On-the-job search equilibrium with endogenous unemployment benefits

Arnaud Chéron \(^{a,b,*}\), François Langot \(^{a,c,d,e}\)

\(^{a}\) GAINS-TEPP (Université du Maine), France
\(^{b}\) EDHEC, France
\(^{c}\) Cepremap, France
\(^{d}\) IZA, Germany
\(^{e}\) ERMES (Université de Paris 2), France

Abstract

This paper develops an on-the-job search model with wage posting where unemployment benefits are proportional to past wages. We emphasize that this contributes to increasing the reservation wages of unemployed workers and introduces a feedback effect of the distribution of wages on the distribution of unemployment benefits. We show that the model predictions are consistent with some stylized French facts and quantify the impact of inefficient rejections of low-wage offers by the unemployed. We find that, by reducing the indexing of unemployment benefits to previous earnings and increasing lump-sum transfers, it is possible to increase both employment and welfare.

1. Introduction

In their seminal paper, Burdett and Mortensen (1998) (BM henceforth) not only show that pure wage dispersion can exist at equilibrium with the on-the-job search, but also that the interplay with unemployment benefits dispersion gives rise to “inefficient unemployment” according to BM’s definition. This means that some unemployed workers reject low-wage offers, which pushes up the unemployment rate. Although this dispersion of the unemployment benefits (UB) does not reflect any heterogeneity of workers’ ability, these job rejections are unambiguously inefficient. The distribution of UB should therefore collapse to a mass point. However, it is obvious that there is also an insurance motive for the UB system because consumption-smoothing raises the well-being of risk-averse workers.\(^{1}\) This argument favors the indexing of UB to previous earnings, which would lead to a dispersed distribution of UB. From another standpoint, Marimon and Zilibotti (1999) and Acemoglu and Shimer (2000) argue that a generous UB system can be considered as a subsidy to the search activity; this allows workers to find high productivity jobs and contributes to raising output and welfare. Overall, the indexing of UB to previous earnings introduces a trade-off between inefficient unemployment on the one hand, and insurance/subsidy motives on the other hand. The aim of this paper is to quantitatively analyze this trade-off by extending the BM framework to allow UB to be proportional to past wages.

In most OECD countries (see OECD (1994)), the UB distribution is not a mass point. UB systems therefore differ according to average replacement rates but also according to the heterogeneity of the unemployment compensations. The UB system typically embodies two components: a “Beveridge” component (lump-sums) associated with redistribution, and a “Bismarck” component associated with the insurance i.e. the UB indexing to previous earnings. The extent of this indexing differs largely across countries (between 57.4% and 75% of gross wages in France, 60% of the net wages in Germany, 40% of gross wages in Italy...). Moreover, the UK, Australia and New Zealand are noticeable exceptions where there are only lump-sum transfers (the “Beveridge” component).

The first goal of this paper is to show how the on-the-job search equilibrium with endogenous wage dispersion is affected by endogenous

A R T I C L E  I N F O

Article history:
Received 18 April 2006
Received in revised form 21 September 2009
Accepted 24 September 2009
Available online 8 October 2009

JEL classification:
C51
J24
J31
J38

Keywords:
Unemployment benefits
Wage posting
Equilibrium unemployment

© 2009 Elsevier B.V. All rights reserved.
unemployment benefits. Secondly, this paper aims at showing the main trade-offs behind the definition of an optimal UB system in the context of the on-the-job search equilibrium.

Previous works in line with BM assumed that the dispersion of unemployed reservation wages is exogenous. This implies that the position of workers within the unemployment distribution does not depend on the worker’s career and his previous wage earnings (see, e.g. Bontemps et al. (2000), or Postel-Vinay and Robin (2002)). Unemployed benefits/reservation wages dispersion modifies the shape of the wage distribution, but the latter has no feedback effect on the distribution of the unemployed. In this paper, we emphasize that the proportionality of UB to past wages implies an unexplored argument on the wage distribution. Numerical experiments based on the French skilled workers the distribution of UB is unambiguously flatter than the distribution of wages. Numerical experiments based on the French low-skilled labor market show that our model allows a good fit of both distributions (wages and unemployment benefits). It implies a large right-hand tailed of the UB distribution, which is in some extent the outcome of job rejections by the unemployed. This suggests, therefore, that to explain a worker’s upward mobility along the wage distribution during his career it could be worthwhile to consider indexing of UB to previous earnings (see Burdett et al. (2009) or Bagger et al. (2006) for alternative explanations of this mobility).3

Because the dispersion of the UB is endogenous, our model is a useful tool to examine the impact of reforming the UB system, on unemployment, productivity and welfare. First, our model is well-suited to quantify the potential extent of inefficient unemployment. Moreover, because we consider endogenous productivity dispersion, as was first suggested by Mortensen (2000)4 to generate the observed hump-shaped wage distributions,5 our model also allows us to deal with the productivity argument discussed in Marimon and Zilibotti (1999) and Acemoglu and Shimer (2000). Finally, we introduce risk-aversion in order to take into consideration the insurance motive related to the UB system.

2. A wage posting model with unemployment benefits proportional to past wages

This paper extends the job search-wage posting framework à la Burdett–Mortensen to allow for endogenous unemployment benefits which are proportional to past wages. Letting denote this unemployed income, we assume:

\[ b = \rho w_{-1} + \alpha l \]  

(1)

where \( w_{-1} \) stands for the former wage, and \( \alpha l \) is a lump-sum transfer. The benefit \( b \) has therefore two components: all the Beveridge component associated with redistribution across the unemployed, and \( \rho w_{-1} \) the Bismarck component associated with insurance.

Overall, this implies that the equilibrium wage offer density function depends on the distribution of unemployed incomes, which in turn depends on the distribution of wage earnings. A first contribution of this paper is then to solve the corresponding fixed-point.

2.1. Labor market flows

We consider a minimum wage \( w \) which bounds below the wage distribution and gives the level of the iso-profit. This suggests that without any variation of the minimum wage, the number of vacancies is fixed as well as contact rates. Therefore, for simplicity, we consider two exogenous arrival rates of wage offers, \( \lambda_0 \) and \( \lambda_1 \) for the unemployed and the employed, respectively.

We denote the steady-state number of employed workers being paid a wage no greater than \( w \) by \( G(w)/(1-u) \), where \( G(w) \) is the distribution of wage earnings across employed workers and \( u \) the overall unemployment rate. Let \( F(w) \) be the distribution of wage offers, and \( s \) be the job destruction rate. At steady-state the flow of workers leaving employers offering a wage no greater than \( w \) equals the flow of workers hired with a wage no greater than \( w \):

\[ \lambda_0 \int_{w}^{\infty} [F(w)-F(x)]u(x)dx \approx (s + \lambda_1[1-F(w)])(1-u)G(w) \]  

(2)

where \( F(w) - F(x) \) is the probability that an unemployed worker with reservation wage \( x \) receives and accepts a wage offer no greater than \( w \). \( u(x) \) gives the mass of unemployed workers with a reservation

<table>
<thead>
<tr>
<th>Table 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wages and unemployment incomes dispersion in France.</td>
</tr>
<tr>
<td>Standard Deviation</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Low-skilled</td>
</tr>
<tr>
<td>Medium-skilled</td>
</tr>
<tr>
<td>High-skilled</td>
</tr>
<tr>
<td>Standard Deviation</td>
</tr>
<tr>
<td>Mean</td>
</tr>
<tr>
<td>Low-skilled</td>
</tr>
<tr>
<td>Medium-skilled</td>
</tr>
<tr>
<td>High-skilled</td>
</tr>
<tr>
<td>UB-2Y</td>
</tr>
</tbody>
</table>

| UB-2Y = UB for workers unemployed for less than 2 years. |

Our quantitative analysis is based on the French low-skilled full-time labor market. We find that the impact of job-offer rejections on the unemployment rate is not very large but significant, around one percentage point. This gives an assessment of the inefficient unemployment for low-skilled workers in France. We then show that the optimal UB system for this population would correspond to a “Beveridge” system with only lump-sum transfers without any indexing of the UB to previous earnings.

The remainder of the paper is as follows. The first section presents the model. The second section is devoted to calibration, model assessment and policy analysis. The last section concludes.

2. See Appendix A for a detailed description of the data.

3 To read these graphs, notice for instance that the value of this ratio approximately equals 1 for the fifth decile of low-skilled workers, both for wages and unemployment benefits; that is, the average wage (UB) is close to the median wage (UB).

4 The papers of Burdett et al. (2009) or Bagger et al. (2006) rule out this problem by abstracting from the labor market institutions. In these models, upward mobility along the wage distribution comes only from experience (human capital accumulation) and the on-the-job search.

5 At the time of job creation, firms invest in match-specific capital.

6 It is now well known that the standard BM framework implies a strictly increasing wage earnings density function. Exogenous productivity dispersion helps to generate hump-shaped wage distributions (see, e.g. Bontemps et al. (2000)). Chéron et al. (2008) show that endogenous productivity dispersion is also able to fit the French distribution of wages.
wage $w$. This mass depends on the distribution of wages according to the following steady-state equilibrium condition:

$$u(R(pw + all)h_0[1-F(R(w))]) = s(1-u)g(w)$$

where $g(w) = G'(w)$ and $R(pw + all)$ stands for the reservation wage of an unemployed worker who earns benefits $pw + all$. Lastly, the overall unemployment rate is given by $u = \int_{R}^{s} u(R) dR$.

2.2. Wage posting and match-specific capital investments

As in Mortensen (2000), each employer commits to both the wage offered and the extent of its match-specific human capital investment. Let $r$ be the real interest rate, since jobs are destroyed at rate $s$ and employed workers quit at rate $\lambda w[1-F(w)]$ when they receive a higher wage proposal, the expected discounted present value of the employer’s future flows of quasi-rents once a worker has been hired at wage $w$ is

$$y(k) - w$$

$$\int_{R}^{s + \lambda w[1-F(w)]} k$$

where $k$ represents the match-specific investment per worker and the value of productivity $y(k)$ is an increasing and concave function of this investment. Because investments are made after the worker and the employer have met, the ex ante asset value associated with a job is given by:

$$\max_{w \in [0, \infty]} h(w) \left( \frac{y(k) - w}{r + s + \lambda w[1-F(w)]} - k \right)$$

where $h(w)$ stands for the probability that a job with wage offer $w$ is accepted by the worker; using Eq. (2) it is defined by:

$$h(w) = (1-u)\lambda w G(w) + \lambda w \int_{R}^{w} u(x) dx$$

$$= \left( \frac{\lambda w}{s + \lambda w[1-F(w)]} \right) \int_{R}^{w} \left( s + \lambda w[1-F(w)] \right) u(x) dx$$

where $u(x)$ is defined by Eq. (3). If we let $\hat{w}(w)$ denote the former wage that would lead an unemployed worker who earns $pw + all$ to accept any wage above $w$, the contact probability turns out to be written as follows:

$$h(w) = \left( \frac{s\lambda w(1-u)}{s + \lambda w[1-F(w)]} \right) \int_{R}^{w} \left( s + \lambda w[1-F(w)] \right) u(x) dx$$

This allows us to emphasize the fact that the wage policy of the firm, which is related to contact rate, depends both on the UB system that determines $\hat{w}(w)$ and the overall distribution of earnings.

For any wage offer $w$, the optimal training investment policy is fully characterized by the first order condition:

$$f'(k) = r + s + \lambda w[1-F(w)] k = k(w) \forall w$$

From $F'(w) \geq 0$, because the expected duration of a job is positively related to the level of the wage offer, employers who post high wages also invest more in match-specific capital, i.e., $k'(w) > 0$. This implies in particular that $k(w) = k^*$ and $k(w) = k^*$ solve

$$y'(k) = r + s + \lambda w; y'(k^*) = r + s$$

Because all jobs are ex ante identically productive, every wage in the support of the equilibrium wage distribution must yield the same profit (see BM). The on-the-job search equilibrium is then characterized by:

$$h(w) \left[ \frac{y(k) - w - k(r + s + \lambda w)}{r + s + \lambda w} \right]$$

$$= h(w) \left[ \frac{y(k(w)) - w - k(w)(r + s + \lambda w[1-F(w)])}{r + s + \lambda w[1-F(w)]} \right]$$

7 As will be stated hereafter, this corresponds to $U(w) = W(w)$.

8 See Mortensen (2000) for more details.
where \( F(w) = 0 \) and \( k(w) \) \( \forall w \geq w \) solves Eq. (6). Using Eq. (4), this expression can be re-stated as follows:

\[
\begin{align*}
\left( s + \lambda_1 \right) \left( 1 - F(w) \right) & = \left( r + s + \lambda_1 \right) \left( 1 - F(w) \right) \\
& = \left[ \frac{y(k(w)) - w - k(w) \left( r + s + \lambda_1 \right)}{f(k) - w - k \left( r + s + \lambda_1 \right)} \right] \\
& \times \int_{\mathbb{R}} \left( s + \lambda_1 \left( 1 - F(x) \right) \right) u(x) dx
\end{align*}
\]  

(8)

In addition, it is straightforward to derive \( \bar{w} \) by evaluating Eq. (8) when \( F(\bar{w}) = 1 \).

### 2.3. Reservation wages

It is well known that heterogeneity across contact rates implies that the reservation wages of the unemployed, \( R(b) \), can be either greater or smaller than their current income \( b \) (see BM).

In our framework, the proportionality of unemployment benefits to past wages also implies that the reservation wages of the unemployed no longer correspond to their current earnings. The basic intuition is that an unemployed worker expects that if he accepts a wage corresponding to his current unemployed income, this would lead to lower unemployment benefits in the future event of job destruction.

This point can be stated clearly by considering the expected lifetime income of employed and unemployed workers according to their current earnings, respectively:

\[
\begin{align*}
rV(w) & = \frac{\left( W + \tau \right)^{1-\alpha}}{1-\alpha} + \lambda_1 \int_{\mathbb{R}} \left( |x| - V(w) \right) df(x) - s\left( \int_{\mathbb{R}} V(w) - U(b(w)) \right) \\
rU(b) & = \frac{\left( b + \tau \right)^{1-\alpha}}{1-\alpha} + \lambda_0 \int_{\mathbb{R}} \left( |x| - U(b) \right) df(x)
\end{align*}
\]

where \( b \) is defined by Eq. (1), \( \alpha \geq 0 \) and \( \tau \) stands for lump-sum transfers (profits – taxes to finance the UB system).

The lowest acceptable offer for unemployed workers with earnings \( b \) is then defined by \( U(b) = V(R) \). The unemployed worker’s reservation wage turns out to be given by the following condition:9

\[
\begin{align*}
\left( R + \tau \right)^{1-\alpha} & = \left( b + \tau \right)^{1-\alpha} + \lambda_0 \int_{\mathbb{R}} \left( |x| - V(R) \right) df(x) \\
& \quad + s\left( U(b) - U(b + R) \right)
\end{align*}
\]

(9)

Consider at this stage \( \alpha = 0 \) and \( \tau = 0 \). The main salient features are:

- \( \lambda_0 > \lambda_1 \) accounts for a reservation wage of the unemployed greater than unemployment benefits (as in BM).
- For \( pw + al = w \forall w \), indexing of UB to previous earnings leads to \( U(b) - U(b + R + al) > 0 \), so that it also accounts for a reservation wage of the unemployed greater than the unemployed income.10
- Otherwise stated, even though \( \lambda_0 = \lambda_1 \), it is in the interest of the workers to accept a wage greater than their unemployed earnings \( b \) because they expect in the future to go back to unemployment with earnings \( pb + al \) lower than \( b \).11 This highlights a new motive for wage offer rejections and suggests that standard structural estimations of the unemployed contact rate, which do not take this motive into account, are biased.

#### 2.4. Labor market equilibrium and evaluation criteria

The labor market equilibrium is characterized by \( \{u(b), g(w), h(w), f(w), k(w), R(b)\} \forall w \) and defined by Eq. 1, which solves the system Eqs. (2), (3), (4), (6), (8) and (9), and where transfers to workers \( \tau \), defined as profits \( \tau \) minus taxes \( T \) to balance the UB system, are defined by:

\[
\tau = \pi - T
\]

\[
\pi = (1 - u) \int_{w}^{w} y(k(w)) - w \cdot g(w) \cdot dw - \lambda_0 \int_{w}^{w} \left( f(w) \cdot k(w) \cdot f(w) \cdot dw \right) u(x) \cdot dx
\]

\[
T = \int_{b}^{b} bu(R(b)) \cdot db; \quad \text{with} \quad u = \int_{w}^{w} u(x) dx
\]

To evaluate the impact of the UB system, we then consider the three following criteria:

- The extent of inefficient unemployment as defined by the gap \( u_{\text{en}} = u - \bar{u} \) where \( \bar{u} \) refers to the unemployment rate without any rejection.
- Aggregate output flow net of training costs, as defined by:

\[
Y = (1 - u) \int_{w}^{w} y(k(w)) - (1 - \lambda_0) \int_{w}^{w} f(w) - k(w) \cdot f(w) \cdot dw \cdot u(x) \cdot dx
\]

where \( \bar{y} \) gives the average job-productivity:

\[
\bar{y} = \int_{w}^{w} y(k(w)) \cdot g(w) \cdot dw
\]

- This allows us to take into consideration the impact of the UB system on training investment, hence on productivity and output.
- Aggregate welfare which takes into account the risk aversion of workers and the redistributive effects of the UB system, as defined by:

\[
W = (1 - u) \int_{w}^{w} V(w) \cdot g(w) \cdot dw + \int_{b}^{b} U(x) \cdot u(x) \cdot dx
\]

#### 3. Equilibrium distributions, inefficient unemployment and the optimal unemployment benefits system

In our model wage and UB distributions are interrelated. One may then wonder to what extent this explains the distribution of wages and UB in a world where no other heterogeneity is introduced. Otherwise stated, a first objective is to look at the empirical relevance of the model. A second objective is to show the extent of the inefficient unemployment associated with these rejections, and what the optimal UB system could be.

##### 3.1. Calibration

We choose to calibrate annually the model on a French low-skilled workers data set, by considering the employed with full-time jobs and the unemployed less for than two years.12

As a preliminary step, we need to specify a functional form for the job-productivity; as in Chéron et al. (2008), we consider the following specification:

\[
y(k) = y + \left( \frac{p}{\alpha} \right) k^\alpha
\]

with \( p > 0 \) and \( \alpha \in (0, 1) \). Then, we distinguish two subsets of parameters, according to the calibration strategy (Table 2). A first subset \( \theta_1 = \{ \tau, \sigma, \alpha, \lambda_1 \} \) is based on external information. In particular, we use the values provided by Postel-Vinay and Robin (2004) to set the contact rate of the employed and the job destruction rate. A second subset \( \theta_2 = \{ \lambda_0, y, p, \alpha \} \) is set in order to reproduce the

---

9. Replacing \( R \) by \( \bar{w} \) and \( b \) by \( w \), one gets \( \bar{w}(w) \) used in Eq. (5).

10. The proof is straightforward since \( U(b) \) is unambiguously increasing with \( b \).

11. This job search strategy does not exist in BM because workers know that they will earn \( b \) whatever their former wage.

12. We use the Labor Force Survey in 2002; see Appendix A for a detailed description of the data. A detailed explanation of the numerical procedure to compute the labor market equilibrium is also provided in Appendix B.
unemployment rate of 9% and three stylized facts which characterized the distribution of wages; we use the mean wage (= 1.46 × mandatory minimum wage) and the value of two wage deciles (5th and 6th), as shown in Fig. 2. Lastly, we normalize the mandatory minimum wage w to one, assume α = 0 and set ρ in order to reproduce the observed average replacement rate of 53%.

Two points then deserve discussion. First, it is worth stressing that the calibrated value for λ is greater than λ. This is consistent with the estimation of Postel-Vinay and Robin (2002) although the magnitude of the gap between contact rates is smaller here; slightly less than 2 instead of 3 in Postel-Vinay and Robin. However, it seems consistent since, as we argued earlier, proportionality of UB to past wages increases the reservation wages of the unemployed, as is also implied by a higher value for λ. Secondly, the value of α is very close to the one obtained by Chéron et al. (2008) in a model with endogenous productivity but exogenous UB (0.76 here instead of 0.72).

3.2. Model properties

Figs. 3 and 4 show the results of model simulations, where the value of 1 refers to the value of the mandatory minimum wage in France. Fig. 3 first shows that there exist some job offer rejections for unemployed workers whose income is above 80% of the minimum wage. For workers with lower unemployment compensations, all wage offers turn out to be acceptable in our simulations. Then, for the unemployed with the highest income (around the minimum wage) the lowest acceptable wage is almost 20% higher than the minimum wage. This figure also shows the value of job-productivity as implied by the training investment of the firms. This job-productivity is increasing with wages, with a range approximately from 1 to 4.

Fig. 4 then shows the equilibrium distributions of wages and UB. Both density functions appear to be hump-shaped as found in the data. The main salient feature refers to the right-hand tail of the distributions: the latter is larger for the UB than for wages. This result is clearly the outcome of job rejections by the unemployed with high unemployment compensations; those workers indeed stay longer in unemployment consistent with the minimum wage (= 1 from normalization); we find all = 0.85 and the associated unemployment benefits distribution is a mass point at this level. Other combinations also exist and Table 3 shows values for unemployment and average replacement rates for some combinations that are consistent with the fact that the unemployed at the top of the UB distribution accept the minimum wage. It is obvious that for all these combinations, both the equilibrium unemployment rate and the distribution of wages are unchanged. Only the distribution of unemployment benefits is modified. Interestingly, we find that we can maximize the average replacement rate without introducing any inefficient unemployment rate when the distribution of unemployment benefits is a mass point at a level corresponding to 85% of the minimum wage; the associated replacement rate (rr) is 58%. Table 3 also shows values concerning productivity, output and welfare that take a worker’s risk-aversion into account. Due to its redistributive impact on the unemployed, the set (ρ = 0; all = 0.85) allows us to reach the highest welfare in this context of no wage offer rejection. More generally, we would like to go beyond unemployment to examine the optimal UB system. One may indeed wonder to what extent it could be worthwhile to keep a UB system leading to some job offer rejections.

3.3. Eliminating inefficient unemployment

A first objective is to focus on the unemployment rate to evaluate the impact of the UB system. More precisely, this section aims at addressing the following two issues: (i) What is the extent of inefficient unemployment? (ii) What should be the design of an unemployment insurance system to eliminate inefficient rejections?

Actually, the answer to the former question is directly implied by our calibration procedure and the resulting value for λ. Inefficient unemployment corresponds to the gap between calibrated unemployment and equilibrium unemployment without any wage offer rejections. Calibration of the model is done in order to match the observed unemployment rate. This means that the calibrated value for λ is “revealed” by simulations of agents’ behaviors and the labor market equilibrium, given the other set of structural parameters. Since we set s = 0.1 and find λ = 1.13 to match the unemployment rate, this means that 0 = 1 − ρ = 8.1% is the value of the unemployment rate in the context of no wage offer rejection. Otherwise stated, we can expect, at most, a 0.9 percentage point decrease of the unemployment rate by eliminating inefficient unemployment (h).

The next issue deals with the design of the UB system according to Bismarck/Beveridge components in order to eliminate rejections. There is a large set of combinations (ρ, all) which would deliver this outcome. On the one hand, one could choose to keep all = 0 and search for the threshold value of ρ which implies that the unemployed with the highest benefits accept the minimum wage; we find ρ = 0.4.

Table 2 Structural parameters.

<table>
<thead>
<tr>
<th>r</th>
<th>σ</th>
<th>s</th>
<th>λ ti</th>
<th>λ u</th>
<th>y</th>
<th>p</th>
<th>α</th>
<th>ρ</th>
<th>α</th>
<th>ρ</th>
<th>all</th>
<th>w</th>
</tr>
</thead>
<tbody>
<tr>
<td>4%</td>
<td>3</td>
<td>0.1</td>
<td>0.7</td>
<td>1.3</td>
<td>1.23</td>
<td>0.28</td>
<td>0.76</td>
<td>0.51</td>
<td>0</td>
<td>1</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

13 Although we consider the proportionality of UB to past wages, our model does not consider any eligibility criteria to access the standard unemployment compensation scheme. Hence, we choose to target the average replacement rate, and do not use the legal definition of the unemployment insurance and assume all = 0. Our policy experiments will then aim at showing the equilibrium impact of alternative values for p and all.

14 This highest value is given by 0.51 × w, where w is derived by considering F(w) = 1 in Eq. (8).

15 To read this graph, notice for instance that the value of the computed ratio approximately equates 1 for the fifth decile of low-skilled workers, both for wages and unemployment benefits; that is, the average wage (UB) is close to the median wage (UB).

16 As could also be noticed, all the combinations (ρ, all) that eliminate inefficient unemployment leave productivity and output unchanged.
3.4. Beyond unemployment: productivity, output and welfare

Fig. 5 first emphasizes that a reform of the UB system which leads to the elimination of all wage offer rejections, pushes the wage distribution slightly to the left. As was already emphasized by Chéron et al. (2008) when examining the impact of tax exemptions on low wages, such an impact on the distribution of wages can lead to reduced productivity. Indeed, due to the on-the-job search, the
value of risk-aversion. Robustness analysis shows that for the value of \( \sigma > 0 \) it remains unambiguously the case that the highest welfare value can be reached by setting \( \rho = 0 \) and all at its highest value so that it prevents job rejection. For \( \sigma = 0 \) we find that the two alternative policies are equivalent. That is, the highest social welfare can be reached either by setting \( \rho \) or all so that it prevents job rejection.

Secondly, one may also wonder to what extent the minimum wage legislation could also be used to improve efficiency and/or reduce inefficient unemployment. Table 4 shows some simulation results. As in BM, the higher the minimum wage the lower the inefficient unemployment. Indeed, the highest wage paid increases less than the minimum wage, and this induces a higher wage concentration at the bottom of the distribution. In our framework, this also implies higher concentration of the UB distribution so that it could be worthwhile for the unemployed workers at the top of this distribution to accept even the minimum wage. This higher concentration at the bottom also leads to a reduction in average training investments, hence in productivity.

Overall, even though a higher social welfare could be reached by increasing the minimum wage and eliminating inefficient unemployment (\( W = –3.291 \)), we find that it would remain more efficient to reduce the Bismarck component of UB and simultaneously increase the Beveridge one (\( W = –3.197 \) when \( \rho = 0, \forall \sigma = 0.85 \)). This is more efficient than increasing the minimum wage, because the risk-aversion of workers gives more value to the unemployed incomes than to the employed earnings.\(^{18}\)

### 4. Conclusion

The contribution of this paper is twofold. It is first to provide an extension of the on-the-job search framework to account for endogenous unemployment benefits as a result of UB indexing to previous earnings. This allows us to emphasize new determinants of the job search decision and to assess the model’s ability to fit the distribution of wages and UB.

Secondly, the paper argues that the proportionality of UB to past wages can undermine well-being. Simulations based on French low-skilled workers indeed show that a decrease of UB indexing together with an increase of lump-sum transfers can improve welfare. This is due to the fact that the negative welfare impact of the related fall in productivity is more than offset by the positive welfare impact of the rise in employment as well as in unemployed workers’ incomes at the bottom of the UB distribution. These results suggest that in an economy with a binding minimum wage, the optimal UB is close to that in, for instance, the UK and the Australia.

This work could be extended in several directions. First, without a mandatory minimum wage, the lowest wage would become endogenous and determine iso-profit value, so that the UB system should modify contact rates. Second, we do not consider the adverse moral hazard effect of UB. This could be discussed by introducing an additional labor market status such as “long-term unemployed” with lower UB. By controlling the UB gap between the “short-term” and “long-term”, the UB system could also be optimized.

\[^{17}\] In turn, if we vary \( \forall \sigma = 0 \) this has no impact on equilibrium, because this does not lead to any wage offer rejection. Furthermore, this should modify the lowest wage paid by firms and accordingly should have an impact on the labor demand (vacancy decision); this is beyond the scope of this paper.

\[^{18}\] Furthermore, we do not take into account the fact that an increase of the minimum wage should also result in a decrease of contact rates.
Acknowledgements

We thank Fabien Postel-Vinay and two anonymous referees for helpful comments. This work has also benefited from financial support of the European Commission (“TAXBEN” program). Errors and omissions are ours.

Appendix A. Stylized facts

We use the French Labor Force survey 2002 to examine the properties of wage distributions and unemployment benefits as well. To that end, we distinguish three types of workers:

• Low-skilled workers = manual workers
• Medium-skilled workers = intermediary professions
• High-skilled workers = Managers

Fig. 6 shows the distribution of wages and unemployment benefits for each type, and Table 5 computes some related statistics. We consider separately the whole unemployed set on the one hand, and the distribution of unemployment benefits for workers with less than 2 years in unemployment (unemployed < 2 years) on the other hand.

The distribution of wages is hump-shaped, and the average wage is increasing with a worker’s skill. It is also obvious that average unemployment benefits are increasing with a worker’s skill, while the average replacement rate slightly decreases with skill level.

Appendix B. Model resolution

The model resolution implies the solution of two fixed points. The first aims at determining the joint distributions of equilibrium wage offers and unemployed incomes, while the second aims at determining the reservation wages of unemployed workers from value functions.

1. Consider a guess for (i) unemployed workers’ reservations wages \( R(b) \), (ii) distribution of unemployed workers among possible income values \( u(x) \) \( \forall x \) (so that it involves also a guess \( u = \int_{0}^{u} R(b) \mathcal{C}(x) dx \)), and (iii) contact rates \( h(w) \).

Fig. 6. Distributions of earnings.
2. Grids for wages and corresponding unemployment benefits are defined according to Eq. (1) for \( b \), and where the highest wage offer solves:

\[
\bar{w} = f(\bar{k}) - k(r + s) - \left( \frac{r + s}{r + s + \lambda_1} \right) \left( \frac{h(w)}{R(w)} \right) (f(\bar{k}) - w - k(r + s + \lambda_1))
\]

Solves for \( F(w) \) Eq. (7).

3. Iterate on value functions to determine reservation wages = determine the function \( R(b) \) \( \forall b \) which verifies simultaneously for both values of unemployed incomes \( V(R(b)) = U(b) \) \( \forall b \) by using \( F(w) \) determined at step 2.

4. According to \( F(w) \), \( R(b) \) and \( u(R(b)) \), determine the distribution of earnings \( G(w) \) from Eq. (2).

5. According to \( G(w) \) and \( R(b) \) determine \( u(R(b)) \) from Eq. (3).

6. According to \( F(w) \) and \( u(R(b)) \) calculate a new guess for the contact rate \( h(w) \) from Eq. (4).

7. Iterate from step 2 until convergence.

References


Table 5

<table>
<thead>
<tr>
<th></th>
<th>Low-skilled Wages</th>
<th>UB</th>
<th>UB&lt;2Y</th>
<th>Medium-skilled Wages</th>
<th>UB</th>
<th>UB&lt;2Y</th>
<th>High-skilled Wages</th>
<th>UB</th>
<th>UB&lt;2Y</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Average</strong></td>
<td>7675</td>
<td>3892</td>
<td>4075</td>
<td>10,675</td>
<td>5141</td>
<td>5481</td>
<td>18,079</td>
<td>8743</td>
<td>8941</td>
</tr>
<tr>
<td><strong>S.D.</strong></td>
<td>2625</td>
<td>1563</td>
<td>1572</td>
<td>3873</td>
<td>2344</td>
<td>2437</td>
<td>8265</td>
<td>4694</td>
<td>4352</td>
</tr>
<tr>
<td><strong>Average</strong></td>
<td>34.2%</td>
<td>40.2%</td>
<td>38.6%</td>
<td>36.3%</td>
<td>45.0%</td>
<td>44.5%</td>
<td>45.7%</td>
<td>53.7%</td>
<td>48.7%</td>
</tr>
<tr>
<td><strong>Replacement rate</strong></td>
<td>50.7%</td>
<td>53.1%</td>
<td>–</td>
<td>48.2%</td>
<td>51.3%</td>
<td>–</td>
<td>48.4%</td>
<td>49.5%</td>
<td>–</td>
</tr>
</tbody>
</table>

S.D.: standard deviation.

UB<2Y: UB for unemployed for less than 2 years.