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when Unemployment Benefits are linked to Wages

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Abstract:

Unions and the Link: Wage determination by a single encompassing trade union when unemployment benefits are linked to wages.

J.A. Vijlbrief, R.F. van de Wijngaert

In this paper, we introduce a model which analyzes the wage and employment effects of linking the level of unemployment benefits to the wage rate. We have based the government's behaviour on its empirical significance. Therefore, the government is assumed to apply simple policy rules, which correspond to policies that were actually used in the Netherlands over the 1970-1991 period. Due to this specification, the model describes constrained utility maximization by the union.

Under some general assumptions, the model yields the following predictions. Firstly, if the government prefers to fix the level of benefits, wages are lowest and, assuming a negatively sloped labour demand curve, employment is highest. Secondly, if the government decides to link the level of benefits to private sector wages, the wage rate will be highest, and hence, employment lowest. Thirdly, if the government decides to make the link conditional, the wage and employment outcomes are between these extreme outcomes. Estimations of an equilibrium wage equation for the Netherlands do not reject the hypothesis that the equilibrium wage rate is lower if the link is abolished.
In the Netherlands, social security benefits are automatically indexed to market sector wages by the so-called 'link'. The restoration of the link by the third Lubbers government in 1990 was a victory for the social-democrats, who regard the link as an important instrument for an equitable income policy. However, the linking of benefits to private sector wages caused serious financial problems for the Dutch government in the 1970s: wage increases in lead of labour productivity growth and unfavourable external conditions raised unemployment in the Netherlands and, consequently, increased expenditures for social security. Therefore, the restoration of the link was conditional. First, the ratio of active versus inactive people should not fall and second, having learned from the experience in the seventies, the development of private sector wages should not be 'irresponsible', i.e. the rise in wages should not endanger private sector employment.

In 1990, unfavourable developments for the government budget have caused a continuous discussion about the link: can the Dutch government afford the automatic indexation of benefits to wages? A major point in answering this question is whether the rise in private sector wages is not too high. In this paper, the effects of the link on wages and employment are studied. It has already been shown that the link itself can be responsible for high union wage claims and deteriorating employment, in the case of an unconditional indexation of benefits to private sector wages (see Mulder, 1988a). The reasoning behind this result is simple: the trade union will be stimulated to raise the wage rate when unemployment benefits rise with private sector wages. However, the present model accounts for the conditionality of the link in the Netherlands: the abolishment of the link is very likely when the government experiences financial problems.

In this paper we focus on the wage and employment effects of the automatic indexation of unemployment benefits to private sector wages, assuming that the Dutch government follows a simple policy rule: it aims at the maintenance of balanced-budget and stabilization of the burden of taxation. If the link causes too much additional government expenditures, it will be abolished in order to prevent taxes from rising. Neither a larger budget deficit, nor a cut in its expenditure on public goods are seen as alternatives for the abolition of the link. Hence, we assume that the two conditions, actually used by the Dutch government (stabilization of the ratio between working and non-working people and a moderate wage increase), are merely instruments to attain the goal of stabilizing the tax rate.

A rational trade union will take this policy rule into consideration when setting
the wage rate. Hence, by making the link conditional, the government mitigates the adverse effects of the link on the wage rate and employment. From an efficiency point of view one might still prefer the abolition of the link, but the costs of the link (in terms of a loss in employment) should not be exaggerated. In the Calmfors and Driffill (1988) framework, a conditional link can be regarded as a policy instrument to internalize part of the external costs of the link: the unions are forced into responsibility for the maintenance of the link. This policy can be regarded as a 'corporatist alternative' to the complete abolition of the link.

In Section 2 of this paper, we give a short survey of the literature on this subject. Section 3 contains an outline of the model, whereas Section 4 discusses the effects of different benefit and tax policies, including a policy that conditionally links benefits to wages. Section 5 investigates whether the data reject the hypothesis that wages in the Netherlands are raised by the linking of benefits to private sector wages. Section 6 summarizes this paper.

2 SURVEY OF THE LITERATURE

In the 1950s, the theory on wage determination to a great extent relied on the Phillips-curve, which explains wage increases by excess demand in the labour market. Despite its empirical success, the Phillips-curve has been criticised on two grounds. First, it is theoretically unsatisfactory to assume monopsony in the labour market as the Phillips-curve does. Second, it ignores institutions in the labour market, such as the trade union.

The theory on wage determination in the 1960s and 1970s paid only little attention to the modelling of the trade union in the labour market. The literature on wage formation in the 1980s, conversely, has integrated the wage setting behaviour of trade unions into mainstream theory. In this type of models a single trade union is assumed to maximise a well-defined utility function under given constraints of the employer's behaviour. Oswald (1982) has popularised Dunlop's (1944) 'monopoly union model' in which the union is assumed to set the wage level, whereas the employer determines the level of employment. Nickell and Andrews (1983) have challenged this view, assuming that union and employers bargain over wage and employment (the so-called 'right to manage model'). Nevertheless, McDonald and Solow (1961) have argued that these models do not share the Pareto efficiency criterion so that unions and employers are better off bargaining over wages and employment simultaneously, as in the 'efficient bargaining model'.
The atomistic bargaining models have been devised to describe decentralised markets. But, for many European countries, bargaining takes place at the intermediate or centralised level, where (a) trade union federation(s) face(s) (an) employers organization(s) and the government. Under these conditions, not only does the government take the behaviour of unions into account when formulating its policy, trade unions also have to consider government reactions when bargaining. Economic policy and wage setting can, therefore, be analyzed as a game between the government and the trade union. In order to study centralised wage determination, a three parties bargaining model has emerged in the literature, in which a single encompassing trade union is involved in two games: one game with an employers’ organization and one with the government. In the earlier contributions, the government pursues an active employment policy (see e.g. Calmfors and Horn, 1986, Hersoug, 1986, and Driffill, 1986), whereas later contributions focus on income policies (Mulder, 1988a).

The three parties bargaining model is, however, not undisputed (Calmfors, 1986). First, the assumption that the union sets the wage, whilst the employer sets employment (the monopoly union model) ignores wage bargaining, which is a widely observed phenomenon in Europe. However, there is little need to specify explicit wage bargaining between the union and the employer, since Oswald (1986) has shown that the predictions of the monopoly union model are similar to the 'right to manage model'. Furthermore, employers’ organizations are usually not empowered to bargain the level of employment in negotiations at the national level (at least not in the Netherlands), making it unnecessary to use the efficient bargaining model.

A second problem constitutes the modelling of government preferences. The government may either be conceived of maximising a social welfare function, or it may be assumed to carry out a policy rule, prescribing a policy which is at issue at that moment. The advantage of a social welfare function, including the level of private consumption (as in Mulder, 1988a) or a loss-function (as in: Driffill, 1986, and Hersoug, 1986), is that government behaviour can be analyzed in line with the standard game-theoretical literature. Alternatively, by specifying simple policy rules (i.e. reaction functions, as in Calmfors and Horn, 1986), the government’s behaviour is not derived from explicit optimization.

The modelling of the game between the government and the trade union comprises the third problem. If the game is confined to one period, co-operative solutions are ruled out since they are either very unstable (Hersoug, 1986, 141-145) or
unenforceable without commitment (Driffill, 1986). However, by playing the game repeatedly, as in multi-period games, both punishments and rewards and reputation-effects come into play. The 'Folk Theorem' then predicts that it becomes more likely that two players will play co-operatively, if they do not see a time-horizon looming (Kreps, 1990). Nevertheless, for democratic societies, it can hardly be maintained that the same government will be in power for ever. Therefore, it is our view that in repeated games with a relative low number of game stages, co-operative behaviour is not very likely.

If the union-government game is played unco-operatively, two possible game-theoretical solution concepts emerge: the Nash- and the Stackelberg-equilibrium. If both players are assumed to make their moves simultaneously (as in Mulder, 1988a), the Nash-equilibrium is the appropriate solution to the game. Conversely, in the Stackelberg-equilibrium the government, being the leader, announces its (fiscal) policy first (see e.g. Driffill, 1986) and subsequently, the union sets the wage. In this paper, the game between the government and the union is not explicitly modelled, since compared to trade union preferences, the modelling of government utility takes a rather ad-hoc character and is not satisfactory formalised. Furthermore, we consider policy rules to be closest to the actual situation in the Netherlands with regard to the link. Therefore, in this paper, it is assumed the government sets a policy rule, so that our model boils down to utility maximization by the union under the constraint of a policy rule. This position of the government is rather close to being the Stackelberg-leader in a game with the union, if the government is implicitly assumed to maximize its utility by setting a certain policy rule. Then, the government announces its tax and benefit policy and the union sets its wage subsequently.

After having discussed atomistic and centralised wage determination, we now examine how wage determination at the intermediate level (at branch or sector level)

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1 The 1972 and the 1982 agreements between the trade union federations, the employers' federations and the government may be interpreted as the only two examples of co-operative solutions since 1963 in the Netherlands.

2 Since, each player has the incentive to play unco-operatively in the final round, he also have the incentive to play the same in the final but one round, and therefore in the final but two round, etc... (see e.g., Kreps, 1990).

3 Public choice literature suggests that a government who wants to be re-elected may have a utility function which depends on more economic variables (the rate of inflation, the number of unemployed, the economic growth rate, and/or the size of the public sector, see e.g. Nordhaus, 1975, and Frey, 1978, cited in Van Winden, 1990), than those specified in the private welfare functions (Mulder, 1988a) or the loss-function (Hersoug, 1986 and Driffill, 1986).
differs from the centralised level. The simplest way to illustrate the effect of a decentralisation is by means of the 'monopoly union model', assuming that the wage rate is now set in two sectors and thus by more than one union (see e.g.: Gylfason and Lindbeck, 1984a and 1984b, Calmfors and Drifill, 1988, Mulder, 1988b, Jacobs and Janssen, 1990). In this model, unions will set higher nominal wages due to three effects. Firstly, there may be a price effect. If one union increases its wage, it induces the union in the other sector to act similarly, because the latter's utility is threatened by a loss in purchasing power due to increased prices which result from higher wages in the former sector. Secondly, higher wages for one union may trigger off tax increases due to higher unemployment, which lowers the utility of the other union, which is again induced to increase its wage demands. Thirdly, there may be envy effects, which lower the utility of one union if the other union manages to agree a higher wage. In sum, a movement from the centralised level to a more decentralised level will, under the circumstances described above, lead towards higher wages. In this paper, it is assumed that wage formation in the Netherlands can be adequately described by the assumption of an encompassing trade union. If the separate unions collude, or if they have correct expectations of demand and what the other union does, the relatively low wages, as under centralism, are possible. Moreover, as Jackman (1990) argues, a fall in the aggregate employment rate caused by one union, may depress the re-employment probability for the other union, leading to a lower wage claim by the latter.

3 OUTLINE OF THE MODEL

In order to grasp the essentials, we first discuss a simplified version of the model. We assume that employers have risk-neutral preferences and determine employment according to the labour demand curve, which incorporates the usual property that labour demand (L) is falling in gross wages (w).

\[ L = L(w), \quad L'(w) < 0 \]  \hspace{1cm} (3.1)

---

4 See, Calmfors and Forslund (1990) for some counter arguments.

5 Mulder 1988b, has formalised the tax externality in a fairly simple model, which indeed confirms that decentralised wage setting leads to higher gross wages, reduced levels of employment and sometimes a smaller net wage rate.
Further, it is assumed that there is only one trade union which determines the wage rate, so that we apply the monopoly union model (see Oswald 1982, and 1986) to the game between the union and the firms.

The trade union is assumed to maximise the sum of its members utility, subject to the labour demand curve (3.1),

\[ \max_w U(w, L) = Lu(w_n) + (M-L)u(b) \quad u'>0, u''<0 \]  

(3.2)

where \((w_n)\) denotes the net wage rate \((w_n = (1-t)w)\) in which \(t\) captures both the tax rate and the rate of social security contributions, \(M\) the size of the labour force, and \(b\) the level of unemployment benefits. This utilitarian utility function is chosen because it can be explicitly derived from workers’ attitude towards risk and nests alternative maximands. The utility that individuals derive from their wage or benefit is represented by \(u(x)\), while the first and second order derivatives reflect the assumption of risk-averse preferences. This assumption is crucial for our conclusions regarding wages and employment under a certain policy rule. Note that we have omitted public sector employment in the utility function in order to simplify the analysis. Furthermore, the size of the labour force is fixed, which makes the utilitarian function similar to the expected utility variant in which the utility of net wages and unemployment benefits is weighted by the probability to become employed \((L/M)\) or to become unemployed \(((M-L)/M)\).

In order to model the optimizing behaviour by the union, given the government’s policy rule, we follow the Scandinavian literature, assuming that our union is an encompassing trade union (see e.g. Mulder, 1988a and 1989, Calmfors and Horn, 1986, Hersoug, 1986 and Driffield, 1986). In the simple version of the model, the government fixes the unemployment benefit level and the tax rate and does not take the budget constraint into account. Thus the union maximises utility (equation (3.2)), given the level of benefits, the tax rate and the labour demand curve, which yields the following equation,

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6 For certain values of risk-aversion, the utilitarian function is equal to other maximands like the wage bill, \(wL\), or the rent over the employment benefit, \((w-b)L\), see Laidler and Estrin, 1989, p.361.

7 The number of government employees has shown to be rather rigid downwardly in the Netherlands, so that it is not unrealistic to assume that the government cannot economize on its budget by firing its employees.
Equation (3.3) expresses that the union equates the marginal cost of raising the wage rate, which is the number of people that lose their jobs \(L'(w)\) multiplied by the loss in utility \([u(w_n) - u(b)]\), to the marginal revenue of such a rise in wages, which is equal to the net utility gain of those who remain employed, \((1-t)L(w)u'(w_n)\).

For the optimum to exist, the second order derivative \(U_{ww}\) must be negative:

\[
U_{ww} = L''(w)[u(w_n) - u(b)] + 2(1-t)L'(w)u'(w_n) + (1-t)^2L(w)u''(w_n) < 0 \quad (3.4a)
\]

Substituting the first order condition into the second order condition and rewriting \(-wL''(w)/L'(w)\) as \(\gamma\), the measure of concavity, \(-wL'(w)/L(w)\) as \(\varepsilon\), the labour demand elasticity and \(-w_nu''(w_n)/u'(w_n)\) as \(r\), the Arrow-Pratt measure of relative risk-aversion, yields that:

\[
U_{ww} = \frac{[(1-t)L(w)u'(w_n)/w][\gamma - 2\varepsilon - r]}{\gamma - 2\varepsilon - r} < 0 \quad \text{if} \quad \gamma - 2\varepsilon - r < 0 \quad (3.4b)
\]

The second order condition is negative if the labour demand function is concave \((\gamma < 0)\), or if the labour demand curve is not too convex \(0 < \gamma < 2\varepsilon + r\) (see Mulder, 1989).

Oswald (1982) surveyed the predictions of the model. Firstly, the size of the labour force does not affect the wage rate \((dw/dM=0)\). Secondly, an increase in the benefit level increases the union wage demands \((dw/db > 0)\). Thirdly, tax rises have ambiguous effects on the wage rate:

\[
U_{wt} = Lu'(w_n)[\varepsilon + r - 1] > 0, \quad \text{only if} \quad \varepsilon + r > 1 \quad (3.5)
\]

Higher taxes have a positive effect on the wage rate \((dw/dt > 0)\) in the case that the sum of the labour demand elasticity and the Arrow-Pratt measure of relative risk-aversion exceed one \((\varepsilon + r > 1)\). This implies that the restriction holds with a downward
sloping labour demand functions and 'not too risk-averse preferences' of union members. In a graph with the tax rate on the X-axis and the (gross) wage rate on the Y-axis, the union's reaction function is positively sloped when this assumption holds.

Figure 1 shows a reaction function, which is drawn linearly for convenience, and the union's indifference curves. The slope of the union's indifference curve, which is given by $\frac{dw}{dt} = -\frac{U_t}{U_w}$, is infinite on any point on the reaction curve ($U_w=0$), for example in the points B and C. If we want to know the shape of the curve beyond these points, we need to derive the partial derivative of the utility function with respect to the tax rate,

$$U_t = -wL_u'(w_n) < 0$$

Thus, increasing $w$ from any point on the union's reaction curve yields a negative slope of the utility curve, since both $U_t$ and $U_w$ will be negative ($U_{ww}<0$) and hence, the ratio of $-U_t/U_w$ will be negative too. Furthermore, the utility of the union increases as its
indifference curves are closer to the Y-axis and reaches its maximum in point A (given a fixed wage rate the utility of the union increases when the tax rate is lowered).

The economics behind this result are that, starting from a low wage (for example point D) and keeping the tax rate constant, the union can increase gross wages with a net utility gain until the reaction curve is reached; the rise in net wages and utility for employed members outweighs the loss in utility due to layoffs. Above the reaction curve, however, there occurs a net utility loss when the wage rate is increased (for example to point E).

4 GOVERNMENT'S BEHAVIOUR

4.1 Introduction

In the model sketched above, the government fixes the tax rate and the level of benefits and it does not care about the budget constraint. Since this seems to be unrealistic, the modelling of government behaviour is now studied more carefully. As we have set out in Section 2, we assume that government behaviour can be modelled as a simple policy rule. Sections 4.2-4.4 discuss the effects of three different policy rules, all under the assumption of balanced-budget: a fixed benefit level, an unconditional link of benefits to wages and a conditional link. The last policy rule is assumed to describe the situation, prevailing in the Netherlands in 1990 and 1991. It is assumed that in the Dutch institutional setting the government announces its policies first and wage setting takes place afterwards, whereas the government sticks to its issued policy after the wage has been set.

4.2 Policy Rule 1: the fixed benefit level

It is assumed that the government wants to keep its budget in balance so that social security contributions are equal to unemployment insurance payments (abstracting from other government revenues and other expenditures):

\[ t wL = (M-L)b \]  \hspace{1cm} (4.1a)

Since, the tax rate is the endogenous variable in this section, we rewrite this to:

\[ t = [(M-L)/L].b/w \]  \hspace{1cm} (4.1b)
The government has two policy instruments, the tax rate and the level of benefits, to keep its budget balanced. In this section the government chooses the level of benefits to be the exogenous variable.

The union takes the benefit level and the balanced budget constraint into account when maximizing its utility. Thus, it substitutes the tax rate out in its utility function, maximizing the utilitarian function (3.2) subject to equation (4.1a) and the labour demand function, equation (3.1). The first order condition yields:

\[ U_w = L'(w)[u(w_n-u(b)) + u'(w_n)L[(1-t) - w\partial t/\partial w] = 0 \] (4.2)

with:

\[ \partial t/\partial w = -bM.\{(c + (M-L)/M) / \omega^2L\} \geq 0 \] (4.3)

Expression (4.3) is positive when:

\[ |c| > |(M-L)/M| \] (4.4)

Expression (4.4) states that, to keep balanced-budget, taxes have to rise with wages when the unemployment rate is smaller than the wage elasticity of labour demand (c); a condition which is likely to be fulfilled in the Netherlands\(^10\).

Figure 2 shows the optimum for the union, given the level of unemployment benefits and the balanced-budget restriction (which is again assumed to be linear for convenience). At the intersection of the balanced-budget line with the Y-axis (point X), the tax rate is zero and there is full employment. In this situation, in which the union optimises against the balanced-budget restriction, the optimum wage rate is lower than in the situation of section 3, because the union internalizes the tax effect of an increase in wages. Comparing equation (4.2) to (3.3), the marginal revenue of a rise in the wage rate is smaller in (4.2) than in (3.3) if \( \partial t/\partial w > 0 \). Since the second order condition \( U_{ww} \) is negative, the wage rate has to fall in order to equate marginal cost and revenue again.

\(^10\) See Den Butter, 1991, p. 29, for a survey of wage elasticities of labour demand in Dutch empirical macroeconomic models. These elasticities range between -0.25 and -0.50, while Dutch unemployment rates have not exceeded 0.17.
4.3 Policy Rule 2: the unconditional link

Again it is assumed that the government wants to maintain balanced-budget, but now unemployment benefits are automatically indexed to the wage rate, reflecting more government’s concern for an equal distribution of income. Hence, the government fixes the replacement ratio $\rho$, the ratio between benefits and wages. The balanced-budget constraint (4.1a) can now be rewritten as:

$$t = \rho \left(\frac{M-L}{L}\right)$$  \hspace{1cm} (4.5)

In which:

$$b = \rho w$$  \hspace{1cm} (4.6)

The union optimises against the balanced-budget constraint, the fixed replacement ratio and the labour demand curve, which yields the following first order condition for an optimum:
\[ U_w = L'(w)[u(w_n) - u'\rho w)] + (M-L)\rho u'\rho w) + u'(w_n)\lambda[(1-t) - w\partial t/\partial w] = 0 \quad (4.7) \]

with

\[ \partial t/\partial w = -ML'(w)\rho / L^2 > 0 \quad (4.8) \]

Equation (4.7) expresses that the union's marginal benefit of a wage increase, rises relative to the former policy rule by \((M-L)\rho u'\rho w)\) (see equation 4.2), since benefits for the unemployed go up with the wage rate. Due to this link between the wage rate and the benefit level, the union sets higher wages than in Section 4.2 under the fixed benefit level, although the tax effects due to higher wages differ (compare equations [4.7] and [4.3]). This holds under the assumptions that the union has risk-averse preferences and the net wage is higher than the level of benefits (see for a formal proof appendix A).

Under the link policy, the slope of the balanced budget condition is steeper than under the policy of fixed benefits, shown in Figure 2. Although the optimal wage rate increases, the tax effect is ambiguous and determined by labour demand elasticity. For example, with an inelastic labour demand curve, higher wages lead to a comparatively small loss in employment, so that benefits for the newly unemployed (compared to the former policy rule) are paid out of a higher wage sum, implying that the tax rate is not required to rise to maintain balanced-budget.

4.4 Policy Rule 3: a conditional link

Under this policy rule, the government again links the unemployment benefit level to the wage rate, but on the condition that the tax rate does not have to rise to maintain balanced-budget. So, if the link causes additional financial problems for the government, neither a rise in the tax rate, nor a cut in government employment are considered to be relevant options, and the level of the replacement ratio will be adjusted. Although, in reality other conditions were announced for the maintenance of the link in the Netherlands - stabilization of the ratio between working and non-working people and a moderation of wage rises - the stabilization of the tax rate is regarded as the final goal of the Dutch government. Therefore, in this section, it is assumed that the union knows that stabilizing the tax rate is the principal aim of the government. The wage rate, set by the union, is derived, given a variable replacement ratio.

Under policy rule 3, the union maximizes its utility, subject to the budget
constraint, the tax rate which is set by the government, and the labour demand curve. The balanced-budget constraint (4.1a) can now be rewritten as:

\[ \rho = t(L/(M-L)) \]  \hspace{1cm} (4.9)

in which:

\[ b = \rho w \]  \hspace{1cm} (4.6)

The first order condition for an optimum is:

\[ U_w = L'(w)[u(w_n)\cdot u(\rho w)] + (M-L)u'(\rho w)(\rho + w\partial \rho / \partial w) \\
+ u'(w_n)L(1-t) = 0 \]  \hspace{1cm} (4.10)

with:

\[ \partial \rho / \partial w = t\{L'(w)(M-L) + L'(w)L\} / (M-L)^2 = tML'(w) / (M-L)^2 < 0 \]  \hspace{1cm} (4.11)

The second term in equation (4.10) expresses that, compared to the former policy rule - the unconditional link - of equation (4.7), the marginal benefit of a wage increase for the unemployed will be smaller: the union takes account of a fall in the replacement ratio when wages are increased. Appendix B proofs that (again assuming risk-averse union preferences and a net wage rate that is higher than the benefit level) unions will set a lower wage under the conditional link, compared to the unconditional link.

Figure 3 shows the union optimum in the situation of the conditional link. The slope of the balanced-budget constraint is given by equation (4.11). Note that in Figure 3 the balanced budget line is again shown as a linear relation. The slope of the union's indifference curve can be found by calculating \( dw/d\rho \), which is equal to \(-U_p / U_w\) by definition. Increasing \( w \) from the point at which the indifference curve has a vertical tangent\(^{11}\), for example from point A, yields a positive slope of the indifference curve, since \( U_p \) is positive (see 4.12) and \( U_w \) is negative (\( U_{ww} < 0 \)).

\[ U_p = (M-L)u'(\rho w)w > 0 \]  \hspace{1cm} (4.12)

The economics behind this result are that, increasing the wage rate from point A, the

\(^{11}\) This is where \( U_w = \delta [\delta u(w_n) + (M-L)\cdot u(\rho w)] / \delta w = 0 \).
net utility gain for the union is negative, so that the replacement ratio is required to rise in order to hold union utility constant.

Figure 3: The optimum for the union, given the conditional link and the balanced budget constraint

4.5 A comparison of the three policy rules

In this section we compare the effects on wages and employment of the three policy rules. We have already discussed that:

i) wages are higher when benefits are unconditionally linked to the private sector wage rate, compared to a fixed level of benefits (see section 4.3 and appendix A);

ii) wages are lower when the link is conditional, compared to the unconditional link (see section 4.4 and appendix B).

One can also proof, under realistic assumptions, that the union sets a higher wage rate under the conditional link than under a fixed benefit level (appendix C). Given the
inverse relationship between wages and private sector employment, we derive the results of Table 1. This table also shows the periods in which the various policy rules were actually used in the Netherlands. Taking the results of policy rule 1 (the fixed benefit level) as the benchmark case, wages are higher and employment is smaller under policy rule 3 (the fixed tax rate), while policy rule 2 (the fixed replacement ratio) generates even higher wages and, hence, smaller employment.

Table 1: Wages and employment under the three policy rules

<table>
<thead>
<tr>
<th>Policy rule</th>
<th>Wages</th>
<th>Employment</th>
<th>Period in which policy was/is used in the Netherlands</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>benefits</td>
<td>tax rate</td>
<td>replacement ratio</td>
</tr>
<tr>
<td>1</td>
<td>fixed</td>
<td>variable</td>
<td>variable</td>
</tr>
<tr>
<td>2</td>
<td>variable</td>
<td>variable</td>
<td>fixed</td>
</tr>
<tr>
<td>3</td>
<td>variable</td>
<td>fixed</td>
<td>variable</td>
</tr>
</tbody>
</table>

According to the outcomes of the different policy rules, we can distinguish various types of government behaviour. Policy rule 1 would imply that the government strongly values private sector employment and that equity considerations regarding the income distribution are of less importance. A government that acts according to policy rule 2, focuses on an equal development of benefits and wages and pays less attention to the consequences for private sector employment. Finally, when policy rule 3 is applied, the stabilization of the tax rate is at the core of government policy and wages and employment take an intermediate position between the outcomes of policy rule 1 and 2. Since the government utility function is not explicitly specified, it is impossible to determine which policy rule should be regarded as optimal from the government’s point of view. If, for instance, government utility was modelled by a loss-function including the level of employment, along the line of Hersoug (1986, p. 130), the government would probably prefer policy rule 1. However, the government could also aim at re-election by maximizing total compensation for employees, which would not lead to a clear preference for one of the policy rules.

In the paper it is assumed a priori that government behaviour can be described by policy rules. The question is whether these rules are the relevant policy options for the Dutch government, especially since we have excluded the possibility of

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cut-backs on public sector employment. Alternatively, it is possible to model the influence of the link on union behaviour as a game between the union and the government in which both players move simultaneously, resulting in a Nash-equilibrium (see Mulder (1988a)). Although this model resembles the situation under policy rule 2, the effects of the link - raising the wage rate and reducing private sector employment - can be expected to be larger in Mulder's model since the union does not take account of the balanced-budget constraint when setting the wage rate.

Another way to model the game between the union and the government would be the 'reversed Stackelberg game' (see Hersoug, 1986, p.140 and Pohjola, 1986). This would be appropriate when the union is the first player to move and the government adjusts its policy afterwards. In this reversed game, the union is able to maximise its utility against the government reaction function and is Stackelberg-leader in the game with the government. However, given the strong adherence of the Dutch government to the stabilization of both the budget deficit and the tax rate, an adjustment of its policy is not very probable. There may even be other, more sophisticated games, that give a more proper description of the Dutch situation.

5 EMPIRICAL RESULTS

Our theoretical model predicts that the automatic link of benefits to wages will have a positive influence on the wage rate, and in this section, we examine whether our model finds support in the data. Therefore we specify a wage level equation which is consistent with modern bargaining theory and has been imbedded in the cointegration technique (see Graafland and Huizinga, 1988, for the Netherlands). We assume that the influence of consumer prices and labour productivity on wages can be described by the so-called wage space; the product of consumer prices and labour productivity. The wage space can be modelled without loss of statistical information and can be combined with actual wage determination in the Netherlands (Den Butter and Van de Wijngaert, 1991). Our theoretical model further requires to model the tax and premiums rate and the level of benefits, or the replacement ratio. Therefore the wage equation is specified as follows,

\[ w = f(ws, ur, t, \rho) \]  

The wage sum per employee \( w \) is regressed on the wage space \( ws \), the unemployment rate \( ur \), the average tax and premium rate \( t \), and the replacement ratio \( \rho \).
In order to identify the effect of the link policy, we add an additive dummy variable (D) for the period in which the link was abolished (policy 2, 1981-1989). If the dummies' t-value is significant and its sign is negative, our hypothesis that an automatic link increases the equilibrium wage level cannot be rejected. However, the dummy may also measure the effects of Dutch wage restraints in the 1980s, which can either be due to general consensus between the negotiating parties and the government, or to weak union power resulting from a decline in the unionization rate\(^{12}\). The results of the regressions are found in Table 2.


<table>
<thead>
<tr>
<th>eq.</th>
<th>ws</th>
<th>ur</th>
<th>t</th>
<th>D</th>
<th>ρ</th>
<th>UNR</th>
<th>R²</th>
<th>DW</th>
<th>LL</th>
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<td>-</td>
<td>0.9989</td>
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<td>-1.37</td>
<td>0.88</td>
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<td>-</td>
<td>-</td>
<td>0.9994</td>
<td>1.90</td>
<td>66.157</td>
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<tr>
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<td>(9.6)</td>
<td>(5.1)</td>
<td>(3.2)</td>
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<td>3*</td>
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<td>-</td>
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<tr>
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<td>(38.5)</td>
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<td>-</td>
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<td>(46.7)</td>
<td>(7.7)</td>
<td>(3.1)</td>
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</tbody>
</table>

D = dummy (0=link, 1=no link); LL = Log Likelihood; the constant is omitted to save space; t-values in parentheses; * refers to the 1969-1988 period.

Equation 1 of Table 2 shows a standard equilibrium wage level equation for the Netherlands which is stable over the sample period\(^{13}\). The dummy variable of Equation 2 of Table 5, which reflects the influence of an abolishment of the automatic link, significantly differs from zero and obtains a negative sign. Our analysis however suggests that the benefit level, or the replacement ratio, should be included in the equilibrium wage equation. According to Equation 3, the replacement ratio for the minimum benefit levels has a positive influence on the equilibrium wage rate. Again adding a dummy for the no-link period to Equation 3 shows that an abolishment of the

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\(^{12}\) Wage restraints, have received support from employers, employees and the government in the 1980s, and were non-existent in the 1970s. The unionization rate is defined as the ratio of union members to total employment.

\(^{13}\) The Chow test-statistic (2.47) is under its critical level.
link still has a negative influence on wages. Thus, even if the level of the replacement ratio is included in the equilibrium wage equation, the automatic link policy increases the equilibrium wage level. Equations 2-4 do not reject our hypothesis that an abolition of the link policy leads to lower wages. However, as stated above, the dummy may also reflect the consensus in industrial relations. Those who believe that union wage restraints were due to massive unemployment and the exodus of union members, may find support in Equation 5 of Table 2, which shows that wages go up with the unionization rate (UNR) over the sample period\textsuperscript{14}. Specifying both the dummy variable and the unionization rate unfortunately gave insignificant t-values for the latter variable. Since our theoretical model requires a specification of the influence of unemployment benefits we believe that Equation 4 rather than in Equation 5 gives a proper description of equilibrium wage formation. Therefore, we conclude that in order to give the dummy a clear interpretation it is impossible to discern between the consensus or the link hypothesis. Due to deficiencies in the data set, finally, we could not test whether the conditional link of 1990 and 1991 have raised equilibrium wages. Moreover, we note that the conditional link seems to have been a short intermezzo since for 1992 the Dutch government has returned to a fixed benefit policy again.

6 CONCLUSIONS

In this paper, we have introduced a model in which the wage and employment effects of linking the level of unemployment benefits to the wage rate are analyzed. More in general, this paper is concerned with the efficiency costs (in terms of a loss in private sector employment) of social security policies. Since the link of benefits to private sector wages is at the core of the attention in Dutch economic policy at present, these effects are of clear interest. For this reason, we have based the assumptions regarding government behaviour (i.e. the modelling of three policy rules) on its empirical significance. Due to this specification of policy rules, we have restricted our model to constrained utility maximization by the union, implicitly assuming that the government chooses its optimal policy rule.

\textsuperscript{14} This equation is, however, based on a different theoretical model. Instead of using the theoretical assumption that the union sets the wage, we assume that the trade union and the employers' federation bargain the wage. In other words, we assume the 'right to manage model' and we therefore need to specify the union's bargaining power over the wage, which we assume to depend on the unionization rate and the unemployment rate.
Compared to the standard literature on centralised wage setting, this model introduces three novelties. First, it describes incomes policies instead of employment policies. Second, the government is assumed to make the first move in the game with the trade union, instead of assuming that both players make their moves simultaneously, or that the government cheats on a previously announced policy. Third, the government is always assumed to keep a balanced budget, which is therefore taken into account by the trade union.

Under the assumptions of risk-averse preferences of employees and of net wages exceeding unemployment benefits, the model yields the following predictions. Firstly, if the government prefers to fix the level of benefits, wages are lowest and, assuming a negatively sloped labour demand curve, employment is highest. Secondly, if the government decides to link the level of benefits to private sector wages, the wage rate will be highest, and hence, employment lowest. Thirdly, if the government decides to make the link conditional, the wage and employment outcomes are between these extreme outcomes.

The tax and benefit policies were actually applied in the Netherlands over the last two decades: the fixed benefit rule in the 1980s, in which fighting unemployment was clearly more important government target than a proportional development of wages and benefits; policy rule 2, the unconditional link, in the 1970s and policy rule 3, the conditional link, in the beginning of the 1990s. Estimating an equilibrium wage equation for the Netherlands, we come to the conclusion that the data do not seem to reject our hypothesis that abolition of the link in the 1980s has reduced the wage level.
REFERENCES


Dunlop, J.T., (1944), Wage Determination under Trade Unions, New York: Macmillan.


APPENDIX A

Proof that unions set a higher wage rate when the level of benefits is linked to the gross wage \((w_2 > w_1)\).

Write,

\[ Z = L'(w)[u'(w_n) - u'(w)] + (M-L)pu'(b) + u'(w_n)\frac{L}{(1-t)w} + X = 0 \]  \hspace{1cm} (A.1)

In this equation \(X\) equals zero if the second policy rule or the 'link situation' holds \((Z_2)\), whereas the first policy rule with a fixed benefit level \((Z_1)\) holds, if:

\[ X = -[(M-L)pu'(b)] + [u'(w_n)L(w_2 - w_1) - u'(w_n)L(w_2 - w_1)] \]  \hspace{1cm} (A.2a)

with subscripts \((1,2)\) referring to \(\frac{\partial t}{\partial w}\) under policy rule one and two. Now, with negative \(X\), \(Z_2\) exceeds \(Z_1\), so that comparing situation 2 to situation 1, \(Z\) is required to increase in order to make \(Z\) equal to zero again. Since \(\frac{\partial Z}{\partial w}\), which is in fact the second order condition \(U_{ww}\), is negative, the wage rate needs to fall. In other words, the wage rate under the second policy rule is higher than under the first, if we can prove that \(X\) is negative. Now, rewrite \(X\) in \((A.2a)\) as,

\[ X = -[(M-L)pu'(b)] + [u'(w_n)L(w_2 - w_1) - u'(w_n)L(w_2 - w_1)] \]  \hspace{1cm} (A.2b)

We substitute equation \((4.3)\) and equation \((4.8)\) into equation \((A.2b)\), so that the part of equation \((A.2b)\) in square brackets, \([\frac{\partial t}{\partial w}]_1 - [\frac{\partial t}{\partial w}]_2\), can be rewritten as,

\[ -b[L'(w)M/(wL)]^2 + L(M-L)/(wL)^2 - [ML'(w)p/L]^2 \]  \hspace{1cm} (A.3a)

replacing \(b = pw\) yields,

\[ -p[L'(w)M/L^2 + L(M-L)/(wL)^2] - [ML'(w)p/L]^2 \]  \hspace{1cm} (A.4a)

pre-multiplication by \(1/L^2\) gives,

\[ -\frac{p}{L^2}[L'(w)M + L(M-L)/w] - [ML'(w)p/L]^2 \]  \hspace{1cm} (A.4b)

which simplifies to,
Thus, $X$ can be rewritten as,

$$X = -\left\{ (M-L)\rho u'(b) \right\} - u'(w_n)L(w)w[-\rho L(M-L)/(wL^2)], \quad (A.5a)$$

which simplifies to,

$$X = -\left\{ (M-L)\rho u'(b) \right\} - u'(w_n)-\rho(M-L), \quad (A.5b)$$

and can be rewritten as,

$$X = -(M-L)\rho[u'(b)-u'(w_n)] < 0 \quad (A.5c)$$

So, $X$ is negative if the utility of a marginal increase in the unemployment benefit exceeds a marginal increase in the net wage rate, $u'(b) > u'(w_n)$. This condition is satisfied when both the net wage exceeds the benefit level, $w_n > b$, and the union is risk averse, $u''(x) < 0$. We appreciate that these conditions are very likely to be fulfilled.
APPENDIX B

Proof that union set a lower wage under a conditional link than under an unconditional link ($w_3 < w_2$).

Again, we write,

$$Y = L'(w)[u(w_n)-u(\rho w)] + (M-L)u'(\rho w)(\rho + w \partial \rho / \partial w) + u'(w_n)L(1-t) + X = 0 \quad (B.1)$$

In equation (B.1) with $Y$ equal to zero, the conditional link situation ($Y_3$) holds, whereas in the unconditional link situation ($Y_2$), $X$ is equal to,

$$X = -(M-L)u'(\rho w)(w \partial \rho / \partial w) + u'(w_n)L - w \theta t / \partial w \quad (B.2)$$

Now, with positive $X$, $Y_2$ exceeds $Y_3$, and in order to make $Y$ equal to zero again the wage needs to increase, since the second order condition is negative: $U_{ww} = \delta Y / \delta w < 0$. Thus, the wage in situation 3 is lower than in situation 2, if we can prove that $X > 0$. Therefore, we substitute $\partial \rho / \partial w$ of equation (4.11) and $\partial t / \partial w$ of equation (4.8) into equation (B.2),

$$-(M-L)u'(\rho w)w \theta t (ML'(w)/(M-L))^2 + u'(w_n)L - w \theta t / \partial w \quad (B.3a)$$

which simplifies to,

$$-u'(\rho w)w tL'(w)M/(M-L) + u'(w_n)L [ML'(w)\rho / L^2] \quad (B.3b)$$

Substitution of $\rho = t[L/(M-L)]$ into equation (B.3b) yields,

$$X = -u'(\rho w)w tL'(w)M/(M-L) + u'(w_n)L [L'(w)tM/(M-L)] \quad (B.4a)$$

which is equal to,

$$X = wL'(w)t[M/(M-L)] [u'(w_n)-u'(\rho w)] \quad (B.4b)$$

$X$ is greater than zero if $L'(w) < 0$, which is true by assumption, and if the assumptions $u''(x) < 0$ and $w_n > b$ hold (see, also Appendix A).
APPENDIX C

Proof that the union sets a lower wage rate if the benefit level is exogenous than if this level is conditionally linked to the wage rate.

Again we write,

\[ G = L'(w)[u(w_n)-u(\rho w)] + (M-L)u'(\rho w)(\rho + w\beta \delta w) + \\
+ u'(w_n)L(1-t) + X = 0 \quad (C.1) \]

In equation (C.1), \( X \) equals zero if situation 3 - the conditional link - holds \((G_3)\), whereas situation 1 - of exogenous benefits - \((G_1)\) holds if,

\[ X = -(M-L)u'(\rho w)(\rho + w\beta \delta w) + u'(w_n)Lw.\beta t/\delta w \quad (C.2) \]

Therefore, with positive \( X \), \( G_1 \) exceeds \( G_3 \), and in order to move from situation 1 to situation 3, \( G \) is required to fall and hence, the wage is required to rise, since \( U_{ww} = \partial^2 X/\partial w < 0 \). Thus, we must prove that \( X \) is positive. Substitute \( \partial \rho / \partial w \) of equation (4.11) and \( \partial t / \partial w \) of equation (4.3) out into equation (C.2),

\[ X = -(M-L)u'(\rho w)\rho -(M-L)u'(\rho w)w.[tML'(w)/(M-L)^2] + \\
+ u'(w_n)Lw.-b{[L'(w).wM+L(w)(M-L)]/(wL)^2} \quad (C.3a) \]

which equals,

\[ X = -(M-L)u'(\rho w)\rho -u'(\rho w)w.tML'(w)/(M-L) + \\
+ u'(w_n)Lw.-b{[L'(w).wM+L(w)(M-L)]/(wL)^2} \quad (C.3b) \]

Note that \( b=\rho w \) and \( \rho=tw/(M-L) \) so that \( b=twL/(M-L) \), which again are substituted into (C.3b). Then the left hand term reduces to,

\[ -(M-L)u'(\rho w)[tL/(M-L)] - u'(\rho w)w.L'(w)M/(M-L) \quad (C.4a) \]

which is equal to,

\[ -tLu'(\rho w) - u'(\rho w)LwL'(w)(M/(M-L)) \quad (C.4b) \]
whereas, the right hand term equals,

\[ u'(w_n) L - w - b \cdot \left\{ [L'(w) w M + L(w) (M-L)] / (wL)^2 \right\} \]  

(C.4c)

which is equal to,

\[ t (wL)^2 u'(w_n) / (M-L) \cdot \left\{ [L'(w) w M + L(w) (M-L)] / (wL)^2 \right\} \]  

(C.4d)

and simplifies to,

\[ tu'(w_n) [L'(w) w (M/(M-L)) + L(w)] \]  

(C.4e)

So \( X \) equals,

\[ X = -t \left\{ u'(\rho w) [L + w L'(w) (M/(M-L))] + \right. \]

\[ + \left. tu'(w_n) [L'(w) w (M/(M-L)) + L(w)] \right\} \]  

(C.5a)

Rewriting (C.5a) yields,

\[ X = -t \left\{ u'(\rho w) [L + w L'(w) (M/(M-L))] + \right. \]

\[ -u'(w_n) [L'(w) w (M/(M-L)) + L(w)] \} \]  

(C.5b)

Substituting the demand elasticity, \( \epsilon = -L'(w) w / L \), into (C.5b),

\[ X = -t / L \left\{ u'(\rho w) [1 - \epsilon w (M/(M-L))] - u'(w_n) [-\epsilon w (M/(M-L)) + 1] \right\} \]  

(C.6a)

which is equal to,

\[ X = +t / L [1 - \epsilon w (M/(M-L))] \{ u'(w_n) - u'(\rho w) \} > 0 \]  

(C.6b)

Thus the \( X \)-term is positive in two cases. First, if \( u''(x) < 0 \), \( w_n > \rho w \) (see Appendix A) and \( 1-\epsilon w (M/(M-L)) < 0 \). This latter term is negative if \( |\epsilon w| > M/(M-L) \), which condition is likely to be fulfilled in the Netherlands. Second, \( X \) could also be positive, if \( u''(x) > 0 \), which would imply risk loving behaviour and \( |\epsilon w| < M/(M-L) \). We have indicated elsewhere in the paper that this last condition is not likely to be fulfilled in the Netherlands. Neither we believe that the union (or its members) show risk-loving preferences.