

Unemployment benefits and unemployment

Olivier Blanchard *

February 1998

This is the first of four notes, each one looking at the potential role of a specific factor in explaining variations in unemployment over time across countries. The four factors are: unemployment insurance, employment protection, shifts in relative demand towards the skilled, and changes in tfp growth.

The evolution of unemployment benefits in the OECD is well described in Chapter 8 of the OECD Jobs Study. Unemployment benefits come in two forms: *unemployment* insurance, typically related to past earnings, and ending after a fixed period of time-typically six months to two years; and *unemployment assistance*, typically unrelated to past earnings, and often without time limits. The replacement ratio, the ratio of unemployment benefits to the past wage, varies over the duration of unemployment, and the characteristics of the worker. The OECD has constructed an average replacement ratio for each country over time. Figure 8-1 gives the evolution of the ratio over time for each country. Table 8-1 gives the ratio by duration, and by characteristics, for each country, for 1991.

I draw two main conclusions from this figure and this table. In many countries, the largest increase in the replacement ratio predates 1973; since 1973, the replacement ratio has typically not increased very much (with some exceptions, in

* Prepared for Lecture 5, Econ 2410d

particular Denmark, Norway, Portugal). The average replacement ratio is lower than one might have expected, based on anecdotal accounts. Looking at table 8-1, few entries have a replacement ratio above 70% (Sweden, Denmark in the first year of unemployment), and the average ratio is typically well below 50%. The average of the “average replacement ratios” in the last column is 29%

How should we think of the effect of unemployment benefits on unemployment? Labor economists have typically focused on the effects of *benefits on search intensity*, and thus on unemployment duration. Typically taking the distribution of wages as given, they have looked at the effects of benefits, and their exhaustion on the exit rate from unemployment. Macro economists have typically focused on the effects of *benefits on the bargained* wage, and thus the effects on equilibrium unemployment. The two channels are distinct, but both are relevant.

I first look at the effects of benefits on search, and through that channel, on equilibrium unemployment. I then look at their effects through the reservation wage, and through that channel, on equilibrium unemployment. I then briefly review the macro-evidence. A review of the micro-evidence will be the subject of a separate hand-out by Marianne Bertrand. (This hand-out is more sketchy than the previous ones, for two reasons. Some of the arguments are more tentative, and exploring each direction in depth would take too long.)

1 Unemployment benefits, search, and equilibrium unemployment

Our benchmark model did not have search intensity. The first step is thus to introduce it, and see how variations in it affect equilibrium unemployment.

Introducing search intensity

Assume that the unemployed search with intensity θ .¹ In this case the matching

1. I shall keep using continuous time. But it may help you to think of time as discrete, and of θ as

function is given by:

$$h = m(\theta u, v) \quad (1.1)$$

The number of hires depends not on unemployment, but on unemployment weighted by search intensity, and on vacancies.

If the matching function has the symmetric Cobb-Douglas form, it now takes the form:

$$h = m \sqrt{\theta uv} = (m\sqrt{\theta}) \sqrt{uv} \quad (1.2)$$

with m now a parameter.

To understand the effects of search intensity on equilibrium unemployment, we can now rely on the results we derived in the benchmark model. There, we looked at a decrease in matching efficiency, parameterized by a decrease in the parameter m . We also saw that, to a first approximation, a decrease of m of $x\%$ led to a decrease in the exit rate of $x\%$, and an increase in unemployment of $x\%$ (of itself).

It is clear from equation (1.2) that m and $\sqrt{\theta}$ play the same role in the extended matching function, and thus have the same effect on equilibrium unemployment. The results of a decrease in search efficiency can therefore be summarized graphically in Figure 1. A decrease in search intensity leads to an upward shift of the wage equation, thus to a lower equilibrium exit rate and, in turn, to a higher equilibrium rate of unemployment. And to a first approximation, an $x\%$ decrease in search intensity leads to an increase in unemployment of $(x/2)\%$ (of itself). If the initial unemployment rate is, say, 5%, and search intensity decreases by 50%, the unemployment rate will increase by 25%, thus from 5 to 6.25%.

Thus, to the extent that unemployment benefits decrease search intensity, they

the number of searches per unemployed per period, so that total searches by the unemployed within a period are equal to θu .

will increase unemployment duration and increase the unemployment rate.

[Question. Suppose, following one of the extensions of the benchmark model, that firms face no matching problem (just one large factory gate), just a cost c of separation. What will be the effect of changes in search intensity (say, trying hard to be close to the gate when it opens) on equilibrium unemployment?]

Search intensity **and unemployment benefits**

What determines search intensity? Think about the first-order condition that must be satisfied by an unemployed worker deciding how much to search.

If the economy wide search intensity is θ , and a particular unemployed searches with intensity θ_i , his exit rate from unemployment will be equal to:

$$x_i = \frac{\theta_i}{\theta u} m(\theta u, v) \quad (1.3)$$

The marginal benefit from an increase in his search intensity will thus be given by $(1/(\theta u)) m(\theta u, v) = m(1, v/(\theta u))$, times the difference in the value of being employed rather than unemployed, $(V_{Ei} - V_{Ui})$.

Assume that the private cost of search is non decreasing in search intensity; call the cost function $f(\theta_i)$, where $f' > 0$. The marginal cost of search intensity is thus given by $f'(\theta_i)$. For search intensity to be (privately) optimal, marginal cost must be equal to marginal benefit:

$$f'(\theta_i) = m(1, v/(\theta u)) (V_{Ei} - V_{Ui}) \quad (1.4)$$

In equilibrium, all unemployed will choose the same search intensity, θ , and face the same surplus from becoming unemployed, so that θ satisfies:

$$f'(\theta) = m(1, v/(\theta u)) (V_E - V_U) \quad (1.5)$$

To get a better feel for the relation, assume that the cost of searching is linear in intensity, $f(\theta) = a\theta$, and that the matching function is symmetric Cobb-Douglas and thus given by (1.2). The condition (1.5) becomes:

$$\theta = \left(\frac{v}{u}\right) \frac{(V_E - V_U)^2}{a^2} \quad (1.6)$$

Search intensity is linear in the vacancy-unemployment ratio, and in the squared surplus from becoming employed. The tighter the labor market, the higher the higher the gains from becoming employed, the higher will be search intensity.

Thus, at a given wage, an increase in unemployment benefits will increase b and thus lead to a decrease in the surplus. By implication, it will lead to a decrease in search intensity. (This is only a partial equilibrium effect. In general equilibrium, as search intensity changes, v/u may change. So may the wage, leading to a change in $V_E - V_U$.)

A brief detour here, about the dangers of matching function estimation. Recall that, with variable search intensity, the Cobb-Douglas symmetric matching function is given by

$$h = m\sqrt{\theta uv}$$

But θ is typically unobservable to the econometrician. Most matching function estimations have thus used unemployment and vacancies on the right hand side, without attempting to capture the intensity of search by workers, or for that matter, by firms.

To see what the econometrician will get, replace θ by its value from (1.6):

$$h = m\sqrt{\frac{v}{u} \frac{(V_E - V_U)^2}{a^2} uv} = mv \frac{(V_E - V_U)}{a}$$

The observable (reduced form) matching function will show constant returns to

vacancies-with an intercept term that will depend, among other things, on the size of the surplus-, and no effect of unemployment! (The constant returns to vacancies result depends entirely on the specific assumptions. But the proposition that if search intensity responds positively to the vacancy unemployment ratio, the estimated matching function will overestimated the role of vacancies is general.) Concluding from such an estimation that firms do not need unemployed workers to fill vacancies would be unwarranted...

Loss of skills, loss of heart, and unemployment

One of the characteristics of the benchmark model and of the extensions so far has been that the exit rate from unemployed was independent of an individual's unemployment duration. This is counterfactual. The proportion of long-term unemployed in most European countries implies that the exit rate is in fact decreasing with duration.

*Exercise: The data in Table 1 give you the average duration of unemployment in months for each OECD country for the period 1985 to 1994, together with the proportion unemployed for more than 6 months, and more than 12 months. From the duration data, compute the average exit rate. Then compute the proportions of long term unemployed which we should observe if the exit rate was constant and thus independent of duration. Compare to the actual numbers. **What do you conclude?***

It is worth exploring the potential origins and the implications for equilibrium unemployment of such a declining exit rate.

Assume that there are two levels of search intensity; normalize the high level to 1 for convenience, and the low one to $\theta \leq 1$. All newly unemployed workers are high intensity searchers, but with probability λ , become low intensity searchers; once low intensity, they remain low intensity for as long as they remain unem-

ployed.

One can think of two interpretations of θ here, with θ reflecting either a decrease in search intensity or reflecting skills deterioration. Under the first interpretation, the longer you have been unemployed, the more likely you are to become less effective at-or less willing to- search. Under the second interpretation, the longer you have been unemployed, the more likely you are to have lost skills, so that only a proportion θ of all firms is now interested in hiring you. Both factors are probably relevant.

Let u_H and u_L be the pools of high and low search intensity unemployed. Then, the matching function must be rewritten in terms of unemployment weighted by search intensity, call it “effective unemployment”, and vacancies:

$$h = m(u_H + \theta u_L, v) \quad (1.7)$$

Define X as the ratio of effective unemployment, $u_H + \theta u_L$ to total unemployment $u = u_H + u_L$, so that the matching function can be rewritten as:

$$h = m(Xu, v) \quad (1.8)$$

The lower X , the more inefficient matching, and thus, following the same argument as above, the higher the equilibrium rate of unemployment.

At any point in time, X can be anywhere between θ and 1, depending on the history of unemployment. If the labor market has been depressed for a long time, most workers may have become low-search intensity workers: effective unemployment may be small relative to total unemployment. And the lower X , the lower the pressure from a given unemployment rate on the wage (the higher the wage equation, in the graphical representation of the benchmark model).

Dynamics are interesting (and feel relevant to the experience of Europe), but would take us too far. Let me narrow the focus on what determines steady state

X .

Call x the exit rate for the high search intensity unemployed. From (1.7) x is given by:

$$x = \frac{1}{u_H + \theta u_L} m(u_H + \theta u_L, v) = m(1, v/(u_H + \theta u_L))$$

Show that the exit rate for low search intensity unemployed is given by θx .

The equations of motion for each of the two stocks u_H and u_L are given by:

$$\begin{aligned} du_H/dt &= s(1 - u) - \lambda u_H - x u_H \\ du_L/dt &= \lambda u_H - \theta x u_L \end{aligned} \quad (1.9)$$

The change in u_H is equal to separations, minus those who shift to low intensity search, minus those who become employed. Similarly, the change in u_L is equal to those who shift to low intensity search, minus those who become employed:

If the economy is in steady state, the stocks of high and low search intensity unemployed are given by:

$$\begin{aligned} u_H &= s(1 - u)/(\lambda + x) \\ u_L &= (\lambda/(\theta x))/u_H \end{aligned}$$

From which it follows that:

$$x = \frac{x\theta + \lambda\theta}{x\theta + \lambda} \quad (1.10)$$

We can now look at the determinants of X. If search intensity is constant ($\lambda = 0$), $X = 1$, and we get back the old matching function. But, otherwise, the higher the probability λ , or the smaller θ , the lower X, the lower the ratio of effective to actual unemployment (and in turn the higher the equilibrium rate of unemployment). There is nothing very surprising here. The most interesting result is not about the first derivatives, but about the second. Consider $dX/d\theta$, the effect of the level of search intensity θ on X (and through X on equilibrium unemploy-

ment) :

$$dX/d\theta = \frac{\lambda(x + \lambda)}{(x\theta + \lambda)^2} \quad (1.11)$$

When x increases, $dX/d\theta \rightarrow 0$. But as x tends to zero, $dX/d\theta \rightarrow 1$.

In words, in good times, i.e. when the exit rate from unemployment is high, it does not matter that the unemployed eventually lose heart or skills: nearly all of them find a job before this happens. But when times are less good, and, for any reason, the exit rate from unemployment is low, many of them remain unemployed enough to lose heart; the proportion of unemployment due to low search unemployed increases a lot; matching becomes worse, and equilibrium unemployment can increase a lot: most of the unemployed are not searching much.

The Sargent-Ljungqvist (1997) result is in the same spirit. In their model, the unemployed lose skills-both when they lose their job, and then over time, as they remain unemployed-and thus the wage they can hope to get also goes down. As unemployment benefits are based on their previous job, there is the risk that if they become unemployed too long, they may become in effect unemployable, having a reservation wage higher than nearly all the wage offers they are likely to receive. Sargent and Ljungqvist then assume that economies can be more or less "turbulent": the more turbulent the economy, the faster the rate at which job skills deteriorate with unemployment. As long as the economy is not too "turbulent," and the rate of skill loss is low, people rarely remain unemployed long enough to be unemployable. But if the economy becomes more turbulent, and the rate of skill loss is higher, then many people remain unemployed long enough to become nearly unemployable, and equilibrium unemployment increases very sharply.

There is a general point here. Some labor market institutions may be time bombs. They may not affect unemployment in the environment they are initially introduced, but affect it a lot when the environment changes (we shall see another example when looking at the effects of employment protection in the next lecture).

[You may want to explore further the model I just sketched. If so, you have to take into account another set of modifications to the benchmark model. Workers can now be in one of 3 states (not 2 as before): they can be employed with value V_E , be unemployed with high search intensity, V_{UH} , or be unemployed with low search intensity, V_{UL} . When thinking the cost of becoming or remaining unemployed, they take into account the fact that, if they remain unemployed, they may shift to low intensity search, and may have a much lower chance of getting out of unemployment. Derive the equations of motion for the values, and solve for the wage in steady state. How is the wage equation modified as a result of the two-level search assumption?]

2 Unemployment benefits, the reservation wage and equilibrium unemployment

While labor economists have focused on the effects of benefits on search, macroeconomists have typically focused on the effects on the bargained wage.

Reservation wages and unemployment

A good starting point here is the wage equation we derived in the benchmark model:

$$(w - b) = \frac{r + s + h/u}{2r + 2s + h/u + h/v} (y - b) \quad (2.1)$$

which under the assumption that matching is symmetric Cobb-Douglas, and the explicit introduction of search intensity, θ , yields:

$$w - b = \frac{r + s + h/u}{2r + 2s + h/u + (\theta m^2)/(h/u)} (y - b) \quad (2.2)$$

In the previous section, we focused on the effects of benefits on θ , and in turn on equilibrium unemployment. Here the focus is on the effects of benefits on b , and in turn on equilibrium unemployment.

It is clear from (2.2) that increases in b lead to an increase in the wage at a given exit rate, and thus to an increase in equilibrium unemployment. Just as in Figure 1, an increase in the reservation wage increases the bargained wage at a given exit rate from unemployment, and thus decreases the equilibrium exit rate and increases equilibrium unemployment. No great surprise here.

It may be useful to put numbers in (2.2) to get a sense of potential magnitudes. Let's use some of the approximations we discussed in the benchmark model. Assume that the wage implied by the free entry condition is fixed (an approximation), that the terms in r and s are small compared to (h/u) and $(h/v) = m^2/(h/u)$, so that we can solve equation (2.2) for the equilibrium exit rate (h/u) :

$$(h/u)^* = \sqrt{(m^2\theta) \frac{w - b}{Y - W}}$$

To get an estimate of $m^2\theta$, recall that $(h/u)(h/v) = m^2\theta$. In the United States, over the last twenty years, the average monthly exit rate from unemployment has been around .3, the average monthly exit rate from vacancies around 1, so we can take $m^2\theta = .3$

Assume $y = 1$ —an innocuous normalization—and $w = .7$, so that the share of labor matches the 70% share in the data. Then, $(h/v)^*$ is simply equal to $\sqrt{.7 - b}$. Thus the equilibrium monthly exit rate is equal to .44 for $b = .5$, to .31 for $b = .6$, to .22 for $b = .65$. If we take the monthly separation rate to be equal to .03, the unemployment rate increases from 6.8% when $b = .5$ to 13.6% when $b = .65$. A high replacement ratio can definitely lead to a large increase in the equilibrium rate of unemployment.

Unemployment benefits and reservation wages

Associating one-for-one movements in b and movements in unemployment benefits is only a first pass. The reservation wage will depend in general, not only on the

utility of leisure, but also on the assets that the unemployed have accumulated, and the amount of borrowing to which they have access.

Assume that unemployment benefits are equal to b . Assume that workers also receive some non-labor income, z [sorry for yet another use of the letter z]. And relax the assumption we made in the benchmark that they were risk neutral. Assume instead that their utility function is of the form $u(c) + \psi(l)$, where l is leisure. Assume that l is equal to 0 if they work, 1 if they are unemployed. Normalize $\psi(\cdot)$ so that $\psi(0) = 0$, $\psi(1) = \psi \geq 0$.

Maintain the assumption that consumption is equal to income—an assumption we shall want to relax below. Then, the reservation wage is given by:

$$u(w + z) = u(b + z) + \psi \quad (2.3)$$

If utility is linear, then $w = b + \psi$, a straightforward extension of our earlier case, and the reservation wage is independent of non-labor income. If instead utility is, say, logarithmic, then the reservation wage is given by:²

$$w - b = (z - b)(\exp \psi - 1) \quad (2.4)$$

The higher non labor income, the higher the reservation wage. The higher non-labor income, the less desperate workers will be to accept a job, the higher the reservation wage.

Again, nothing very surprising here. But it raises a large number of very relevant issues. If we relax the assumption that z is given to the worker, and that consump-

2. As we shall see when we discuss the effects of productivity growth on unemployment, the assumption of logarithmic utility is particularly interesting in this context. Unless the utility of leisure grows with productivity, logarithmic utility is a necessary assumption to generate a balanced growth with constant unemployment.

tion is equal to income, but allow instead workers to accumulate or decumulate assets over time, a number of important interactions arise between saving behavior, the reservation wage, and unemployment. Among them:

- Higher expected unemployment benefits will lead employed workers to decrease precautionary saving, so that we should not expect the reservation wage to increase one-for-one with unemployment benefits.
- A long period of unemployment, to the extent that it was unexpected, may lead to a decrease in non-human wealth of the unemployed and decrease the reservation wage. The point has been made and examined for individual workers. But it applies to the economy as a whole. The longer a period of unemployment, the lower should be the reservation wage.
- High expected unemployment however may play the other way. If workers anticipate a high probability of being unemployed, they will build up assets, so as to sustain a higher level of consumption when unemployed. The structure of family transfers may also adapt to high unemployment. Unemployment appears for example to have led to an increase in the proportion of young people living at home in Spain. From a macro perspective, this will increase the reservation wage, increase the bargained wage, and lead to higher equilibrium unemployment.

There is much theoretical work to be done here. (There is a macro-literature on the degree to which people will self-insure in the presence of idiosyncratic shocks. That line of research is very relevant here. Connecting the level of assets held by the unemployed to the Carroll-Deaton description of consumers may be very productive as well. There is a paper by Jim Costain, from Michigan, that makes some progress in integrating consumption/saving behavior and the labor market. But more can be done.)

In short, the relation between reservation wage and unemployment benefits is likely to be substantially more complex than in the benchmark model. Empirical studies of the consumption behavior of the unemployed, as a function of benefits

and other characteristics, can be of great use here.

3 A brief look at the evidence

Whichever the channel (search, or/and bargained wage), one would expect to see a positive effect of the replacement ratio on the unemployment rate.

The natural first step is thus to do a pooled time-series cross-country regression of the unemployment rate on some index for the replacement ratio. This regression has been done by the OECD, and is reported in appendix 8c of the Jobs Study.

The regression has the form:

$$\log(u_{it}) = a_1 \log(u_{it-1}) + a_2 \text{ rep ratio} + D_i + D_t + \epsilon_{it}$$

where the D_i and D_t are country and time dummies respectively. There are 21 countries, and four time periods, 67-71, 73-77, 79-85 and 87-93. (The replacement ratio is computed only every two years).

When country and time dummies are included, a_2 is small and insignificant, .16 with a t-statistic of .2. The reason is clear from chart 8-2, also from the OECD Jobs Study. For the subsamples 73-77 and 79-85, the relation between changes in unemployment and changes in the replacement ratio is, if anything negative: a larger increase in benefits is associated with a smaller increase in unemployment. Only in the last period, 87-93, is there a strong positive relation: countries in which benefits have decreased the most, are also the countries where unemployment has decreased the most. (I have a strong suspicion of reverse causality: countries in which things have improved, say the United Kingdom, have been able to tighten their unemployment benefit system.)

When country or time dummies are excluded, a_2 becomes larger and marginally significant. For example, without time dummies, $a_2 = .75 (t = 2.2)$; without

country dummies, $a_2 = 1.97$ ($t = 2.2$). But attributing all variations across countries or across time to unemployment benefits appears excessive.

The first pass is therefore not a great success. But one cannot stop here, for at least two reasons.

- It could be that the effect of benefits comes out more strongly, when other factors are controlled for. The Jackman-Layard-Nickell paper listed in lecture 10 in the reading list presents pooled time series cross country regressions, (20 countries, two time periods 83-88, and 89-94), regressing the unemployment rate on a number of variables, but no country dummies). They find no effect of the replacement rate, but a fairly strong effect of benefit duration. We shall return to these regressions later.
- It could be that time bomb effects are important. The effect of a given system of unemployment benefits may be small in a particular context, big in another. This requires using the right interaction terms. This remains to be done.

Another complementary strategy is to gather micro evidence on the various links potentially at work, benefits on search, reservation wage on bargained wage, benefits on the consumption level of the unemployed. What we know and do not know is described in the hand out by Marianne.