pi_{i-1})N_{t-1,i-1}[\lambda + (1-\lambda)\max\{0, G_{i-1}(\overline{w}_i) - G_{i-1}(\overline{w}_{i-1})\}]}_{\text{new unemployed workers coming from age } i-1} \\ & + \underbrace{\pi_i\lambda N_{t-1,i}}_{\text{new unemployed workers}} + \underbrace{\pi_i[\phi(\overline{s}_i)F_i(\overline{w}_i) + (1-\phi(\overline{s}_i))]U_{t-1,i}}_{\text{surviving unemployed workers}} \end{aligned}$$

where $G_i(w)$ denotes the fraction of age i employed workers at wage w or less. The right side of these equations is the sum of new unemployed worker of age i and the survivors at age i of workers who were unemployed at the end of the period, which correspond to the workers who reject offers that are less than the optimal reservation wage ($\overline{w}_i$).

Given that the size of the population is a constant, denoted by P, one can define stationary equilibrium unemployment rates by age. These constant levels of unemployment rates, denoted by $u_i = U_i/P$, are defined by:

$$u_1 = \frac{(1-\pi_6)p_6 + \pi_1\lambda p_1}{1 - \pi_1[\phi(\overline{s}_1)F_1(\overline{w}_1) + (1-\phi(\overline{s}_1))] + \lambda\pi_1}$$

and for $i > 1$,

$$\begin{aligned} (1 - \pi_i[\phi(\overline{s}_i)F_i(\overline{w}_i) + (1-\phi(\overline{s}_i))] + \pi_i\lambda)u_i = \\ (1-\pi_{i-1})[\phi(\overline{s}_{i-1})F_{i-1}(\overline{w}_{i-1}) + (1-\phi(\overline{s}_{i-1}))]u_{i-1} \\ -[\lambda + (1-\lambda)\max\{0, G_{i-1}(\overline{w}_i) - G_{i-1}(\overline{w}_{i-1})\}]u_{i-1} \\ +(1-\pi_{i-1})[\lambda + (1-\lambda)\max\{0, G_{i-1}(\overline{w}_i) - G_{i-1}(\overline{w}_{i-1})\}]p_{i-1} + \pi_i\lambda p_i \end{aligned}$$

where p_i denotes the fraction of population of age i in the total population.

Finally, the equilibrium rates of retired workers are given by:

$$\begin{aligned} & \text{if } V_5^r < V_5^u \Longrightarrow U_{5,t} > 0 \text{ and,} \\ R_{5,t} &= 0 \\ & \text{if } V_5^r < V_5^u \Longrightarrow U_{5,t} = 0 \text{ and,} \\ R_{5,t} &= \pi_5[R_{5,t-1} + \lambda N_{5,t-1} \\ & +(1-\pi_4)[\lambda + (1-\lambda)\max\{0, G_4(\overline{w}_5) - G_4(\overline{w}_4)\}]N_{4,t-1} \\ & +(1-\pi_4)[\phi(\overline{s}_4)F_4(\overline{w}_4) + 1 - \phi(\overline{s}_4)]U_{4,t-1} \\ R_{6,t} &= \pi_6 R_{6,t-1} + (1-\pi_5)P_5 \end{aligned}$$

At steady state, these equations imply that the rate of retired workers (R_i/P) are given by:

$$\begin{aligned}
& \text{if } V_5^r < V_5^u \\
r_5 &= 0 \\
& \text{if } V_5^r > V_5^u \\
r_5 &= \frac{(1-\pi_4)[\phi(\overline{s}_4)F_4(\overline{w}_4) + (1-\phi(\overline{s}_4)) - \lambda - (1-\lambda)\max\{0, G_4(\overline{w}_5) - G_4(\overline{w}_4)\}]}{1-\pi_5(1-\lambda)} u_4 \\
& + \frac{\lambda\pi_5 p_5 + (1-\pi_4)[\lambda + (1-\lambda)\max\{0, G_4(\overline{w}_5) - G_4(\overline{w}_4)\}] p_4}{1-\pi_5(1-\lambda)} \\
r_6 &= \frac{(1-\pi_5)p_5}{1-\pi_6}
\end{aligned}$$

After solving this system of equations, one can deduce the aggregate equilibrium unemployment rate: $u = \sum_i u_i/(1-\sum_i r_i)$ and the equilibrium rate of retirees $r = \sum_i r_i$. Equilibrium unemployment rates by age are defined by $\widetilde{u}_i = u_i/p_i$.

2.4 Equilibrium wage distributions

Let $G_{i,t}(w)$ denote the fraction of age i employed workers at wage w or less at time t. These functions are derived from the following equilibrium flows:

$$(p_1 - u_{1,t})G_{1,t}(w) = \pi_1\left[(1-\lambda)(p_1 - u_{1,t-1})G_{1,t-1}(w) + \phi_{1,t-1}(F_1(w) - F_1(\overline{w}_1))u_{1,t-1}\right]$$

where $\phi_{1,t-1} \equiv \phi(\overline{s}_{1,t-1})$. At steady state, this equation implies:

$$[1-\pi_1(1-\lambda)](p_1 - u_1)G_1(w) = \phi_1(F_1(w) - F_1(\overline{w}_1))u_1$$

$$\Leftrightarrow G_1(w) = \frac{\phi_1 u_1}{[1-\pi_1(1-\lambda)](p_1-u_1)}(F_1(w) - F_1(\overline{w}_1))$$

For age $i > 1$, the dynamics of the fraction of age i employed workers at wage w or less at time t is given by:

$$\begin{aligned}
(p_i - u_{i,t})G_{i,t}(w) &= \\
\pi_i\left[(1-\lambda)(p_i - u_{i,t-1})G_{i,t-1}(w) + \phi_{i,t-1}(F_i(w) - F_i(\overline{w}_i))u_{i,t-1}\right] & \\
+(1-\pi_{i-1})\left[\phi_{i-1,t-1}(F_{i-1}(w) - F_{i-1}(\overline{w}_{i-1}))u_{i-1,t-1}\right. & \\
\left.+(p_{i-1} - u_{i-1,t-1})G_{i-1,t-1}(w)[(1-\lambda)(1-\max\{0, G_{i-1}(\overline{w}_i) - G_{i-1}(\overline{w}_{i-1})\})]\right] &
\end{aligned}$$

For employees, the transition between age $i-1$ and age i could lead to a voluntary quit if the wage accepted at age $i-1$ is lower than the reservation age at age i. This fraction of voluntary quits is measured by $(1-\pi_{i-1})(p_{i-1}-u_{i-1,t-1})G_{i-1,t-1}(w)(1-\lambda)\max\{0, G_{i-1}(\overline{w}_i) - G_{i-1}(\overline{w}_{i-1})\}$. At steady state, we then obtain:

$$\begin{aligned} & [1-\pi_i(1-\lambda)](p_i-u_i)G_i(w) = \\ (1-\pi_{i-1})[(1-\lambda)(1-\max\{0, G_{i-1}(\overline{w}_i) - G_{i-1}(\overline{w}_{i-1})\})](p_{i-1}-u_{i-1})G_{i-1}(w) \\ +u_i\pi_i\phi_i(F_i(w)-F_i(\overline{w}_i)) + u_{i-1}(1-\pi_{i-1})\phi_{i-1}(F_{i-1}(w)-F_{i-1}(\overline{w}_{i-1})) \end{aligned}$$

Notice that the equilibrium rates of unemployment by age depend on the equilibrium wage distributions, because some workers decide to quit their jobs. Moreover, the equilibrium wage distribution for age i worker is a function of the equilibrium wage distribution of workers of age $i-1$.

Finally, one can define the aggregate equilibrium wage distribution as follow:

$$(p-u)G(w) = \sum_i (p_i - u_i)G_i(w)$$

where the the aggregate participation rate p is defined by $p = 1 - r$, where r denotes the rate of retired workers.

3 Quantitative results

3.1 Calibration

To study the effect of mandatory retirement on the optimal behavior of job search, we now turn to numerical simulations. We set the model period to a month. The discount factor β is equal to 0.9967, making the annual interest rate 4 percent. The four age groups before the retirement periods are such that each individual has an expected duration of 5 years in the first classe (C_1), 10 years in C_2, 20 years in C_3 and 5 years in C_4: this leads to an expected duration of 40 years in the labor market. As for the last two age groups, we assume that the expected duration is 5 years for C_5 and 15 years for C_6: if the worker enters the labor market at 20, his life expectancy at that age is 60 years.

We assume that the exogenous wage offer distribution $F(w)$ is a log-normal distribution in order to have an equilibrium wage dispersion close to the observed one (see Chéron, Hairault and Langot [2004]). The 1998 mean of this distribution equals 9641 French Francs (see Legendre [2004]). The lower value of the wage distribution is the minimum wage in 1998: 5280 French Francs. We truncate to the $[5280; 2.75 \times 5280]$ interval, given that the variance of wage distribution amounts to 0.25, and normalized to integrate to one. Finally, following Legendre [2004], unemployment benefits and pensions equal their 1998 mean value, respectively 5896 and 8299 French Francs.

Using European Panel (EP) data set, we calibrate the job quarterly destruction rates, which correspond to the average probabilities of being fired for employed worker: λ is set to 0.0153.

The utility function has the following form:

$$u(y, T-z) = \frac{(y^{\nu}(T-z)^{1-\nu})^{1-\sigma}}{1-\sigma}$$

The parameters of this utility function are calibrated as follows: $\sigma = 2$ and $\nu = 0.85$ which leads to $\widetilde{\sigma} = 1.85$ where $\widetilde{\sigma}$ is defined by $1 - \widetilde{\sigma} = \nu(1-\sigma)$. This value of the relative risk aversion is close to the estimates provided by Attanasio, Banks, Meghir and Weber [1999]. Furthermore, the function that maps search intensity into probabilities of obtaining a wage offer is calibrated as follows:

$$\phi(s) = \gamma s = 0.1 s \quad \text{where } s \in [0;1]$$

Finally, in this benchmark calibration, we assume that workers do not accumulate experience during their life-cycle: the efficiency of labor input is constant across age groups ($x_i = 0, \forall i$). This assumption allows to shut off search behaviors over the life-cycle.

3.2 The benchmark economy

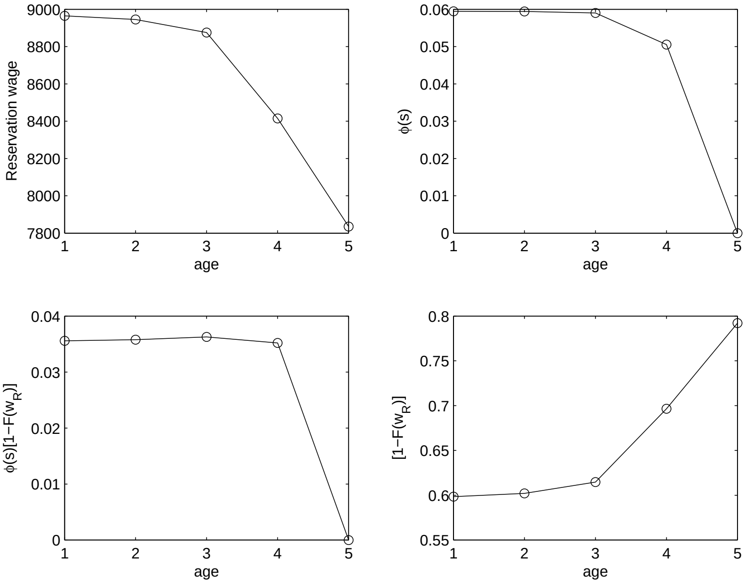
Figure 2 illustrates the main forces at work in the model. First, the older the agent, the shorter his expected life-time duration in the labor market. Old workers will accept lower wages because impatience increases with age: the reservation wage decreases with age (see first panel of the figure 2). This decline in the reservation wage implies that a larger number of job offers becomes acceptable. This is directly measured by $[1 - F(w_R)]$, where w_R denotes the reservation wage by age (see figure 2).

Nevertheless, even if old unemployed workers accept lower wage offers, their incentives to search more intensively a job offer decline. After 55 years old, their search intensity falls and so does the probability of getting a job offer, measured by $\phi(s)$ (see figure 2). According to our assumptions on the search intensity behavior, the optimal search intensity is given by[2]:

$$s_i \;=\; T - \left\{ \frac{\gamma \beta \mathcal{S}}{(1-\nu)(bH_i)^{\nu(1-\sigma)}} \right\}^{\frac{1}{(1-\nu)(1-\sigma)-1}} \qquad \text{where:}$$

[2]Notice that, with our utility function, experience does not change the shape of search intensity during the life-cycle.

Figure 2: Search behavior over the life-cycle



$$\mathcal{S} \;=\; \pi_i \left[\int \max[V_i^e(w), V_i^u] dF(w) - V_i^u \right]$$

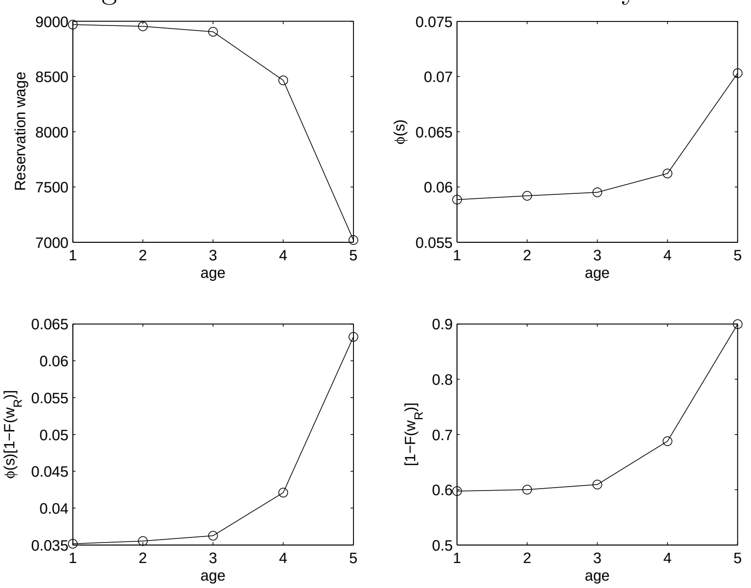
First, as the reservation wage decreases with age, the gap between the values of an employed and an unemployed worker drops (measured by $\mathcal{S}$). Furthermore, with the fall in the expected duration of the last period of activity (measured by π_i), the search intensity decreases: the opportunity cost of search is higher if the number of offers is low simply because duration of search is limited by the mandatory retirement. This last effect magnifies the first one.

Two economic forces move in opposite directions during the life-cycle : *(i)* the decrease in the reservation wage and *(ii)* the decline in search intensity. The first effect leads to an increase in employment at the end of the life-cycle, while the second mechanism, capturing the "discouraged effect", implies that the transition rate from unemployment-to-employment goes down at the end of the life-cycle. Our numerical exemple (see figure 2) measures the combination of these two effects and shows that the "discouraged effect" gets the upper hand. Indeed, the transition rate to employment, $\phi(s)[1-F(w_R)]$, decreases. This result could explain why the elderly unemployment is high in countries with high average retirement age, as it is observed in the data.

3.3 The economy with incentives

Let us assume that the tax on continued work is lowered: the pension increases by 25% if employed workers choose to retire at age 65. This calibration is based on a previous study (Hairault, Langot, Sopraseuth [2004]) where actuarially fair schemes in the French system are computed for individual of age $z \in [60; 65]$. This increases a lot the value to be employed before retirement. Then, for unemployed workers older than 55 years, incentives to search and accept a job go up. Is this uncertain return on the search, anticipated today, large enough to reduce the "discouraged effect" which dominated the labor choice of older workers?

Figure 3: Search behavior over the life-cycle



In view of figure 3,the answer to this question is a qualified *yes*. First, we have now a larger fall in the reservation wage than in figure 2. The transition to employment is a better opportunity due to the higher pension in case of continued work. This high value of future retirement conditional on being employed is an incentive to find a job in order to have an access to this opportunity. As the reservation wage declines, the value of employment relative to unemployment is now larger. The search effort thus increases. With the incentive scheme, the "discouraged effect" is now dominated: the unemployment is no longer an absorbing state for old workers.

4 Empirical investigations

Our empirical investigation is based on the French Labor Force Employment Survey (2002). The theoretical model predicts that as individuals get closer to the expected retirement age, they are less likely to search and find work. We assess the empirical relevance of such a mechanism on French microdata.

The expected retirement age effect is captured by the difference between the current age and the expected retirement age. A rough proxy for this variable is computed by adding to the age of first job the required number of contributive years to draw full pension (40 years). The number of years before retirement is then discretized into dummy variables (more than 10 years before retirement, 5 to 10 years before retirement, less than 5 years and already entitled to pension [3]). The dependant variable is the probability of employment (coded as 1 = working, 0 = otherwise). We estimate a logit on the probability of being employed whose estimates are summarized in table 1.

Table 1 displays the estimates of employment probabilities along with standard deviations and p-values. The explanatory variables consist of distance to retirement, age (linear and squared), sex, martial status, number of children, size of the city with a dummy for living in the Parisian area, sector and citizenship. The reference individual is a French man, blue collar in the industry, living with his spouse in the Parisian area and still has to contribute more than 10 years before retirement. The estimates yield significant and unsurprising results as experience (summarized by age), higher skills (captured by the occupational group) and living in the Parisian area increase employment probabilities. Women bear a 32.7% [4] decrease in their employment probability as compared to a man with the same characteristics. In addition, activities in services (Tertiary sector) and French citizenship favor employment odds. Finally, family characteristics affect employment status : not having a spouse (respectively an additional child) tends to reduce employment probabilities by 47% [5] (respectively by 6.8% [6]).

Interestingly, although the goodness of fit is rather low, indicating the importance of factors that our model do not control for, the number of years before the expected retirement age appears signifi-

[3] As some individuals enter the job market at very young ages, they accumulate 40 contributive years before the legal retirement age (60 years old). Hence, in the sample, we find individuals being entitled to pension but forced to remain on the labor market as they are not 60 years old yet.

[4] $1 - e^{-.3972061}$

[5] $1 - e^{-.6399312}$

[6] $1 - e^{-.0709091}$

Table 1: Estimated Logit model for the probability of being employed

Variables	Coeff.	p - value
Number of years before retirement (reference : More than 10 years)		
5 to 10 years	**-.1329461**	0.056
less than 5 years	**-.4206167**	0.000
Already entitled to pension	**-.2095719**	0.100
Age	.0439075	0.001
Squared Age	-.0002231	0.238
Sex (Reference : Male)		
Female	-.3972061	0.000
Marital status (Reference : live with a spouse)		
Live alone	-.6399312	0.000
Number of children	-.0709091	0.000
Size of city (Reference : Parisian Area)		
more than 200000 inhab. Outside Parisian Area	-.1697429	0.001
20000 to 200000 inhab.	-.1354261	0.008
less than 20000 inhab.	.0196333	0.716
Rural town	.2774521	0.000
Sector (Reference : Industry)		
Agriculture	-.3145189	0.000
Construction	-.0353249	0.559
Tertiary	.4872651	0.000
Occupational group (Reference : Blue collar)		
Clerk	.1224674	0.004
Middle skilled worker	.6727076	0.000
Executive	.8601963	0.000
Citizenship (Reference : French)		
Non French	-.7442339	0.000
Constant	1.153512	0.000
Observations	66983	
Pseudo - R2	0.0622	

cant and correctly signed. The lower the expected number of years before retirement, the lower the probability of being employed : an individual who still has 5 to 10 years before retirement bears a decrease of 12.4% [7] in his/her employment probabilities compared to an individual far from retirement (more than 10 years). This decline in employment probability jumps to 34.4% [8] when the individual has less than 5 years to wait before retirement. As the individual gets closer to his expected retirement age, his employment probabilities fall. This evidence is consistent with the predictions of the model.

This empirical investigation provides a first support to our theoretical model. However, we are aware that the logit estimates is a preliminary framework to test the empirical relevance of our search model. This econometric exercise is to be extended along several lines. First, we are currently working on the European Community Household Panel (ECHP) to check the empirical relevance of our model in European countries. This international study obviously requires to adjust the computation of expected retirement age to the Social Security rules specific to each country. Secondly, since the theoretical model analyzes the behavior of unemployed workers, we are focusing on the key elements governing the behavior of this specific group. We are then restricting our sample to unemployed individuals and are attempting to uncover how the length of time before retirement affects transitions from unemployment to employment.

This preliminary empirical investigation provides a first support to our theoretical framework. However, we are aware that the logit model is not the most suitable econometric framework to test the empirical relevance of our search model. We are currently working on a duration model that is better equipped to measure the match between search models and the data.

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[7] $1 - e^{-.1329461}$

[8] $1 - e^{-.4206167}$

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