DISCUSSION PAPER SERIES

IZA DP No. 4071

Optimal Unemployment Insurance for Older Workers

Jean-Olivier Hairault
François Langot
Sébastien Ménard
Thepthida Sopraseuth

March 2009

Forschungsinstitut
zur Zukunft der Arbeit
Institute for the Study
of Labor

Optimal Unemployment Insurance for Older Workers

Jean-Olivier Hairault
Paris School of Economics, University of Paris I Panthéon-Sorbonne and IZA

François Langot
GAINS-TEPP, University of Maine, ERMES-TEPP, University of Paris 2 and IZA

Sébastien Ménard
GAINS-TEPP, University of Maine

Thepthida Sopraseuth
GAINS-TEPP, University of Maine, Paris School of Economics and Cepremap

Discussion Paper No. 4071
March 2009

IZA

P.O. Box 7240
53072 Bonn
Germany

Phone: +49-228-3894-0
Fax: +49-228-3894-180
E-mail: iza@iza.org

IZA Discussion Paper No. 4071
March 2009

ABSTRACT

Optimal Unemployment Insurance for Older Workers*

This paper shows that optimal unemployment insurance contracts are age-dependent. Older workers have only a few years left on the labor market prior to retirement. This short horizon implies a more digressive replacement ratio. However, there is a sufficiently short distance to retirement for which flat unemployment benefits can be the optimal contract as the nearly retired unemployed workers rationally expect never to suffer from the punishment. This is why imposing a tax on the future job is particularly efficient in the context of older workers because the agency can now reward the job search by present employment subsidies. Moreover, we propose adopting a global approach to unemployment insurance by determining an optimal contract that integrates unemployment insurance and retirement pension systems.

JEL Classification: C61, J64, J65

Keywords: unemployment insurance, retirement, recursive contracts, moral hazard

Corresponding author:

Jean-Olivier Hairault
EUREQua, maison des Sciences Economiques
Bureau 313
106-112, boulevard de l'Hôpital
75647 Paris Cedex 13
France
E-mail: joh@univ-paris1.fr

* We thank participants in SED, EALE, SCSE, SESAME and AFSE conferences for their valuable comments and suggestions. We benefited from fruitful discussions with P. Cahuc, S. Pallage, F. Portier, H. Sneessens and Y. Zenou. Any errors are ours.

1 Introduction

In many European countries, older workers receive more generous unemployment benefits before retirement. In some countries (Belgium, Finland, France, Germany and the United Kingdom), older people on unemployment benefits are exempt from the general eligibility requirement of having to look for work after a certain age. This was also the case previously in Austria and the Netherlands. In some countries (Ireland, Sweden), job-search requirements for people on unemployment benefits are less demanding for older people than for younger people. The "Unemployment tunnel" leading to early exit from the labor market operates as a result of a general exemption from job-search requirements for the older unemployed which allows them to remain on unemployment benefits until they reach the official retirement age. For these reasons, unemployment benefits are often considered as early retirement or pre-retirement schemes (Gruber and Wise, 1998). Is there any rationale behind these specific unemployment benefit schemes? In this paper, we analyze the optimal features of unemployment benefits for older workers. In a moral hazard environment, the unemployment agency faces a trade-off between providing insurance against consumption fluctuations and enticing unemployed workers to search for a job. So, the unconditional benefits given to older unemployed workers could mean that only the insurance part of the trade-off is valid when the retirement age is coming. This paper provides theoretical insights supporting this view.

Since the seminal work of Shavell & Weiss (1979), it has been recognized that the optimal unemployment benefits should be such that the replacement ratio decreases with the unemployment spell. Providing incentives to find a new job quickly derives from the assumption that the search intensity made by the agent (the unemployed worker) cannot be observed by the principal (the unemployment insurance agency). The unemployment insurance contract is a sequence of transfers between the principal and the agent which aims to cope optimally with moral hazard. It minimizes the expected discounted value of net transfers provided by the principal for a given ex-ante utility. Hopenhayn & Nicolini (1997) propose introducing an increasing wage tax after re-employment together with the decreasing sequence of unemployment benefits. With this wage-tax, the principal provides a better consumption smoothing without decreasing incentives to search for a job.

The objective of this paper is to study the characteristics of the optimal unemployment benefit contract for older workers. We then propose to extend the framework of Shavell & Weiss (1979)'s and Hopenhayn & Nicolini (1997) by introducing a definitive exit rate from the labor market, i.e. retirement. More precisely, unemployed workers face a given probability of retiring which determines the distance to retirement. This allows us to compute very easily the optimal contracts for any values of this probability. For the sake of simplicity, we omit financial asset accumulation, even though it is known that the optimal contract is quite sensitive to this assumption (Shimer & Werning (2008))[1].

We show that there is a specific design for the optimal unemployment insurance for older

[1] Shimer & Werning (2008) have recently shown that a benefit schedule that decreases with unemployment duration performs worse than a constant sequence in an economy where saving is allowed.

workers. Young and old workers are characterized by different expected horizons on the labor market, which leads to an age-specific optimal unemployment insurance contract. Indeed, we put forward the idea that the proximity to retirement modifies the trade-off between insurance and incentives faced by the unemployment scheme. This proximity makes the recommendations by Shavell & Weiss (1979) irrelevant. The existence of a retirement date intrinsically creates a sharp decrease in the search intensity just before this age. To the extent that there are search frictions on the labor market, the return on jobs is determined by their expected duration: the time to retirement is then key to understanding older workers' transitions from unemployment to employment[2]. The unemployment benefit agency is then faced with this intrinsic low search intensity. Along the lines of Shavell & Weiss (1979), we show that it would imply proposing a highly decreasing profile of unemployment benefits. For unemployed older workers close enough to the retirement age, this policy becomes inefficient: for a given amount of insurance promised by the agency, there is a sufficiently short distance to retirement which does not allow the agency to implement this highly decreasing profile as the nearly retired unemployed workers rationally expect never to suffer from the punishment. This is why imposing a tax on the future job along the lines of Hopenhayn & Nicolini (1997) is particularly efficient in the context of older workers because the agency can now reward the job search by present employment subsidies (a negative tax after re-employment). However, a short horizon before the retirement age decreases the actualized sum of these subsidies and so limits the efficiency of the Hopenhayn & Nicolini (1997)'s contract. There are still older unemployed workers that are exempted from job search requirements and must be provided with a constant unemployment benefit until their retirement.

Faced with the short horizon of older workers on the labor market, we propose that the unemployment benefit agency takes advantage of the retirement period to introduce taxes on pensions in order to reintroduce incentives to search for a job at the end of working life. This proposition provides some foundation for an integration of unemployment and retirement schemes, allowing the agency to increase older workers' employment rate. It then supports the idea of an unified insurance system recently put forward by Stiglitz & Yun (2005)[3]. In that case, when a worker retires, her pension level would depend on the length of spells of past unemployment. As the time horizon of a retired worker is longer than that of the older workers near to retirement, this tax on pensions provides a better smoothing of consumption without removing any search incentives for older workers, and thus increases the effectiveness of the optimal contract. We show that the integration of these two social programs (unemployment and retirement) leads to a significant decrease in the cost of the insurance programs. As suggested by J-J. Laffont in Hopenhayn & Nicolini (1997), with our optimal unemployment insurance program, the principal acts as a bank account: workers can borrow against their future pension to finance consumption during an unemployment

[2]This thesis has already received some empirical support (Hairault, Langot and Sopraseuth; 2008) and some theoretical foundation based on the job search theory (Seater, 1977; Lungqvist and Sargent, 2007; and Hairault, Langot and Sopraseuth, 2008).

[3]Stiglitz & Yun (2005) propose in a very different framework that unemployed workers can borrow against future pensions. In the case of incomplete financial markets, this provides both insurance and effective incentives to all unemployed workers. There is nothing specific to older workers in their analysis.

episode.

The paper is organized as follows: The next section reviews the literature on optimal unemployment insurance. In Section 3, we describe the model. Section 4 presents the calibration and the results. Finally, Section 5 concludes.

2 Related Literature

The optimal contract of unemployment insurance in a moral hazard environment was first studied by Shavell & Weiss (1979)[4]. Their main result is that an optimal contract is such that the replacement ratio has to decrease throughout the unemployment spell. An extension of this paper is provided by Hopenhayn & Nicolini (1997) who introduce a new instrument in the optimal contract: a wage tax after re-employment. They show that the optimal wage tax increases with the unemployment spell. The main result of this paper is that the wage tax improves the contract by significantly reducing the cost to the principal. Shimer & Werning (2003) show that Hopenhayn & Nicolini (1997)'s results are robust to the nature of the informational structure. They present a model where the moral hazard does not come from the uncertainty about the search intensity, but about the reservation wage. They show that the optimal replacement ratio is still decreasing with the length of the unemployment spell as in Hopenhayn & Nicolini (1997). From a methodological point of view, all these papers hinge on the recursive contract literature as developed by Spear & Srivastava (1987), Phelan & Townsend (1991), Abreu et al. (1990) and Atkeson & Lucas (1992).

Following these seminal papers, a growing literature has studied the optimal unemployment insurance contract. Recent contributions assume that workers are not ex-ante identical. Hagedorn & Mennel (2002) propose reconsidering the optimal unemployment insurance when heterogeneity comes from the fact that agents face different search costs. In this model, there are two types of agent, differing in their probability of finding a job: the "good searchers" have a high probability whereas the "bad searchers" have a low re-employment probability. The principal cannot observe the agents' type. Hagedorn & Mennel (2002) show that the UI agency has to offer two different contracts: a contract for the "good" searchers which is characterized by a decreasing replacement ratio, and a contract for the "bad" searchers which has an upward-sloping benefit profile because of an adverse selection effect.

The above papers examine the optimal contract in models where only the search behavior is unobservable. Pavoni (2003) and Pavoni & Violante (2007) investigate the optimal

[4]We limit our review of the literature to papers that focus on labor supply. Cahuc & Lehmann (2000) introduce labor demand through a matching process. In Cahuc and Lehmann, the "threatpoint" of the union is the expected value of being laid off. Then, early UI payments might be kept low in order to decrease the insiders' power, while later UI payments could be more generous so as to improve unemployed workers' welfare. In this case, UI payments increase with the unemployment duration. This is in contradiction with the argument developed by Shavell & Weiss (1979), where the job search effort is unobserved, implying a decrease in the UI payments with the unemployment duration. Millard & Mortensen (1997) or Fredriksson & Holmlund (2001) obtain this last result in job matching models. Coles & Masters (2006) show that the introduction of strategic bargaining in a simple matching model (the job search effort is observable) gives some foundation for a decreasing UI payment.

unemployment insurance when the human capital depreciates with unemployment duration. Consequently, job offers decrease during unemployment. In these models, the optimal unemployment benefits have to decrease with the length of the unemployment spell. However, Pavoni (2003) and Pavoni & Violante (2007) show that unemployment insurance benefits are bounded below by a minimal "assistance" level.

Shimer & Werning (2008) study the optimal design of the unemployment insurance system when the agent can save. The individual amount of savings are unobservable. If the agents can save or borrow, it is not necessary to reduce unemployment insurance benefits for consumption to be decreasing. Unlike Hopenhayn & Nicolini (1997), they show that the optimal contract can be characterized by constant benefits. In our paper, we do not introduce precautionary saving as in Shimer & Werning (2008). Their result hinges on an assumption of a high degree of self-insurance and this assumption can be considered as extreme as the restriction of no borrowing and no saving at all. There remains a lot of empirical evidence along the lines of Gruber (1997) that displaced workers do suffer from a sizable decrease in consumption.

To the best of our knowledge, no papers have so far investigated the optimal unemployment insurance for older workers. These latter expect that their average duration in the labor market will be short because they are close to the retirement age. Consequently, the expected returns on the search effort are relatively low for older workers, and thus the optimal search intensity decreases with age (see Hairault et al., 2008). Another important point introduced by the finite life-time hypothesis is that employment can no longer be viewed as a permanent state as in Hopenhayn & Nicolini (1997): there is a definitive transition from (un)employment to retirement. The introduction of a finite life-time horizon for the agents implies firstly that unemployed workers can exit from unemployment without finding a job, and secondly, that the employment duration can be short. For these older workers, the wage tax incentive scheme is not effective: this clearly suggests that social programs (unemployment benefits and pensions) must be integrated. Stiglitz & Yun (2005) have proposed the same integration strategy, but in a very different framework and with no particular emphasis on older workers. They support this idea as one way to counter the financial market imperfections. In this paper, we show that this integration is an answer to the specific problem posed by the short distance to retirement of older workers.

3 The model

Our objective is to determine the optimal timing of the UI benefits for older workers in a repeated moral-hazard environment. The first-best solution is not reachable, due to informational asymmetries: the search effort level is the agent's own private information and the planner has no way of monitoring this effort level. The second-best allocation is such that the principal (the UI agency) minimizes the expected discounted cost of the unemployment insurance, subject to two constraints: *(i)* to provide a certain lifetime utility level to the agent when she becomes unemployed, and *(ii)* to respect the incentive compatibility constraints

implying that the agent makes her own optimal decisions for search effort and consumption given the optimal timing of UI benefits.

The originality of our analysis is to introduce a finite horizon for workers. For simplicity, we present a model where workers are characterized by a given probability of retiring which determines the expected horizon of the working life. We choose this stochastic aging structure for computational reasons. This reduces the dimension of the discrete state variables. With age as a deterministic and discrete state variable, the computational burden would have dramatically increased.

3.1 The agent

In this section, we present the behavior of the (unemployed) agent characterized by her preference and probability of retiring. If she finds a job in period τ, she is employed from $\tau+1$ until retirement, as jobs are permanent until retirement[5]. Once employed, the workers receive a wage w each period. There is an exogenous exit from the labor market to retirement and, once retired, individuals face a constant probability of dying.

The agent's preferences are given by:

$$\sum_{\tau=0}^{\infty} \beta^{\tau} \phi(z^t)[u(c_\tau) - a_\tau]$$

where $\beta < 1$ denotes the intertemporal discount factor, c_τ consumption at time τ, and a_τ the job search intensity. The stochastic event z^τ in this economy describes the age of the agent and labor market transitions: hence, the history of events at time τ is denoted z^τ and gives the age of the agent and her labor market occupation. The unconditional probability of z^τ, when z_0 has not been realized, is denoted by $\phi(z^\tau)$.

The instantaneous utility function $u(.)$ is increasing, twice differentiable, strictly concave with $u'(0) = \infty$. We assume that:

$$u(c_\tau) = \frac{c_\tau^{1-\sigma}}{1-\sigma}$$

where σ is the coefficient of relative risk aversion. The probability of receiving a job offer depends on the level of search intensity. This probability is given by an exponential distribution:

$$\pi(a) = 1 - \exp(-\psi.a)$$

with $\psi > 0$. This hazard function is increasing, strictly concave, twice differentiable and satisfies the Inada conditions.

The optimal search intensity is derived from the following Bellman equation:

$$\begin{aligned} V^u(t) &= \max_{a(t)} \{u(b(t)) - a(t) \\ &\quad +\beta\Big[(1-\lambda_w)[\pi(a(t))V^e(\tau^e(t)) + (1-\pi(a(t)))V^u(t+1)] + \lambda_w V^r\Big]\Big\} \end{aligned}$$

[5] Assuming that employment is permanent simplifies the analysis and is consistent with the literature.

where t denotes the length of the unemployment spell and $b(t)$ the level of the unemployment compensation after t period of unemployment. $V^e(\tau^e(t))$ and V^r denotes the value function for an employed worker and a retiree respectively. λ_w is the probability for a worker to become a retiree and $\tau^e(t)$ denotes the tax paid by the employed worker. As in Hopenhayn & Nicolini (1997), we assume that this tax depends on the length of the past unemployment spell t.

The optimal search intensity is then given by:

$$\begin{aligned} \frac{1}{\pi'(a(t))} &= \beta(1-\lambda_w)\left[V^e(\tau^e(t)) - V^u(t+1)\right] \qquad (1) \\ \text{where } \frac{1}{\pi'(a^i(t))} &\equiv \mathcal{A}(a^i(t)) \quad \text{with } \frac{\partial \mathcal{A}(a^i(t))}{\partial a^i(t)} > 0 \end{aligned}$$

The right hand side of equation (1) states that, for a given gap between the employment and the unemployment value functions, when the individual ages, the incentives to search decrease as the probability of remaining in employment $(1-\lambda_w)$, which determines the employment duration, decreases with age. Moreover, as the retirement age gets closer, the gap between employment and unemployment value functions narrows, since they depend on the same retirement value. The return on the job search effort is then lowered when the distance to retirement decreases.

The employed worker value function takes into account the probability of retiring λ_w and is the solution of the following Bellman equation:

$$V^e(\tau^e(t)) = u(w - \tau^e(t)) + \beta\left[(1-\lambda_w)[V^e(\tau^e(t))] + \lambda_w V^r\right]$$

An employed worker is assumed to receive a constant wage w (net of the disutility of working). A retiree receives a pension p and faces a probability of dying λ_r. The Bellman equation for a retiree is then given by:

$$V^r = u(p) + \beta(1-\lambda_r)V^r$$

where λ_r denotes the probability of death[6].

3.2 The principal

We consider a risk-neutral planner (the principal) providing the risk-averse agent with an optimal unemployment compensation scheme. The principal cannot observe the search intensity $a(t)$, but knows the economic environment, in particular the hazard function $\pi(a)$. On the other hand, the principal perfectly observes and controls workers' consumption: the consumption of employed workers through the wage tax and that of unemployed workers through the unemployment benefit.

As in Hopenhayn & Nicolini (1997), the contract is 2 vectors $B = \{(b(1), b(2), ..., b(T))\}$ and $\mathcal{T}^e = \{(\tau^e(1), \tau^e(2), ..., \tau^e(T))\}$, where $b(t)$ and $\tau^e(t)$ are respectively the benefit level

[6] At this stage, no pension taxes are considered.

and taxes after t periods of unemployment. Given these vectors, the agent maximizes her intertemporal utility by choosing a vector of search intensity $A^i = \{(a(1), a(2), ..., a(T))\}$ where $a(t)$ is the search intensity after t periods of unemployment.

The objective of the principal is to minimize its total expenditures, under two constraints: *(i)* a given expected utility $V^u(1)$ for a newly unemployed worker (the promise-keeping constraint), and *(ii)* an incentive-compatibility constraint:

$$\begin{aligned} C(V^u(t)) &= \min_{\mathcal{C}} \{b(t) + \beta(1-\lambda_w)\left[(1-\pi(a(t)))C(V^u(t+1)) + \pi(a(t))G^e(t+1)\right]\} \\ \text{subject to} & \\ V^u(t) &= u(b(t)) - a(t) \\ &\quad +\beta\left\{(1-\lambda_w)[\pi(a(t))V^e(\tau^e(t)) + (1-\pi(a(t)))V^u(t+1)] + \lambda_r V^r\right\} \\ \text{and} & \\ 1 &= \beta\pi'(a(t))(1-\lambda_w)[V^e(\tau^e(t)) - V^u(t+1)] \end{aligned}$$

where $\mathcal{C} \equiv \{b(t), a(t), V^u(t+1), \tau^e(t)\}$ and $G^e(t+1)$ represents the discounted sum of taxes paid by an individual if she finds a job. This discounted sum of taxes depends on the expected duration of this job and so on the probability of retirement. This is defined as follows:

$$G^e(t+1) = \frac{-\tau^e(t)}{1-\beta(1-\lambda_w)}$$

For any unemployment spell t, a given contract is defined by an expected discounted utility $V^u(t)$ and an expected discounted cost of unemployment benefit $C(V^u(t))$. Different contracts $\{B, \mathcal{T}^e\}$ can provide the same initial utility $V^u(1)$ to the agent, but with different costs $C(V^u(1))$ to the principal. The optimal contract minimizes the cost of the unemployment insurance and guarantees the same ex-ante lifetime utility $V^u(1) = V^u$.

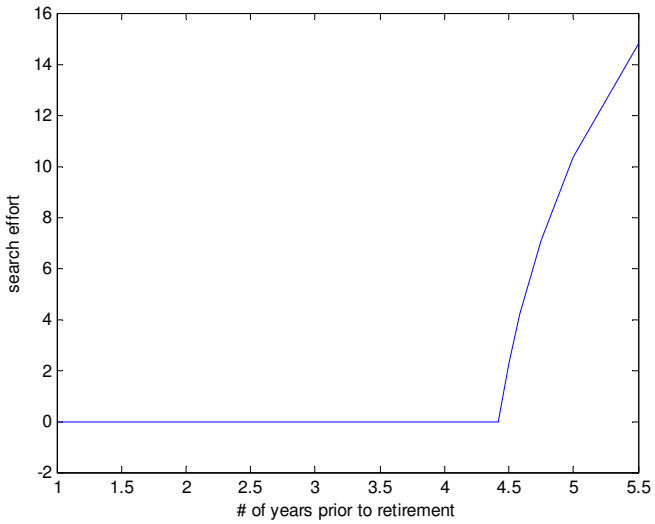
3.3 Calibration

This model is calibrated on a monthly basis. We set the discount factor β to 0.993. Following Hopenhayn & Nicolini (1997), the coefficient of relative risk aversion equals $\sigma = 0.5$. The average length of retirement is set to 20 years. A retiree then dies with probability $\lambda_r = (1/(20 \times 12))$. The number n of years prior to retirement is the key parameter and will be changed in order to measure how unemployment insurance affects the search behavior as individuals get closer to retirement ($\lambda_w = 1/(n \times 12)$).

We normalize the wage w at 100, so that the unemployment benefit equals the replacement rate. The latter $\bar{b}$ is set at 50, which is the average replacement ratio for individuals eligible for unemployment insurance (as computed by the French unemployment insurance agency). The pension level is calibrated to $p = 70$, which is consistent with the replacement ratio observed for French retirees in the late 1990s for an individual in the private sector with an earning history corresponding to the average wage profile (Charpin, 1999; COR, 2001).

We choose to calibrate the search efficiency ψ on the seniors who are not exempt from job-search requirements. The search efficiency ψ is then set at 0.0045 so as to replicate the average unemployment spell for individuals aged 50-55 with $\bar{b} = 50$ (11 months according to the French unemployment insurance agency).

Figure 1: Search effort as a function of the number of years prior to retirement



4 The impact of the short horizon on the traditional optimal UI contracts

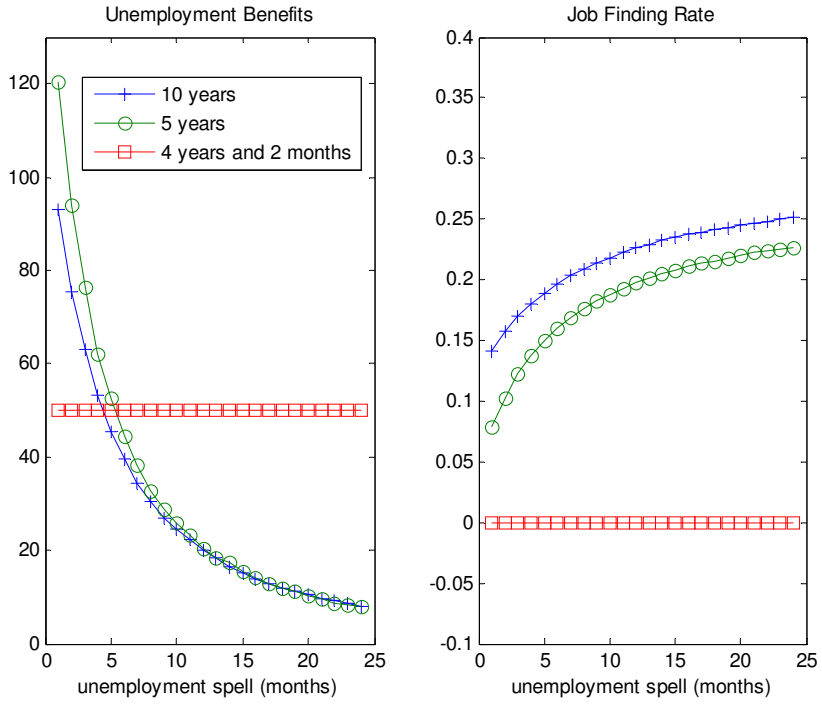
In this section, we analyze the optimal UI contract for various horizon before retirement. As a benchmark, we first analyze the impact of the horizon in the context of constant benefits. Then, we introduce the optimal contract when the unemployment benefit $b(t)$ varies with the unemployment spell and without taxes after re-employment ($\tau^e(t) = 0$). Finally, we introduce the taxes after re-employment.

4.1 Distance to retirement and search: the case of constant UI benefits

In a setting with constant unemployment benefits, individuals' search behavior depends on the number of years prior to retirement (Figure 1). The search effort increases with the size of the horizon prior to retirement.

When individuals are far away from retirement (more than 4 years and 5 months), the search effort is strictly positive. Even though unemployment benefits remain constant whatever the length of unemployment spell, individuals are enticed to look for a job because, if they find one, the gains from employment will be enjoyed for a long time. This is no longer the case when they are close to retirement (less than 4 years and 5 months). Individuals no longer look for a job, resulting in a zero job finding rate. It is not worthwhile looking for a job because the individual will enjoy the gains from employment for only a short period. The next section investigates whether the unemployment insurance agency can entice workers to search for a job at the end of the working life. The effectiveness of the incentive policy can be

Figure 2: Downward sloping unemployment benefits



measured by the number of years prior to retirement at which individuals stop looking for a job. With constant unemployment benefits, individuals who are 4 years and 5 months away from retirement have a zero search effort. Efficient incentive policies may entice individuals who are closer to retirement (less than 4 years and 5 months) to actually look for a job.

4.2 The case of downward sloping unemployment benefits

As in Shavell & Weiss (1979), the unemployment insurance agency can choose the profile of unemployment benefits as a function of the length of the unemployment spell. Figure 2 displays the optimal replacement ratio when the individual is at different distances to the retirement age. With 10 years to wait before retirement, the optimal UI is downward sloping while it becomes completely flat at 4 years and 2 months before retirement. As in Shavell & Weiss (1979), 10 years away from retirement, the optimal time sequence of unemployment benefits displays a downward slope, which punishes unemployed workers who do not find a job, thereby giving them a strong incentive to put effort into the search process. The high replacement ratio at the beginning of the unemployment spell reconciles the incentive-compatibility constraint with the promise-keeping constraint. The shorter the horizon on the labor market, the steeper the unemployment benefit profile, at least until a threshold age. As the individual gets closer to the retirement date, individuals search less due to the distance effect (see section 4.1). The return on the search effort goes down with age as the gains of

re-employment will be enjoyed for a shorter time. The incentive constraint then requires a sharper punishment to individuals who do not find a job: the downward sloping benefit curve shifts to the right. The higher replacement ratio for newly unemployed individuals compensates for a steeper fall for longer unemployment spells.

But this incentive policy succeeds in inducing only a little more search effort for individuals at the end of the working life. With optimal contracts, the zero search effort appears for individuals who are 4 years and 2 months away from retirement (Figure 2). For those individuals, UI benefits are the same from one period to the next. The gain associated with the optimal contract is then small. Without optimal contracts, individuals with less than 4 years and 5 months before retirement had a zero search effort (Figure 1). The economic mechanisms behind this result are straightforward. The short distance prior to retirement intrinsically limits the effectiveness of decreasing unemployment benefits. As those individuals near retirement face a low return on their search effort, a sharp decline in unemployment benefits would then be needed to entice those workers to look for a job, which would imply a high replacement ratio at the beginning of the unemployment spell. However, such a strategy is actually inefficient because the insurance agency would pay particularly high benefits today and promise particularly low benefits to individuals who will retire soon. The short horizon does not allow the agency to implement the highly decreasing profile as the nearly retired unemployed workers rationally expect to never suffer from the punishment, whereas they would benefit from high present benefits. This result provides an economic rationale behind the unconditional unemployment benefits available to older workers in some European countries: unconditional income to old inactive individuals (for example the *Dispense de Recherche d'emploi* in France), or disability and pre-retirement programs available in Belgium and the Netherlands (see OECD 2006 for more details of these programs).

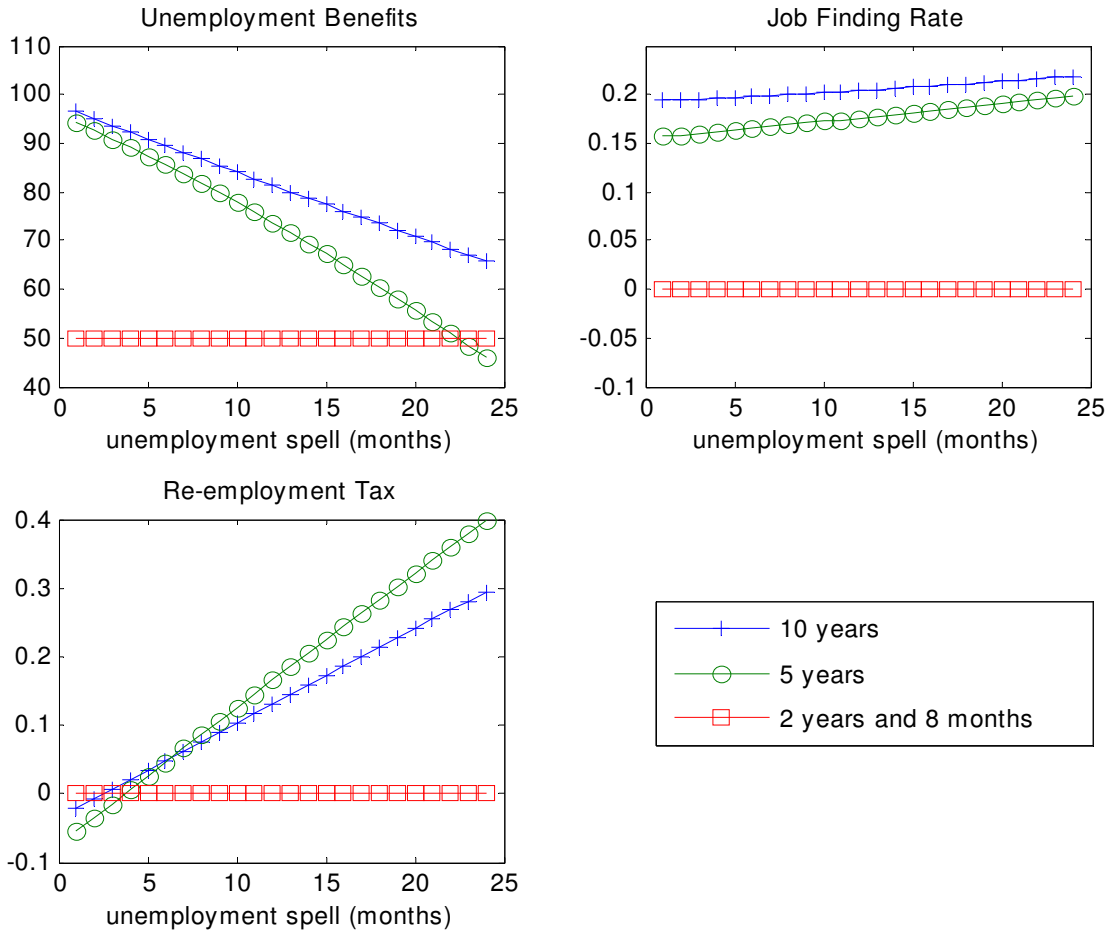
4.3 Introducing the wage tax after re-employment

The previous subsection investigated the optimal insurance contract without taxes after re-employment. We now explore the design of insurance contracts *à la* Hopenhayn & Nicolini (1997) with a wage tax after re-employment whose magnitude will depend on the length of past unemployment spell. In Hopenhayn & Nicolini (1997), this tax constitutes a powerful tool since it implies a permanent decrease or increase on the re-employment wage, whose magnitude depends on the duration of past unemployment.

We show that imposing a tax on the future job along the lines of Hopenhayn & Nicolini (1997) is particularly efficient in the context of older workers because the agency can now reward the job search by present employment subsidies (a negative tax after re-employment). The shorter the horizon, the higher the subsidy because the employment duration is short. It must be emphasized that the carrot dimension is more crucial than the stick in the context of older unemployed workers.

Figure 3 displays the unemployment insurance scheme for individuals who differ in terms of distance to retirement. As in Hopenhayn & Nicolini (1997), with a long horizon prior to retirement, unemployment benefits display a flatter profile compared with the case without

Figure 3: Optimal insurance with a re-employment tax



tax on wages (Figure 2). Indeed, the principal now has two policy instruments to induce unemployed workers the to put effort into the search process and smooth the unemployed worker's consumption. By taxing future wages, individuals are encouraged to look for a job while the slow decline in unemployment benefit ensures a smoother consumption. Actually, the principal rewards individuals who quickly find a job with a subsidy. Finally, as the shorter the horizon before retirement, the shorter the re-employment period, the subsidy must therefore be more generous in the case of a quick exit from unemployment. On Figure 2, the tax schedule is then steeper for individuals who are closer to retirement.

The optimal policy is modified for individuals who are the closest to retirement. With the tax on wages, the principal can give a large subsidy if the unemployed worker rapidly finds a job. Nevertheless, the expected duration horizon during which this subsidy can be provided is short. Given the concavity of the agent utility, this strategy would imply such a huge subsidy that it is too costly for the UI agency. The optimal contract à la Hopenhayn & Nicolini (1997) becomes ineffective when considering people sufficiently close to retirement. Then, for the principal, the only policy instrument left is the constant unemployment benefit. People who are 2 years and 8 months away from retirement do not search for a job since, should they find one, the gains from employment would be enjoyed for a very short time. For individuals who are close enough to retirement, adding the wage tax does not succeed in inducing a positive search effort. Again, the short horizon also limits the effectiveness of incentive policies proposed by Hopenhayn & Nicolini (1997).

4.4 Sensitivity analysis

The inefficiency of the optimal unemployment insurance policy to induce some older workers to search for a new job is intrinsic to the short distance to retirement. In this section, we show that this result is robust to changes in parameters, even if the age at which the policy becomes inefficient depends on the calibration. This sensitivity analysis allows us to unveil some interesting features of the distance to retirement effect for the optimal unemployment benefit scheme. To illustrate the mechanisms at work, we look for the horizon before retirement at which individuals cease to look for a job.

The risk aversion parameter σ determines the job search intensity. With a lower risk aversion ($\sigma = 0.45$ versus 0.5 in the benchmark calibration, panel a in Table 1), older workers are more inclined to search for a job. The job search intensity is positive until 3 years and 4 months, whereas this age threshold is higher in the benchmark case. On the other hand, the relative effectiveness of the different contract is not much altered by the value of the risk aversion parameter. It must, however, be emphasized that taking into account subsidies on re-employment is relatively more efficient when the risk aversion is low. Indeed, the re-employment subsidy is a risky strategy, especially when the retirement age is close.

The effectiveness of incentive policies is also affected by the average benefit ratio (panel b in Table 1). With lower unemployment benefits ($\bar{b} = 0.4$ versus $\bar{b} = 0.5$ in the benchmark calibration), individuals are more motivated to look for a job since they cannot afford to cease searching, even when retirement is close. In contrast, with a generous income when

Table 1: Sensitivity Analysis

a.	Risk Aversion		
	$\sigma = 0.55$	$\sigma = 0.50$	$\sigma = 0.45$
	(1)	(2)	(3)
		Benchmark	
Constant UB	5 years and 11 months	4 years and 5 months	3 years and 4 months
Downward sloping UB	5 years and 7 months	4 years and 2 months	3 years and 1 month
Downward sloping UB and wage tax	3 years and 1 month	2 years and 8 months	1 year and 9 months

b.	Average replacement ratio		
	$\bar{b} = 40$	$\bar{b} = 50$	$\bar{b} = 60$
	(1)	(2)	(3)
		Benchmark	
Constant UB	3 years and 3 months	4 years and 5 months	6 years and 5 months
Downward sloping UB	3 years and 1 month	4 years and 2 months	5 years and 10 months
Downward sloping UB and wage tax	2 years and 1 month	2 years and 8 months	4 years and 3 months

unemployed ($\bar{b} = 0.6$), the distance effect is stronger: the search effort falls as early as 6 years and 5 months prior to retirement with constant unemployment benefits. These results come from the interaction between the distance to retirement and the generosity of the unemployment benefits already discussed in Hairault, Langot and Sopraseuth [2008]. More generous unemployment benefits naturally give more efficiency to policies introducing incentives to search for a job more intensively. The incentive policy *à la* Hopenhayn & Nicolini (1997) allows the agency to reduce the age threshold by more than 2 years with $b = 0.6$.

5 Integrating SS and UI programs

Faced with the short horizon of older workers on the labor market, the unemployment benefit agency could take advantage of the retirement period to introduce taxes on pensions in order to reintroduce more incentives to job search at the end of working life. In this section, we explore the benefits of integrating the unemployment insurance with the pension system as recently suggested by Stiglitz & Yun (2005). Hereafter, we assume that the unemployment agency can tax wages after re-employment as well as pension. The tax on pensions may constitute a powerful policy instrument. Indeed, the integration of the SS and UI programs is a natural way to increase the horizon of older unemployed workers. While the tax on future wages only operates during a short period (a few years prior to retirement), the pension tax affects the individual's income during all the retirement period (calibrated to 20 years on average).

5.1 The optimal contract in a finite-horizon model

We assume that the principal can transfer incomes from the retirement periods to the periods when the agent participates in the labor market. The principal chooses a contract now defined by 3 vectors of instruments $B = \{(b(1), b(2), ..., b(T))\}$, $\mathcal{T}^e = \{(\tau^e(1), \tau^e(2), ..., \tau^e(T))\}$ and $\mathcal{T}^r = \{(\tau^r(1), \tau^r(2), ..., \tau^r(T))\}$, where $\tau^r(t)$ is the tax paid by a retiree if her last unemployment spell has a length equal to t periods. We assume that the taxes paid as employee can be different from the ones paid as retiree because the income is not the same in these two life stages. The principal's program is now given by:

$$C(V^u(t)) = \min_{\mathcal{C}} \left\{ \begin{array}{l} b(t) + \beta(1-\lambda_w)\left[(1-\pi(a(t)))C(V^u(t+1)) + \pi(a(t))G^e(t+1)\right] \\ +\beta\lambda_w G^r(t+1) \end{array} \right\}$$

subject to

$$\begin{aligned} V^u(t) &= u(b(t)) - a(t) \\ &\quad +\beta \left\{ \begin{array}{l} (1-\lambda_w)[\pi(a(t))V^e(\tau^e(t)) + (1-\pi(a(t)))V^u(t+1)] \\ +\lambda_r V^r(\tau^r(t)) \end{array} \right\} \end{aligned}$$

and

$$1 = \beta\pi'(a(t))(1-\lambda_w)[V^e(\tau^e(t)) - V^u(t+1)]$$

where $\mathcal{C} \equiv \{b(t), a(t), V^u(t+1), \tau^e(t), \tau^r(t)\}$. $G^s(t+1)$, for $s = e, r$ represents the discounted sum of taxes paid by an individual as employee and/or as retiree. This discounted sum of taxes is defined as follows:

$$G^e(t+1) = \frac{-\tau^e(t) + \beta\lambda_w \frac{-\tau^r(t)}{1-\beta(1-\lambda_r)}}{1-\beta(1-\lambda_w)} \quad (2)$$

$$G^r(t+1) = \frac{-\tau^r(t)}{1-\beta(1-\lambda_r)} \quad (3)$$

Equations (2) and (3) show that the horizon during which the principal receives taxes is longer than in the UI contract limited to wage taxes. When an employee becomes a retiree, she keeps on paying taxes; when an unemployed worker becomes a retiree without being an employee before, she starts to pay taxes. Let us redefine the value of a retiree as follows:

$$V^r(\tau^r(t)) = u(p - \tau^r(t)) + \beta(1-\lambda_r)V^r(\tau^r(t))$$

5.2 Optimal unemployment insurance with a pension tax after retirement

Figure 4 shows the results for the contract integrating unemployment insurance and pension systems. The optimal pension tax increases with the length of unemployment spells. The pension tax constitutes an additional policy tool: unemployed individuals who quickly find a job can be rewarded with a subsidy on the pension that will be paid over a 20 year period on average. A quick return to employment is rewarded with a higher pension while a long unemployment spell results in a fall in old age income. The decline in pension constitutes a strong incentive for unemployed workers to look for a job since the pension tax will apply during the whole retirement period.

Figures 3 (with wage tax) and 4 (with both wage and pension taxes) show that the introduction of pension taxes significantly lowers the number of years prior to retirement at which individuals cease to look for a job (1 year and 11 months in Figure 4 versus 2 years and 8 months in Figure 3 and 4 years and 2 months in Figure 2). The pension tax removes the distance effect which intrinsically limited the effectiveness of incentive policies in Shavell & Weiss (1979). It strengthens Hopenhayn & Nicolini (1997)'s strategy of considering the after-unemployment history. Moreover, the introduction of an additional tax on pension allows the unemployment agency to implement a smoother consumption profile: first, the unemployment benefit profile is flatter and, secondly, there are positive taxes during the employment spell which transfer income toward retirement (Figure 4).

Only individuals who are at 1 year and 11 months away from retirement are now characterized by constant optimal unemployment benefits. For individuals who are very close to retirement, incentives are still ineffective, even in the case of pension taxes. It must be emphasized that the pension tax is strictly positive for these workers. By taxing the retirement pension, the planner can improve consumption smoothing by transferring income from a period when individuals are better-off (retired) to a period when they suffer from a low

Figure 4: Optimal insurance with a tax on re-employment and on pension

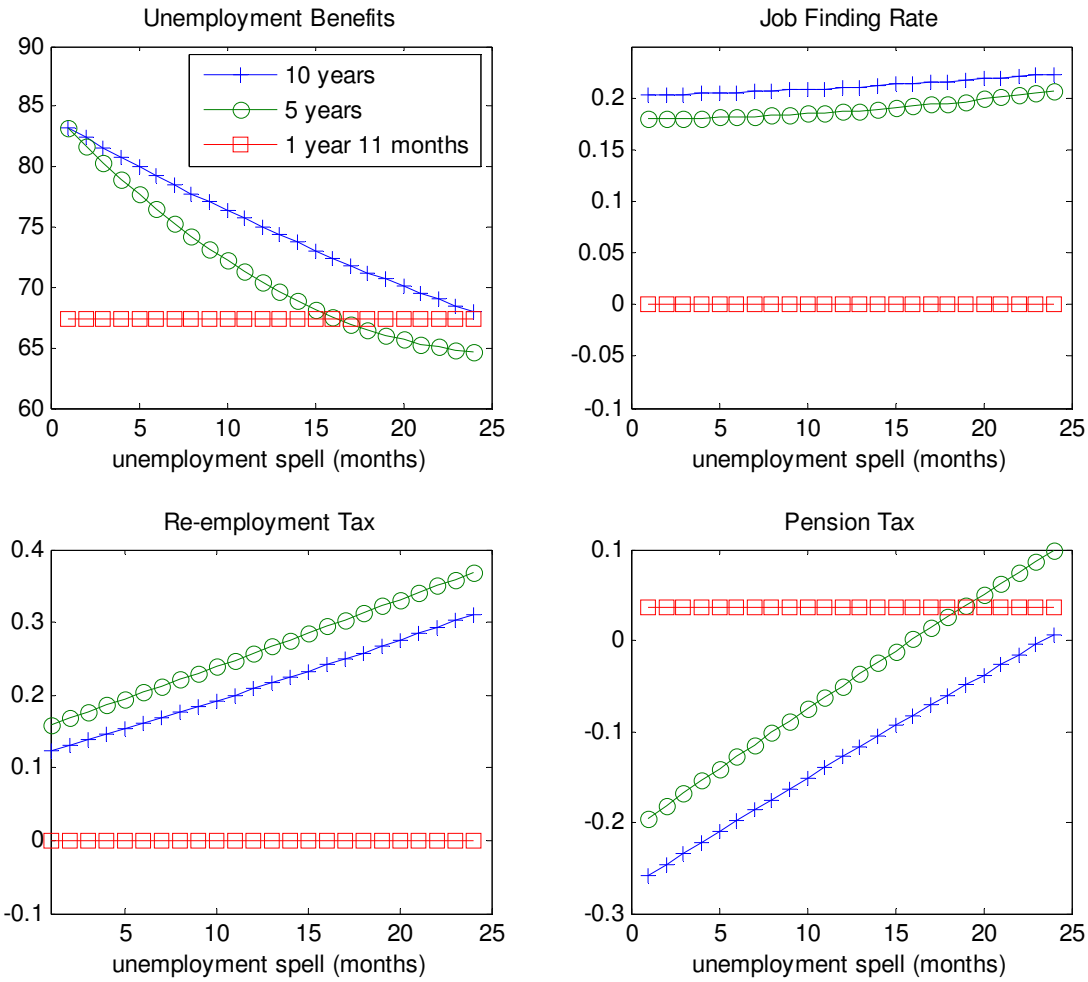
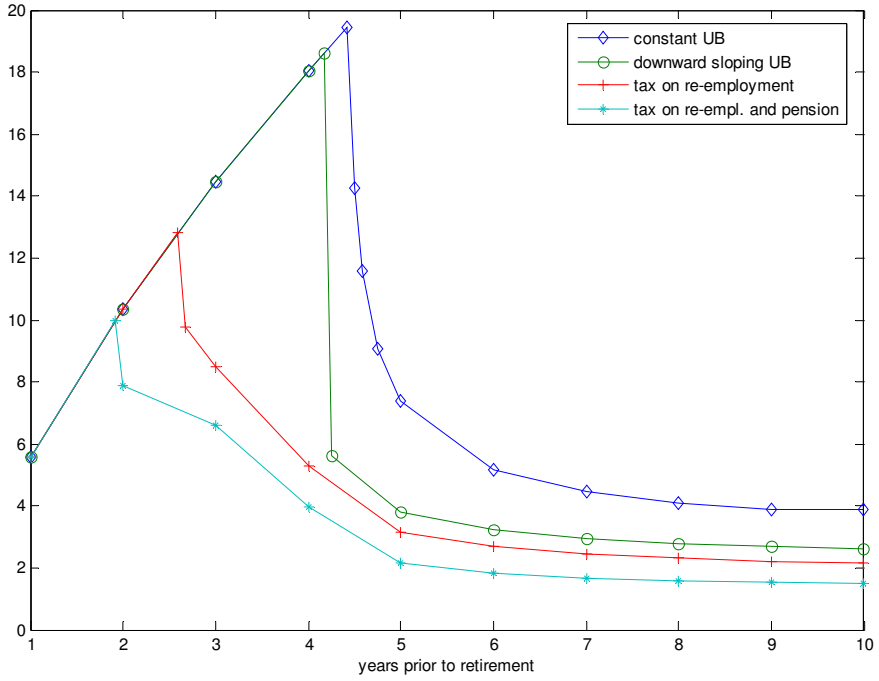


Figure 5: Cost of UI (cost in terms of monthly wage)



income (unemployed). This allows the social planner to grant more generous unemployment benefits (67% in Figure 4 versus 50% in Figure 3). Indeed, the planner has two objectives: providing both insurance and incentives.

5.3 Cost of alternative optimal policies

In this section, we compare the cost of each unemployment insurance policy according to the horizon of a unemployed worker until retirement (Figure 5).

Let us first analyze the right hand side of Figure 5, for individuals who are far away from retirement (5 years and more). Figure 5 confirms Hopenhayn & Nicolini (1997)'s conclusions: the constant unemployment scheme is the most expensive policy as unemployed workers search for a job without any incentive schemes. Introducing downward sloping unemployment benefits allows the principal to cut the costs, which are even further reduced by the introduction of the re-employment tax. The incentive policy is indeed more effective when the unemployment agency imposes a tax on the re-employment wage for individuals far away from retirement: the decrease in the expected unemployment duration leads to a fall in the costs of the unemployment insurance contract. In contrast with Hopenhayn & Nicolini (1997), the gains obtained thanks to the introduction of a tax after re-employment (Shavell & Weiss (1979) versus Hopenhayn & Nicolini (1997) incentive schemes) do not exceed those provided by the decreasing profile of the unemployment benefits (flat UB versus

Shavell & Weiss (1979) incentive schemes). As, in a finite life-time setting, the job duration is limited, the efficiency of the re-employment tax is lowered. Integrating the Social Security and Unemployment Agency, by pushing away the horizon of both the agent and the principal, then leads to decreasing the costs with a magnitude more in line with that obtained by Hopenhayn & Nicolini (1997).

Let us now focus on the left hand side of Figure 5. For individuals who are at the very end of their working life (1 year and 11 months away from retirement and less), none of the policies mentioned above succeed in encouraging a positive search effort. A flat unemployment policy is optimal. Then, all policies result in the same cost level. Flat unemployment benefits is an expensive policy because the unemployed workers do not search for a job. The cost of constant benefits falls as the individual gets closer to retirement since the duration of unemployment goes down.

When individuals are between 1 year and 11 months and 2 years and 8 months years away from retirement, the contracts *à la* Shavell & Weiss (1979) or *à la* Hopenhayn & Nicolini (1997) fail to encourage a positive search effort. The costs are then similar across the constant UB, downward sloping UB and tax on re-employment policies. On the other hand, the policy where both taxes on re-employment and on pension are taken into account succeeds in making those workers look for a job, leading to a significantly lower cost. As more than 50% of French older workers between 55 and 59 are not employed, this gives a potentially high cost saving which the Welfare State could generate by implementing this policy.

When the horizon before retirement is between 2 years and 8 months and 4 years and 2 months, the re-employment tax allows the principal to generate a significant decrease in the costs of the unemployment insurance contract. For these older unemployed workers, the Hopenhayn & Nicolini (1997)'s policy dominates that of Shavell & Weiss (1979) by subsidizing the short re-employment spell. However, it is still more costly than the strategy of integrating SS and UI programs.

6 Conclusion

The existence of specific insurance programs for older workers in many European countries which leads them to retire early from the labor market is often viewed as responsible for the low employment rate at these ages. This paper shed light on this question in the framework initiated by Shavell & Weiss (1979) and Hopenhayn & Nicolini (1997). We show that the short distance to retirement implies strong specificities which can justify renouncing to the incentive part of the optimal unemployment benefits and focusing on the insurance part. Whereas the optimal strategy of the unemployment agency is to propose benefits decreasing with the unemployment spell for older workers who have to wait several years prior to retirement, the optimal contract becomes completely flat when retirement is imminent: it results from the inefficiency of incentives contract when the horizon of both the agent and the principal is very short. We then provide some theoretical foundations for the generous

insurance programs put in place, for instance in France, for older workers. We also show that the inefficiency zone could be reduced by introducing a tax on pension. This tax is the appropriate tool to offset the effects of the expected short job duration at the end of the working cycle. It plays an equivalent role in a finite working life-time setting to the tax on re-employment proposed by Hopenhayn & Nicolini (1997).

This paper puts forward the view that the normal retirement age is a key institution that governs both search behavior and optimal unemployment benefits provided by the unemployment agency. Delaying the retirement age could increase older workers' employment rate and would translate to older ages the problem created by the proximity to retirement. Finally, this paper emphasizes that the age issue cannot be reduced to the biological age: the social age defined by a distance to the normal retirement age is the key dimension for positive as well as normative analysis.

References

Abreu, D., Pearce, D., & Staccheti, E. (1990). Towards a theory of discounted repeated games with imperfect monitoring. *Econometrica*, 58, 1041–1064.

Atkeson, L. & Lucas, R. (1992). On efficient distribution with private information. *Review of Economic Studies*, 59, 427–453.

Cahuc, P. & Lehmann, E. (2000). Should unemployment benefits decrease with the unemployment spell. *Journal of Public Economics*, 77, 135–153.

Charpin, J. M. (1999). *Rapport Au Premier Ministre : L'avenir de Nos Retraites*. Documentation Française.

Coles, M. & Masters, A. (2006). Optimal unemployment insurance in a matching equilibrium. *Journal of Labor Economics*, 24(1).

COR (2001). *Retraites : Renouveler Le Contrat Social Entre Les Générations*. Conseil d'Orientation des Retraites.

Fredriksson, P. & Holmlund, B. (2001). Optimal unemployment insurance in search equilibrium. *Journal of Labor Economics*, 19, 370–399.

Gruber, J. (1997). The consumption smoothing benefits of unemployment insurance. *American Economic Review*, 87(1), 192–205.

Gruber, J. & Wise, D. (1998). Social security and retirement: An international comparison. *American Economic Review*, 88(2), 158–163.

Hagedorn, M., K. A. & Mennel, T. (2002). *An Adverse Selection Model of Optimal Unemployment Insurance*. IZA Discussion paper 681, IZA.

Hairault, J.-O., Langot, F., & Sopraseuth, T. (2008). Distance to retirement and older workers employment: The case for delaying the retirement age. *Journal of the European Economic Association*. Forthcoming.

Hopenhayn, H. & Nicolini, J. (1997). Optimal unemployment insurance. *Journal of Political Economy*, 105, 412–438.

Millard, S. & Mortensen, D. (1997). The unemployment and welfare effects of labour market policy: A comparison of the u.s and u.k. In D. Snower & G. DelaDehesa (Eds.), *Unemployment Policy:How Should Governments Respond to Unemployment?* Cambridge: University Press.

OECD (2006). *Live Longer, Work Longer*. Ageing and Employment Policies. Paris: OECD.

Pavoni, N. (2003). *Optimal Unemployment Insurance, with Human Capital Depreciation, and Duration Dependence*. UCL Discussion paper 03-08, UCL.

Pavoni, N. & Violante, G. (2007). Optimal welfare-to-work programs. *Review of Economic Studies*, 74(1), 283–318.

Phelan, C. & Townsend, R. (1991). Computing multi-period, information constrained optima. *Review of Economic Studies*, 58, 853–881.

Shavell, S. & Weiss, L. (1979). The optimal payment of unemployment benefits over time. *Journal of Political Economy*, 87, 1347–1362.

Shimer, R. & Werning, I. (2003). *Optimal Unemployment Insurance with Sequential Search*. Mimeo, MIT.

Shimer, R. & Werning, I. (2008). Liquidity and insurance for the unemployed. *American Economic Review*. forthcoming.

Spear, S. & Srivastava, S. (1987). On repeated moral hazard with discounting. *Review of Economic Studies*, 39, 623–634.

Stiglitz, J. & Yun, J. (2005). Integration of unemployment insurance with retirement insurance. *Journal of Public Economics*, 89(11-12), 2037–2067.