A Structural Model of the Unemployment Insurance Take-up

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Abstract

This paper provides a structural model for explaining the empirical evidence of unemployment insurance non take-up. Our framework is focused on four determinants of the take-up: the monetary gains, the imperfect information about the eligibility rules, the administrative difficulties to make a claim and the non-monetary incentives such as the effectiveness of the unemployment agency as a search method. Our model accounts for the dynamical dimension of the take-up and the endogenous link between job search and benefit claiming. It also provides simple way to model selection into participation. We estimate our structural model using the French Labor Force Survey. The advantage of our structural model is its ability to identify clearly, through the estimates, the economic mechanisms behind the take-up.
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1 Introduction

Unemployment insurance (UI hereafter) has been designed to insure workers against the loss of income they may experience after a job loss. However, as it is more generally the case for all welfare benefits (Currie [2006], Hernanz *et al.* [2004]), the take-up among the eligible unemployed workers is far from 100%. For the US, the estimated take-up is around 70% depending on the

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state and the year (Blank and Card [1991], Anderson and Meyer [1997], McCall [1995]), the estimations for the UK or Canada lie between 60% and 80% (Storer and Van Audenrode [1995], DWP [2008]). The theoretical studies and empirical evaluations of the UI system usually ignore these empirical evidences and assume that all eligible workers receive benefits (see Davidson and Woodbury [1997] and Kroft [2008] for notable exceptions). However, the empirical low take-up rates question this assumption and a study of the efficiency of the actual UI systems should take this empirical evidence seriously. For that purpose, it is first crucial to investigate the determinants of the take-up. This paper provides and estimates a structural model to address this issue.

It build on the existing welfare benefits take-up literature and consider the take-up of benefits as the result of an utility-maximizing decision (see Moffit [1983] and Currie [2006] for a recent survey). In our framework, the individual makes a trade-off between the gains of participating to the UI system (the expected unemployment compensation or the job search assistance provided by caseworkers) and the expected costs which depend on the practical difficulties to make a claim. We also include the possibility of an imperfect information about the eligibility rules. In addition to these determinants, an important feature of our model is its ability to explicitly take into account the link between the job search activity and the take-up behavior. This is crucial to estimate the impact of the take-up rate on the cost of unemployment. Indeed, some eligible workers are not observed as receiving unemployment benefits because they leave unemployment too quickly. If a worker expects a relatively low unemployment duration, it has few incentives to participate in the UI system. The existing literature does not account explicitly for this link. Moreover, it uses static choice models (McCall [1995], Blank and Card [1991], Anderson and Meyer [1997]). We argue that one must take into account the duration of the insured and uninsured unemployment spells to measure the impact of the determinants. Some workers receive unemployment benefits but after a relatively long period of uninsured unemployment.

We thus provide a dynamic framework in which we model both the job search of the worker and his effort to collect information to make a claim. We go beyond the idea of a binary choice between claiming or not by introducing the idea of claiming effort. This allows us to account for temporary non take-up, *i.e.* to study the distribution of the duration without receiving benefits, and not only the share of the eligible population who receive the unemployment insurance. In our framework, the administrative barriers lower the optimal claiming effort. On the contrary, the effectiveness of the unemployment agency as a search method can increase the take-up. Interestingly, our model exhibits selection in the UI participation and substitution between job search activities and the claim for the unemployment compensation.

Rather than estimating a reduced-form hazard rate model, we proceed to a structural estimation of our model using data from the French Labor Force Survey. The advantage of a structural model is its ability to identify clearly, through the estimates, the economic mechanisms behind take-up. The decomposition of the participation process is crucial to design better informed policies and to improve the effectiveness of the UI system as an insurance device (Heckman and Smith [2004]). For instance, if non take-up is due to the complexity of the claiming process, there is an inefficiency in the design of the system which can be corrected for.

The model is presented in section 2. In section 3, we shed lights on the economic mechanisms behind the take-up decision. Section 4 is devoted to the data set and the empirical strategy. Section 5 presents our results. We discuss our results and conclude in section 6.

2 A model of unemployment insurance take-up

The features of the UI system

We investigate the case of the UI system ongoing in France between 2003 and 2006. The model mimics the main features of this system, which is largely similar to the existing systems in most of OECD countries. The French system, named *Plan d'Aide au Retour à l'Emploi* (PARE hereafter), provides constant unemployment benefit profiles for a limited period of time. All the workers registered at the unemployment agency are helped and followed during their job search (See Crépon *et al.* [2005] for a description of the French active policy). Regular interviews with caseworkers and eventually participation in training programs create non monetary costs of participation and affect the job search efficiency (Black *et al.* [2003])[1]. As uninsured unemployed workers receive a more limited support, recipients and non recipients do not face the same job search technologies. Last, until a recent change, the job search monitoring and the sanction rate were almost null. For that reason and for sake of simplicity, we do not model sanctions.

The receipt of the unemployment compensation is not systematic. The eligibility depends on the past employment duration. Although this rule is fairly simple, it is generally unknown and the claiming process is complicated and time consuming. The unemployed worker has first to contact his local unemployment agency. He has to fill a form, describing precisely his situation and has to provide different documents to prove his entitlement rights. Eventually, he has to show up at his local agency within the first week following his claim. Hence, to make successfully a claim, a worker has to be informed, understand and follow different administrative steps.

We distinguish in our structural model three unemployment states depending on whether the unemployed worker is in the claiming process, is insured or has exhausted his rights for the insurance. In each of these states, the individual chooses his job search effort and reservation wage. Notice that the search technology can be different in each state. In the same way, in the first step, the claiming effort is defined optimally. It determines, along with the administrative complexity/frictions, the duration without compensation.

The model

We provide a partial equilibrium search model with infinitely lived agents. Time is discrete and the labor market is at the steady state. An individual can be either employed or in one of the three unemployment states we distinguish. After he loses his job, the worker enters into state N where he can make a claim for the unemployment benefits. If the claim is accepted the worker enters into the compensated unemployment state, denoted P. After a while, if the worker hasn't found a job during his entitlement period, he enters into the third unemployment state, denoted L, where he is no longer compensated.

[1]Besides, the UI can cause a shift from informal job search methods (which cannot be observed by the employment agency) to observable methods (van den Berg and van der Klaauw [2006]).

In each unemployment state the individual searches for a job. The search efforts are determined endogenously given state-specific job arrival rates and effort costs. Although we do not model precisely each search technology, their efficiencies, represented by λ_{ij}, can be different[2]. More precisely, the job offer arrival rate of a worker i depends on his search effort e_{ij}, with $j = \{N, P, L\}$. The probability to receive a job offer reads $\lambda_{ij}e_{ij}$. The cost of the search effort is $c_j(e_{ij})$, where $c_j(.) > 0$, $c_j(0) = 0$, $c_j'(.) > 0$ and $c_j''(.) > 0$. A job offer is associated with a wage drawn from a distribution $F(.)$. For sake of simplicity, the wage offer distribution is assumed to be the same in each state, but the reservation wages are different across states.

Consider a worker in state N. In order to receive the unemployment compensation, he has first to understand and fulfill the administrative requirements. He makes an effort δ_i in the claiming process and pays a cost $c_\gamma(\delta_i)$, with $c_\gamma(.) > 0$, $c_\gamma(0) = 0$, $c_\gamma'(.) > 0$ and $c_\gamma''(.) > 0$. If this worker knew with certainty that he is eligible, then given an effort δ_i, the probability that he received the benefits next period, *i.e.* that he entered in state P, would equal $\gamma_i\delta_i$. γ_i represents the different features of the existing unemployment insurance systems. For example, the difficulty for the individual to understand which documents he has to provide or the time needed by the administration to process the claim. Here we loosen this assumption of perfect information and rather assume that has only an imperfect measure of his entitlement status. To model this uncertainty, we assume that a worker with an employment duration t_i expects to be eligible with a probability $P(t_i) \in [0, 1]$, with $P(0) = 0$. This amounts to assume that the individual knows that the eligibility lies on the work history, but not exactly how. Then, if the worker provides an effort δ_i, he expects his claim to succeed with a probability $P(t_i)\gamma_i\delta_i$ at each period. In our framework, the effort δ_i is chosen optimally and depends on the worker i's characteristics. In some cases, the worker has no incentive to claim the unemployment compensation and his optimal claiming effort equals zero.

In state P, the individual receives the unemployment compensation. His search strategy is represented by his search intensity, e_P and his reservation wage R_P. We assume that, at each period, the worker exhausts the rights, i.e. switches from state P to state L, with exogenous probability μ_i[3]. In

[2] Note that we do not need to put assumptions on the relative efficiency of the N, P and L environments

[3] In the actual UI system, this duration is not stochastic. This assumption simplifies

this last state, he is still looking for a job but no longer receives the unemployment compensation.

The different transition probabilities (unemployment to job, non-insured to insured etc...) are mutually exclusive. Moreover we assume the effort cost high enough such that the sum of the probabilities is always lower than one[4].

We denote $u(.)$ the instantaneous utility function. The utility in state $j = \{N, P, L\}$ reads $u(a_{ij} + b_{ij} w_i)$. Hence we assume that the instantaneous utilities depends on the last wage of the worker w_i. Of course, in most of the UI system, the compensation depends on the previous wage[5]. Moreover, $b_i j$ is a very stilized way to account for precautionary savings that we do not model here directly. Notice that even in state P, this 'remplacement ratio' can be different from the UI's remplacement ratio. $b_i j$ is more general and represents the link between the previous wage and the instantaneous utility. It will be estimated. a_{ij} stands for the preference for leisure or domestic production. We denote β the discount rate.

Consider a job seeker i who stayed t_i periods in employment before entering in unemployment. Let $V_{iN}(t_i, w_i)$, $V_{iP}(w_i)$ and $V_{iL}(w_i)$ be his expected utilities respectively in state N, when his is insured (state P) and when his entitlement rights are exhausted (state L). Given our assumptions, the values functions read:

$$
\begin{aligned}
V_{iN}(t_i, w_i) &= u(a_{iN} + b_{iN} w_i) - c_N(e_{iN}) - c_\gamma(\delta_i) \\
&+ \beta \lambda_{iN} e_{iN} \int \max\{J_i(0, x), V_{iN}(t_i, w_i)\} dF(x) \\
&+ \beta \gamma_i \delta_i P(t_i) \max\{V_{iP}(w_i), V_{iN}(t_i, w_i)\} + \beta \gamma_i \delta_i (1 - P(t_i)) V_{iN}(0, w_i) \\
&+ \beta (1 - \lambda_{iN} e_{iN} - \gamma_i \delta_i) V_{iN}(t_i, w_i)
\end{aligned}
$$

the analysis since it implies that the optimal search strategy is constant in state P. It also allows us to introduce uncertainty about the insurance duration.

[4]A continuous time framework with Poisson arrival rate would be a simpler way to encompass these competing events. However, we need to solve the model by iteration on the value functions and we thus need a discrete time framework.

[5]In France the replacement rate ranges between 57 and 75% depending on the previous wages.

$$
\begin{aligned}
V_{iP}(w_i) &= u(a_{iP} + b_{iP} w_i) - c_P(e_{iP}) \\
&+ \beta\lambda_{iP} e_{iP} \int \max\{J_i(0,x), V_{iP}(w_i)\} dF(x) + \mu_i V_{iL}(w_i) \\
&+ \beta(1 - \lambda_{iP} e_{iP} - \mu_i) V_{iP}(w_i)
\end{aligned}
$$

$$
\begin{aligned}
V_{iL}(w_i) &= u(a_{iL} + b_{iL} w_i) - c_L(e_{iL}) + \beta\lambda_{iL} e_{iL} \int \max\{J_i(0,x), V_{iL}(w_i)\} dF(x) \\
&+ \beta(1 - \lambda_{iL} e_{iL}) V_{iL}(w_i)
\end{aligned}
$$

with $J_i(0, x)$ the expected intertemporal value of a new job with a wage x. The first argument of J accounts for the elapsed employment duration which at the time of reemployment is zero. Remark that the worker expects in state N to discover to be ineligible with a probability $1 - P(t_i)$ which is equivalent to a worker with a zero employment duration.
The first order conditions for the search and claiming efforts satisfy:

$$
\begin{aligned}
c'_j(e_{ij}(.)^*) &= \beta\lambda_{ij} \int_{R_{ij}(.)} (J_i(0,x) - V_{ij}(.)) dF(x) \text{ for } j = N, P, L \quad (1) \\
c'_\gamma(\delta_i(t_i, w_i)^*) &= \beta\gamma_i P(t) \max(V_{iP}(w_i) - V_{iN}(t_i, w_i), 0) \\
&+ \beta\gamma_i (1 - P(t_i))(V_{iN}(0, w_i) - V_{iN}(t_i, w_i)) \quad (2)
\end{aligned}
$$

with R_{ij} the reservation wage. As usual, the worker chooses the search efforts such that the marginal cost equals the marginal return. The optimal search strategy defines a reservation wage, R_{ij}, such that:

$$
J_i(0, R_{ij}(.)) = V_{ij}(.) \text{ for } j = N, P, L
$$

Eventually, we need to define the value of a job. Our framework borrows from Burdett and Mortensen [1998] job search model and allows for job-to-job transitions, with a probability λ_{Ei}, and job destruction, with a probability q_i. To simplify the model and its estimation, both probabilities are exogenous. One of the special feature of our model, is that workers's eligibility hinges on their employment spell duration. The value of a job with a wage w_i in an employment spell with an elapsed duration t_i reads:

$$
\begin{aligned}
J_i(t_i, w_i) &= u(w_i) + \beta\lambda_{Ei}\int_{w_i}(J_i(t+1,x) - J_i(t+1,w_i))dF(x) + \beta q_i V_{iN}(t_i+1, w_i) \\
&+ \beta(1 - q_i - \lambda_{Ei}\bar{F}(w_i))J_i(t_i+1, w_i)
\end{aligned}
$$

Notice that the model and its estimation would be much simpler if we assumed $J_i(w_i) = w_i/(1-\beta)$. However, this would be an important simplification, especially for workers with a high destruction rate (especially the unskilled workers). In the following, we assume the cost functions to be quadratic: $c_j(x) = c_j x^2$, with $j = \{N, P, L, \gamma\}$.

3 How claiming and job search react to a change in the UI system?

What are the effects of a change in the UI design, especially a change in the unemployment benefit ratio or in the insurance duration? In our framework, these effects are not standard for two reasons. First, the unemployment insurance claiming and the job search interact. A change which increases the incentives to claim for benefits can decrease the job search intensity. Second, as already noticed by Mortensen [1977], the eligibility depends on the employment duration. Hence, an unemployed worker who expects to have a low probability to be eligible can increase his search effort when the value of being insured increases. In the following, we go more into details and study the case of an increase of the unemployment benefit ratio b_P. The effects of a rise of the insurance duration, in our model a decrease in μ, are similar.

The eligibility effect. Consider an unemployed worker who has no doubts that he is not eligible ($P(t_i) = 0$) or who has exhausted his unemployment benefits (he is in state L). What is the effect of an increase in the unemployment benefit ratio b_P? Using the optimality conditions one gets:

$$
\begin{aligned}
\frac{\partial e_N(0,w_i)^*}{\partial b_P} &> 0 \quad \text{and} \quad \frac{\partial R_{iN}(0,w_i)^*}{\partial b_P} < 0 \\
\frac{\partial e_L(w_i)^*}{\partial b_P} &> 0 \quad \text{and} \quad \frac{\partial R_{iL}(w_i)^*}{\partial b_P} < 0
\end{aligned}
$$

Of course, there is no direct effect since the worker will not receive any unemployment compensation during his current unemployment spell. However, the value of being employed and thus to have a chance to be eligible in the future increases. Hence the exit rate from unemployment increases since he rises his search intensity and lower his reservation wage.

Opposite effects on the claiming and job search efforts. What is the effect on the search effort of workers who have just been laid off and for whom $P(t_i) > 0$? Remember that, in our model, the value of employment includes the probability to lose the job and to be unemployed. It would not be the case, if the worker considers that his probability to be fired after reemployment is zero: $q_i = 0$. Assume that we are in that situation. Using equation (1) and the value functions, one gets

$$\begin{aligned}\frac{\partial e^*_{iN}}{\partial b_{iP}} &= -\beta\frac{\lambda_{iN}}{2c_N}\bar{F}(R^*_{iN})\frac{\partial V_{iN}}{\partial b_{iP}}\\ \Rightarrow \frac{\partial e^*_{iN}}{\partial b_{iP}} &= -\beta\frac{\lambda_{iN}\bar{F}(R^*_{iN})}{\left(1+\beta e^*_{iN}\lambda_{iN}\bar{F}(R^*_{iN})\right)}\frac{c_\gamma}{c_N}\delta^*_{iN}\frac{\partial \delta^*_{iN}}{\partial b_{iP}}\end{aligned}$$

and, in the same way,

$$\frac{\partial \delta^*_{iN}}{\partial b_{iP}} = \beta\gamma_i\frac{P(t_i)\frac{\partial V_{iP}}{\partial b_{iP}} + 2c_N e^*_{iN}\frac{\partial e^*_{iN}}{\partial b_{iP}}}{2c_\gamma(1+\beta\gamma_i\delta^*_{iN})}$$

combining these two equations, one shows that

$$\frac{\partial \delta^*_{iN}}{\partial b_{iP}} > 0 \qquad \text{and} \qquad \frac{\partial e^*_{iN}}{\partial b_{iP}} < 0$$

Besides, it is easy to show that the rise of b_p increases the reservation wage R_{iN}. Since the worker thinks that he will never lose his job again after reemployment, an increase of the unemployment benefit ratio does not affect the value of employment. Then, it decreases the exit rate from unemployment by rising the value of unemployment. The worker postpones his job search to state P and increases his claiming effort since the unemployment insurance is more profitable.

The ambiguous effect of the unemployment insurance on the exit rate from unemployment. What happens now when the worker takes into account the increase in the unemployment value and the eligibility effect (the increase in the reemployment value)? The overall effect is then ambiguous. Especially, it depends on the worker's expectations about his present eligibility status. A low probability to be eligible induces a low value of the current unemployment period and a small direct effect of a change in the unemployment insurance generosity. The consequences of such a change are mainly due to its effect of the value of reemployment since it decreases the cost of the future unemployment periods. The UI generosity can, in this case, increase the exit rate from unemployment. On the contrary, if the worker's probability to be eligible is high, higher unemployment benefits or a longer unemployment compensation decrease the exit rate from unemployment in state N but increases the take-up.

Implications for the empirical analysis. What can we learn from this simple examples? First, the take-up and the job search behavior both interact. A rise in the incentive to job search lowers the take-up if it has the opposite effect on the claiming effort or if the increase in the exit rate from unemployment is higher than the increase in the take-up rate. If one considers estimating the determinants of the take-up, it means that both the job search and the claiming efforts must be taken into account. Besides, the perception of the eligibility is crucial since it can change the response the unemployment compensation. By estimating the model structurally, we consider these issues carefully.

4 Empirical Application and Estimation Method

4.1 The data

We estimate our model using data from the French Labor Force Survey ("Enquête Emploi") between 2003 and 2006[6]. This survey is a 18 months rotating panel of individual trajectories similar to the American CPS. People are interviewed every three months and report, on a monthly basis, labor market transitions which occurred during the previous months. The short interval between two interviews limits memory problems and provides a reliable calendar of activity. At each interview, the workers declare whether

[6]Between January 2003 and January 2006 the design of the unemployment insurance system has been unchanged. Before and after, the entitlement rules were different. Our model is not designed to take such a change into account.

they have a job or not, their elapsed duration in the current state and their previous job duration. During the first interview, they also report their labor market status for each month of the previous year. We use these informations to rebuild the individual trajectories on the labor market. We can thus determine the eligibility status at the time of job loss and define the variable t on which the worker bases his eligibility expectations (the $P(t)$ function). Moreover, when a worker is unemployed and receives unemployment benefits we know the date of entry in unemployment and of registration (even if it occurred before the first interview). We thus observe the (censored) take-up decision and the duration without and with compensation. When s/he is unemployed but non-recipients, s/he reports the reason why s/he does not receive benefits. Finally, the survey includes information about current (past when unemployed) and reemployment wages.

We restrict the analysis to the spells for which the worker is aged under 50 at the time of entry into unemployment. Older workers have specific entitlement rights and their decision set is complex. Our data set does not provide sufficient information to determine the eligibility in this case. For workers under 50, the entitlement to unemployment benefits hinges on the number of days the worker were affiliated to the unemployment insurance whatever the number of hours[7]. A worker who has worked more than six months during the last 22 months is eligible. Depending on their past employment duration, workers can be entitled to seven or twenty-three months of unemployment insurance (see Table 5 in Appendix).

For some individuals, the calendar of activity and the retrospective informations are not sufficient to determine their eligibility status[8]. We discard these observations. However, if compare in term of gender, education and age (see Table 2) the entitled workers population and the population of workers with an uncertain status are very similar. The selection we impose on the data is thus probably limited. The final sample consists of 1970 unemployed workers entitled to the UI. We follow theses workers from their entry in state N to the job transition if any, including transition in state P.

[7]For those who do not have a sufficient number of days, an alternative rule counts the number of hours. Nevertheless, it is very unlikely that the worker satisfies this second criterion if he does not fulfil the first one.

[8]Especially, notice that the unemployed only report the duration of their previous job and not the sum of all the employment periods last two years.

Table 3 describes the composition of the sample. 13% of the indivuals are entitled to the first type of insurance and 58% to a longer inurance duration. For the remaining 29% we are uncertain about the duration they are entitled to[9].

[Table 3 about here]

Finally, we classify as recipient an individual who is entitled to the benefit and reports a date of registration at the national unemployment agency. The level of non take-up is in the range of the rates estimates for other countries using administrative data (Anderson and Meyer [1997], DWP [2008]).

Table 4 shows the characteristics of the recipients and non recipients entitled populations. Only 61% of the eligible workers receive unemployment benefits during their unemployment spell. The longer the compensation duration they are eligible for, the higher the take-up rate: 57% of the workers not entitled to the second type of insurance receive the benefits *versus* 67% of those who are observed as entitled to the longest benefit duration (the observed take-up rate is 56% for those who are uncertain about their entitlement to the second type of insurance). Men and young workers are more represented among the taker population. The past employment duration is on average longer for the individuals who are registered at the national agency.

[Table 4 about here]

The mean duration in state N amounts to 3.1 months (Table 3). 20% of the sample is censored (stay in state N).

4.2 Specification of the model

The model is estimated by maximum likelihood. For each possible combination of observed and unobserved variables, we need to solve our model to find the optimal search efforts, the claiming effort and the reservation wages. Then these values are used to compute the individual contributions to the likelihood. Since our structural model cannot be solved analytically in the general case we use value function iteration to solve it. To make

[9] Administrative data give a similar repartition between the different types of insurance.

the estimation tractable, we stratify our sample by education and consider two groups of workers: “high”-skilled (>undergraduate) and “low”-skilled (<undergraduate) workers (respectively 580 and 1149 observations). The model is estimated on each group separately.

The utility function reads $u(x) = log(x)$ and the discount rate β is set to .995. We discretize the wage support: we draw 300 wages in the observed wage distribution and use them as a wage grid. When a wage does not equal any point on the grid, we use spline interpolation to obtain the worker’s optimal efforts (see Adda and Cooper [2002] for an introduction to the interpolation methods in dynamic programming).
Log-wage offers are assumed to be randomly drawn from a Weibull distribution truncated from below with cdf

$$F(w) = 1 - \exp\left(-\left(\frac{w - wp_3}{wp_1}\right)^{wp_2}\right)$$

with positive parameters wp_1 and wp_2. The truncation point, wp_3, is set to the minimum wage observed in our sample. The parameters of the offers distribution only depend on the strata and not on the additional observable characteristics. For workers without information about the wage in their previous job, w_i^p, we use the value predicted by a linear wage equation estimated on the unemployed’s observed wages belonging to In the same way, if the reemployment wage w_i^r is not observed, we use the prediction made using the observed reemployment wages.

Finally, we limit the possible values of t for which the intertemporal values in state N can be different. For the moment, $t \in [0, 18]$, which means that workers with more than 17 months of employment duration expect to be eligible with probability one. The perceived probability to be eligible, $P(t)$, reads

$$\begin{aligned} P_i(t) &= p_{i1} \times \frac{t}{5} \quad \text{for}t \in [0, 5] \\ P_i(t) &= p_{i2} + (1 - p_{i2}) \times \frac{t-6}{12} \quad \text{for } t \in [6, 18] \end{aligned}$$

with $p_{ij} = 1/(1+\exp(-\nu_{pj} X_{io}))$ the determinant of the slope of the function. This specification encompass the perfect information case, in which $p_{i1} = 0$ and $p_{i2} = 1$.

The arrival rates and transition rates are log-linear functions of the X_o:

$$\lambda_{ij} = \exp(\nu_j X_{io}) \qquad \mu = \exp(\nu_\mu X_{io})$$
$$\gamma_i = \exp(\nu_\gamma X_{io}) \qquad \text{if there is no unobserved heterogeneity}$$

Recall that the job destruction rate is exogenous and do not hinge on the other structural parameters. Therefore, we estimate it separately using a time-independent discrete duration model.

4.3 The likelihood function

We denote $\theta = \{wp_1, wp_2, \nu_p, \nu_j, \nu_\mu, \nu_\gamma\}$ the vector of parameters to estimate.We follow individuals from their transition from employment into non-registered unemployment until their transition to employment if any. For each worker, we observe his unemployment history that is his transitions between the unemployment states and the duration D_{ij} in months in each state. If the worker finds a job, we also observes his reemployment wage.

Consider a worker i. Assume that we can assess his eligibility with certainty. Assume that he begins in state N, moves to P after D_{iN} periods and finds a job with a wage w_i^r after D_{iP} periods in this state. His contribution to the likelihood amounts to:

$$\begin{aligned}\ell_i(D_{iN}, D_{iP}, D_{iL} = 0, w_i|\theta, w_i^p, t_i, X_{io}) &= \gamma_i\delta_i^* \times (1 - \lambda_{iN} e_{iN}^* \bar{F}(R_{iN}^*) - \gamma_i\delta_i^*)^{D_{iN}-1} \\ &\times \ (1 - \lambda_{iP} e_{iP}^* \bar{F}(R_{iP}^*) - \mu_i)^{D_{iP}-1} \times \lambda_{iP} e_{iP}^* \times f(w_i)\end{aligned}$$

This equation deserves some comments. First, the effective claiming success do not depend *directly* on $P(t_i)$ since this function only represents the expectation of the worker and not necessary the real eligibility. However, it affects the transition through its effect on the search and claiming effort e_{iN}^* and γ_i. Second, recall that the optimal values depend on the structural parameters and the worker's characteristics X_{io}. The other contributions are similar and easily derived from the model.

4.4 Identification

The identification of the transition parameters and wage distribution is standard and uses the observed durations and the reemployment wages (see Eckstein and Van den Berg [2003] for a survey of the estimation of job search models).

The identification of the $P(t)$ parameters is achieved through variation in the exit rate from state N to job with respect to t. Indeed, if workers' information about the eligibility rules was perfect, the exit rate of workers with identical eligibility statuses should follow the same probability distribution. For identical workers, the transition rate from N to P should be the same if their are eligible ($t > 6$) whatever their exact employment duration. If the transition patterns change with t (give $t > 6$), it means that the perceived probability to be eligible varies with t. The parameters which link the instantaneous utility with the wage in the previous job are identified through variation in the transition rates and reemployment wages. Both the unemployment-to-job and N-to-P transitions convey useful information since the search efforts and claiming effort are functions of these parameters. Since the reemployment wages depend on the reservation wages, their variation offers useful information.

For a former version of the model, similar to the current one up to some functional specifications, we tested our model using a Monte-Carlo study on 500 simulated samples of 2000 workers. The results are displayed in Table 6 in Appendix. We were able to recover the values for all the parameters except a_N for which the mean estimate is very close to the value we set but with large standard errors.

5 Results

We present in Table 1 the estimated structural parameters obtained using the sample of the entitled population, *i.e.* of the individuals who are observed on employment during at least 6 months before their entry into unemployment. Remember that we use a simplified version of the model, without job-to-job transition and without L state. Moreover, we reduce the set of parameters further by assuming that the workers know that their probability to be eligible is zero for employment duration less than six months (p_1=0) and by putting the constant in the utility functions (a) to zero. Due to discountinuity in the log likelihood around the estimates, the s.d. cannot be obtained with the usual approximation of the variance-covariance matrix. One of the solution would be to bootstrap. This has not be done yet. The results are thus preliminary and are displayed for illustration purpose.

Table 1: **Results**

	Unskilled		Skilled	
	Est.	s.d.	Est.	s.d.
Replacement rates				
b_N	0.118	$(-)$	0.158	$(-)$
b_P	0.793	$(-)$	0.498	$(-)$
Misperception				
p_2	0.906	$(-)$	0.823	$(-)$
Claiming frictions				
γ	0.137	$(-)$	0.101	$(-)$
Frictions				
λ_{0N}	0.328	$(-)$	0.334	$(-)$
λ_{0P}	0.448	$(-)$	0.425	$(-)$

The parameters b_N and b_P capture the link between the previous wage and the instantaneous utility in state N and P. For a given wage level, unskilled workers benefit from higher instantaneous utilities than the skilled ones. It is worth noting that these estimates seem reasonable when compared with the actual UI rules. Indeed, the remplacement rates varies from 57% to 75%. The rules are such that lower wages get a higher replacement rate. Moreover the wage used to determine the unemployment benefits is not necessary the exact previous wage since it excludes some form of compensation. The 'real' remplacement rate can thus be lower that the official replacement rate. Notice that the differences between the two groups take also into account that compensated unemployment may be experienced differently according to the individual characteristics. Because of the social stigmatisation, high skilled workers could suffer more strongly from being unemployed and have lower *subjective* remplacement rates.

The estimations confirm the theoretical hypothesis of a change in the job search technology between the unemployment states. The job search is indeed more effective when insured, for both skill levels. This might be due to the positive impact of counseling and job search assistance provided by caseworkers.

The misperception of the eligibility rules appears rather limited, as the estimated parameter p_2 of the probability fonction is close to 1, case where there is no imperfect information. The skilled workers seem more subject to misperception than the unskilled. However, without standard errors, this difference can be insignificant. While the imperfection of information about the rules is limited, the frictions in the claiming process are important and similar for both groups. The job search and the claiming frictions are represented in the same way in the model. The index of claiming frictions is three time lower which mean the claiming frictions are at least as important as the job search frictions. For a similar efforts and costs devoting in both activities, the monthly probability to exit unemployment to employmen is three time higher than the probability to end in insured unemployment.

6 Discussion

This paper provides a structural model to understand the UI take-up 'puzzle'. We take a duration approach and account for the link between job search and UI take-up. We estimate our model by maximum likelihood and iteration on the value functions on French data. The early results indicate a limited misperception of the eligibility rules, but a real complexity in the claiming process. The UI take-up could then be increased by simplifying the claiming process.

The next step of this paper consists in adding heterogeneity. This is necessary to give credible welfare results and evaluate the cost of the UI's inefficiencies. We intent to use our theoretical framework to study the effect of a change in the claiming process on the take-up rate, exit from unemployment and the insured unemployed workers composition.

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Tables

Table 2: **Sample Selection**

	Entitled population (entitled for sure)	Rest of the data set (uncertain status)
Number of observations	1970	1242
% of the sample	61,6	38,7
% Female	47,0	50,6
%Unskilled	66,14	65,5
Age		
% 16-30	44,7	44,8
% 30-40	32,3	31,2
% 40-50	23,0	24,0

Table 3: **Characteristics of the sample by entitlement status**

Entitled population	All (Type-1 sure)	Type-1 only (no Type-2 sure)	Type-2 uncertain	Type-2 sure
Number of observations	1970	254	578	1138
% of the sample	100	13	29	58
% Female	47	52	45	47
%Unskilled	66	66	66	66
Age				
% 16-30	45	52	51	40
% 30-40	32	26	30	35
% 40-50	23	22	19	25
Take-up rate	62	57	56	67
Mean past empl. duration	19	8	10	26
Duration in state N				
mean	3.1	2.7	4.1	2.8
standard error	4.2	3.6	5.3	3.1
Q1	1	1	1	1
median	1	1	1	1
Q3	3	3	5	3

Appendix

Table 4: **Composition of the sample by take-up status**

	Non Takers	Takers
Number of observations	764	1 206
% of the sample	38.8	61.2
% Female	49	46
%Unskilled	66	66
Age		
% 16-30	42	47
% 30-40	34	31
% 40-50	24	22
Past empl. duration		
mean	17	21
standard error	12.1	14.7
Q1	10	11
Q2	13	16
Q3	20	24

Table 5: **Entitlement for unemployment benefits (January 2003 - January 2006)**

age and work activity	maximal length of compensation
6 months of work during the past 22 months	7 months
14 months of work during the past 24 months	23 months
over 50 year-old 27 months of work during the past 36 months	36 months
over 57 year-old 27 months of work during the past 36 months 100 trimesters of old age pension	42 months

Table 6: **Monte Carlo simulations**

	True value	Mean est.	s.d.
Transition parameters			
λ_N	0.1	0.1158	(0.0109)
λ_P	0.2	0.1973	(0.0216)
λ_L	0.1	0.1027	(0.0171)
γ	0.3	0.3111	(0.0668)
μ	0.1	0.0943	(0.0036)
Instantaneous utilities			
a_N	0.05	0.0593	(0.0390)
b_N	0.2	0.2087	(0.0387)
a_P	0.05	0.0486	(0.0261)
b_P	0.45	0.4323	(0.0533)
a_L	0.05	0.0468	(0.0147)
b_L	0.2	0.2049	(0.0475)
Job offer distribution			
ν_1	25	25.004	(0.0687)
ν_2	10	9.994	(0.1832)
Eligibility prob. function			
p	0.5	0.5015	(0.0542)