Duration Dependent Unemployment Benefits in Trade Union Theory*

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Abstract

The basic trade union model is generalized to allow for an unemployment benefit system consisting of two benefit levels, one for short-term and one for long-term unemployed, and a rule determining whether an unemployed is short- or long-term. Under relatively mild conditions we show that benefit systems with no or positive duration dependence are dominated by a system with negative duration dependence in the sense that all union members achieve higher utility, unemployment is lower, and benefit expenditures are smaller.

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1 Introduction

Should unemployment benefits depend on peoples' past unemployment records? We address this question by analysing how unemployment duration dependence in benefit systems influences labour markets characterized by monopolistic wage setting. Our results suggest that an unambiguous improvement can be obtained by changing benefit systems with no or positive duration dependence to one with negative duration dependence, where unemployment benefits fall to a lower level after some duration of unemployment. By unambiguous improvement we mean that unemployment falls, all workers get more utility, and benefit expenditures decrease. Thus, an optimal benefit system has negative duration dependence, and in general rebalancing of benefit rates valid for different durations of unemployment may potentially achieve all of the above goals contrary to the often considered change of an overall benefit level.

Standard trade union theory predicts that increases in unemployment benefits increase wages and unemployment, see e.g. Oswald (1985), Farber (1986), or Booth (1995). This literature considers "flat rate" benefit systems where a specific monetary compensation is paid in each period of unemployment independently of the duration of unemployment. This is a quite crude treatment of the actual benefit systems in most countries. For OECD countries, Atkinson and Micklewright (1991) conclude (among other things) that 'UI benefit is paid for a limited duration, and the rate of benefit may decline over time' [p. 1689].

Two problems may arise when making conclusions from models which are oversimplified in the description of the unemployment benefit system. First, identifying one of the real world's several benefit rates with the single benefit rate of a model may lead to wrong predictions. Second, one may overlook some interesting ways of reforming the benefit systems. This paper concentrates on the second issue, but gives also an illustrative example of the first.

To keep the analysis as simple as possible, we start from the simple monopoly union framework first suggested by Dunlop (1944), and now found in major text books. We extend the basic model to allow for a more general benefit system consisting of two benefit levels, one for short-term and one for long-term unemployed, and a rule determining whether an unemployed is classified as short-term or long-term. Such a rule may state that a person unemployed in a specific month is long-term unemployed if having experienced less than 6 months of employment during the last 12 months, or more simple, if having been unemployed in all of the 6 preceding months. Negative duration dependence in the benefit system then means that short-term unemployed receive a higher benefit rate than long-term unemployed.

Our analysis thus contains a dynamic element, the dependence of benefits on the duration of unemployment. We will first impose some assumptions - mainly a zero discounting assumption - which imply that our model nevertheless preserves the simple static nature of the Dunlop model which facilitates comparison and gives transparency. The assumptions also imply that the trade union has a well-defined, unambiguous objective, and furthermore that other elements such as the rule distinguishing between short-term and long-term unemployment can be given a general treatment. Within the static model we demonstrate that starting from an initial benefit system with no or positive duration dependence, one can rebalance the benefit rates so that short-term unemployed get more and long-term unemployed get less and thereby achieve lower unemployment, higher welfare for all workers, and lower unemployment benefit expenditures. The existence of such an unambiguous (Pareto) improvement is our main result. It implies that an optimal system must have negative duration dependence.

The rebalancing of the benefit rates gives an immediate benefit loss to the long-term unemployed, and so it is not obvious whether the result holds with positive discounting. We therefore drop the zero discounting assumption and assume instead that the future is discounted by a positive real interest rate common to all. This leads to a dynamic and more complicated model in which we have to be more specific about issues such as the short-term/long-term rule. Furthermore, union members do no longer have common interests. We show, however, that for a reasonable class of union objectives our main result is unchanged if the real interest rate is not too large relative to initial unemployment.

A key to understanding our main results is that, contrary to the conventional wisdom, an isolated increase in the benefit level for short-term unemployed may *reduce* wages and unemployment. This may occur because the incidence of long-term unemployment, that is, the fraction of the unemployed who fall for the long-term criterion, can reasonably be assumed to be increasing in unemployment itself.

This creates an incentive for unions to reduce unemployment in order to move a larger fraction of the unemployed to the now higher short-term benefit level. This effect counteracts and may even overturn the traditional incentive for wage pressure caused by the higher opportunity cost of employment. Thus, it may be misleading to conclude from the standard union model that higher benefit rates in general increase unemployment.

Our main purpose is to analyse structural reforms that rebalance the benefit levels. If the increase in the benefit rate for short-term unemployed is accompanied by an appropriate reduction in the rate for long-term unemployed then the incentive for the union to move unemployed from long-term to short-term unemployment is only reinforced, while the increase in the opportunity cost of employment is eliminated. This results in an unambiguous incentive for wage moderation, which is the channel through which lower unemployment, higher worker welfare, and reduced benefit expenditures are obtained.

It is very important for our results that the incidence of long-term unemployment, that is, the *fraction* of unemployment carried by long-term unemployed, is increasing in unemployment itself. We argue theoretically for this below, and more thoroughly in Hansen and Jacobsen (1998), but it also seems to be an empirical regularity. Figure 1 below is based on Danish data for the years 1979 to 1998. For each year a point indicates the rate of unemployment and the fraction of total unemployment carried by people who were employed less than 6 months during the year, which could be a relevant criterion for distinguishing between short-term and long-term unemployment. It reveals a clear, and perhaps surprisingly strong, positive correlation. A doubling of unemployment from around 6% to around 12%, seems to imply an increase in the incidence of long-term unemployment from around 50% to slightly below 75%, that is, long-term unemployment goes from 3% of the workforce up to a little less than 9%.

< Figure 1 here >

The idea that negative duration dependence of unemployment benefits, in one form or the other, may be a remedy against unemployment has been demonstrated in other labour market models too. Using 'partial-partial' search models, Mortensen (1977) and Burdett (1979) show that limited benefit duration has important effects on job search incentives implying (a) that the escape rate from unemployment is increasing towards benefits' exhaustion, an effect documented empirically by e.g. Katz and Meyer (1990), and (b) that a rise in the benefit rate given for a limited duration may reduce unemployment because those not currently eligible for benefits have increased incentives for job search. Shavell and Weiss (1979) show in a partial search model that a declining duration profile for given total benefit expenditures increases average search intensity of the unemployed and thereby increases (average) employment and welfare. This result has more recently been extended to a general equilibrium search model by Frederiksson and Holmlund (1998). Also in efficiency wage models there may be positive effects, Atkinson (1995), but the mechanisms through which lower unemployment is achieved in all those contributions are different from the "unemployment composition effect" that drives our result.

One recent paper, Cahuc and Lehmann (2000), also analyses the implications of duration dependent benefit rates in a framework where workers push wages above the competitive level. However, they consider a pure insider wage determination where wage setters do not take into account how they affect overall unemployment on their labour market. Hence, the composition effect driving our result is not present in Cahuc and Lehmann (2000). They find, contrary to us, that a flat rate system produces lower unemployment than one with negative duration dependence. The basic reason is a combination of insider wage determination and discounting. Unlike currently unemployed workers, those employed are sure to get the short-term benefit rate in the first periods of unemployment. A rebalancing of the benefit rates in favour of short-term unemployed will then reduce the expected discounted income loss of unemployment for those currently employed who respond by increasing the wage claims. This effect is also present in our model with discounting. However, we show that for labour markets with just moderate unemployment the composition effect dominates if discounting is within realistic limits, and this holds even if the union cares only about employed members. Thus, we think our result is appropriate for labour markets with considerable unemployment problems and where wages are highly influenced by trade unions.

The paper is organized as follows. In Section 2 we generalize the standard static trade union model to include the situation where unemployment benefits depend on the duration of unemployment. Section 3 states and proves our main result for the static model. In Section 4 we show that our main result also holds for realistic discounting. Section 5 concludes.

2 The Generalized Trade Union Model

We consider a labour market with many identical workers all organized in a trade union. Each worker supplies inelastically one unit of labour in each period. The number of workers and thus the total per period labour supply is normalized to one. Firms demand labour in each period according to a downward sloping demand curve $L(w)$. The wage rate w is set unilaterally by the trade union and assumed to be the same also in all future periods.[1] In a period with wage rate w, the rate of unemployment is $u(w) = 1 - L(w)$, if $w > w^c$, and $u(w) = 0$ if $w \leq w^c$, where w^c is the competitive wage rate, $L(w^c) = 1$. The elasticity of labour demand at the wage rate w is $\varepsilon(w) \equiv -\frac{L'(w)w}{L(w)} = \frac{u'(w)w}{1-u(w)} > 0$.

Each union member is interested in the expected value of the discounted sum, or average, of future incomes; either because each member has a periodwise utility function that is linear in consumption implying that the marginal utility of income is the same across periods or because each member has access to perfect capital markets implying that each member can freely choose among all consumption profiles that are equal in discounted value to expected future income.[2] As said we first

[1] We thus apply two "limit assumptions": The wage rate is set forever and the future is discounted by an interest rate equal to zero. It is easy to demonstrate, however, that the results we obtain are the limit of those obtained from an appropriately formulated model with non-stationary wages and discounting when the interest rate goes to zero. The limiting model we consider is in this sense the correct approximation for sufficiently small discounting. Another issue, which we return to in Section 4, is whether the results survive with realistic discounting.

[2] The results are nearly identical in the other extreme case where members have a strictly

assume,

A1. The time preference, or interest, rate of all workers is zero.

Further, we assume that if the rate of unemployment remains constantly u for many periods then every individual worker will in distant periods have probability u of becoming unemployed independently of initial status,

A2. At a constant rate of unemployment u each and every worker's *long run* probability of unemployment is u.

Under the often considered "simple unemployment dynamic" where in any period every worker has individual unemployment risk equal to the period's unemployment rate, A2 is trivially fulfilled; already from the first period everybody has probability u of unemployment. It is, however, also fulfilled under more general and realistic assumptions allowing individual unemployment risks to depend on past unemployment records, see Hansen and Jacobsen (1998). What A2 buys us is thus generality with respect to the underlying unemployment dynamic.

We consider an unemployment benefit system that consists of two elements. There is a *rule* which decides whether an unemployed is short-term or long-term unemployed. Further, there are *two rates* of unemployment benefits, b_1 and b_2, for short-term and long-term unemployed, respectively. Negative duration dependence then means that $b_1 > b_2$. The standard case of a "flat rate" system corresponds to

concave periodwise utility function over consumption of a non-storable good and where there is no access to capital markets, cf. Appendix A.

$b_1 = b_2 = b$, where the rule does not matter.

The rules typically used in legislation are of the form: A worker who is unemployed in a specific period is classified as long-term unemployed if having experienced j or fewer employment periods within the last m preceding periods (that is, $m - j$ or more unemployment periods), where a period is, e.g., a week or a month. A particular case is $j = 0$, where one is long-term unemployed only if one was also unemployed in *all* of the preceding m periods. Such a rule is, however, more manipulable than a rule with a positive j; just one period of employment implies that one will be eligible for the short-term benefit rate for another m periods of unemployment. Therefore, real world rules usually operate with positive j's. Here, we will not be specific about the rule. Instead, we assume

A3. (i) After a number of periods with a constant unemployment rate u, the fraction of unemployed who are long-term unemployed reaches a certain level $\phi(u)$, the *incidence of long-term unemployment.*

(ii) Given a constant u, the terms $u(1 - \phi(u))$ and $u\phi(u)$ are the fractions of all workers who will be short-term and long-term unemployed, respectively. These fractions are also each individual worker's long run probabilities of being short-term and long-term unemployed, respectively.

(iii) When unemployment increases, the incidence of long-term unemployment increases, that is, $\eta(u) \equiv \frac{\phi'(u)u}{\phi(u)} > 0$ everywhere.

This assumption buys us generality with respect to the short-term/long-term rule. To justify A3, consider first the simple unemployment dynamic where everybody has unemployment risk u in each period, and the simple rule stating that an unemployed is long-term unemployed if having experienced unemployment in all of the preceding m periods, $j = 0$. In this case, the stationary distribution is established no later than after m periods, and the division of unemployment in long term/short term is given by $\phi(u) = u^m$, which is increasing in u. In Hansen and Jacobsen (1998) we show that A3 is also fulfilled for the general rule, $j \in [0, m]$, and also under more general unemployment dynamics allowing individual unemployment risks to depend on past unemployment records. Finally note that the crucial part (*iii*) also holds empirically as shown in the Introduction, cf. Figure 1.

Assumptions A1 to A3 imply that we avoid complications arising from truly intertemporal optimization and ensure that there is an unambiguous objective for the union, that is, common interests across members. Indeed, at a wage rate w, each union member's periodwise expected income will, according to A2 and A3, converge to one and the same level, the *long run* periodwise expected income of a worker,

$$\Omega(w, b_1, b_2) \equiv (1-u)\,w + u\left[(1-\phi(u))\,b_1 + \phi(u)\,b_2\right], \tag{1}$$

where $u = u(w)$. However, Ω is also the expected average of all future incomes for each member,[3] and from A1 this is exactly what all members are interested in. So, the welfare of all union members is exactly $\Omega(w, b_1, b_2)$, and consequently Ω is also

[3]Here we use the fact that if $E(y_t)$ converges towards some $\bar{y}$ then $E\left[\lim_{T\to\infty}\frac{1}{T}\sum_{t=0}^{T} y_t\right] = \lim_{T\to\infty}\frac{1}{T}\sum_{t=0}^{T} E[y_t] = \bar{y}$.

what the union should care about. Given b_1 and b_2 the union sets w to maximize $\Omega(w, b_1, b_2)$.

The special case of a flat rate system, $b_1 = b_2 = b$, gives $\Omega = (1-u)w + ub$ which is the union objective function in the standard monopoly union model. The model considered here is thus a generalization.[4]

The first order condition, $\Omega_w = 0$, for maximizing Ω with respect to w yields,

$$w = \frac{(1-\phi)b_1 + \phi b_2 - \phi\eta(b_1 - b_2)}{1 - 1/\varepsilon}, \tag{2}$$

where $\varepsilon = \varepsilon(w)$, $\phi = \phi(u)$, $\eta = \eta(u)$, and $u = u(w)$. In what follows it will be assumed that the optimal wage rate of the union is given uniquely by the first order condition and is interior, $w > w^c$. This implies that there is unemployment in equilibrium, the second order condition $\Omega_{ww} < 0$ is fulfilled, and - as in the standard monopoly union model - the elasticity of labour demand is above unity, $\varepsilon(w) > 1$.

In the standard case of a flat rate system, $b_1 = b_2 = b$, we get as a special case $w = \frac{1}{1-1/\varepsilon(w)}b$. The wage rate is a markup over the opportunity cost of employment equal to the benefit loss of sending a worker from unemployment to employment. Lower b means lower w and thus lower u. In the general case, the solution can still be interpreted as a markup over the opportunity cost of employment. A reduction of w

[4] Assumptions A1 and A2 are not always seen as underlying the standard model. If one assumes the simple unemployment dynamic where every member has the same, history independent probability u of becoming unemployed and a flat rate benefit system, then the trade union can optimize for each period separately and A1 and A2 are not needed. However, realistically unemployment risks depend on former unemployment records, see e.g. Layard et al. (1991), p. 226. When this is the case, members may have conflicting interests, also under a flat rate system, as their periodwise expected incomes depend on their individual employment records. Assumptions A1 and A2 ensure that the results of the standard monopoly union model also hold under such more general and realistic unemployment dynamics. Thus, assumption A3 is what we really need in excess of the assumptions in the standard monopoly union model.

and thus u yields the benefit loss $(1-\phi)b_1+\phi b_2$, since the now additionally employed workers would in the long run have been long-term unemployed the fraction ϕ of the time getting b_2 etc. However, when u falls a larger fraction of the unemployed will become short-term unemployed, and hence obtain a benefit gain by going from b_2 to b_1. The total benefit gain equals $\phi\eta(b_1 - b_2) = u\phi'(u)(b_1 - b_2)$, or in words the number of already unemployed times the fraction of them going from long-term to short-term unemployment times the difference between the short-term and long-term benefit levels.

3 Rebalancing Unemployment Benefits

Our interest is in structural reforms which, at an appropriately chosen short-term/long-term rule, rebalance the two rates b_1 and b_2. In particular we investigate under what circumstances such reforms can achieve lower unemployment, higher welfare for all union members, and lower benefit expenditures. With the zero-discounting assumption the total discounted value of future benefit expenditures can be identified with the long run periodwise benefit expenditure,

$$B(w, b_1, b_2) = u\left[(1 - \phi(u))\, b_1 + \phi(u)\, b_2\right], \tag{3}$$

where again $u = u(w)$. In order to illuminate the basic incentive effects at work, consider first the simple, non-structural policy experiment of increasing b_1 leaving everything else unchanged, an unambiguous improvement for the unemployed. Equation (2) shows that an increase in b_1 reduces w if $1 < \phi(u)(1 + \eta(u))$, or stated differently,[5]

$$\frac{1-\phi\left(u\right)}{\phi(u)} < \eta(u). \tag{4}$$

It may be surprising that an improvement in the conditions of the unemployed may imply lower wages and unemployment in an otherwise standard union model. There are, however, two opposite incentive effects involved in an increase in b_1: (i) It makes unemployment better relative to employment to which the union unambiguously responds by increasing w in accordance with the standard result. The size of this effect is proportional to the left hand side of the above condition expressing how heavily the short-term unemployed, now getting higher benefits, weigh in total unemployment. (ii) It makes short-term unemployment better relative to long-term to which the union responds by attempting to push workers from long-term to short-term unemployment. Since ϕ is increasing in u, this can be done only by lowering w and hence u; the right hand side of the above condition measures the strength of this effect, since it indicates how increasing ϕ is in u.

Although we do not claim that condition (4) is likely to be fulfilled for plausible short-term/long-term rules, the above indicates that the effects of changing benefits may be far less pronounced if what is changed is a temporary benefit level b_1 rather than an ever lasting b, as normally presumed in trade union models. Since most countries have an end to the unemployment benefit period this could be a reason

[5] This argument uses the second order condition. The total effect of a change in b_1 is determined by the first order condition $\Omega_w(w, b_1, b_2) = 0$. From the Implicit Function Theorem,

$$\frac{dw}{db_1} = -\frac{\Omega_{wb_1}\left(w, b_1, b_2\right)}{\Omega_{ww}\left(w, b_1, b_2\right)} = -u'\left(w\right)\frac{1-\phi\left(u\right)\left(1+\eta\left(u\right)\right)}{\Omega_{ww}\left(w, b_1, b_2\right)},$$

which is negative exactly under the stated condition because $\Omega_{ww} < 0$.

why it has been hard empirically to document large significant effects on wages and unemployment of changing unemployment benefits.[6]

An increase in b_2 leads unambiguously to an increase in w. As usual, it makes unemployment better relative to employment, which pulls the wage rate upwards, but in addition, it makes short-term unemployment worse relative to long-term, which raises the wage further.

Now, suppose that the rise in b_1 considered above is combined with a reduction of b_2. This implies that it is possible to get rid of effect (i) and at the same time reinforce (ii). One is then left with an incentive effect unambiguously pulling the wage rate, and hence unemployment, downwards. This wage moderation effect works entirely through the incentives of the union to move workers from long-term unemployment to short-term unemployment. It is therefore completely different from the standard wage moderation effect arising from a general reduction of the benefit levels. In particular, a lower wage rate can be obtained without reducing worker welfare, as we prove below. Since labour demand is more than unit elastic at the old equilibrium, the lower wage rate implies a higher wage bill, and since total worker welfare comes from the wage bill plus the benefit bill, this also gives room for lower benefit expenditures. This gives the intuition for Theorem 1.

Theorem 1 *Assume A1 and A2, and consider a rule distinguishing between short-term and long-term unemployment such that A3 is fulfilled. Then for any initial*

[6] Atkinson and Micklewright (1991) note that empirical studies from UK and US indicate that a 10 percentage point increase in the replacement ratio (ratio of benefits to earnings in work) will increase average duration of unemployment by only about one week.

two benefit rates b_1, b_2, where $b_2 > 0$, it is possible to rebalance the benefit rates to a higher b_1 and a lower b_2, such that worker welfare, Ω, increases, benefit expenditures, B, decrease, and unemployment, u, falls.

Proof. We start by looking at an increase in b_1 and a corresponding reduction in b_2 (from an initial situation where $b_2 > 0$), such that Ω is kept constant. Thus, a rebalancing has to fulfill $\Omega(w, b_1, b_2) = \bar{\Omega}$, and from the first order condition, $\Omega_w(w, b_1, b_2) = 0$. Total differentiation of $\Omega(w, b_1, b_2) = \bar{\Omega}$ with respect to b_1, b_2, and w, and use of $\Omega_w(w, b_1, b_2) = 0$, give the following reduction in b_2,

$$\frac{db_2}{db_1} = -\frac{1-\phi(u)}{\phi(u)}.$$

Total differentiation of $\Omega_w(w, b_1, b_2) = 0$, and insertion of db_2/db_1 gives,

$$\frac{dw}{db_1} = -\frac{\Omega_{wb_1}(w, b_1, b_2)\,\phi(u) - (1-\phi(u))\,\Omega_{wb_2}(w, b_1, b_2)}{\phi(u)\;\Omega_{ww}(w, b_1, b_2)}.$$

After derivation of Ω_{wb_1} and Ω_{wb_2} from (1), the expression becomes

$$\frac{dw}{db_1} = \frac{u'(w)\,\eta(u)}{\Omega_{ww}(w, b_1, b_2)}.$$

This is negative since $\Omega_{ww} < 0$, $u'(w) > 0$ and $\eta(u) > 0$. This shows that a rebalancing of unemployment benefits that keeps Ω fixed reduces wages and therefore unemployment. The expenditures on benefits can be written as

$$B = \Omega - (1-u)\,w,$$

which shows that the above experiment reduces total benefit expenditures, since $(1-u)\,w$ increases when w decreases because $\varepsilon(w) > 1$. Thus, in this experiment, where Ω is kept fixed, both lower unemployment and lower benefit expenditures are achieved. By continuity, with a slightly smaller reduction of b_2, one would also obtain higher Ω, and still lower u and B. ■

Theorem 1 implies that both flat rate systems, $b_2 = b_1 = b > 0$, and systems with positive duration dependence, $b_2 > b_1 \geq 0$, can be (Pareto) improved by increasing b_1 and decreasing b_2. Thus, the optimal benefit system has negative duration dependence. In fact, it is optimal to continue the rebalancing until $b_2 = 0$. It may therefore be argued that the analysis supports the limited duration benefit system used by most countries. However, this last conclusion does not necessarily apply when workers are risk averse, whereas Appendix A demonstrates that Theorem 1 still holds when union members are risk averse (having periodwise utility functions which are concave rather than linear in income) and do not have access to capital markets, but only if $b_2 \geq b_1$. Therefore, the overall conclusion from this section is that an optimal benefit system involves negative duration dependence if there is only minor discounting.

4 On Discounting

Theorem 1 was derived under an assumption of zero discounting. This was done in order to ensure the analytical advantages of a well-defined union objective and a simple static model. Turning to discounting it follows from pure continuity that the result would still hold in an appropriately formulated model with positive discounting as long as the interest rate by which the future is discounted is sufficiently small.[7] One could suspect, however, that for realistic interest rates, say yearly real rates in the range of $3-5$ per cent, the result would disappear. We now turn to that question.

For A1 we substitute,

A1'. There is a common interest rate, $\rho > 0$, by which the future is discounted by everybody (workers, union, government).

Assume that up to and including period zero there has been a flat rate system with benefit level $b > 0$. From period 1, a reform introduces a system with negative duration dependence, $b_1 > b > b_2$, at a specific short-term/long-term rule. Workers will then have conflicting interests even a priori period 1. Those who have experienced much unemployment in the past will, if they become unemployed in period 1, fall for the long-term criterion and receive the low benefit rate, b_2, while those who have experienced only little past unemployment will get the high benefit rate, b_1. Under zero discounting this difference in the early periods after a reform does not matter, but with discounting it does. Those receiving a low benefit rate will, ceteris paribus, be more interested in a wage reduction which increases the likelihood of becoming employed. Furthermore, it will be more difficult to obtain a Pareto improvement through a rebalancing of the benefit rates since the most unfortunate will, in the early periods after a reform, receive the lower b_2 if they

[7] An "appropriately formulated model" could, e.g., use the union objective considered below and a Pareto improvement could then be obtained for sufficiently small interest rates.

continue to be unemployed.

The question is now whether the Pareto dominance of negative duration dependence also holds with realistic interest rates given an appropriately defined objective of the union. This can only be investigated in a truly dynamic model, and to keep the analysis tractable we will have to be more specific on issues where we were quite general before. We still assume that the wage rate is set by the union to be the same forever, and to simplify we also assume that labour demand is isoelastic, $\varepsilon(w) = \varepsilon > 1$. With respect to the unemployment dynamic we substitute for A2 the simple dynamic,

A2'. In each period all union members have the same probability of unemployment (equal to the period's overall unemployment rate, u),

and with respect to the short-term/long-term rule we substitute for A3 the simplest possible one,

A3'. The rule used in the unemployment benefit system to distinguish between short-term and long-term unemployment states that a worker who is unemployed in a specific period is long-term unemployed if he was also unemployed in the period before and short-term unemployed otherwise.[8]

In view of A3' and the benefit systems actually existing or proposed in different countries, the period length should perhaps be thought of as being in the range $\frac{1}{2} - 1$

[8] Cahuc and Lehmann (2000) also assume that an unemployed is long-term unemployed after only one period of unemployment, and that short-term unemployed and long-term unemployed have the same risk of becoming unemployed in each period.

year, and then realistic periodwise interest rates ρ would be in the range $1\frac{1}{2}-5$ per cent. With A2' and A3', the incidence function ϕ is simply $\phi(u)=u$, and hence $\eta(u)=1$. Further, A2' and A3' imply that the only period of the past that matters is the last one before the reform, period zero. Let the rate of unemployment in that period be u_0 whereas the unemployment rate prevailing after the reform is given by $u=u\left(w\right)$ like in the previous analysis.

As said, there is no longer common interests between the union members. It is therefore open for discussion what the union should try to maximize. We consider the following general objective function

$$\Omega=\alpha\Omega^u+\left(1-\alpha\right)\Omega^e, \quad 0<\alpha<1, \tag{5}$$

where Ω^u is the expected discounted income of a worker who was unemployed in period 0,

$$\Omega^u=\left(1-u\right)w+ub_2+\sum_{t=2}^{\infty}\left(1+\rho\right)^{-(t-1)}\left[\left(1-u\right)w+u\left(\left(1-u\right)b_1+ub_2\right)\right],$$

or

$$\Omega^u=\left(1-u\right)w+ub_2+\frac{1}{\rho}\left[\left(1-u\right)w+u\left(\left(1-u\right)b_1+ub_2\right)\right], \tag{6}$$

Ω^e is the expected discounted income of a worker who was employed in period 0,

$$\Omega^e=\left(1-u\right)w+ub_1+\frac{1}{\rho}\left[\left(1-u\right)w+u\left(\left(1-u\right)b_1+ub_2\right)\right], \tag{7}$$

and α is a parameter that determines the weight given to the two types by the union. Special cases of this objective are $\alpha=u_0$ corresponding to a "utilitarian" union which maximizes the average utility of the members and $\alpha=0$ corresponding to an "insider" union which maximizes utility of only those employed in period 0. Note also that the only difference between the two types of workers is that the previously unemployed receive b_2 if unemployed the first period after the reform whereas the previously employed receive b_1. From period 2 and onwards the unemployment history before the reform does not matter any longer.

As before we assume that the equilibrium wage rate of the union is given uniquely by the first order condition and is interior. From the first order condition, $\Omega_w = 0$, one gets the wage setting rule

$$w = \frac{1}{1+\rho} \frac{b_1 (1+\rho) - (2u + \rho\alpha)(b_1 - b_2)}{1 - 1/\varepsilon}, \tag{8}$$

where $u = u(w)$. Note that

$$\lim_{\rho \to 0} w = \frac{b_1 - 2u(b_1 - b_2)}{1 - 1/\varepsilon},$$

which is exactly the optimal wage under zero discounting given by formula (2), when we in that formula insert $\phi = u$ and $\eta = 1$.

Initially, in period zero, there is a flat rate benefit system or one with positive duration dependence, $b_2 \geq b_1 > 0$, and from period 1, the rates are rebalanced to higher b_1 and lower b_2. As before we ask if such a rebalancing can give a Pareto improvement by increasing both Ω^u and Ω^e and reducing the present value of future benefit expenditures given by

$$B = u\left[(1-u_0) b_1 + u_0 b_2\right] + \sum_{t=2}^{\infty} (1+\rho)^{-(t-1)} u\left[(1-u) b_1 + u b_2\right],$$

or

$$B = u\left[(1-u_0)\,b_1 + u_0 b_2\right] + \frac{u}{\rho}\left[(1-u)\,b_1 + u b_2\right]. \tag{9}$$

Theorem 2 *Assume A1' to A3'. If* $\rho < \frac{u_0}{1+u_0-\alpha}$ *then for any initial two benefit rates* b_1, b_2*, where* $b_2 \geq b_1 > 0$*, it is possible to rebalance the benefit rates to a higher* b_1 *and a lower* b_2*, such that welfare increases for all workers, benefit expenditures decrease, and unemployment falls.*

Proof. See Appendix B.

The scope for a Pareto improvement depends on the weight given to the two types in the union objective function. If the union cares only about previously unemployed union members, $\alpha = 1$, the condition for an improvement is just that the real interest rate is below 100%. For a utilitarian union, $\alpha = u_0$, the requirement is that the initial unemployment rate is above the real interest rate. Finally, the requirement is strongest with an insider union, $\alpha = 0$, where the condition becomes $\rho < u_0/(1+u_0)$.

We have argued above that relevant interest rates are perhaps to be found in the range $1\frac{1}{2} - 5$ per cent. This implies that there is scope for a Pareto improvement by going from a flat rate benefit system to one with negative duration dependence if there is a substantial unemployment problem to deal with initially, say an unemployment rate that is above 5 per cent after excluding frictional unemployment. For what they are worth, these numerical exercises at least suggest that the Pareto improvement which exists generally under zero discounting does not necessarily disappear with realistic levels of discounting. Rather they point to the opposite: that the scope for a Pareto improvement survives realistic discounting whenever there is substantial unemployment initially.

Theorem 2 also has the implication that an "optimal" benefit system involves negative duration dependence as long as the above condition on discounting is fulfilled, and we restrict attention to simple rules where one falls for the long-term criterion only after a certain period of uninterrupted unemployment.[9]

5 Conclusion

We have generalized the basic monopoly union model to encompass unemployment benefit systems where benefits depend on the duration of unemployment. This is in contrast to standard theory on trade unions which assumes that all unemployed receive the same benefit rate independently of unemployment duration. We have focused on reforms that rebalance the benefit rates for different durations in favour of the short-term unemployed. Our results show that such reforms can reduce unemployment, increase utility of all union members, and reduce benefit expenditures in unionized labour markets if the initial unemployment and the real interest rate are within realistic limits. This holds at least when the initial benefit system has no or positive duration dependence implying that negative duration dependence is optimal.

[9] It is essentially used in the proof of Theorem 2 that one starts from an initial situation of $b_1 \leq b_2$. So, under realistic discounting it does not follow that an optimal system is of limited duration, i.e. $b_2 = 0$, like in the no discounting case. However, it cannot be concluded either that the optimal system is never of limited duration.

It may be argued that in the real world it is not possible to achieve a Pareto improvement by a rebalancing of the benefit rates, since there are persons who will never get a job. These will often receive the benefit rate valid for long-term unemployed and when this is reduced they will experience a permanent income loss. It is therefore important to point out that our analysis should be viewed as a contribution to the theory of optimal unemployment insurance/compensation, not to the theory of poverty alleviation.

Focusing on optimal unemployment insurance puts emphasis on the case of risk averse workers. Risk aversion does not matter if workers have perfect access to capital markets since they are then only concerned with expected income as we have assumed. Turning to the other extreme case, where workers do not have access to capital markets at all, we have shown in Appendix A that it is still possible to make a (Pareto) improvement by going from a system with no or positive duration dependence to one with negative duration dependence. A deviation from a flat benefit rate reduces the insurance value of the benefit system, and creates thereby a welfare loss if workers are risk averse. This only reinforces the welfare gain of rebalancing if the initial system has positive duration dependence. With no duration dependence there is a negative welfare effect but only of second order. It does not immediately follow from these extreme cases, however, that our results also hold when workers have access to a limited credit market. If credit opportunities decrease with the duration of unemployment, consumption of an unemployed worker may decrease with the length of the unemployment spell implying that marginal utility is higher for long-term unemployed than for short-term unemployed. A rebalancing will then give a negative first order insurance effect even with no duration dependence initially. This could limit the scope for rebalancing in favour of short-term unemployed.

The possibility of a Pareto improvement in our analysis depends crucially on the assumption that wage setters take into account how they affect unemployment on their labour market. The beneficial effect vanishes under a purely decentralized, insider wage determination where wage setters do not take this into account. However, a trade union should care about aggregate unemployment because it influences the probability of unemployment not only for those already unemployed, but also for the employed. Thus, we believe that our results are relevant for labour markets where wages are highly influenced by trade unions.

For instance, for unskilled workers in Denmark unemployment is high, unions are encompassing and, according to empirical work, strong in wage determination. Since wages are low for the unskilled and the benefit level is more or less the same for all, benefits are also very high relative to wages. Furthermore, it is possible to receive the same benefit level for up to five years.[10] It is often advocated, for instance with reference to trade union theory, that benefits for unskilled workers must be reduced in order to bring down unemployment. It is counterargued, however, that such a reduction would hurt exactly those who are already among the poorest and this argument seems to prevent reforms. Our analysis suggests that an

[10] After one year a recipient has to participate in some kind of labour market program, but the monetary compensation to the unemployed continues to be the same.

interesting alternative to a general benefit cut, and one that may have acceptable distributional consequences, could be to introduce, e.g., a 6 months duration criterion in the benefit system and let benefits be even higher during the first 6 months of unemployment, and lower afterwards.

Anyhow, introduction of duration criteria in benefit systems and rebalancing of benefit rates valid for different unemployment durations should, when it comes to fighting unemployment, be considered as an interesting alternative to the often advocated general benefit cuts, which are usually motivated with reference to labour market theories such as the trade union model.

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A Risk Aversion

Here, we consider the case where members have a strictly concave periodwise utility function over consumption of a non-storable good and where there is no access to capital markets. This implies that workers consume their entire income in each period. We assume that the flow utility is characterized by the strictly concave function $v(x)$, where x is the flow income equal to w, b_1, or b_2 depending on the current state of the worker. We prove that Theorem 1 is unchanged if the initial equilibrium is characterized by no or positive duration dependence, $b_1 \leq b_2$.[11] Now, the objective function of the union is

$$\Omega(w, b_1, b_2) = v(w)(1 - u(w)) + u(w)[(1 - \phi(u(w)))v(b_1) + \phi(u(w))v(b_2)]$$

$\Rightarrow$

$$\begin{aligned} \Omega_w(w, b_1, b_2) &= v'(w)(1 - u(w)) - u'(w)[v(w) - v(b_1)] - \\ &\quad u'(w)[\phi(u(w)) + u(w)\phi'(u(w))][v(b_1) - v(b_2)]. \end{aligned}$$

The rates b_1 and b_2 are again rebalanced so as to keep Ω fixed. Total differentiation of $\Omega(w, b_1, b_2)$, and the first order condition, $\Omega_w(w, b_1, b_2) = 0$, give

$$\frac{db_2}{db_1} = -\frac{\Omega_{b_1}(w, b_1, b_2)}{\Omega_{b_2}(w, b_1, b_2)} = -\frac{1 - \phi(u(w))}{\phi(u(w))}\frac{v'(b_1)}{v'(b_2)}.$$

Total differentiation of the first order condition, $\Omega_w(w, b_1, b_2) = 0$, yields

$$\frac{dw}{db_1} = -\frac{\Omega_{wb_1}(w, b_1, b_2) + \Omega_{wb_2}(w, b_1, b_2)\frac{db_2}{db_1}}{\Omega_{ww}(w, b_1, b_2)}.$$

[11] There may still be scope for a Pareto improvement if $b_1 > b_2$ initially, but not necessarily. Thus, a limited duration benefit system, i.e. $b_2 = 0$, needs not be optimal when workers are risk averse. And if it is assumed that the marginal utility of income converges to infinity when income converges to zero, it will never be optimal to have such a system.

Inserting $\frac{db_2}{db_1}$ and the two derivatives $\Omega_{wb_1}(w, b_1, b_2)$ and $\Omega_{wb_2}(w, b_1, b_2)$ gives

$$\frac{dw}{db_1} = \frac{u'(w)\,\eta(u(w))\,v'(b_1)}{\Omega_{ww}(w, b_1, b_2)},$$

which is negative since $\Omega_{ww}(w, b_1, b_2) < 0$ is the second order condition of the union's problem.

Differentiation of (3) yields

$$\begin{aligned}\frac{dB(w, b_1, b_2)}{db_1} &= u(w)\left(1 - \phi(u(w))\right) + u(w)\phi(u(w))\frac{db_2}{db_1} \\ &+u'(w)\left(b_1 - \phi(u(w))\left(1 + \frac{u(w)\phi'(u(w))}{\phi(u(w))}\right)(b_1 - b_2)\right)\frac{dw}{db_1}.\end{aligned}$$

Inserting $\frac{db_2}{db_1}$ from above gives

$$\begin{aligned}\frac{dB(w, b_1, b_2)}{db_1} &= u(w)\left(1 - \phi(u(w))\right)\left(1 - \frac{v'(b_1)}{v'(b_2)}\right) \\ &+u'(w)\left(b_1 - \phi(u(w))\left(1 + \eta(u)\right)(b_1 - b_2)\right)\frac{dw}{db_1},\end{aligned}$$

from which it follows that $\frac{dB(w,b_1,b_2)}{db_1} < 0$ if $b_1 \leq b_2$. Now, by decreasing b_2 a little less one can obtain higher Ω and still fulfill the other goals. ■

B Proof of Theorem 2

Using equations (5), (6), and (7), the objective function of the union can be written

$$\Omega(w, b_1, b_2) = (1 - u)\,w + u\left[\alpha b_2 + (1 - \alpha)\,b_1\right] + \frac{1}{\rho}\left[(1 - u)\,w + u\left((1 - u)\,b_1 + ub_2\right)\right].$$

The wage equation (8) is derived from the first order condition $\Omega_w(w, b_1, b_2) = 0$ where

$$\begin{aligned}\Omega_w(w, b_1, b_2) &= (1 - u - u'(w)\,w)\left(1 + \frac{1}{\rho}\right) + u'(w)\left[\alpha b_2 + (1 - \alpha)\,b_1\right] \\ &+\frac{1}{\rho}u'(w)\left[b_1 - 2u\,(b_1 - b_2)\right].\end{aligned}$$

We consider the consequence of a rebalancing of b_1 and b_2 from an initial situation where $u(w_0) = u_0$, such that the utility of workers who where unemployed in period 0, $\Omega^u(w, b_1, b_2)$, is kept fixed during the change. Thus, a solution has to fulfill,

$$\Omega^u(w, b_1, b_2) = \bar{\Omega}^u, \tag{10}$$

$$\Omega_w(w, b_1, b_2) = 0. \tag{11}$$

A marginal rebalancing of b_1 and b_2 that keeps Ω^u fixed requires,

$$\Omega^u_w(w_0, b_1, b_2)\, dw + \Omega^u_{b_1}(w_0, b_1, b_2)\, db_1 + \Omega^u_{b_2}(w_0, b_1, b_2)\, db_2 = 0,$$

or,

$$\frac{db_2}{db_1} = -\frac{\Omega^u_w(w_0, b_1, b_2)\frac{dw}{db_1} + \Omega^u_{b_1}(w_0, b_1, b_2)}{\Omega^u_{b_2}(w_0, b_1, b_2)}. \tag{12}$$

From (6), we get

$$\Omega^u_{b_1}(w_0, b_1, b_2) = \frac{1}{\rho}u_0(1 - u_0),$$
$$\Omega^u_{b_2}(w_0, b_1, b_2) = u_0\left(1 + \frac{1}{\rho}u_0\right),$$
$$\Omega^u_w(w_0, b_1, b_2) = \Omega_w - u'(w_0)(b_1 - b_2)(1 - \alpha),$$

where $\Omega_w = 0$ due to the first order condition of the union. Inserting these derivatives in (12) yields

$$\frac{db_2}{db_1} = -\frac{1 - u_0}{\rho + u_0} + \frac{u'(w_0)(b_1 - b_2)(1 - \alpha)}{u_0\left(1 + \frac{1}{\rho}u_0\right)}\frac{dw}{db_1}. \tag{13}$$

Equation (8) gives

$$\frac{dw}{db_1} = \frac{\varepsilon}{(1 + \rho)(\varepsilon - 1)}\left((1 + \rho) - (2u_0 + \rho\alpha)\left(1 - \frac{db_2}{db_1}\right) - 2u'(w_0)\frac{dw}{db_1}(b_1 - b_2)\right).$$

Inserting (13) and simplifying yields

$$\frac{dw}{db_1} = \frac{(1-\alpha)\left(\rho - \frac{u_0}{1-\alpha}\right)}{\frac{\varepsilon-1}{\varepsilon}(\rho+u_0) - u'(w_0)(b_1-b_2)\left(\frac{\rho^2\alpha(1-\alpha)}{u_0(1+\rho)} - \frac{2(\alpha\rho+u_0)}{1+\rho}\right)}. \tag{14}$$

The numerator is negative if $\rho < \frac{u_0}{1-\alpha}$ which is fulfilled due to the condition in Theorem 2. We now show that the second order condition implies that the denominator is positive. First note that the initial condition $b_2 \geq b_1$ implies that the denominator is most negative when $\alpha = 1$. Thus, a sufficient condition for a positive denominator is

$$\frac{\varepsilon-1}{\varepsilon}(\rho+u_0) + u'(w_0)(b_1-b_2)\frac{2(\rho+u_0)}{1+\rho} > 0. \tag{15}$$

The second order condition is $\Omega_{ww} < 0$, where

$$\begin{aligned}\Omega_{ww} &= u'(w_0)\left(-2 - \frac{u''(w_0)w_0}{u'(w_0)}\right)\left(1+\frac{1}{\rho}\right) + \frac{u''(w_0)}{\rho}\left(b_1(1+\rho) - (2u_0+\rho\alpha)(b_1-b_2)\right) \\ &\quad -\frac{2}{\rho}(b_1-b_2)\left(u'(w_0)\right)^2.\end{aligned}$$

From the labour demand curve, we have $\frac{w_0 u''(w_0)}{u'(w_0)} = -(1+\varepsilon)$ implying

$$\begin{aligned}\Omega_{ww} &= u'(w_0)(\varepsilon-1)\frac{1+\rho}{\rho} - \frac{(1+\varepsilon)u'(w_0)}{\rho}\frac{b_1(1+\rho) - (2u_0+\rho\alpha)(b_1-b_2)}{w_0} \\ &\quad -\frac{2}{\rho}(b_1-b_2)\left(u'(w_0)\right)^2.\end{aligned}$$

Inserting w_0 from equation (8) yields the second order condition:

$$\Omega_{ww} = -u'(w_0)\left(\frac{\varepsilon-1}{\varepsilon}\frac{1+\rho}{\rho}\right) - \frac{2}{\rho}(b_1-b_2)\left(u'(w_0)\right)^2 < 0,$$

or

$$-\frac{\varepsilon-1}{\varepsilon}(1+\rho) < 2(b_1-b_2)u'(w_0).$$

From this inequality it is now straightforward to show that (15) is fulfilled. Thus, $\frac{dw}{db_1} < 0$.

Turning to benefit expenditures, equation (9) yields,

$$\begin{aligned}\frac{dB}{db_1} &= u_0\left(1-u_0+u_0\frac{db_2}{db_1}\right)(1+1/\rho)+u'(w_0)\left((1-u_0)b_1+u_0b_2\right)(1+1/\rho)\frac{dw}{db_1}\\&-\frac{1}{\rho}u_0u'(w_0)(b_1-b_2)\frac{dw}{db_1},\end{aligned}$$

or,

$$\frac{dB}{db_1}=u_0\left(1-u_0+u_0\frac{db_2}{db_1}\right)(1+1/\rho)+\frac{dw}{db_1}\frac{u'(w)}{\rho}\left(b_1(1+\rho)-(b_1-b_2)u_0(2+\rho)\right),$$

or,

$$\begin{aligned}\frac{dB}{db_1} &= u_0\left(1-u_0+u_0\frac{db_2}{db_1}\right)(1+1/\rho)-\frac{dw}{db_1}\frac{u'(w)}{\rho}(b_1-b_2)\rho(u_0-\alpha)\\&+\frac{dw}{db_1}\frac{1-u_0}{\rho}\frac{u'(w)w_0}{1-u_0}\frac{b_1(1+\rho)-(b_1-b_2)(2u_0+\rho\alpha)}{w_0}.\end{aligned}$$

Inserting $\frac{u'(w)w_0}{1-u_0}=\varepsilon$ and w_0 from equation (8) yields

$$\begin{aligned}\frac{dB}{db_1} &= u_0\left(1-u_0+u_0\frac{db_2}{db_1}\right)(1+1/\rho)-\frac{dw}{db_1}\frac{u'(w_0)}{\rho}(b_1-b_2)\rho(u_0-\alpha)\\&+\frac{dw}{db_1}\frac{1-u_0}{\rho}(1+\rho)(\varepsilon-1),\end{aligned}$$

and after inserting (13), we have

$$\frac{dB}{db_1}=(1+\rho)u_0\frac{1-u_0}{\rho+u_0}+\frac{dw}{db_1}(1-u_0)\left(u'(w_0)(b_1-b_2)\frac{u_0+\rho\alpha}{\rho+u_0}+\frac{1+\rho}{\rho}(\varepsilon-1)\right).$$

Inserting (14) gives

$$\frac{dB}{db_1}=(1+\rho)u_0\frac{1-u_0}{\rho+u_0}+\frac{(1-\alpha)\left(\rho-\frac{u_0}{1-\alpha}\right)(1-u_0)\left(u'(w_0)(b_1-b_2)\frac{u_0+\rho\alpha}{\rho+u_0}+\frac{1+\rho}{\rho}(\varepsilon-1)\right)}{\frac{\varepsilon-1}{\varepsilon}(\rho+u_0)-u'(w_0)(b_1-b_2)\left(\frac{\rho^2\alpha(1-\alpha)}{u_0(1+\rho)}-\frac{2(\alpha\rho+u_0)}{1+\rho}\right)}$$

$\Leftrightarrow$

$$\frac{dB}{db_1} = \frac{\left(\left(\rho-\varepsilon\right)u_0+\varepsilon\rho\left(1-\alpha\right)\right)\left(1-u_0\right)\frac{\varepsilon-1}{\varepsilon}\frac{1+\rho}{\rho}+u'\left(w_0\right)\left(b_1-b_2\right)\left(1-u_0\right)u_0}{\frac{\varepsilon-1}{\varepsilon}\left(\rho+u_0\right)-u'\left(w_0\right)\left(b_1-b_2\right)\left(\frac{\rho^2\alpha(1-\alpha)}{u_0(1+\rho)}-\frac{2(\alpha\rho+u_0)}{1+\rho}\right)}.$$

The denominator is again positive due to the second order condition. When $b_1 \leq b_2$ a sufficient condition for a negative numerator is $\left(\rho-\varepsilon\right)u_0+\varepsilon\rho\left(1-\alpha\right)<0$, or

$$\rho < \frac{\varepsilon u_0}{u_0+\varepsilon\left(1-\alpha\right)},$$

which is always fulfilled when $\rho < \frac{u_0}{1+u_0-\alpha}$. Thus, when this condition is fulfilled it is possible to reduce u, reduce B, and keep Ω^u fixed. The only difference between a worker who was unemployed in period 0 and one who was employed is that the former obtains a lower b_2 if unemployed after the rebalancing whereas the latter receives a higher b_1 if unemployed. Therefore, it follows that Ω^e increases in the above experiment. By continuity, with a slightly smaller reduction of b_2, one would also obtain higher Ω^u, and still fulfill the other goals. ■

Figure 1

Fraction of unemployment carried by long-term unemployed as function of unemployment. Annual data from 1979 to 1998.