DEPARTMENT OF ECONOMICS

RESEARCH MEMORANDUM
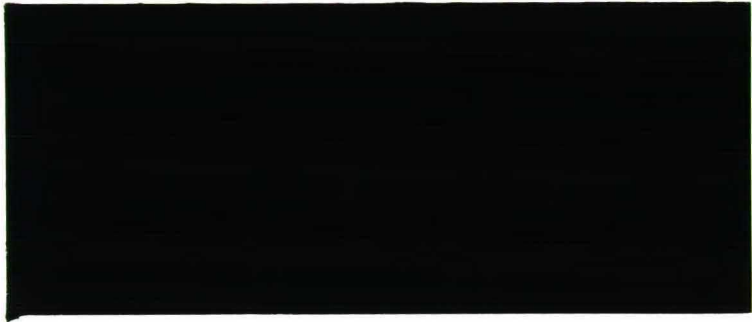
WAGE MODERATING EFFECTS OF CORPORATISM

DECENTRALIZED VERSUS CENTRALIZED WAGE SETTING IN A UNION, FIRM, GOVERNMENT CONTEXT

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FEW 316

Wage moderating effects of corporatism

Decentralized versus centralized wage setting
in a union, firm, government context

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Abstract

Corporatism is observed to exert a moderating influence on the wage gap, the difference between the actual wage rate and the full employment wage rate. Corporatist countries therefore show a lesser degree of unemployment. This paper explores and models one of the reasons why these results might be observed. An important reason for wage moderation is the endogeneity of the wage tax rate for a centralized or encompassing trade union. Centralized trade unions, which are an essential feature of corporatist countries, will realize that a higher gross wage level generally implies higher government expenditures and therefore a higher wage tax rate, which reduces the gains of increasing the gross wage rate. This will moderate their wage claims. Trade unions in a decentralized setting on the other hand will neglect the government budget constraint because the effect of their behaviour on net government expenditures is very small for every single trade union.

It is shown that both gross and net wages and the unemployment rate are higher in case of decentralized wage setting, whereas the level of economic activity is lower.

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1. Introduction [*]

The institutional organization of a country can make quite a difference for the way its economy performs. The growing attention paid to trade unions in the literature (e.g. Calmfors 1985; McDonald and Solow 1981; Oswald 1985; van der Ploeg 1986; Sampson 1983) is like writing on the wall. Recently a number of writers (Bean, Layard and Nickell 1986; Bruno and Sachs 1985; McCallum 1983; Newell and Symons 1987) have focussed especially on the effect of corporatism on macro economic performance.

Bruno and Sachs found that corporatism exerts a moderating effect on the wage gap; the difference between the actual and the full employment wage level. In their index of corporatism, they use several structural characteristics as indicators of corporatism. These are: whether negotiations take place at a national or local level; the power of national vis a vis local labour organizations; the extent of employer coordination; and the power of local shop stewards. Examples of countries with a very centralized form of wage setting and trade union organization or, in the terminology of Bruno and Sachs, with a high degree of corporatism are Austria, Norway, Sweden and the Netherlands. At the other extreme countries can be found, where not much power is vested in the trade union federation, and the constituent or local trade unions have the dominant say in the decentralized wage setting process, with England as the prime example (see Table 1).

Table 1. Corporatism, the wage gap and unemployment.

Country	Corporatism index	Wage gap 75-79	Unemployment rate
Austria	4.0	2.3	1.9
Germany	4.0	-0.4	3.5
Netherlands	4.0	0.4	5.3
Norway	4.0	2.5	1.9
Sweden	4.0	-3.6	1.9
Denmark	3.0	3.6	6.5
Switzerland	2.0	2.5	0.4
Finland	1.5	0.1	5.1
Japan	1.5	8.2	2.0
Belgium	0.5	8.9	7.0
Italy	0.5	5.0	6.8
New Zealand	0.5		1.0
Australia	0.0	8.8	5.5
Canada	0.0	3.4	7.5
France	0.0	5.7	4.9
United Kingdom	0.0	2.6	5.8
United States	0.0	-2.1	6.9

Source: Bruno and Sachs (1985). The original source of the wage
        gap and unemployment data is the OECD.

Bruno and Sachs have tried to explain the inverse relationship be-
tween corporatism and the wage rate they observed. Bruno and Sachs
suggest that corporatism may be effective in overcoming informational
inefficiencies (Grossman and Hart 1981, Brunner, Cukierman and Meltzer
1980), that it might forestall interunion rivalries (Lange, Ross and
Vannicelli 1982) and that the greater role in economic policy making un-
der corporatism may have been bought with a wage moderating attitude by
the trade unions.

Some other papers on the role of trade unions in wage setting (Hart 1982; Jackman 1985; Abraham 1988) are relevant for the explanation of the relation between corporatism and the wage level as well. Jackman (1985) shows among other things that decentralized trade unions are inefficient because each tries to increase its real wage rate by raising the nominal wage rate, but instead of succeeding in this purpose, the trade unions cause inflation and thereby diminish real aggregate demand and overall employment. This result crucially depends on the assumption of a constant returns to scale production technology, a constant mark-up of prices over wages and a nominally fixed aggregate demand. If on the other hand aggregate demand would be fixed in real terms or if the aggregate supply curve would slope vertically, this inefficiency result would disappear. Abraham (1988) concentrates on the existence of an aggregate demand externality as well, to prove the inefficiency of decentralized wage setting. His externality comes about if a high wage rate in one industry reduces the demand for the product and thereby the demand for labour in another industry. A national union takes this externality into account and settles for a lower wage rate than the local or decentralized trade unions. From Hart's paper (1982) it is clear that when trade unions are monopolistic competitors who compete to get their fixed memberships employed with the same group of firms, the wage rate is an inverse function of the number of unions; the smaller the number of unions the greater their monopoly power and the higher their wage demands. So Hart's paper seems to point at the advantages of decentralized wage setting and interunion rivalries, contrary to what Bruno and Sachs (1985) and Lange, Ross and Vannicelli (1982) argue. It should be noted however that Hart's unions have quite definite reasons for merging and there is generally not a body like the Monopolistic Trade Commission to keep them from merging or cooperating.

This paper explores another reason for the observed wage moderating effect of corporatism. This argument focusses on an essential feature of corporatism, the degree of centralization in wage setting. It seeks the explanation of wage moderation under corporatism in the different way decentralized trade unions and centralized trade unions regard the tax rate. Trade unions in a decentralized setting can neglect the effects of their behaviour on tax rates and benefit levels, because

the effect of their behaviour on the average wage level is very small for every single trade union. Therefore they need not take account of the government budget constraint. The effect on the average wage level is not negligible however in case an all encompassing or centralized trade union or a trade union federation is involved in centralized wage setting. Such a trade union (federation), which is referred to in this paper as a centralized trade union, realizes that the average wage level influences government expenditures (through benefit pay for the unemployed and the payroll for the public sector employees) and tax income and this in turn will influence the tax rate on wage income (or equivalently the rates of social security contributions). To determine the effect of its behaviour on the net wage rate, an optimizing centralized trade union which cares about the net wage rate, will therefore have to take the public sector budget constraint into account and the effects of its wage setting behaviour through the budget constraint on the wage tax rate and thereby on the net wage rate.

The consequences for the macro economic performance, the wage rate, the unemployment rate and the levels of employment and economic activity of the differences between situations of centralized and decentralized wage setting are examined in this paper. For that purpose two models of nation wide wage setting are set up. In the first model the wage rate for every firm in the economy is determined by a firm specific trade union which is referred to as a decentralized trade union and which does not cooperate with other trade unions. In the second model an economy wide centralized trade union sets the wage rate for all firms. Profit maximising firms determine in both models the levels of employment in their firms, whereas the government sets the wage tax rate in such a way that its budget constraint is satisfied.

The setup of the second model follows the Scandinavian tradition, in assuming an encompassing or centralized trade union which dominates the wage setting (e.g. Calmfors 1982; Calmfors and Horn 1985, 1986; Hersoug 1985). The methodology for the decentralized wage setting model is the same in the sense that the decentralized trade unions also dominate the wage setting in the negotiations with the firms and aim at the same goals. This is done in order to stress the key distinction between the models; the different attitude towards the government budget

constraint and the ensuing tax rate by decentralized and centralized trade unions.

This paper is organized as follows. In section 2 the decentralized wage setting is set up. The consequences of the public sector budget constraint for the behaviour of every individual trade union are outlined and the effects of changing exogenous variables such as the level of benefits, are presented. In section 3 the centralized wage setting is elaborated and the outcome is compared to the results of the decentralized wage setting situation. Section 4 concludes the paper.

2. Decentralized wage setting

Consider an economy which consists of I identical firms and an equal number of identical firm specific trade unions. Every firm, and the trade union it deals with, is identified by a real number i. Firm i maximises its profits, Π_i, subject to a given gross real wage rate, w_i, and a given price level, which is one for convenience,

$$\max_{\ell_i} \; \Pi_i = f(\ell_i) - w_i \ell_i, \qquad y_i = f(\ell_i), \; f_1 > 0, \; f_{11} < 0 \qquad (2.1)$$

where y_i is the firms output and $f(\ell_i)$ its production function, which shows diminishing marginal returns in the production factor labour, ℓ_i, and which satisfies the Inada conditions. The firms wage costs are linear in labour input and gross wages.

Maximisation of firm i's profits with respect to its labour input leads to the following labour demand curve,

$$\ell_i = L_i(w_i), \qquad\qquad L_i'(w_i) < 0 \qquad (2.2)$$

The wage rate for the employees of firm i is determined by the firm specific trade union i. In achieving its goals, trade union i is restricted by firm i's labour demand function, equation (2.2). Trade union i is therefore a so called monopoly trade union (McDonald and Solow 1981).

Trade union i cares about the wage income and the level of employment of its membership. Such preferences allow for various specific possibilities regarding its utility function. The trade union might be supposed to maximise the wage bill $w\ell$ (Dunlop 1944), total rent, that is the surplus of income over the wage bill under perfect competition (De Menil 1977), or a more general Stone-Geary utility function that allows for subsistence levels of wages and employment and the importance of supernumerary wages and employment (Pencavel 1984).

Here it is assumed that the trade union maximises a utilitarian utility function with respect to the gross wage rate (McDonald and Solow 1981; Oswald 1982a, 1985; van der Ploeg 1986),

$$\text{Max}_{w_i} \quad U_i^D = \ell_i u((1-t)w_i) + (n_i - \ell_i)u(b),$$

$$(1-t)w > b, \quad u'>0, \quad u''<0 \qquad (2.3)$$

where U_i^D denotes the level of utility achieved by trade union i, n_i denotes the size of its membership or reference group which is assumed to be larger than the number of employed ℓ_i, b the level of real unemployment benefits and t the labour tax rate, which can be taken to comprise wage taxes, employers and employees social security contributions and the like (see Layard and Nickell 1986). The advantage of this specification is that it has a micro economic foundation and can be derived from aggregating the preferences of two groups of employed and unemployed workers with risk averse (u''<0) or riskneutral (u''=0) preferences.

Trade union i is aware of the fact that restrictions exist not only on the firms behaviour, but on the governments behaviour as well, because of the public sector budget constraint. The government maintains a balanced budget by manipulating the wage tax rate. The wage tax rate is set according to the following rewritten budget constraint,

$$t = T(w,g,b,m) = \frac{1}{w(\ell+g)} \{(m-\ell-g)b + gw\} \geqq 0 \qquad (2.4)$$

where,

$$\ell = \sum_i^I \ell_i, \quad w = \sum_i^I \frac{\ell_i w_i}{\ell} \quad \text{and} \quad \ell = IL_i(w) = L(w)$$

Hence ℓ is aggregrate private sector employment and w is the average private sector wage rate. m denotes total fixed labour supply and g public sector employment including people on employment programs. The wage tax rate is equal to the government expenditures on the unemployed and on the public sector labour force, divided by the wage sum. Note that the unemployed $(m-\ell-g)$ are granted real benefits b, while the public sector employed get the same pay as the average worker in the private sector.

The tax rate depends amongst other things on the average private sector wage level w, the level of benefits b, the number of public sector employees g, and the size of the labour force m. Assuming identical firms, the derivatives of the tax rate can be calculated as,

$$T_w = \frac{1}{w(\ell+g)}\{g - L'(w)(b+tw) - t(\ell+g)\},$$

$$T_w > 0 \text{ iff } e_{\ell+g} < -\frac{b(m-\ell-g)}{b(m-\ell-g) + gw + b(\ell+g)} \cdot < -\frac{(m-\ell-g)}{m} \quad (2.5)$$

$$T_b = \frac{m-\ell-g}{w(1+g)} > 0 \quad (2.6)$$

$$T_g = \frac{1}{w(\ell+g)}\{(1-t)w - b\} > 0 \quad (2.7)$$

$$T_m = \frac{b}{w}(1+g) > 0 \quad (2.8)$$

Three different forces influence the tax rate when the average wage level changes. First of all tax revenues from existing private and public sector employees, $(\ell+g)$, rise, secondly tax revenues are reduced and expenditure on social security increased because some people become unemployed and no longer pay taxes but instead claim benefits, $(L'(w)(b+tw))$, and thirdly government expenditures go up because of a higher wage bill for the public sector employees, g. It is most likely that the latter two effects dominate and that an increase in the gross wage rate will lead to an increase in the wage tax rate $(T_w > 0)$. Only if the elasticity of the demand for labour in absolute terms is very small indeed, will T_w be negative. A sufficient condition for a positive T_w is that the labour demand elasticity in absolute terms is larger than the rate of unemployment. In allmost all countries T_w will be positive if the demand for labour elasticity is larger than 0.20 in absolute terms. Given the empirical evidence on the labour demand elasticity (see e.g. Symons and Layard 1983), it seems natural to take T_w as positive without much reservations[1]. The sign of T_w is by the way rather crucial for the relation between the outcomes of centralized and decentralized wage setting as will become clear in section 3.

The wage tax rate will go up as well if the level of benefits is increased $(T_b>0)$, as might be expected. Higher benefits imply increased social security expenditure and require therefore a higher wage tax rate if the budget deficit is to remain unchanged. The same applies for a rise in public sector employment. This too will lead to a increase in the tax rate $(T_g>0)$, but this increase is small if net unemployment benefits are high relative to net wages. In that case it does not make much difference in terms of costs to the public sector whether some is unemployed or is employed in the public sector. A rise in the labour supply increases expenditures on social security and will therefore make the tax rate go up $(T_m>0)$.

Every trade union i is aware of the public sector budget constraint and the consequences this constraint implies for the height of the wage tax rate, but this knowledge does not imply that it will affect their behaviour. The effect of the wage rate set by one trade union on the average wage rate, will be small if the size of trade union i is not very large, and the effect of a change in its wage rate on the wage tax rate for the economy might therefore be neglected $(T_w \cdot \frac{dw}{dw_i} \sim 0)$. The for trade union i's behaviour important derivative of the net wage rate with respect to the gross wage rate, simplifies then from: $\frac{d(1-t)w_i}{dw_i} = 1 - t - wT_w \cdot \frac{dw}{dw_i}$ to $\frac{d(1-t)w_i}{dw_i} = 1-t$. It will be assumed that all trade unions in the decentralized setting neglect the effect of their behaviour on the wage tax rate and thereby on the net wage sum of its membership or its reference group. This simplification (taking $\frac{dw}{dw_i}$ as zero instead of very small) does not make a difference for the nature of the result obtained, nor will it make much of a difference in the size of the effect unless decentralized wage setting comprises say just two or three unions.

Trade union i's goal is therefore to maximise its utility function (2.3) subject to the constraint of the labour demand curve (2.2) under the assumption that $\frac{d(1-t)w_i}{dw_i} = 1-t$. Solving this problem yields[2]

$$U^D_{iw_i} = L'_i(w_i)[u((1-t)w_i) - u(b)]$$

$$+ (1-t)\ell_i u'((1-t)w_i) = 0 \qquad (2.9)$$

where $U^D_{iw_i}$ is the derivative of trade union i's utility with respect to its wage rate.

Equation (2.9) expresses that the trade union federation equates the utility loss $[u((1-t)w_i) - u(b)]$ for the workers who become unemployed, $L'_i(w)$, as a result of a marginal rise in the wage rate, to the marginal gain in utility $(1-t)u'((1-t)w_i)$ for the employed, ℓ, of such a marginal rise in the wage rate. In other words, the union sets as a typical monopolist a markup of $u((1-t)w_i)$ over $u(b)$ that is an inverse function of the elasticity of demand for labour e_ℓ that the trade union faces. Equation (2.9) implies therefore that the wage rate is set higher, the higher the marginal utility which is associated with an increase in wage income and the less elastic labour demand is with respect to changes in the wage rate.

Since all decentralized trade unions deal with similar firms and since their memberships are of similar size, they will set the same wage rate and hence a symetric equilibrium results. Because of this, the demand for labour elasticity for one firm is the same as the demand for labour elasticity of the I firms taken together[3]. Equation (2.9) can therefore be written as,

$$U^D_w = L'(w)[u((1-t)w) - u(b)] + (1-t)\ell u'((1-t)w) = 0,$$

$$w_i = w, \quad \ell = L(w) = IL_i(w_i) \qquad (2.10)$$

The solution to the decentralized trade unions problem can easily be depicted graphically for the situation where the number of public sector employed is zero (g=0). Note that the labour demand curve can be conceived in terms of the gross wage rate as well as in terms of the net wage rate $(\ell_i = L^n_i((1-t)w_i, b, g))$. Since g=0, the tax rate is zero at the full employment wage rate, and at that point the labour demand curves in terms of gross and net wage rates coincide. For every other (positive) tax rate, the labour demand curve in terms of the net wage rate lies below the labour demand curve in terms of the gross wage rate.

Each trade union chooses the gross wage rate where its indifference curve is tangent to its labour demand curve in terms of the net wage rate at the given tax rate (see figure 1). If the trade unions are risk neutral, they maximise the shaded area, the surplus of the net wage sum over the sum of the benefits the employed would receive in case of unemployment. If the trade unions are risk averse, they will attach relatively more value to the degree of employment.
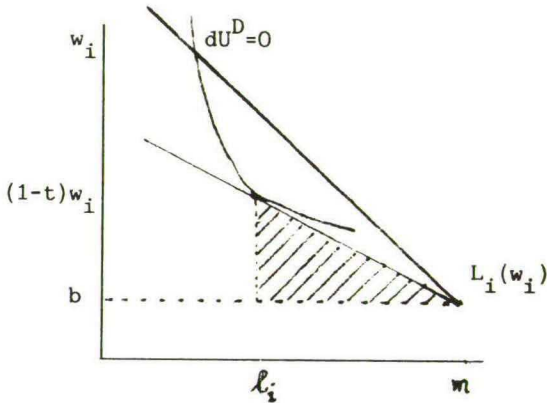

Figure 1. The solution to the decentralized trade unions problem

The gross wage rate can be solved from equation (2.10), as a function of the level of benefits and the tax rate,

$$w = Q^D[b,t] \tag{2.11}$$

The effects of changes in the tax rate respectively the level of benefits on the gross wage rate can be determined by applying the implicit function theorem to equation (2.10),

$$Q^D_j = \frac{dw}{dj} = -\frac{U^D_{wj}}{U^D_{ww}}, \qquad j \in \{b,t\} \tag{2.12}$$

which is by the way equivalent to the application of this theorem to equation (2.9). These effects are,

$$Q_t^D = \ell\{(e_\ell+1)u'((1-t)w) + (1-t)wu''((1-t)w)\}/U_{ww}^D,$$

$$Q_t^D > 0 \text{ iff } e_\ell < -1 - \frac{(1-t)wu''((1-t)w)}{u'((1-t)w)} \tag{2.13}$$

and,

$$Q_b^D = L'(w)u'(b)/U_{ww}^D > 0 \tag{2.14}$$

An increase in the wage tax rate will make the unions increase the gross wage rate if (sufficient condition) the demand for labour elasticity which the unions face is larger than unity in absolute terms. If the trade unions are very risk averse, $u''((1-t)w)/u'((1-t)w)$ is negative and large in absolute terms), this condition is substantially relaxed.

The effect of an increase in the level of benefits on the gross wage rate is unambiguously positive ($Q_b^D > 0$). An increased level of benefits reduces the opportunity costs for the trade unions of increasing the wage rate; the unemployed resulting from a rise in the gross wage rate get better paid. The decentralized trade unions behaviour is not affected by a change in the size of the the labour force (m) or by a change in the number of public sector employees, because it does not affect their utility.

These results are well known for the one union one firm case (e.g. Calmfors 1982; McDonald and Solow 1981; Oswald 1982; Van der Ploeg 1986) but they do not take account of the effect of the government budget constraint c.q. her tax setting policy. For every tax rate there exists an optimal gross wage rate for the trade unions (see figure 2), but there exists just one tax rate, that satisfies the government budget constraint in the symetric equilibrium.
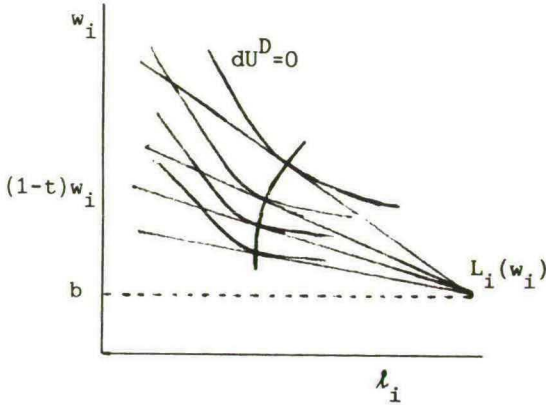
Figure 2. The solution to the decentralized trade unions problem

It follows from the government budget constraint, equation (2.4), that the tax rate changes as a result of a change in the level of benefits, the size of the labour force, the number of public sector employees and the average private sector wage level. The reduced form equation for the wage rate is,

$$w = Q^D[b, T(w,b,g,m)] = W^D[g,b,m] \qquad (2.15)$$

which derivatives can be calculated by applying the implicit function theorem to equation (2.10) with the labour demand and the tax rate substituted out using the aggregate version of the labour demand equation (2.2) respectively the governments tax rule, equation (2.4), as,

$$W_b^D = \frac{1}{1-T_w Q_t^D} \cdot \{T_b Q_t^D + Q_b^D\},$$

$$W_b^D > 0 \text{ if } -1 < e_\ell < -\frac{(m-\ell-g)}{m} \qquad (2.17)$$

$$W_g^D = \frac{1}{1-T_w Q_t^D} T_g Q_t^D \qquad (2.18)$$

and,

$$W_m^D = \frac{1}{1-T_w Q_t^D} T_m Q_t^D \tag{2.19}$$

Taking account of the budget constraint makes the effect of a change in the level of benefits on the gross wage rate ambiguous. The sign is likely to be positive however. This will be the case if an equilibrium exists and if the labour demand elasticity in absolute terms is larger than the unemployment rate.[4] The ambiguity arises because a rise in the level of benefits not just induces the trade unions to raise their wage demands c.p. the tax rate $(Q_b^D > 0)$, but also drives up the tax rate $(T_b > 0)$. This increased tax rate might in turn cause the trade unions to moderate their wage demands to the extent that they may fall on balance. This however will only be the case if a small rise in the tax rate makes the trade unions cut their wage demands amply, $(Q_t^D$ is negative and large)[5].

The effects of a change in the number of public sector employees g, and in labour supply m, $(W_g^D$ resp. $W_m^D)$, on the gross wage rate, depend on the sign of Q_t^D, which in turn depends on the size of the demand for labour elasticity and the degree of risk aversion of the trade union. This dependence of W_g^D and W_m^D on the sign of Q_t^D is not surprising because the number of public sector employees, g, and the size of the labour supply, m, exert their effect on the wage setting behaviour of the trade unions solely through the tax rate (see equations (2.10) and (2.11)).

Once the effects on the gross wage rate are established it is easy to derive the effects of changes in the level of benefits, the number of public sector employees and the size of the labour force on the rate of unemployment and the levels of employment and economic activity. They can be derived from the aggregate version of the labour demand curve $(L_w < 0)$, the production function $(dy/d\ell < 0)$ and the definition of the unemployment rate $((m-\ell-g)/m)$. So the effects on the levels of employment and economic activity are opposite to the effects on the gross wage rate.

Having determined the behaviour of decentralized trade unions in this section and the way the wage rate reacts to changes in the exogenous variables both ceteris paribus the tax rate and with the tax

rate   determined   by the governments budget constraint, attention is now
turned to centralized wage setting.

3. Centralized wage setting

Consider an all encompassing private sector trade union or trade union federation, referred to as a centralized trade union, which faces the same economy as the decentralized trade unions described in the previous section. The centralized trade union guards furthermore the same interests as the independent trade unions in the decentralized wage setting situation and negotiates seperately with all the firms. Note that this is an innocuous assumption because the centralized trade union can not wield more power than the decentralized trade unions in dealing with the various firms.

The basic difference in behaviour between the centralized trade union and the I firm specific trade unions is that the centralized trade union will not neglect the tax rule or budget constraint of the government.

The centralized trade union maximises a utilitarian utility function that is equivalent to the sum of the utilitarian utility functions of the I small trade unions in the decentralized wage setting situation,

$$\max_{w} \; U^C = \ell u((1-t)w) + (m-\ell-g)u(b),$$

$$\ell = IL_i(w) = L(w), \; \frac{n}{n_i} = I \qquad (3.1)$$

The reference group of the centralized trade union includes all the members of the reference groups of the trade unions in the decentralized case. The labour demand function the centralized trade union faces, is the sum of all the labour demand curves the decentralized trade unions faced.

The unions problem can be solved by maximising the centralized trade unions utility function (3.1) subject to the aggregate version of the labour demand function, equation (3.2) and the government budget constraint equation (2.4)[6], for,

$$U^C_w = L'(w)[u((1-t)w) - u(b)] + \ell(1-t-wT_w)u'((1-t)w) = 0 \quad (3.2)$$

which in turn can be solved for the wage rate,

$$w = W^C[b,g,m] \tag{3.3}$$

where t and T_w are defined according to equations (2.4) and (2.5) respectively and $(1-t-wT_w)$ is positive in the relevant area because otherwise the centralized trade union could obtain a higher net wage rate and a higher level of employment at the same time. Equation (3.2) expresses basically the same wage setting behaviour as that described by equation (2.10). The centralized trade union makes the utility loss, $[u((1-t)w) - u(b)]$, for the workers who become unemployed, $L'(w)$, as a result of a marginal rise in the wage rate equal to the marginal gain in utility, $u'((1-t)w)$, for the employed workers, ℓ, of a rise in the wage rate.

The basic difference between the condition for an optimum for centralized wage setting (equation (3.2)) and this condition for decentralized wage setting (equation (2.10)) is the term wT_w on the right hand side of equation (3.2). This term wT_w, the effect of a change in the (average) wage rate on the wage tax rate multiplied by the wage rate, shows up in equation (3.2), because the trade union federation takes into account the effect on the wage tax rate and thereby the net wage rate it produces by changing the gross wage rate.

The solution to the centralized trade unions problem can easily be depicted graphically (see figure 3) for the situation where the number of public sector employed is zero ($g=0$). The aggregate labour demand curve can be conceived in terms of the gross wage rate as well as in terms of the net wage rate ($\ell=L^n((1-T(w,b,g,m))w,b,g)$) with an endogenous tax rate. The slope of the labour demand curve in terms of the net wage rate is positive, but less steep than the slope of the labour demand curve in terms of the gross wage rate if the net wage rate increases with the gross wage rate, but less than the gross wage rate ($1 > 1-t-wT_w > 0$). The centralized trade union chooses the gross wage rate where its indifference curve is tangent to the labour demand curve in terms of the net wage rate at the endogenous tax rate which satisfies the government budget constraint.
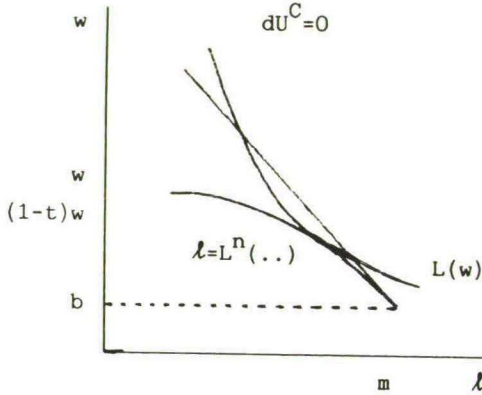
Figure 3. The solution to the centralized trade unions problem

The effect of a change in the level of benefits on the gross wage rate under centralized bargaining, can be determined by applying the implicit function theorem to equation (2.3) and the government budget constraint, equation (2.4), as,

$$W_b^C = - \frac{U_{wb}^C + T_b U_{wt}^C}{U_{ww}^C + T_w U_{wt}^C} = \frac{\ell\{\frac{m-\ell-g}{\ell+g}\}[1-t-wT_w]u''((1-t)w)}{U_{ww}^C + T_w U_{wt}^C} +$$

$$\frac{L'(w)[u'(b)-Zu'((1-t)w)]}{U_{ww}^C + T_w U_{wt}^C}, \quad Z = \frac{\ell}{\ell+g} - \frac{g}{\ell+g}\frac{m-\ell-g}{\ell+g} \lessgtr 1 \quad (3.5)$$

If the second order condition for an optimum is fulfilled, $(U_{ww}^C + T_w U_{wt}^C < 0)$, then the effect of a rise in the level of benefits on the gross wage rate is positive. Note that such a definite result could not be obtained for the decentralized wage setting situation (see equation 2.16). Similarly the effects of a change in the number of public sector employees g, and in labour supply m, (W_g^C resp. W_m^C), on the gross wage rate, are positive.

$$W_g^C = - \frac{T_g U_{wt}^C}{U_{ww}^C + T_w U_{wt}^C} > 0 \qquad (3.6)$$

$$W_m^C = - \frac{T_m U_{wt}^C}{U_{ww}^C + T_w U_{wt}^C} > 0 \qquad (3.7)$$

where,

$$U_{wt}^C = (\frac{\ell}{\ell+g} - \frac{1}{\ell})e_\ell u'((1-t)w) + w\ell(1-t-wT_w)u''((1-t)w) > 0$$

Now the interesting question is, how do the wage level, the rate of unemployment and the levels of employment and economic activity under decentralized wage setting compare with their counterparts under centralized wage setting for similar levels of benefits and labour supply? This question is sought to be answered in the rest of this section.

Denote with the letter D, the solution to the decentralized wage setting problem as defined by equations (2.1) - (2.3) and (2.9) - (2.10), and denote with the letter C the solution to the centralized wage setting problem as defined by equations (3.1) - (3.3).

Definition:
$$X = L'(w)[u((1-t)w) - u(b)]$$
$$+ \ell(1-t-wT_w)u'((1-t)w) + Y = 0$$
$$Z = t - \frac{1}{w(\ell+g)}\{b(m-\ell-g) + gw\} = 0$$

Proposition 1: $w^C < w^D$ if $T_w^D > 0 \; \forall \; w \in W\{w^D, \ldots, w^C\}$, $b^C = b^D$, $m^C = m^D$,
$$(U_{ww}^C + T_w^C U_{wt}^C < 0) \text{ and } g^C = g^D$$

Proof Proposition 1: It follows that $Y = 0$ in C and $Y < 0$ in D since $\ell_w^D T_w^D u'((1-t^D)w^D) < 0$. If a positive impulse of size $Y = -\ell_w^D T_w^D u'((1-t^D)w^D)$, is given to the system consisting of the equations X and Z, evaluated at w^D, the wage rate changes from w^D to w^C. From the implicit function theorem follows that

$$w^C - w^D = -\frac{\ell^D_w D_w T_w]u''((1-t)w)}{U^C_{ww} + T_w U^C_{wt}} < 0 \text{ if } U^C_{ww} + T_w U^C_{wt} < 0,$$

Q.E.D.

What makes this proposition interesting is ofcourse that the if conditions are very likely to hold. First $U^C_{ww} + T_w U^C_{wt} < 0$ in w^C is a condition for the existence of a maximum for the unions optimization problem (see equations 2.9 and 2.10). The proposition requires just marginally stronger conditions, namely that $U^C_{ww} + T_w U^C_{wt}$ is negative not only in w^C, but also in the area between w^C and w^D and secondly a positive T_w, which, as is argued in section 2, is most likely the case.

The size of wage difference between the situations of centralized and decentralized wage setting, depends among other things on the signs of T_w and U^C_{wt}. If both these terms are positive and a higher wage rate therefore leads to a higher tax rate, and a higher tax rate to a higher wage rate, then the nominator $U^C_{ww} + T_w U^C_{wt}$ is likely to be small (since U^C_{ww} is negative) and the size of the wage difference therefore large. This will especially be the case if T_w is large, because that affects the denominator as well. A large T_W is among other things caused by a high demand for labour elasticity.

From proposition 1 it follows suite that the level of employment is higher under centralized wage setting since the demand for labour curve is downward sloping in the wage rate (L'(w)<0). From this it follows that the rate of unemployment is smaller while the level of economic activity is higher under centralized wage setting because output increases with labour input (dy/dℓ>0).

Generally the net wage rate will be higher in the decentralized wage setting situation. This need not be the case however. If 1-t-wT$_w$ is negative in this situation and the labour demand curve in terms of the net wage rate and with an endogenous tax rate slopes downward, it is possible that the net wage rate in the decentralized wage setting situation lies below the wage rate of the centralized wage setting situation although the gross wage rate is higher. This situation is illustrated in figure 4.
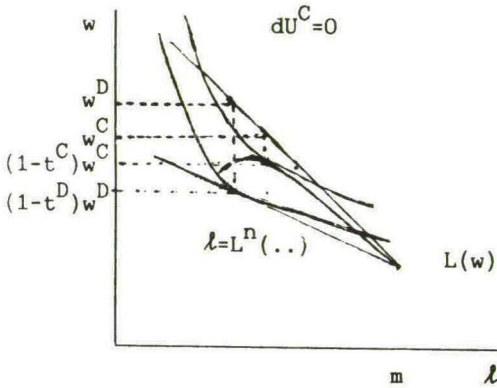
Figure 4. A smaller net wage rate in decentralized wage setting

The centralized wage setting situation is Pareto superior; all decentralized trade unions would benefit if the wage rate from the centralized wage setting situation would prevail. This results from the assumption that the centralized trade unions utility function consists of the sum of the decentralized trade unions utility functions, while the centralized trade union is in the position to internalize the externality that comes about through the tax setting policy of the government.

The question can therefore be raised, why the decentralized trade unions do not merge. One reason could be that in order to facilitate centralized bargaining some of the trade unions would have to give up other advantages that outweigh the benefits of internalizing the external effect, such as the exploitation of a relatively inelastic labour demand curve or the exploitation of the trade off between employment and wages, which might be easier to arrange if bargaining takes place at the firm or plant level. Another reason could be that it might be very hard for decentralized trade unions to cooperate in a cheating proof way due to communication problems (note that small and homogeneous countries are more likely to score higher on Bruno and Sachs's corporatism index).

An argument in favour of corporatism, which is not pursued here, is the possibility for a centralized trade union to exploit the trade off between its goals and the governments goals (see Mulder 1988). Combining these arguments with the arguments put forward in Harts (1982)

and Abrahams (1987) paper, one obtains the global notion that there ex-
ists a U-shaped relation between the level of the wage rate and the
level of wage setting (see figure 5), instead of a linear relation (see
table 1). More likely however the relationship is multi dimensional with
a role for the factors influencing the level of bargaining, such as com-
munication problems, legal arrangements and exogenous historic events
(for example war) as well.
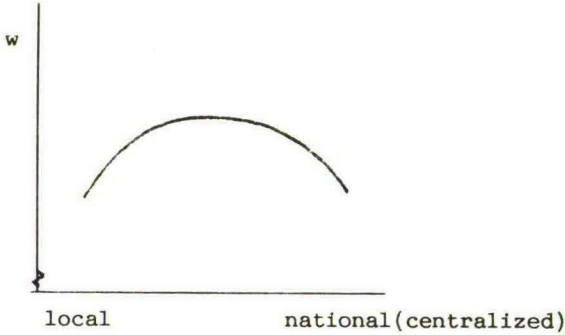
Figure 5. The relation between the wage rate and the level of wage
         setting

4. Concluding remarks

Bruno and Sachs (1985) noted that "unfortunately little if any formal theoretical modelling of national-level bargaining has yet been carried out". This paper aims to fill part of this gap. It models an important reason for the observed wage moderating effect of centralized wage setting or corporatism in Bruno and Sachs's terminology in two set ups for nation wide bargaining; a situation for centralized nation wide wage setting and a set up for nation wide decentralized wage setting.

It has been shown that under conditions that are quite likely satisfied, decentralized wage setting results in a higher gross wage rate, reduced levels of employment and economic activity, an increased rate of unemployment and sometimes a smaller net wage rate, for the same levels of benefits, labour supply and government employment. The first condition for this to be true concerns the positivity of T_w, the effect of a change in the wage rate on the wage tax rate, which is the case if the demand for labour elasticity is in absolute terms larger than the unemployment rate. The second condition requires that the solutions for the optimization problems exist and hold in a somewhat larger area than is necessary to ensure a maximum.

The crucial difference between centralized and decentralized wage setting which leads to this result is the exogeneity of the wage tax rate in case of wage setting by decentralized trade unions versus the endogeneity of this variable in case of wage setting by a centralized trade union. A centralized trade union will realize that a higher gross wage level will generally imply higher net government expenditures on social security and the like, and therefore a higher wage tax rate, which reduces the gains of increasing the gross wage rate. This will moderate the wage demands of a centralized trade union. Trade unions in a decentralized setting on the other hand will neglect the government budget constraint because the effect of their behaviour on net government expenditures is very small for every single trade union.

The central argument put forward in this paper is robust in the sense that it does not disappear in a steady state situation while the reasons for the decentralized trade unions not to merge can be sufficiently strong to prevent collusion.

Quantatively the argument put forward in the paper will be impor-
tant in countries with a relatively large number of public sector
employees and a sizable labour demand elasticity.

Footnotes

1. T_w is regarded as positive as well by for example Calmfors and Horn
   (1986). They quote evidence from Sweden to substantiate the realism
   of this assumption.

   If positive other public expenditures are included in the budget con-
   straint, the labour elasticity required for a positive T_w becomes
   somewhat larger. If on the other hand profit tax revenues which are
   negatively related to the wage rate, are included in the government
   budget constraint the required labour demand elasticity is smaller.

2. The second order condition for a maximum for the unions problem is
   given by:

   $$U^D_{ww} = L''(w)[u((1-t)w) - u(b)] + 2L'(w)(1-t)u'((1-t)w)$$

   $$+ \ell(1-t)^2 u''((1-t)w) < 0, \qquad U^D_{ww} < 0 \text{ if } L''(w) < 0$$

   A sufficient condition for a maximum is that the second derivative of
   the demand for labour function is negative, i.e. that the demand for
   labour curve is concave to the origin in the relevant area.

3. If other production factors are included in the production function,
   such as capital, the argument will go through as well if output is
   homogeneous of degree one in these other factors of production.

4. Positivity of $1-T_w Q^D_t$ is a condition for the existence of an
   equilibrium, while positivity of $T_b Q^D_t + Q^D_b$ is ensured if the demand
   for labour elasticity is larger than the unemployment rate in ab-
   solute terms. This latter condition is quite likely to be fulfilled,
   especially since it is just a sufficient and not a necessary
   condition.

5. This result contrasts with the findings of Kemp, Leonard and Van Long (1987). They find that a <u>rise</u> in the level of benefits, defenitely results in a <u>smaller</u> gross wage rate. This surprising outcome is basically due to the assumption that trade unions just maximise the net wage rate, without regard of the pay unemployed get or the number of people that are employed as long as at least half the labour force is employed. Higher benefits therefore in general only influence the wage setting behaviour of the trade unions by driving up the tax rate. The higher tax rate unambiguously reduces the wage claims of the trade unions because a smaller gross wage rate makes the tax rate go down and the net wage rate go up, which is in the absence of any other effect, a sufficient motive even for the small decentralized trade unions assumed in their set up, to reduce their wage claims.
If the trade unions would just marginally care about the level of benefits for the unemployed their result would change, because in the present set-up the motive to reduce the gross wage claim in the face of a rise in the level of benefits is very week indeed. Their results are therefore not quite general.

6. The second order condition for the centralized trade union or trade union federation optimization problem is,

$$U^C_{ww} + T_w U^C_{wt} = L''(w)[u((1-t)w) - u(b) + \frac{\ell}{\ell+g}(b+tw)u'((1-t)w)] +$$

$$(\ell+g)(1-t-wT_w)^2 u''((1-t)w) +$$

$$[2(1-t-wT_w) + (2t + T_w + wT_w)\frac{\ell}{\ell+g}]L'(w)u'((1-t)w)$$

$$U^C_{ww} + T_w U^C_{wt} < 0 \text{ if } L''(w) < 0 \text{ and } e_{\ell+g} < -\frac{1}{2}$$

A twofold sufficient condition for this second order condition to hold is first a second derivative of the demand for labour with respect to the gross wage rate $L''(w)$, which is negative, and second that the elasticity of total labour demand $e_{\ell+g}$, which the trade union federation faces is less than minus half.

References

Abraham, F. (1987) "Bargaining structures and macroeconomic performance in a small open European economy with imperfectly competetive world markets", University of Michigan discussion paper no. 200.

Bean, C.R., Layard, P.R.G. and Nickell, S.J. (1986) "The rise in unemployment: A multi-country study", Economica Vol. 53, Supplement, pp. 1-22.

Bruno, M and Sachs, J. (1985) Economics of world wide stagflation, Basil Blackwell, Oxford

Calmfors, L. (1982) "Employment policies, wage formation and trade union behaviour in a small open economy", The Scandinavian Journal of Economics, Vol. 84, No. 2, pp. 345-373.

Calmfors, L. and Horn, H. (1985) "Classical unemployment, accomodation policies and the adjustment of real wages", Scandinavian Journal of Economics, Vol. 87 (2), pp. 234-261.

Calmfors, L. and Horn, H. (1986) "Employment policies and centralized wage-setting", Economica 53, pp. 281-302.

DeMenil, G. (1971) "Bargaining: Monopoly power versus union power, MIT Press, Cambridge, Massachusetts.

Dertouzos, J.N. and Pencavel, J.H. (1981) "Wage determination under trade unionism: the international typographical union", Journal of Political Economy, 89, pp. 1162-81.

Dunlop, J.T. (1944) Wage determination under trade unions, Mac Millan, New York.

Gordon, R. (1982) "Why US wage and employment behaviour differs from that in Britain and Japan, The Economic Journal, 92, pp. 13-44.

Grossman, S. and Hart, O. (1981) "Implicit contracts, moral hazard and unemployment", American Economic Review, vol. 71, pp. 301-307.

Grout, P.A. (1984) "Investment and wages in the absence of binding contracts: a Nash bargaining approach", Econometrica, 52, pp. 449-460.

Hart, O. (1982) "A model of imperfect competition with Keynesian features", Quarterly Journal of Economics, XCVIII, 2, pp. 109-138.

Hersoug, T. (1985) "Workers vs. government - who adjusts to whom?", The Scandinavian Journal of Economics, Vol. 84, No. 2, pp. 270-292.

Jackman, R.J. (1985) "Counterinflationary policy in a unionised economy with non-synchronized wage setting", Scandinavian Journal of Economics, Vol. 87 (2), pp. 357-378.

Kemp, M.C., Leonard, D. and Van Long, N. (1987) "Trades Unions, seniority and unemployment", European Economic Review, 31, pp. 1093-1112.

Lange, P. Ross, G. and Vannicelli (1982) Union, change and crisis: French and Italian union strategy and the economy 1945-1980, London, Allen and Unwin.

Manning, A. (1987) "Collective bargaining institutions and efficiency. An application of a sequantial bargaining model", European Economic Review, 31, pp. 168-176.

McCallum, J. (1983) "Inflation and social consensus in the seventies", The Economic Journal", 93, pp. 784-805.

McDonald, I. and Solow, R. (1981) "Wage bargaining and employment", American Economic Review, 71, pp. 896-908.

Mulder, C.B. (1988) "Efficient contracts between a government and an encompassing trade union", unpublished mimeo, Tilburg University.

Newell, A. and Symons, J.S.V. (1987) "Corporatism, laissez-faire and the rise in unemployment", European Economic Review, 31, pp. 567-614.

Nickell, S.J. and Andrews, M. (1983) "Unions, real wages and employment in Britain 1951-1979", Oxford Economic Papers, vol. 35, Supplement, pp. 183-206.

Oswald, A. (1979) "Wage determination in an open economy with many trade unions", Oxford Economic Papers, 31, vol. 3.

Oswald, A. (1982a) "The micro-economic theory of the trade union", Economic Journal, Vol. 92, pp. 576-595.

Oswald, A. (1982b) "Wages, trade unions and unemployment: What can simple models tell us?", Oxford Economic Papers, Vol. 34, pp. 526-545.

Oswald, A. (1985) "The economic theory of trade unions: an introductory survey", Scandinavian Journal of Economics, 87, pp. 160-193.

Pencavel, J.H. (1984) "The trade-off between wages and employment in trade union objectives", Quarterly Journal of Economics, vol. 99, pp. 215-232.

Pissarides, C.A. (1986) "Trade unions and the efficiency of the natural rate of unemployment", Journal of Labor Economics", vol. 4, no. 4, pp. 582-595.

Van der Ploeg, F. (1986) "Trade unions, investment and employment: a non cooperative approach", Centre for Labour Economics, Discussion paper no. 224, European Economic Review forthcoming.

Sampson, A.A. (1983) "Employment policy in a model with a rational trade union", The Economic Journal, 93, pp. 297-311.

Symons, J.S.V. and Layard, R. (1983) "Neo-classical demand for labour functions for six major economies", discussion paper No. 166, Centre for Labour Economics, London School of Economics.

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