Seminar Paper No. 402

CENTRALIZATION OF WAGE BARGAINING
AND MACROECONOMIC PERFORMANCE

by

Lars Calmfors and John Drifill

INSTITUTE FOR INTERNATIONAL ECONOMIC STUDIES

University of Stockholm
Seminar Paper No. 402

CENTRALIZATION OF WAGE BARGAINING AND MACROECONOMIC PERFORMANCE

by

Lars Calmfors and John Driffill

Seminar Papers are preliminary material circulated to stimulate discussion and critical comment.

December, 1987

Institute for International Economic Studies
S-106 91 Stockholm
Sweden
CENTRALIZATION OF WAGE BARGAINING AND MACROECONOMIC PERFORMANCE

by

Lars Calmfors, Institute for International Economic Studies,
University of Stockholm.

and

John Driffield, Department of Economics,
University of Southampton

Abstract

Differences in macroeconomic performance among countries are often attributed to differences in wage setting structures. This paper examines the effects of varying degrees of centralization of wage bargaining. The analysis is both theoretical and empirical, and also includes numerical examples. The upshot is that both highly centralized systems with national bargaining (such as in Austria and the Nordic countries), and highly decentralized systems with wage setting at the level of individual firms (such as Japan, Switzerland and the US) are likely to perform well. The worst outcomes with respect to employment are to be expected in systems with an intermediate degree of centralization (such as in Belgium and the Netherlands). These conclusions challenge the conventional wisdom according to which more "corporatist" economies always perform better than less "corporatist" ones.

We are grateful to Judith Weibull for help with compilation of data and regressions, and to Håkan Lyckeborg for help with the non-parametric statistical tests. Annica Hjertmman, Annika Gustafsson and Anna Thompson typed numerous versions with great care and patience.
It has gradually become recognized that wage setting may be as important for macroeconomic performance as policies on the part of governments. Today it is a commonplace to explain the diverse experiences of countries with reference to differences in wage setting institutions. But the literature in the field often lacks precision due to an attempt to cover too much ground. There seems to be much to be gained from pursuing a systematic analysis of one aspect at a time. We choose to analyze how macroeconomic performance is affected by the extent of centralization of wage bargaining, which we believe to be a crucial factor.

Wage setting arrangements differ fundamentally among OECD countries in this respect. At one extreme are countries like, e.g., the US, Switzerland, Japan and Canada with decentralized wage setting mainly at the level of individual firms. At the other extreme are the Nordic countries and Austria with centralized bargaining between national trade union movements and employer federations. In between, there are countries such as, e.g., Germany, Belgium and the Netherlands, where bargaining occurs at industry level.

The success especially of Sweden, Norway and Austria in keeping up employment is usually attributed to their centralized bargaining structures that allow macroeconomic considerations to be taken. Similarly, the absence of such considerations under decentralized bargaining in, say, Britain, France and Canada is a widely held explanation for the high unemployment there. But, at the same time, the real wage flexibility resulting from decentralization is regarded as a major cause of the low unemployment in Japan and Switzerland. It is also standard to explain the success of the US economy in generating more employment growth over the past decade than the European economies in the same way.
There seem to exist two fundamentally different views. According to the first, centralization is seen as a guarantee that wage setters will act according to broader interests. In particular, this view has been expressed by political scientists in the literature on "corporatism", and it has recently also been adopted by many economists.

The opposing view holds instead that wage increases would be restrained if market forces were allowed to play a larger role. This is, the rationale behind the Thatcher government's attempt to break union power. Similar ideas have inspired the employer side in the Nordic countries to try to break up the central wage negotiations.

It is easy to be sympathetic to both views. Both the idea that competitive forces will restrain wages, and the idea that there are gains to be had from internalization of the external effects of wage increases within large encompassing organizations have solid foundations. Indeed, we shall claim that both heavy centralization and far-reaching decentralization are conducive to real wage restraint, whereas intermediate degrees of centralization are harmful. Our basic hypothesis is one of a hump-shaped relation between centralization and real wages (unemployment) as depicted in Figure 1 rather than one of a monotonic relation according to which increased centralization always reduces (or increases) real wages and unemployment. The hypothesis is related to Mancur Olson's (1982) idea that organized interests may be most harmful when they are strong enough to cause major disruptions but not sufficiently encompassing to bear any significant fraction of the costs for society of their actions in their own interests.

The article reviews both empirical evidence and relevant theory on the effects of centralization. Section 1 describes the basic differences in wage setting institutions between OECD countries, and section 2 presents
some stylized facts on macroeconomic performance. Section 3 examines critically the literature on corporatism. Section 4 develops an analytical framework and provides numerical simulations on the effects of centralization. Section 5 contains our conclusions.

1. Wage setting institutions in the OECD countries

Below the broad features of wage setting arrangements for individual countries are described.

1.1. Individual country descriptions

Central wage agreements between powerful national employer associations and union confederations characterize the Nordic countries (Denmark, Finland, Norway and Sweden). These centralized systems have proved quite stable in the past, although there has been a strong tendency to increased decentralization recently. The main threat to the established framework seems to be the competition about wage relativities between three groups of employees that usually bargain separately at the national level: private-sector blue-collar workers, private-sector white-collar workers and public-sector employees in general (Flanagan et al 1983 and Elvander 1987).

In Austria wage agreements are formally made at the industry level, but all wage contracts have to be approved by the central confederation of labor (ÖGB), which organizes both blue-collar and white-collar workers in the private as well as in the public sector. No negotiations are allowed without the approval of the central Subcommittee on Wages and Prices consisting of union and employer representatives. It is concluded by Flanagan et al (1983) that "the centralization of authority in the ÖGB probably exceeds that of any other democratic trade union movement".
In Canada, US, Japan, Switzerland, Britain, France and Italy, wage bargaining is instead mainly at the enterprise level, although there are certain elements of industry bargaining in the latter three countries. In Canada and the US, there is no tradition of involvement by central organizations in bargaining, and indeed there exist no central employer organizations. In the other countries central organizations play some role, but primarily in negotiations on general working and employment conditions. In Switzerland, France and Italy unions are split along political and religious lines.

As to Japan, there are several national confederations of labor but the coordinating roles are minor, and the actual negotiations take place exclusively at the enterprise level. Britain distinguishes itself from the other countries because of the complex intermingling of crafts and industrial unions, which has come to mean that in, e.g., large engineering firms 15-20 different unions may be represented in one working place (Bratt 1986).

In Germany, the Netherlands and Belgium the main negotiations occur at industry level. In Germany there exists one central employer association and one central union confederation but they are not usually involved in actual bargaining (Flanagan et al 1983). Wage agreements are usually struck within industries on a regional basis. The wage agreements in the metal industry are typically pattern making.

In the Netherlands and Belgium, organizations are split along ideological and religious lines. The Belgian system of industry negotiations within so called Parity Commissions, consisting of labor and employer representatives has been quite stable over time, whereas the Dutch system changed in the sixties from one of high centralization in connection with government income policies to one of industry bargaining (Faxén 1982
and Bratt 1986). In contrast to Germany, several contracts are struck within each industry since the jurisdictions of the various parallel unions overlap, but there is a high degree of coordination on the union side (Flanagan et al 1983).

The least transparent systems occur in New Zealand and Australia, which have ingredients of both centralization and decentralization. On the one hand there is a large element of wage setting in individual enterprises and for individual crafts often on a regional basis. On the other hand compulsory arbitration tribunals that attempt to follow common norms play important roles. The trend in both countries is in the direction of increased centralization connected with government attempts at tripartite agreements (Rimmer 1985 and Easton 1986).

1.2. Rankings of countries

If one wants to relate wage setting behavior and macroeconomic performance empirically to centralization, a more exact quantification of inter-country differences in this respect is required. This in turn presupposes a more precise definition of centralization. We shall define it as the extent of inter-union and inter-employer cooperation in wage bargaining with the other side. In game-theoretic term the focus is thus on the extent to which coalitions are formed among unions and employers respectively.

We prefer the above definition to others that are concerned more with the formal than the behavioral contents of wage setting. One such is the level at which bargaining occurs. Another is the extent to which unions and employers are joined into aggregate bodies with varying powers vis a vis member unions and employers. These alternatives are good "proxies" for
centralization as we have defined it, but, as described above, there are also exceptions.

Column 1 in Table 1 is an attempt to rank countries according to our definition. The ranking is based on an index developed in Appendix 1, which takes into account the extent of coordination both within and between various central organizations. We prefer to put more emphasis on the ranking developed than on a cardinal scale, because we have more confidence in the relative positions assigned to countries than in measurements of the magnitudes of differences.

We have been able to find three other authors, who have ranked countries according to criteria that come close to ours. Schmitter's (1981) ranking (column 2) is based on an index that considers basically the same factors as we do but only for the union side. So is Cameron's (1985) in column 3, which in addition also takes into account the extent of unionization. This can be seen as an attempt to measure cooperation among workers in general rather than among unions only. The main problem with this approach is to judge the extent to which variations in unionization rates reflect differences in the - formal and informal - coverage of union contracts. Blyth (1979), finally, ordered countries according to two criteria: the extent to which unions and employers are joined into central bodies with executive negotiating powers, and the level at which bargaining takes place. We have attempted to weight together these two aspects with equal weights into a composite index of centralization in column 4.

The differences between our ranking and the three in columns 2-4 are minor. Nevertheless, since any classification, must be more or less subjective, it appears important to check the sensitivity of empirical results from cross-country comparisons to variations in the rankings used.
2. Some stylized facts

Our basic hypothesis is the existence of a hump-shaped relation between centralization and real wages. If one believes in a downward-sloping labor demand schedule - for which there is abundant empirical evidence (cf Metcalf 1987) - one should then expect also better employment performance in both centralized and decentralized economies than in those with intermediate centralization. To start with we shall examine the stylized facts in this respect. We prefer this indirect method of comparison, because of the difficulties of comparing real wages and their development across countries in a meaningful way.  

2.1. Measures of macroeconomic performance

Table 1 groups countries into three categories of centralization, and gives a series of macroeconomic indicators relating to employment performance. These concern both 1974-85 and the change in performance between this period and 1963-73, i.e. the period preceding the supply shocks of the seventies.

Columns 1 and 2 refer to actual unemployment rates as standardized by the OECD.

Columns 3 and 4 instead refer to employment as a percentage of working-age population. This measure has the advantage over unemployment that it is not based on adjustments of national statistics in order to account for differences in registration of the unemployed. Nor is it influenced by differences in the extent to which unemployed drop out of the

---

1 The main problem is how to control for differences with respect to technical progress. It has been argued by, e.g., Layard and Nickell (1986) that in any reasonable model of wage determination, technical progress should only affect real wages but not employment: otherwise any application to longer historical periods would give ridiculous results - cf also sections 4.5.5 and 4.5.8.
labor force because of early retirement or discouraged-worker effects. But on the other hand the measure may reflect differences with respect to old age retirements and female work that exert an exogenous influence on wages rather than respond endogenously to them.

Columns 5 and 6 refer to the Okun "misery index", used, e g, in Soskice (1983), according to which rates of unemployment and inflation are added up. The idea is that it may be misleading to measure the workings of the wage setting system by employment performance only as inter-country differences in this respect may also reflect differences in government policies. To the extent that inflationary expectations are similar across countries, one should expect faster inflating countries to be able to buy lower unemployment this way. The Okun index can be seen as a crude attempt to control for such policy differences.

Columns 7 and 8, finally, refer to a performance index of our own, which is obtained by adding up the rate of unemployment with the current account deficit in per cent of GDP. The motivation is similar to the one for using the Okun index: to the extent that there exists a trade-off between unemployment and external balance, actual unemployment may not only reflect the efficiency of the wage setting system per se but also the governments's choice of a point on the economy's "production possibility frontier" with respect to unemployment and external balance. One government may - like in Sweden towards the end of the seventies or in the US in the eighties - choose to inject demand into the economy through expansionary fiscal policies - with the result that the current account deteriorates. Governments with other priorities - say the Dutch or German
ones—may instead prefer situations with current-account surpluses despite high unemployment.²

Some striking observations can be made from the table that lend support to our hump-shape hypothesis. Looking at changes in the different measures between the 1963–73 and 1974–85 periods, the intermediate group shows the worst outcome in all cases. The same holds true for the levels of the various indicators for the 1974–85 period with the exception of the Okun index. Comparing centralized and decentralized economies, the former have performed better both in terms of levels and changes according to the first three indicators, the reverse being true for our own performance indicator.

One obvious distortion in the measures concerns differences with respect to foreign labor. In the post-oil-shock period there has been a large net outflow of foreign labor from especially Switzerland. Between 1973 and 1984 the share of foreign labor in this country fell by 3.1 percentage points, and the bulk of this reduction occurred already in the middle of the seventies (Danthine and Lambelet 1987), so it could be argued that the 1974–85 figures have been significantly affected. ³ Therefore we also give the averages for the decentralized group excluding Switzerland. In most cases the reported pattern still remains.

---

² In a standard open-economy model, fiscal expansion lowers the product real wage (the money wage deflated by the domestic output price), even if the consumption real wage (the money wage deflated by the consumer price index) stays the same. This is possible if the real exchange rate (the domestic output price divided by the foreign output price measured in the same currency) appreciates. Formally, if \( W \) = the money wage, \( \bar{P} \) = the domestic output price, \( \bar{P}^* \) = the foreign output price measured in the same currency and \( P \) = the consumer price index, we have that \( W/\bar{P} = (W/P)/(P/P) \) and \( P = P(P,\bar{P}^*) \). Thus \( W/P \) will fall at unchanged \( W/P \), if \( P/P \) falls, which occurs if \( P/P^* \) increases.

³ It is not clear on theoretical grounds how an adjustment for the net emigration of foreign labor should be done. For instance, for how long should foreign labor that have returned home be regarded as part of the domestic labor force?
2.2. Rank correlations

It is desirable with a proper statistical test of whether the differences in country experiences conform to our hump-shape hypothesis. Lacking a cardinal scale of centralization, we had to do this through rank correlation tests.

In principle rank correlations can only be used to test for monotonic relations between two rankings but not for non-monotonic ones as we have hypothesized. We therefore proceeded in two steps. First, we examined the evidence in favor of the alternative hypothesis of a monotonic relation between macroeconomic performance and centralization. The countries were then ranked according to each of the eight indicators in Table 2, and Kendall rank correlation coefficients were computed with respect to both our and Cameron's centralization rankings in Table 1. Rows 1 and 2 in Table 3 give the results. Only one significant correlation was found, so the evidence is clearly against such a monotonic relation.

A direct test with rank correlations of our hypothesis presupposes that we develop new institutional rankings, according to which both very centralized and very decentralized economies rank above the intermediate ones. More exactly, if we believe that countries perform better the closer they are to either institutional extreme (centralization or decentralization), we should order them according to precisely that criterion. We therefore constructed new rankings based on both our own and the Cameron rankings according to which the most centralized economy and the most decentralized one were ranked the highest, followed by the second most centralized and the second most decentralized etc. Columns 2 and 5 in Table 4 give the new rankings, and rows 3 and 4 in Table 3 the rank correlations with the various macroeconomic indicators. There appears
strong statistical significance with respect to all measures of change in
performance. This confirms the visual impressions from Table 2. With
respect to the level of macroeconomic performance in 1974-85, the support
for our hypothesized pattern is weaker: only two correlations out of eight
are significant.

We also tried an alternative rearrangement of the original rankings
to allow for the possibility that although intermediate economies may
perform the worst, decentralized countries may also perform worse than
centralized ones, as was suggested by Table 2. To test for this, we ranked
the three most centralized economies first, then took the three most
decentralized ones, the three second most centralized ones etc (column 3
and 6 in Table 4). It appears from rows 5 and 6 in Table 3 that the
correlations in most cases turn out somewhat higher than before: again
there is statistical significance with respect to all measures of change in
performance, but also in six cases out of eight with respect to levels.

Because of the large net emigration of foreign labor from
Switzerland, some kind of sensitivity analysis is required to account for
possible biases resulting from this. The results should be affected most
for unemployment (Switzerland is an outlier in terms of this variable, and
possible mismeasurements are not dampened by any weighting such as with the
performance indices). The problem is more serious with our rankings than
with the Cameron ones, since we classified the country as more
decentralized. Nevertheless, it turned out that the support for a hump-
shaped relation with respect to the unemployment change remained even under
the unreasonable assumption that the "true" unemployment increase in
Switzerland should have been largest and not smallest among the countries
in Table 2 - a 0.24 correlation (significant at a 6.2 per cent level)
remained with the institutional ranking in column 2 of Table 4. On the
other hand it was enough to rank Switzerland as number three instead of as number one in terms of the level of unemployment for 1974-85 to get significance at the 10 per cent level for a monotonic relation with our centralization index. For the performance indices the results are less sensitive, since plausible adjustments of the Swiss figures are not likely to change the rank ordering of the country.

3. A brief survey of the literature

The stylized facts indeed suggest the idea of a hump-shaped relation between centralization and real wages. Still it does not form part of the conventional wisdom. The empirical literature has instead evolved around the related concept of "corporatism" developed in political science. It is widely held that there exists instead a monotonic relation, according to which a larger extent of corporatism always works in favor of real wage moderation. Since it has attracted much attention, we shall take this literature as our starting point.

3.1. The concept of corporatism

The concept of corporatism is given different definitions by various authors, as should be clear from the following quotations:

"institutionalized negotiation, bargaining, collaboration, and accord about wages and 'income policies' (and perhaps additional economic issues) between representatives of the major economic groupings in the society (most typically labor confederations and employers' associations) and often including, in addition, representatives of the government" (earlier version of Cameron 1984 quoted by Bruno and Sachs 1985

"cases in which a centrally coordinated union movement has developed within a political system responsive to labor demand" (Crouch 1985)

"the integration of trade unions in economic policy making in exchange for their incorporation of capitalist growth criteria in union wage policy and their administration of wage restraint to their members" (Panitch 1980)
"wage setting by central organizations, commanding the obedience of individual workers and employers to achieve a high level of employment" (Newell and Symons 1987)

The concept of corporatism is thus very vague. The idea is to characterize the extent to which a more general interest influences the determination of individual wages. But in consequence most definitions come to embrace several diverse aspects that could be expected to have quite different effects, and which probably should be analyzed within different analytical frameworks. In addition to the centralization aspect, the corporatist concept appears also to incorporate the following.

(i) The degree of government involvement in wage negotiations.

Larger government involvement is no doubt facilitated by a high degree of centralization, since the number of actors is then reduced. Norway and Finland, where formal social contracts have sometimes been concluded, are good examples. But it is not a necessary requirement, as shown by, for instance, the experiences of Britain and the Netherlands. Nor does centralized bargaining within the private sector mean that the government has to become directly involved in the negotiations: indeed, the driving force behind the centralization of wage setting in Sweden in the fifties was precisely a desire to avoid government intervention through "private incomes policies" (Flanagan et al 1983).

(ii) The existence of "consensus" between labor and firms with shared perspectives on the goals of economic activity (cf Soskice 1983). This may be reflected in a low frequency of industrial disputes, the existence of works councils and other elements of co-determination in firms etc. The most frequently quoted example is probably Japan with almost paternalistic relations between firms and employees. The emergence of consensus may be related to the possibilities of labor to achieve its goals via the political system, as has been claimed for e.g Sweden and Austria.
(cf. Crouch 1985). However, it is hard to see any causal link from the extent of centralization.

(iii) The aims of the wage setting system rather than the characteristics of it. This is expressed most clearly by Newell and Symons (1987) who state that "the purpose of corporatism, whether overt or covert, must be to obtain lower wages than would otherwise hold". This is the definition we find most problematic, since it is more or less circular.

Classifications of countries according to the degree of corporatism give other results than those according to centralization. The most frequently used one is the Bruno-Sachs ranking (1985), which is shown as column 5 in Table 1. It is based on an index considering central union influence on wage setting, employer coordination, shop-floor union power, and the presence of works councils within firms. The first three factors are closely related to centralization but the fourth variable is designed to measure the extent of consensus between labor and employers. The main difference to the other classifications is that Germany and the Netherlands are ranked above all the Nordic countries, and Switzerland above Denmark and Finland. Japan is also ranked higher than in the centralization rankings, and Australia lower.

3.2. Empirical studies of corporatism

In the most serious studies, wage or reduced-form price equations are estimated, and systematic attempts made to relate estimated parameters to the extent of corporatism.

Bruno and Sachs (1985), and McCallum (1983, 1986) have estimated Phillips-type price equations on a cross-country basis with a measure of corporatism as one of the explanatory variable. In general it turns out strongly significant. The effects are very pronounced: the difference
between the most and least "corporatist" economies may account _ceteris paribus_ for as much as a 5-7 per cent difference in rates of inflation. The results can be taken to indicate lower equilibrium rates of unemployment (NAIRUs) for more corporatist economies.

Bean, Layard and Nickell (1986), and Newell and Symons (1987) have instead estimated wage equations on time series data for individual countries, which are based on union wage setting and bargaining models. Bean _et al_ relate the estimated parameters to the Bruno-Sachs corporatism indicator through rank correlation tests. They are primarily interested in how wages respond to shocks. A main finding is a strong negative correlation between the Bruno-Sachs ranking and the reaction of wages to changes in the wedge between the product real wage (the money wage cost to employers deflated by the output price) and the net consumption real wage to workers (the after-tax money wage deflated by the consumer price index). Since this wedge increased dramatically in most countries in the seventies due to the oil price shocks and tax increases, they interpret the diverse wage responses in more and less corporatist economies as one main determinant of the differences in employment developments.

Newell and Symons (1987) limit their study to five countries (Sweden, Germany, Britain, Japan and the US), but instead analyze each country in great detail. They do not only compare estimated coefficients across countries but also distinguish between "corporatist" and "non-corporatist" episodes within some of the countries. A basic conclusion is that unemployment exerts a more powerful influence on wages in corporatist wage equations. Hence, according to their interpretation, smaller increases of unemployment have been required under corporatism in order to promote a desired downward adjustment of real wages.
The studies quoted may appear to give overwhelming support for a monotonic relation between corporatism and real wage moderation. It is, for example, concluded by Metcalf (1987) that "there is strong evidence, both across countries and over time that corporatism, consensus and superior macroeconomic performance go hand in hand".

We are, however, sceptical about the interpretation of these results. There are two reasons for that. The first is that the vagueness of the concept of corporatism makes it unclear what the studies catch. For instance, if one as McCallum (1986) ranks so diverse countries as on the one hand Austria, Norway and Sweden (on the basis of high centralization) and on the other hand Japan and Switzerland (because of a large amount of consensus) in the same corporatist group, it becomes unclear what is driving the results. In Newell and Symons (1987) considerations with respect to centralization, government intervention and consensus are mixed in a puzzling way. When comparing countries the first aspect is stressed, but when distinguishing between "corporatist" and "non-corporatist" episodes within a country the emphasis is instead on the latter two. We are especially critical against the focus on consensus. Although we do not want to deny that the explanatory power of the regressions can be improved in this way, it is unclear to us what we learn from the exercise; indeed, one should be surprised if one did not find wage moderation in periods when there is consensus about it, especially since it is difficult to define such periods without looking at actual outcomes.

Our second objection has to do with the lack of a firm theoretical basis. In none of the studies are wage equations derived in a general form designed to cover a spectrum of well specified institutional conditions. Instead an equation is typically derived only for wage setting under "non-
corporatist" conditions but then used for ad hoc comparisons of parameter values between various institutional arrangements.

Our criticism of the corporatism literature suggests two lines of analysis. **First**, it seems worthwhile to take the studies at face value and sort out whether the results claimed for a monotonic relation between corporatism and macroeconomic performance could be interpreted also as support for a monotonic relation between centralization and macroeconomic performance. This would contradict our hump-shape hypothesis. Section 3.3. focuses on this topic. **Second**, our discussion points to the need for a consistent analytical framework, which we try to develop in section 4.

### 3.3. Some empirical results

In this section we repeat some of the quoted studies on corporatism substituting indicators of centralization for the corporatist ones in order to shed light on the interpretation. In addition, we exploit a number of other multi-country studies that have not so far been used to test the effects of different wage setting structures. We start out staying as close as possible to the original studies by reviewing the evidence in favor of monotonic relations with respect to centralization in the same way as they did with respect to corporatism.

We first reestimated the equations of Bruno-Sachs (1985) and McCallum (1983) in Appendix 2, distinguishing between the same groups of centralized, decentralized and intermediate economies as in Table 2. The evidence was clearly against a monotonic relation with ceteris paribus lower inflation in more centralized economies. Our centralization variable was insignificant in both the original Bruno-Sachs equation and in an updated version based on later observations. In McCallum's equations it turned out significant in only one out of four equations compared to three
out of four for the corporatism variable in his original study. Indeed, some of his equations now performed very badly. Updated versions worked even worse.

If one focuses on the inter-country comparisons in Newell and Symons (1987) (without distinguishing between "corporatist" and "non-corporatist" periods), the smallest unemployment responsiveness of wages is found in the US, and the largest in Japan. And there is a larger response in Britain than in Germany. No clear-cut conclusions regarding the effects of centralization can be drawn from this.

For the Bean et al study we computed rank correlations between on the one hand our centralization ranking in Table 1 and on the other hand the responses of wages to unemployment and to the wedge. Row 1 in Table 5 shows the results. There emerged significant correlations with respect to the long-run responses of wages both to unemployment and to the wedge.

We also performed the same rank correlation test on a number of other multi-country studies. Of these, Newell and Symons (1985) is most comparable to Bean et al, since it uses a similar framework relating the level of real wages i.a. to the level of unemployment. The only main difference is that the level of real wages (for somewhat unclear reasons) depends upon the change rather than the level of the wedge. The other four studies, Grubb-Jackman-Layard (1983), Grubb (1986), Gordon (1985) and Coe and Gagliardi (1985), are all more traditional Phillips-curve estimations.

Looking first at Newell-Symons (1985), it did not confirm the Bean et al results. As shown in Table 5, neither the responses to unemployment nor the ones to the wedge were significantly correlated with our measure of centralization. As to the four Phillips-curve studies, we found no significant correlations between centralization and the responses wages to slack in three of them. The exception was Gordon, who uses a measure of
the output-gap instead of unemployment as an explanatory variable. In his study there was also a significant influence of centralization on the effect on wage inflation of changes in the ratio between consumer and output prices, with a rise leading to smaller wage changes at higher centralization. But the estimated responses of wages to the productivity slowdown after 1973 appeared to be unaffected.

To check the robustness of our results we repeated the correlation tests using the other rankings in Table 1. In general the Cameron ranking proved insignificant, whereas the others worked more or less as our ranking. Interestingly enough, the Bruno-Sachs ranking did not perform much better than the others, indicating that not even the results claimed for corporatism appear very robust across studies.

We also tested explicitly for the existence of hump-shaped relations in the various studies. The results were mixed. The Bruno-Sachs and McCallum equations in general performed even worse under this specification. For the other studies we examined rank correlations between the response parameters in Table 4 and the rankings designed to capture a hump shape in Table 5. With respect to wage responses to unemployment, significant relations were found in the majority of cases for the rankings derived from the original Cameron one, but not for the rankings derived from our classification. The latter rankings, however, performed well with respect to the wedge and productivity shocks in the Gordon study - as did the Cameron ones - and for long-run changes in the wedge in the Bean et al study.

The conclusion is that we do not find much support for the interpretation that the results claimed for corporatism from price and wage equations are due to centralization. But nor do such studies provide clear
evidence in favor of a non-monotonic relation between centralization and macroeconomic performance.

4. A theoretical framework and numerical illustrations

One main criticism against the corporatism literature has been about the lack of theory. This section aims to show that, in contrast, centralization can be analyzed with well-specified models of union wage setting and bargaining, in which we can easily introduce our definition of centralization as the extent to which various unions and various employers cooperate. These models may help to account for the findings in the preceding section, since they predict that centralization influences the \textit{ceteris paribus levels} of real wages and (un)employment rather than the size of various response parameters. Numerical illustrations of the effects are also provided.

We construct a stylized model economy consisting of 64 separate industries. The details are described in Appendix D, but the main features are as follows. Each industry produces a good with a fixed capital stock and a labor input that can be varied according to the same constant-elasticity-of-substitution production function. Each industry consists of a large number of perfectly competitive price-taking firms. The goods of various industries are imperfect substitutes in demand for each other. The goods may be aggregated into broader and broader groups, at five levels. Each group of goods at one level can be treated as a single good at the next higher level. Goods demand thus has the tree structure illustrated in Figure 2. At any level of aggregation, goods within a group are closer substitutes than goods from different groups, and goods from different groups are more distant substitutes the longer the distance one has to travel along the branches in the tree in order to move from one good to
another. Total nominal demand in the economy is controlled by the government. The economy is completely symmetrical in the sense that the world looks exactly the same from the point of view of each individual firm, sector and union. In equilibrium wages, prices, output and employment will therefore be the same in all sectors.

The labor force is entirely unionized, and unions behave in such a way so as to take into account both employment and the welfare of their employed members. That depends upon the consumption real wage, viz. the money wage deflated by an index of the price level. Unemployed union members receive unemployment benefits.

The model is used to analyze the effects of various wage setting structures ranging from the centralized ones of Austria and the Nordic countries to the decentralized ones of, say, Canada, the US, Switzerland and Japan. In so doing we vary the assumptions on the degree of substitutability between the outputs of different sectors, the extent of union influence on wage setting, and the financing of unemployment benefits. Throughout we impose parameter values relating to the elasticity of labor demand, union welfare functions, the amount of unemployment benefits etc that conform to conventional estimates.

4.1. The monopoly union case

The simplest wage-setting model taking unions into account is the so-called monopoly-union model, according to which unions set wages and firms choose employment on the basis of their labor demand schedule (cf Oswald 1985). A union wage decision then involves making a trade-off between the welfare gain of an increase in the consumption real wage and the welfare loss of the resulting fall in employment. In our framework each union sets a money wage, given total nominal demand in the economy and the money wages
of other unions, so as to reach a desired consumption real wage. The money wage in a sector is positively related to the consumption real wage and to the product real wage (the money wage deflated by the output price) for its labor.

We represent an increase in centralization by letting individual unions form groups within which they determine wages jointly. At the most decentralized level the labor of each firm is organized into separate unions, each acting on its own. These unions might then form separate industry unions organizing all the labor in each industry, and setting industry wages. The next step is when our 64 industry unions form 32 pairs of more aggregate unions, with each pair determining wages jointly. A further level of centralization could involve the 32 pairs joining up to make 16 groups of 4. The final step is when a single economy-wide union confederation sets wages for all unions jointly.

We assume throughout that when industry unions amalgamate, they always do so by forming coalitions between those in sectors producing the closest substitutes. This is a crucial assumption necessary to generate our results. It seems to conform to the pattern of unionization that one observes, and can be motivated theoretically on the ground that the perceived utility gains of cooperation are larger, the closer substitutes the goods involved (cf Calmfors and Driffill 1988). In Figure 2, increasing centralization is thus synonymous with climbing up the tree. At the lowest level of cooperation, industry union (6.1) first cooperates with union (6.2). The next step involves cooperation between these two unions and unions (6.3) and (6.4), so that (5.1) forms an aggregate union, which then at the next higher level of centralization cooperates with union (5.2) to form effectively the more aggregate union (4.1) etc.
We model the impact on wages of increasing centralization as depending on two forces which work in opposite directions: (i) market power and (ii) effects of wages on prices. These can be elaborated as follows.

As unions get larger, they acquire greater market power, in that the demand for labor may fall less rapidly in response to a given money wage increase. In an individual firm, workers have little market power. Any isolated increase in the money wage results in a large employment fall, since the firm is unable to raise its output price unless all firms in the industry do so. But, if the union were to control labor supply to all firms within the industry, the total elasticity of demand for labor with respect to the money wage is lower, since each firm no longer faces a fall in employment relative to other firms in the same industry: the rise in the product real wage due to a given money wage increase is reduced, because the output price of the sector increases. Consequently, an industry union tends to set a higher wage. A similar argument explains why wages tend to become progressively higher as unions encompass more sectors. The larger union enjoys a lower total money wage elasticity of demand for its labor than did the constituent members, because a given money wage increase results in a larger output price rise the more sectors that it encompasses. The rise is larger, and thus also the incentive to raise money wages, the larger the elasticity of substitution between the goods produced by the cooperating sectors, since this increases the cross effects in product demand.

But the effect of money wage rates on the aggregate price level works in the opposite direction. Money wage increases for small unions have only small effects on the price level, so that the percentage rises in consumption real wages are approximately the same. As unions become larger, the effect of the money wage set by the unions on the aggregate
price level increases in size. Hence the real wage gains of a given money wage increase are reduced. This tends to reduce wages as centralization proceeds. For obvious reasons the reductions in real wage gains from given money wage increases are larger when big unions choose to cooperate than when small ones do so. Hence the incentive to lower money wages is also larger in the case of cooperation of large unions.

Alternatively centralization can be seen as the progressive internalization of an externality (cf Calmfors 1987). When each union sets its wage independently of all other unions, it maximizes its own welfare, and ignores the effects on other unions. But when two industry unions cooperate, each can be thought of as setting its own money wage taking the welfare implications for the other into account. There are two such effects: (i) by raising the own sector's output price and hence, via the demand system, the output price of the other sector, an own money wage increase tends to increase employment there (the effect being larger, the closer substitutes are the goods involved); and (ii) by contributing to price rises in general it tends to reduce the purchasing power of money wages in the other industry. If, at the wage which maximizes each union's welfare when it acts independently, the marginal effect of an increase of its wage on the welfare of the other union is positive, then cooperation results in higher wages than independent actions and vice versa.

Whichever way we see it, increased centralization thus produces two opposing influences on wages. The net effect may go in either direction, and certainly there is no need for the relationship to be monotonic. Indeed, it is likely to be hump-shaped. The reason is that one should expect the elasticities of substitution between goods to be larger, the lower the level of aggregation: for instance, butter and margarine are closer substitutes than provisions in general and cars. Hence the increase
in market power is larger when small unions choose to cooperate according to our postulated pattern, at the same time as the difference with respect to price effects are small. When large unions join up the opposite holds.

The argument for a hump shape can also be seen by comparing complete centralization with one economy-wide union and maximum decentralization with firm-specific unions. If unemployment benefits are financed totally out of a tax on profits, the two cases produce identical outcomes. The reason is that in both instances the union decision effectively involves choosing a consumption real wage under the constraint that the relative price of the own sector's output will be unaffected. In the former case this results from equal wage increases in all sectors of the economy, in the latter from the assumption that the output price is exogenous for the individual firm. In all intermediate cases wages are higher. A given increase of the real consumption wage in a sector is then associated with an increase in the relative price of the sector's output, which reduces the increase in the product real wage and thus also the fall in employment. 4

Table 6 illustrates numerical magnitudes of wage differences between various degrees of cooperation between industry unions given that unemployment benefits can be paid for by a profit tax (the feasibility of

---

4 If we let $U^i$ = utility of the union in firm $i$, $W_i = $ the money wage for the union, $P = $ the consumer price index, $L_i = $ employment in firm $i$ and $P_i = $ the output price for firm $i$, maximization of $U^i = U(W_i/P, L_i)$ subject to $L_i = L(W_i/P_i)$, where $W_i/P_i = (W_i/P) \cdot (P/P_i)$, gives $U_1 + U_2 L_1 (P/P_i + (W_i/P)d(P/P_i)/d(W_i/P) = 0$. If the union acts on its own, $dP = dP_i = 0$. If it acts together with all other unions in the economy, so that all money wages are raised equally, $dP/P = dP_i/P_i$. In both cases $d(P/P_i) = 0$. In all other cases $d(P/P_i) < 0$. 
which is checked). We have calibrated the model so that complete
centralization (and thus also complete decentralization to the firm level)
gives a (product and consumption) real wage 4.6 per cent above the full-
employment level with resulting unemployment of the same magnitude.
Simulation 1 sets the elasticity of substitution in demand to 2.5 at all
levels of aggregation. In this case the gain in market power when industry
unions amalgamate is never so large as to dominate the price effect, and
hence increased centralization results in progressively lower wages. The
effects of small industry unions joining up (when the number of unions
falls from 64 to 16) are small. The largest changes come when large unions
get together. When the number of unions falls from 2 to 1, the real wage
falls from 10.2 to 4.6 per cent of the full-employment level. The reason
is, of course, that the fewer the number of unions that amalgamate, the
larger the externality that is internalized.

When the elasticities of substitution at lower levels of aggregation
are progressively raised as in simulations 2, 3 and 4, the real wages set
by small industry unions progressively fall, while those set by larger
unions remain unchanged. It does not require very large elasticities of
substitution to give a hump shape. In simulation 2, the real wage reaches
a maximum with 8 unions. The same pattern is more pronounced for the even
larger degrees of substitutability at lower levels of aggregation in
simulations 3 and 4. The hump shape also appears (at 4 unions) with the low
but still increasing elasticities of substitution at more disaggregated
levels in simulation 5, in which the main difference to the other
simulations is that the real wage decrease when going from 2 unions to 1 is
magnified. The explanation is that the gain in market power is reduced in
comparison with the other simulations.
4.2. The bargaining case

The monopoly-union approach allows no role for the employer side in wage bargaining. To check the robustness of our results we repeated the computations for the so called "right-to-manage" model of Nickell and Andrews (1983). According to that, firms continue to determine employment unilaterally, but wages are set in bargaining between firms and workers. Firms are assumed to care about the real value of profits.

We can build on recent advances in game theory, according to which the outcome of bargaining is viewed as being reached by a sequence of alternating offers and responses (cf e.g Rubinstein 1982)\(^5\). During this process no transactions occur between the players. The outcome of the bargain can be represented as the solution to this non-cooperative game. Under not too restrictive assumptions it is equivalent to the appropriately specified cooperative Nash bargaining solution. More exactly, the solution is the bargain - the money wage in our case - which maximizes an exponentially weighted product of the gain in utility made by each player relative to the utility obtained in the absence of an agreement (i.e here during an industrial dispute). This means that the wage is set so that the marginal benefit to the union of a wage increase is traded off against the marginal welfare loss for the employer. The result is a lower wage than a monopoly union would have chosen.

Just as unions may form larger union confederations, employers can join into larger employer federations. Increased centralization is now taken to mean that both unions and employers simultaneously form larger groups. For example, if the steel industry and coal industry unions form effectively a single union in order to negotiate together with employers,

\(^5\) Such models have been used in a similar context to ours by Davidson (1985), and Horn and Wolinsky (1985, 1986).
we assume that steel industry and coal industry employers form a single federation. This catches the stylized fact that centralization usually goes together on the two sides of the labor market. In consequence we assume that the scale of industrial disputes increases when bargaining breaks down, and that the conflict levels of welfare for individual employees and individual firms are unaffected by the size of bargaining units. 6

In general the effect of increased centralization now depends on the impact of wage increases on both marginal benefits to unions and marginal real profits of firms. The former effects were found too ambiguous. The same applies to profit effects (cf Calmfors and Driffield 1988). On the one hand money profits in an individual sector are always higher after a given money wage increase that has involved several sectors at the same time, since this allows a larger rise of the own output price. On the other hand the negative effect on real profits due to price rises in general are magnified. The first effect tends to raise wages, the second to reduce them. Alternatively, if we view centralization as an internalization of externalities, wage increases in one industry tends to increase money profits in other sectors, since product demand spillovers increase output prices there too. But at the same time the tendency to an increase in the general price level reduces the real value of profits there.

Table 7 shows that bargaining leads to the same pattern as before with the tendency to higher wages dominating when cooperation increases

6 There may be good reasons for the assumed symmetry. Cooperation on one side of the labor market is likely to enhance the bargaining strength of that side by letting each union (or employer) have access to larger conflict funds if it gets involved into a labor conflict. That is likely to change the optimal degree of cooperation on the other side as well. An ex ante increase in the conflict level of utility due to increased cooperation on one side may, of course, be consistent with an ex post unchanged level, if the consequence is larger bargaining units on both sides, so that the scale of disputes increases
from low levels but not from high. The reason is that the cross effects of
money wage increases on money profits, just as on employment, are largest
between sectors producing close substitutes which we assume to cooperate
first. Our results are thus insensitive to variations in relative
bargaining strength of employers and unions.

4.3. Fiscal externalities

In our model there is a conflict of interest between the employed and
the unemployed. In order for the latter to get into employment, the real
product wage and hence also the real consumption wage of the employed must
fall. This conflict is reduced if we, instead of assuming that
unemployment benefits are paid for out of a tax on profits, let these be
financed by an income tax that falls on employed workers as well.

Then, when employment increases, the real product wage (the pre-tax
money wage deflated by the output price in this case) must fall, but the
tax base (the value of GDP with a uniform income tax) grows, and
expenditure on unemployment benefits falls. This induces a fall in the tax
rate that tends to offset the fall in the pre-tax consumption real wage, so
that the net consumption real wage (the after-tax consumption real wage)
falls by less.

Such fiscal externalities will affect wage setting. In general they
tend to lower the wages set at higher degrees of centralization as compared
to the earlier analysis. The explanation is that unions now take into
account that the real after-tax gains of money wage rises are reduced to
the extent that increased costs for unemployment and a smaller tax base
increase taxes. For the same reasons, the profit consequences of money
wage increases for employers become more negative.
The effect on our analysis of a proportional income tax is illustrated for the monopoly-union case in Table 8. The main pattern remains unchanged. However, comparing with table 6, under more decentralized bargaining (viz., number of unions = 64, 16, and 4), unions set a higher product real wage but a lower net consumption real wage. But more centralized bargaining (with 2 unions, or a single economy-wide union) leads to lower product and net consumption real wages, and higher employment. Indeed, an economy-wide union confederation would now even lower wages to the full employment level.\footnote{In fact, under the assumptions here a given set of exogenous factors may give rise to two equilibria, one with low unemployment and a low tax rate, and one with high unemployment and a high tax rate. The reason is that the net consumption real wage falls as the pre-tax wage rises beyond a certain point: the increase in the tax rate needed to make up for increased costs for unemployment benefits and a reduced tax base then more than offsets the rise in the pre-tax consumption real wage. This has been labelled "fiscal increasing returns to scale" by Blanchard and Summers (1987). Equilibria with fiscal increasing returns are possible only at low levels of centralization: large unions will find it in their interest to lower money and thus also product real wages in order to raise simultaneously both employment and the net consumption real wage, if this is possible. When these equilibria occur they are always unstable in the sense that in the case of deviations, it is rational for individual unions to change money wages in the "wrong" direction. The table shows only the stable low unemployment equilibria. Computations for the high unemployment ones gave implausibly low levels of employment.}

The conclusion is that the internalization of tax effects may lower real wages under centralization substantially compared to decentralization. It breaks the symmetry between maximum centralization and maximum decentralization to the level of individual perfectly competitive firms. This provides a theoretical argument for why the hump-shaped relation should look as in Figure 1 with lower real wages under high centralization than under far-reaching decentralization.
4.4. The model and the facts

The upshot is that we can generate wage and employment differences of plausible magnitudes between different degrees of centralization that support our hump-shape hypothesis. The theoretical framework has nothing to say about the pattern of various response parameters that most empirical studies have focused on, as discussed in section 3. Instead it predicts a relation between levels of real wages and employment on the one hand and centralization on the other. A remaining puzzle is how this squares with the observation in section 2, that a hump-shaped relation comes through most evidently with respect to changes in employment performance between the periods after and before the first oil shock.

Our explanation is based on the claim that our framework is better suited to the latter than the former period. It may be more appropriate to characterize the labor market situation in most countries in the sixties and early seventies as a more or less full-employment one rather than as one where unions held wages above market-clearing levels. The interpretation in terms of our model is that labor demand was then so buoyant that corner solutions at full employment emerged, as illustrated in Figure 3. Such solutions appear in union and bargaining models if labor demand is high enough (cf Oswald 1985). The supply shocks of the seventies, shifting the labor demand schedule to the left, may then have thrown labor markets into the kinds of interior underemployment solutions that our models describe.

With this interpretation, inter-country un(employment) variations in the 1963-73 period should be due primarily to differences in structural labor market characteristics reflecting e.g. various types of mismatches or labor supply behavior. This receives some support from the observation that, for instance, unemployment variations among countries were then much
smaller. In fact, during this period most countries were clustered in the 0 - 3 per cent interval, the outliers being US, Italy and Canada, for which there are good reasons to believe that the higher unemployment could be explained by more serious structural mismatches than elsewhere.

Our reasoning can motivate why it may be more relevant to look at changes in macroeconomic indicators related to employment performance between the periods before and after the first oil shock than at their levels. It presupposes that inter-country differences with respect to structural labor market changes and supply shocks have been of secondary importance as compared to differences with respect to centralization.

4.5. Modifications and extensions

We have provided a barebones model containing only the key ingredients necessary to explain a hump shape. This section incorporates a number of additional factors.

4.5.1. Public sector unions. In the Nordic countries, and in Britain, trade unions are particularly strong in the public sector, where unions do not face an explicit market labor demand. In order to model public sector wage setting, it would be necessary to make behavioral assumptions on the supply of public services. Arguably this would introduce negative relations between the amounts of such services and their costs. This would leave our analysis virtually unchanged. Indeed, a reasonable interpretation of the move from two to one bargaining units in our numerical examples, might just be as cooperation between central private sector and public sector bargaining units (with obvious relevance for, e.g., the Nordic countries where such cooperation does not exist).
4.5.2. Professional unions. We do not model professional unions such as in Britain. Their inclusion would necessitate an explicit disaggregation of labor inputs and would add another dimension to centralization. It would be necessary to specify whether increased cooperation involves unions within the same profession in different industries or various professional unions in the same industry. The former case is exactly analogous to the earlier analysis. But the aggregation of professional unions can also be analyzed similarly, since money wage increases for one union again give rise both to general price rises and to cross effects on employment (via the production system in the latter case).

If we let the professions being the closest substitutes cooperate first, a hump shape is again likely to occur. So is the pronounced fall in wages when going from a small number of unions to one. Indeed, this experiment would be highly relevant, e.g., for a comparison of Austria (with one all encompassing union confederation) and Sweden (with separate central organizations for white-collars and blue-collars workers).

4.5.3. Open economy aspects. We have not taken into account the existence of foreign competition and its dampening influence on domestic price increases. Take as an extreme illustration the case of an economy with a fixed exchange rate, and which consists of a number of "tradables" sectors, each producing goods that are perfect substitutes for those produced abroad. If the economy is small enough, all prices can be taken as exogenously determined in world markets. Domestic money wage increase in an individual sector cannot then give rise to neither employment nor price level effects on other sectors. Only the fiscal externalities from section 4.3 remain. But the other effects reappear if we make the more realistic assumptions that domestically produced tradables are imperfect
substitutes for foreign ones, and/or that there exist "non-tradables" sectors. This again allows wage increases to influence domestic output and consumer prices. If we continue to aggregate sectors as before, the hump shape should remain, although larger degrees of openness tends to make it less pronounced.

Flexible exchange rates add another element to the extent that money wage changes induce exchange rate adjustments. If wage increases for some domestic union (e.g., Swedish metal workers) are partly offset by exchange rate depreciations, the result is increased import prices for consumers and increased international competitiveness with subsequent employment effects for other production sectors. These effects would be superimposed on the earlier ones.

4.5.4. Monopolistic competition. We have treated individual firms as price takers. The analysis can easily be extended to monopolistic competition with price setting firms meeting sloped product demand schedules. The aggregation has then to be done across firms and groups of firms rather than across sectors. The only main difference is that decentralization of wage setting to the firm level in this case will produce a higher wage than complete centralization also in the absence of fiscal externalities.⁸

A natural extension in this case is to allow also for wage setting in individual plants (working places) of the same firm as occurs in, e.g., Britain and the US. This would add an additional layer of decentralization. To the extent that the firm chooses how to allocate its output between alternative plants, a money wage increase in one may shift

---

⁸ The reason is that an increase of the consumption real wage in an individual firm now is perceived to increase the relative price compared to other firms. Cf. footnote 5. See also Strand (1987).
output in favor of other plants, increasing employment there. This effect is important also in an open economy with only a small number of producers in a sector (e.g., Swedish car manufacturing with the two producers Volvo and SAAB). It thus reinforces the arguments for a hump shape in this case.

4.5.5. Internationally mobile capital. The assumption of fixed capital may give unions greater power to raise wages than they actually have in the long run, when capital investment is able to respond to the rate of return. Real wages that lower the return to capital below the world rate should lead to international reallocations of capital that gradually shift domestic labor demand schedules inwards. The result will be simultaneously proceeding reductions of real wages and employment. In fact, in an economy where goods are produced by capital and labor under constant returns to scale, and where capital in the long run is supplied perfectly elastically at a constant world rate of interest, there is a unique equilibrium real wage, to which the economy must converge over time. In the long run differences in wage setting behavior due to differences in centralization are therefore reflected only in employment. This provides a good argument for the focus on employment performance in section 2.

4.5.6. Other types of cross effects. We have neglected inter-industry sales of goods to be used as intermediate inputs. A money wage increase in one sector affects other sectors also via input prices. For employers this gives an additional cross effects on profits. For employees there will be cross effects on labor demand, the sign of which depend upon whether labor and the intermediate inputs are substitutes or complements. One should probably expect internalization of these input price effects to lower wages. Although in general there is more internalization at higher
levels of aggregation, the cooperation between sectors (or firms) producing close substitutes may entail relatively minor changes in this respect: when, e.g., various unions in the mining industry cooperate, there may not be much of inter-industry trade to internalize as compared to the case of cooperation between industry unions for, say mining, steel and automobile production. The main effect of intermediate inputs would therefore seem to be to reduce wages at high degrees of centralization, rather than to affect the hump shape per se.

"Jealousy" effects, as discussed by Oswald (1979, 1984) and Gylfason and Lindbeck (1984), may lead to higher wages under decentralized bargaining, if each union in addition to real wages and employment also cares about the members' wages relative to others. To the extent that such jealousy effects exist, the wage moderation effects of centralization increase. But, like Oswald (1979), we remain skeptical about their importance: our hunch is that wage changes for other groups are seen as providing information on the potential for wage increases rather than creating envy.

The welfare of one union may also be affected by wage decisions in other sectors, which affect the probability with which disemployed members can find employment elsewhere, and at what wages. It is not clear whether this effect would cause real wages to fall or rise with centralization.

4.5.7. The hysteretic argument. "Hysteresis" effects may add another complication. The argument is that unemployed workers tend to lose union membership and become disenfranchised from the wage setting process. As a consequence any fall in employment tends to become permanent because it creates an incentive to adjust wages so as to validate it. Wage-
employment outcomes then become indeterminate, and largely a function of recent history.

For example, consider shifts in the degree of centralization in a given country under the assumptions in section 4.1. Suppose we start from complete centralization and move towards increasing decentralization, and that this as before results in rising wages and falling employment. But once one arrives at the top of our "hump" there are no incentives for a monopoly union to lower wages again when decentralization increases further, if only the previously employed decide on wages and do not care about the unemployed. The reasoning is analogous for movements from an initial level of high decentralization: increasing centralization would raise wages until the hump was reached, but once there, further increases in centralization leave wages unchanged.

A more common point relates to how recent downward employment shocks have tended to perpetuate unemployment. It has been argued, e.g., by Blanchard and Summers (1986), that these hysteresis effects are stronger in more decentralized systems because of a larger tendency for laid-off workers to drop out of local than out of industry or national unions.

We are sceptical about the hysteresis arguments for a number of reasons. First, the empirical evidence on such effects in general is mixed. Gregory (1986), Layard and Nickell (1986) and Blanchard and Summers (1986) find support for it, whereas Coe and Gagliardi (1985), Blanchflower and Oswald (1987) and Eriksson (1987) do not. Second, it remains to be shown that drop-out rates in the case of unemployment differ between unions at various degrees of centralization, and that this is reflected in differences with respect to which the interests of the unemployed influence wage setting. Third, hysteresis effects work only on the union side but not on the employer side in a bargaining model. Fourth, the incentives
created to substitute unorganized workers for organized ones or to substitute production in the non-unionized sectors for production in unionized ones put limits to the wage rises for unionized labor induced by falling membership, as argued by Lindbeck and Snower (1986).

4.5.8. Relative wages and centralization. The most serious deficiency is probably that we do not address the issue of relative wage flexibility. It is a common argument that more decentralized wage setting gives a freer play to industry or firm specific factors. It receives support from empirical studies such as OECD (1985) and Martin (1986).

In principle wage dispersion could be introduced into our framework by allowing random shocks that differ between industries. We could then model centralization to restrict the role of industry-specific factors in wage determination by assuming that within groups of workers that bargain together a uniform wage rate is negotiated. There seems to be such a tendency, as argued by Newell and Symons (1987). It might be explained by the difficulties of handling disaggregated information at a central level. This feature is likely to affect the relation between centralization and employment at a given average real wage to the extent that a reduction in relative wage flexibility leads to excess demand for labor (that cannot be met) in certain sectors and increased unemployment in others. This provides an argument in favor of better output and employment performance under decentralization as compared to centralization. If the tax base is affected positively, it may also tend to reduce pre-tax real wages for reasons similar to the ones in section 4.3.

4.5.9. Overall judgment. On balance one would probably expect the additional factors to lower real wages under centralization as compared to
decentralization, and perhaps also unemployment (although this is less certain because of the argument with respect to relative wage flexibility). We like to believe that the factors incorporated into our formal analysis are the dominating ones, so that the hump shaped relation between centralization and real wages remain. Nevertheless high centralization seems likely to produce lower wages than high decentralization as in Figure 1. This also appears consistent with the stylized facts in section 2.

6. Conclusions

The upshot of our paper has been to question the conventional belief that centralization of wage bargaining is always to prefer to decentralization from the point of view of macroeconomic performance. We have instead argued that both highly centralized and highly decentralized economies are likely to do better than intermediately centralized ones. The argument does not rest on larger relative-wage flexibility under decentralization but on the existence of a hump-shaped relation between centralization and the aggregate real wage.

If our hypothesis holds true, both those who argue in favor of more centralization and more decentralization may be right. Intermediate systems (such as, for instance in, Belgium and the Netherlands, and maybe also in Germany!) with bargaining on the industry level are likely to contribute the least to wage restraint. If so, one should go either for complete centralization with wages determined on the national level (Austria) or for extreme decentralization with wage bargaining at the level of individual firms or plants (US, Japan or Switzerland). No substantial effects will emerge from pushing intermediate systems a bit in one direction or the other.
In a system like, e.g., the Swedish one with negotiations between a small number of central organizations, a coordination among these would be highly beneficial. But it may be impossible to achieve because there are always strong forces working in the direction of decentralization so as to let wages of individual groups respond better to their specific conditions. Therefore wage bargaining at the level of individual firms or plants may be to prefer. What one, according to our analysis, should not do is to go only part of the way to a somewhat more decentralized system with, say, industry bargaining. In economies with wage setting at this level one should not resist tendencies to enterprise bargaining in order to preserve some coordination. And countries with very decentralized wage setting may do best to remain where they are, since complete centralization may not anyway be a feasible alternative.
REFERENCES


Davidson, C., 1985, Multi-Unit Bargaining in Oligopolistic Industries, Michigan State University, mimeo.


OECD, 1985, Labour Markets Flexibility, Manpower and Social Affairs Committee, MAS (85) 25, mimeo.


Figure 1: The hump shape hypothesis

Figure 2: The structure of demand

Elasticity of substitution $\theta_1$

$\theta_2$

$\theta_3$

$\theta_4$

$\theta_5$
Figure 3: Corner solutions and labor demand shocks

N = Labor demand
I = Union indifference curves
| Rank Orderings of Countries According to the Degree of Centralization |
|-----------------------------|----------------------------|
| Schmitter                    | Cameron                    |
| 1. Austria                  | 1. Austria                 |
| 2. Norway                   | 2. Sweden                  |
| 3. Denmark                  | 3. Belgium                 |
| 4. Finland                  | 4. New Zealand             |
| 5. Germany                  | 5. Australia               |
| 7. Netherlands              | 7. Finland                 |
| 8. Germany                  | 8. Belgium                 |
| 10. Australia               | 10. Switzerland            |
| 11. France                  | 11. Canada                 |
| 12. Britain                 | 12. Italy                  |
| 13. Canada                  | 13. Switzerland            |
| 15. Switzerland             | 15. France                 |
| 16. Austria                 | 16. US                     |
| 17. Canada                  | 17. Canada                 |

46
### Table 2:
Indicators of macroeconomic performance (averages for 1974-85 and changes between 1974-85 and 1963-73 averages)

<table>
<thead>
<tr>
<th></th>
<th>Unemployment</th>
<th>Change of unemployment</th>
<th>Employment/population</th>
<th>Change in employment/population</th>
<th>Okun index</th>
<th>Change in Okun index</th>
<th>Our performance index</th>
<th>Change in our performance index</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Centralized economies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Austria</td>
<td>2.5</td>
<td>0.8</td>
<td>66.3</td>
<td>-1.6</td>
<td>8.2</td>
<td>2.9</td>
<td>3.6</td>
<td>2.3</td>
</tr>
<tr>
<td>Norway</td>
<td>2.2</td>
<td>0.6</td>
<td>72.6</td>
<td>8.7</td>
<td>11.2</td>
<td>4.3</td>
<td>5.0</td>
<td>1.8</td>
</tr>
<tr>
<td>Sweden</td>
<td>2.4(4.2)</td>
<td>0.4(1.1)</td>
<td>78.2</td>
<td>5.8</td>
<td>12.2(13.8)</td>
<td>5.3(6.0)</td>
<td>4.1(5.7)</td>
<td>2.3(3.0)</td>
</tr>
<tr>
<td>Denmark</td>
<td>7.9</td>
<td>6.9</td>
<td>73.1</td>
<td>-0.3</td>
<td>17.6</td>
<td>10.4</td>
<td>11.3</td>
<td>8.4</td>
</tr>
<tr>
<td>Finland</td>
<td>5.0</td>
<td>3.8</td>
<td>72.2</td>
<td>0.7</td>
<td>16.0</td>
<td>7.6</td>
<td>7.0</td>
<td>3.3</td>
</tr>
<tr>
<td><strong>average</strong></td>
<td>4.0(4.4)</td>
<td>2.3(2.6)</td>
<td>72.5</td>
<td>2.7</td>
<td>13.0(13.4)</td>
<td>6.1(6.2)</td>
<td>6.2(6.5)</td>
<td>3.6(3.8)</td>
</tr>
<tr>
<td><strong>Intermediate economies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Germany</td>
<td>4.8</td>
<td>4.0</td>
<td>63.2</td>
<td>-5.9</td>
<td>9.2</td>
<td>4.8</td>
<td>4.3</td>
<td>4.2</td>
</tr>
<tr>
<td>Netherlands</td>
<td>8.0</td>
<td>6.8</td>
<td>53.4</td>
<td>-5.6</td>
<td>13.9</td>
<td>7.0</td>
<td>6.4</td>
<td>5.4</td>
</tr>
<tr>
<td>Belgium</td>
<td>9.3</td>
<td>7.1</td>
<td>58.5</td>
<td>-2.5</td>
<td>17.0</td>
<td>10.7</td>
<td>11.0</td>
<td>10.0</td>
</tr>
<tr>
<td>New Zealand</td>
<td>2.2</td>
<td>2.0</td>
<td>63.9</td>
<td>-0.1</td>
<td>15.6</td>
<td>10.1</td>
<td>7.5</td>
<td>6.9</td>
</tr>
<tr>
<td>Australia</td>
<td>6.3</td>
<td>4.4</td>
<td>65.6</td>
<td>-1.9</td>
<td>16.7</td>
<td>10.8</td>
<td>9.3</td>
<td>5.7</td>
</tr>
<tr>
<td><strong>average</strong></td>
<td>6.1</td>
<td>4.8</td>
<td>60.9</td>
<td>-3.2</td>
<td>14.5</td>
<td>8.7</td>
<td>7.7</td>
<td>6.5</td>
</tr>
<tr>
<td><strong>Decentralized economies</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>France</td>
<td>6.4</td>
<td>4.3</td>
<td>63.2</td>
<td>-2.8</td>
<td>16.9</td>
<td>10.8</td>
<td>7.5</td>
<td>5.4</td>
</tr>
<tr>
<td>Britain</td>
<td>8.1</td>
<td>5.4</td>
<td>68.4</td>
<td>-2.6</td>
<td>20.5</td>
<td>12.3</td>
<td>8.2</td>
<td>5.2</td>
</tr>
<tr>
<td>Italy</td>
<td>7.9</td>
<td>2.8</td>
<td>55.3</td>
<td>-2.1</td>
<td>23.5</td>
<td>13.5</td>
<td>8.6</td>
<td>5.1</td>
</tr>
<tr>
<td>Japan</td>
<td>2.2</td>
<td>1.0</td>
<td>70.1</td>
<td>-1.4</td>
<td>9.1</td>
<td>1.7</td>
<td>1.6</td>
<td>1.2</td>
</tr>
<tr>
<td>Switzerland</td>
<td>0.5</td>
<td>0.3</td>
<td>73.3</td>
<td>-5.0</td>
<td>4.6</td>
<td>0.1</td>
<td>-3.1</td>
<td>-2.7</td>
</tr>
<tr>
<td>USA</td>
<td>7.3</td>
<td>2.8</td>
<td>66.1</td>
<td>2.5</td>
<td>15.0</td>
<td>6.9</td>
<td>7.6</td>
<td>3.4</td>
</tr>
<tr>
<td>Canada</td>
<td>8.5</td>
<td>3.7</td>
<td>64.6</td>
<td>3.4</td>
<td>17.1</td>
<td>8.6</td>
<td>9.9</td>
<td>4.4</td>
</tr>
<tr>
<td><strong>average</strong></td>
<td>5.8(6.7)</td>
<td>2.9(3.3)</td>
<td>65.8(64.6)</td>
<td>-1.1(-0.5)</td>
<td>15.2(17.0)</td>
<td>7.7(9.0)</td>
<td>5.8(7.2)</td>
<td>3.1(4.1)</td>
</tr>
</tbody>
</table>
1) Population 15-64 years.
2) Rate of unemployment plus rate of inflation.
3) Rate of unemployment plus current account deficit in per cent of GDP.
4) In the parentheses for Sweden the number of workers in labor market retraining and relief works has been added to the official unemployment figures. The averages are also adjusted accordingly.
5) Figures in parentheses exclude Switzerland.

Source: OECD Historical Statistics and OECD Main Economic Indicators, various issues.
Table 3:
Kendall correlation coefficients between various indicators of macroeconomic performance and various centralization rankings.

<table>
<thead>
<tr>
<th></th>
<th>Unemployment</th>
<th>Change of unemployment</th>
<th>Employment/population</th>
<th>Change in employment population</th>
<th>Okun index</th>
<th>Change in Okun index</th>
<th>Our misery index</th>
<th>Change in our misery index</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Our Centralization index (cf Table 3)</strong></td>
<td>0.19(0.14)</td>
<td>0.05(0.39)</td>
<td>0.13(0.24)</td>
<td>0.07(0.34)</td>
<td>0.22(0.11)</td>
<td>0.24(0.09)*</td>
<td>0.18(0.15)</td>
<td>-0.05(0.39)</td>
</tr>
<tr>
<td><strong>The Cameron index 1 (cf Table 3)</strong></td>
<td>0.19(0.15)</td>
<td>0.01(0.48)</td>
<td>0.19(0.15)</td>
<td>0.17(0.18)</td>
<td>0.08(0.33)</td>
<td>0.11(0.28)</td>
<td>0.04(0.41)</td>
<td>0.02(0.46)</td>
</tr>
<tr>
<td><strong>Our revised index 1 (cf Table 11)</strong></td>
<td>0.15(0.20)*</td>
<td>0.39(0.02)*</td>
<td>0.36(0.03)*</td>
<td>0.35(0.03)*</td>
<td>0.21(0.12)</td>
<td>0.36(0.03)*</td>
<td>0.22(0.11)</td>
<td>0.56(0.001)*</td>
</tr>
<tr>
<td><strong>The revised Cameron index 1 (cf Table 11)</strong></td>
<td>0.28(0.07)*</td>
<td>0.39(0.02)*</td>
<td>0.22(0.13)</td>
<td>0.48(0.006)*</td>
<td>0.22(0.12)</td>
<td>0.25(0.09)*</td>
<td>0.21(0.14)</td>
<td>0.32(0.05)*</td>
</tr>
<tr>
<td><strong>Our revised index 3 (cf Table 11)</strong></td>
<td>0.24(0.09)*</td>
<td>0.48(0.004)*</td>
<td>0.41(0.01)*</td>
<td>0.41(0.01)*</td>
<td>0.28(0.06)*</td>
<td>0.44(0.007)*</td>
<td>0.29(0.05)</td>
<td>0.63(0.000)*</td>
</tr>
<tr>
<td><strong>The revised Cameron index 3 (cf Table 11)</strong></td>
<td>0.32(0.04)*</td>
<td>0.44(0.07)*</td>
<td>0.26(0.08)*</td>
<td>0.45(0.008)*</td>
<td>0.27(0.08)*</td>
<td>0.28(0.07)*</td>
<td>0.20(0.14)</td>
<td>0.31(0.05)*</td>
</tr>
</tbody>
</table>

Numbers in parenthesis indicate levels of significance. An asterisk indicates significance at the 10 per cent level.
<table>
<thead>
<tr>
<th>Our original ranking</th>
<th>New ranking</th>
<th>Cameron original ranking</th>
<th>New ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Austria</td>
<td>1.5</td>
<td>1. Sweden</td>
<td>1.5</td>
</tr>
<tr>
<td>Sweden</td>
<td>5.5</td>
<td>3. Austria</td>
<td>5.</td>
</tr>
<tr>
<td>5. Finland</td>
<td>9.5</td>
<td>5. Finland</td>
<td>9.</td>
</tr>
<tr>
<td>10. Australia</td>
<td>15.5</td>
<td>10. Australia</td>
<td>13.</td>
</tr>
<tr>
<td>15. Switzerland</td>
<td>5.5</td>
<td>15. France</td>
<td>3.</td>
</tr>
<tr>
<td>17. Canada</td>
<td>1.5</td>
<td></td>
<td>4.</td>
</tr>
<tr>
<td>Rank</td>
<td>Authors</td>
<td>Short-run response to un-employment</td>
<td>Long-run response to un-employment</td>
</tr>
<tr>
<td>------</td>
<td>-----------------</td>
<td>--------------------------------------</td>
<td>-------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Bean-Layard-Nickell</td>
<td>0.25(0.08)*</td>
<td>0.29(0.05)*</td>
</tr>
<tr>
<td>2</td>
<td>Newell-Symons</td>
<td>0.02(0.46)</td>
<td>-0.14(0.24)</td>
</tr>
<tr>
<td>3</td>
<td>Grubb-Jackman-Layard</td>
<td>-0.03(0.44)</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Grubb</td>
<td>-0.06(0.37)</td>
<td>-0.01(0.47)</td>
</tr>
<tr>
<td>5</td>
<td>Gordon</td>
<td>0.64(0.001)*</td>
<td>-0.36(0.04)*</td>
</tr>
<tr>
<td>6</td>
<td>Coe and Gagliardi</td>
<td>-0.13(0.30)</td>
<td></td>
</tr>
</tbody>
</table>

Figures in parenthesis indicate levels of significance. An asterisk indicates significance at the 10 per cent level. The equivalent and the methods of computing the effects in the table are given in Appendix C.
<table>
<thead>
<tr>
<th>Simulation</th>
<th>Elasticity of substitution</th>
<th>Number of unions</th>
<th>64</th>
<th>16</th>
<th>8</th>
<th>4</th>
<th>2</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\theta_1$ $\theta_2$ $\theta_3$ $\theta_4$ $\theta_5$</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>2.5 2.5 2.5 2.5 2.5</td>
<td>real wage</td>
<td>14.3</td>
<td>14.0</td>
<td>13.5</td>
<td>12.5</td>
<td>10.2</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>employment</td>
<td>-16.5</td>
<td>-16.1</td>
<td>-14.6</td>
<td>-13.5</td>
<td>-11.1</td>
<td>-5.1</td>
</tr>
<tr>
<td>2</td>
<td>2.5 2.5 2.5 5.0 5.0</td>
<td>real wage</td>
<td>9.8</td>
<td>11.2</td>
<td>13.5</td>
<td>12.5</td>
<td>10.2</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>employment</td>
<td>-10.6</td>
<td>-12.2</td>
<td>-14.6</td>
<td>-13.5</td>
<td>-11.1</td>
<td>-5.1</td>
</tr>
<tr>
<td>3</td>
<td>2.5 2.5 2.5 10.0 10.0</td>
<td>real wage</td>
<td>7.6</td>
<td>9.7</td>
<td>13.5</td>
<td>12.5</td>
<td>10.2</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>employment</td>
<td>-8.3</td>
<td>-10.6</td>
<td>-14.6</td>
<td>-13.5</td>
<td>-11.1</td>
<td>-5.1</td>
</tr>
<tr>
<td>4</td>
<td>2.5 2.5 2.5 80.0 80.0</td>
<td>real wage</td>
<td>5.6</td>
<td>8.3</td>
<td>13.5</td>
<td>12.5</td>
<td>10.2</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>employment</td>
<td>-6.2</td>
<td>-9.1</td>
<td>-14.6</td>
<td>-13.5</td>
<td>-11.1</td>
<td>-5.1</td>
</tr>
<tr>
<td>5</td>
<td>1.0 2.0 2.5 2.5 2.5</td>
<td>real wage</td>
<td>14.6</td>
<td>15.0</td>
<td>15.7</td>
<td>17.1</td>
<td>17.1</td>
<td>4.6</td>
</tr>
<tr>
<td></td>
<td></td>
<td>employment</td>
<td>-15.7</td>
<td>-16.2</td>
<td>-16.8</td>
<td>-18.4</td>
<td>-18.4</td>
<td>-5.1</td>
</tr>
</tbody>
</table>

Real wages and employment are measured as percentage deviations from the full-employment levels.
<table>
<thead>
<tr>
<th>Simulation</th>
<th>Number of unions</th>
<th>θ_1</th>
<th>θ_2</th>
<th>θ_3</th>
<th>θ_4</th>
<th>θ_5</th>
<th>θ_6</th>
<th>θ_7</th>
<th>θ_8</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>64</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>2</td>
<td>16</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
<td>2.5</td>
</tr>
<tr>
<td>3</td>
<td>8</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
<td>5.0</td>
</tr>
<tr>
<td>4</td>
<td>4</td>
<td>10.0</td>
<td>10.0</td>
<td>10.0</td>
<td>10.0</td>
<td>10.0</td>
<td>10.0</td>
<td>10.0</td>
<td>10.0</td>
</tr>
<tr>
<td>5</td>
<td>8</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
<td>8.0</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of unions</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>real wage</td>
<td>11.3</td>
<td>11.0</td>
<td>10.6</td>
<td>9.7</td>
<td>9.7</td>
</tr>
<tr>
<td>employment</td>
<td>-18.3</td>
<td>-12.0</td>
<td>-11.5</td>
<td>-10.6</td>
<td>-8.4</td>
</tr>
<tr>
<td>real wage</td>
<td>7.3</td>
<td>8.6</td>
<td>10.6</td>
<td>9.7</td>
<td>7.7</td>
</tr>
<tr>
<td>employment</td>
<td>-8.0</td>
<td>-9.4</td>
<td>-11.5</td>
<td>-10.6</td>
<td>-8.4</td>
</tr>
<tr>
<td>real wage</td>
<td>5.3</td>
<td>7.3</td>
<td>10.6</td>
<td>9.7</td>
<td>4.8</td>
</tr>
<tr>
<td>employment</td>
<td>-5.8</td>
<td>-7.9</td>
<td>-11.5</td>
<td>-10.6</td>
<td>-8.4</td>
</tr>
<tr>
<td>real wage</td>
<td>3.6</td>
<td>6.0</td>
<td>10.6</td>
<td>9.7</td>
<td>7.7</td>
</tr>
<tr>
<td>employment</td>
<td>-4.0</td>
<td>-6.6</td>
<td>-11.5</td>
<td>-10.6</td>
<td>-8.4</td>
</tr>
<tr>
<td>real wage</td>
<td>1.6</td>
<td>12.0</td>
<td>12.6</td>
<td>13.8</td>
<td>14.8</td>
</tr>
<tr>
<td>employment</td>
<td>-12.6</td>
<td>-13.0</td>
<td>-11.5</td>
<td>-14.9</td>
<td>-14.9</td>
</tr>
</tbody>
</table>
### Table 8: Monopoly Union Model: Unemployment Benefits Financed by an Income Tax

<table>
<thead>
<tr>
<th>Simulation</th>
<th>Parameters</th>
<th>Number of unions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$\theta_1$ $\theta_2$ $\theta_3$ $\theta_4$ $\theta_5$</td>
<td>64 16 8 4 2 1</td>
</tr>
<tr>
<td>1</td>
<td>2.5 2.5 2.5 2.5 2.5</td>
<td>product real wage 23.4 21.4 18.8 13.7 3.4 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>net consumption real wage 8.2 8.0 7.5 6.2 1.8 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>employment -24.9 -22.8 -20.1 -14.8 -3.7 0</td>
</tr>
<tr>
<td>2</td>
<td>2.5 2.5 2.5 5.0 5.0</td>
<td>product real wage 14.3 18.5 18.8 13.7 3.4 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>net consumption real wage 5.1 6.0 7.5 6.2 1.8 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>employment -15.4 -17.0 -20.1 -14.8 -3.7 0</td>
</tr>
<tr>
<td>3</td>
<td>2.5 2.5 2.5 10.0 10.0</td>
<td>product real wage 10.6 13.3 18.8 13.7 3.4 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>net consumption real wage 5.1 6.0 7.5 6.2 1.8 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>employment -11.5 -14.3 -20.1 -14.8 -3.7 0</td>
</tr>
<tr>
<td>4</td>
<td>2.5 2.5 2.5 80.0 80.0</td>
<td>product real wage 9.3 10.3 18.8 13.7 3.4 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>net consumption real wage 3.9 5.2 7.5 6.2 1.8 0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>employment -8.4 -12.0 -20.1 -14.8 -3.7 0</td>
</tr>
</tbody>
</table>
### Appendix A: Index of centralization of wage bargaining

<table>
<thead>
<tr>
<th></th>
<th>Coordination level within central organization</th>
<th>Existence of parallel central organization and their cooperation</th>
<th>Total score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Austria 3</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>2.</td>
<td>Norway 3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3.</td>
<td>Sweden 3</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>4.</td>
<td>Denmark 3-</td>
<td>2</td>
<td>5-</td>
</tr>
<tr>
<td>5.</td>
<td>Finland 3-</td>
<td>2</td>
<td>5-</td>
</tr>
<tr>
<td>6.</td>
<td>Germany 2-</td>
<td>3-</td>
<td>5-</td>
</tr>
<tr>
<td>7.</td>
<td>Netherlands 2</td>
<td>2+</td>
<td>4+</td>
</tr>
<tr>
<td>8.</td>
<td>Belgium 2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>9.</td>
<td>New Zealand 1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>10.</td>
<td>Australia 1</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>11.</td>
<td>France 1+</td>
<td>2</td>
<td>3+</td>
</tr>
<tr>
<td>12.</td>
<td>Britain 0+</td>
<td>3</td>
<td>3+</td>
</tr>
<tr>
<td>13.</td>
<td>Italy 1+</td>
<td>2</td>
<td>3+</td>
</tr>
<tr>
<td>14.</td>
<td>Japan 1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>15.</td>
<td>Switzerland 1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>16.</td>
<td>US 1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>17.</td>
<td>Canada 1</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

(i) The first column indicates the levels within national union confederations and within national employer organizations at which actions are coordinated. 3 indicates national level, 2 industry level, 1 enterprise level and 0 occupational level within enterprises (in the case of labor). In the cases of Australia and New Zealand, 1 represents a compromise between the large element of wage setting on the occupational
level and the centralization imposed by the arbitration tribunals and
government income policies.

(ii) The second column reflects the number of existing central union
confederations and the extent of their cooperation, and the number of
existing central employer federations and their cooperation. 3 indicates
one dominating union confederation and one dominating private-sector
employer organization, 2 the existence of 2-5 union confederations and/or
2-5 central employer organizations, and 1 the absence of a central
organization on one or both sides of the labor market.

Plus and minus signs indicate minor differences between countries.

The main sources are Bratt (1986), Faxén (1982) and Flanagan et al
(1983).

More specific judgments

• Norway is ranked above Sweden because of (slightly) less fragmentation
  at the union confederation level and (significantly) less apparent
  inter-union conflicts on distribution (Flanagan et al 1983).

• The minus signs in the first column for Denmark and Finland reflect a
  larger element of decision-making power on the local levels (cf Crouch
  1983). Denmark is ranked above Finland because of less fragmentation
  at the union confederation level.

• The plus sign in the second column for Netherlands is due to the
  existence of coordination between independent organizations at the
  central level (Flanagan et al 1983).

• The mixture of centralized and decentralized elements make the ranking
  of New Zealand and Australia compared to Belgium difficult. We judge
  the differences with respect to the first column to be larger than with
  respect to the second. New Zealand is ranked above Australia in
  conformity with Blyth (1979), and Bruno and Sachs (1985).

• The plus signs for France and Italy reflect a certain element of
  industry bargaining. The same applies to a lesser extent to Britain,
  where also government incomes policies before 1979 imposed some
  centralization. Our relative rankings of the three countries conform to
  Blyth and Schmitter in Table 1.

• Japan is ranked above Switzerland because of a larger synchronization in
time of wage negotiations.

• Canada is ranked below the US because of larger fragmentation of the
  union side at the central level.
Appendix B: Reestimations of Bruno - Sachs and McCallum equations

\( \hat{p}_{73-79} - \hat{p}_{65-72} = 7.24^* + 0.70(\hat{y}_{73-79} - \hat{y}_{65-73}) - 1.18 \text{ CI} \)
\[ (4.51) \quad (1.15) \quad (1.39) \]
\( R^2 = 0.03 \)
SEE = 2.87
DW = 1.91

\( \hat{p}_{73-85} - \hat{p}_{61-72} = 8.46^* + 1.12(\hat{y}_{73-85} - \hat{y}_{61-72}) - 1.22 \text{ CI} \)
\[ (4.85) \quad (2.06) \quad (1.63) \]
\( R^2 = 0.17 \)
SEE = 2.47
DW = 1.86

\( p = \) consumer price index
\( y = \) GDP
CI = centralization index

A hat over a variable indicates percentage change. The subscripts indicate the year for which averages have been taken. Significance at the 10 per cent level is indicated by an asterisk. The centralization index is defined as: CI = 2 for Austria, Norway, Sweden, Denmark and Finland, CI = 1 for Germany, Netherlands, Belgium, New Zealand and Australia, and CI = 0 for Switzerland, France, Britain, Italy, Japan, US and Canada.
(_ii) _McCallum_equations_

<table>
<thead>
<tr>
<th></th>
<th>constant</th>
<th>( \hat{\rho} )</th>
<th>( \Delta \hat{q} )</th>
<th>( (\hat{m}-\hat{y}-\hat{\rho}) \times )</th>
<th>S</th>
<th>CI</th>
<th>U</th>
<th>( R^2 )</th>
<th>SSE</th>
<th>DW</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>((\sigma - \bar{\sigma}))</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>4.03*</td>
<td>0.57*</td>
<td>-0.07</td>
<td>-0.046*</td>
<td>1.40*</td>
<td>-0.28</td>
<td>0.94</td>
<td>0.92</td>
<td>1.13</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(2.9)</td>
<td>(5.3)</td>
<td>(0.3)</td>
<td>(1.8)</td>
<td>(5.9)</td>
<td>(0.9)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>-10.13*</td>
<td>1.39*</td>
<td>-0.62*</td>
<td>-0.054</td>
<td>2.08*</td>
<td>-0.029</td>
<td>0.90</td>
<td>1.22</td>
<td>1.94</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4.5)</td>
<td>(6.7)</td>
<td>(2.4)</td>
<td>(1.7)</td>
<td>(8.5)</td>
<td>(0.007)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>-3.34</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>1.84*</td>
<td>-1.00</td>
<td>-1.04*</td>
<td>0.79</td>
<td>1.50</td>
<td>2.24</td>
</tr>
<tr>
<td></td>
<td>(1.4)</td>
<td></td>
<td></td>
<td></td>
<td>(4.7)</td>
<td>(1.7)</td>
<td></td>
<td>(1.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>6.97*</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-2.17*</td>
<td>-1.08</td>
<td>0.34</td>
<td>2.55</td>
<td>2.51</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(4.1)</td>
<td></td>
<td></td>
<td></td>
<td>(2.4)</td>
<td>(1.1)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2.87</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>+0.46</td>
<td>-0.32</td>
<td>0.15</td>
<td>2.87</td>
<td>2.43</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(0.97)</td>
<td></td>
<td></td>
<td></td>
<td>(1.13)</td>
<td>(0.85)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>-1.30</td>
<td>1</td>
<td>-</td>
<td>-</td>
<td>-0.23</td>
<td>-0.10</td>
<td>0.05</td>
<td>1.25</td>
<td>1.88</td>
<td></td>
</tr>
<tr>
<td></td>
<td>(1.08)</td>
<td></td>
<td></td>
<td></td>
<td>(0.48)</td>
<td>(0.76)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The dependent variable is the average rate of change of consumer price in 1973-79 in equations (1)-(4), for 1974-85 in equation (5), and for 1979-85 in equation (6).

\( \hat{\rho} \) = average rate of change of consumer price index 1971-72 in equation (1)-(4), in 1963-73 in equation (4) and in 1977-78 in equation (6).

\( \Delta \hat{q} \) = change in rate of growth of real GNP per person employed (adjusted for changes in the terms of trade), mean growth rate 1973-79 minus mean growth rate 1965-72.
\[ \sigma = \text{standard deviation of annual rates of growth of narrowly defined money supply 1970-79 in equation (1)-(4)}. \]

\[ \dot{m} = \text{average rate of growth of narrowly defined money supply 1972-78 in equation (1)-(4)}. \]

\[ \ddot{y} = \text{trend growth rate of real GNP, 1972-78 in equation (1)-(4)}. \]

\[ S = \log \text{of average annual working days lost per thousand non-agricultural employees, 1950-69 in equation (1)-(4)}. \]

\[ \text{CI} = \text{the same centralization index as in the Bruno-Sachs reestimations}. \]

\[ U = \text{standardized OECD rates of unemployment in 1973-79 in equation (1)-(4), in 1974-85, in equation (5) and in 1979-85 in equation (6)}. \]
Appendix C: Wage equations on which Table 5 is based

1. Bean-Layard-Nickell:

$$\Delta \log \left( \frac{W}{PQ} \right) = \beta_0 + \frac{\beta_1}{\alpha_2} \left[ \alpha_1 \log \left( \frac{L}{K} \right) + \alpha_2 \log \left( \frac{W}{PQ} \right)_{-1} + \alpha_5 t + \alpha_6 t^2 \right] + \beta_2 \log \left( \frac{L}{N} \right) + \beta_3 \theta + \beta_4 \phi,$$

where $W$ = nominal wage cost to employer, $P$ = price of output, $L$ = labor force, $K$ = capital stock, $t$ = time, $N$ = employment, $\theta$ = wedge between consumption and product real wage, and $\phi$ = structural-shift variable in the labor market. The short-run response to unemployment is measured by $\beta_2$, the long-run response by $-\beta_2/\beta_1$, the short-run response to the wedge by $\beta_3$, and the long-run response by $-\beta_3/\beta_1$.

2. Newell and Symons

$$\log \left( \frac{W}{P} \right) = \alpha_0 \log \left( \frac{W}{P} \right)_{-1} + \alpha_1 \log \left( \frac{W}{P} \right)_{-2} + \alpha_2 D + \alpha_3 \Delta \theta + \alpha_4 U,$$

where $D$ = dummy for union militancy during the seventies, and $U$ = unemployment rate. The short-run response to unemployment is measured by $\alpha_4$, the long-run response by $\alpha_4(1-\alpha_0-\alpha_1)$, the short-run response to a change in the wedge by $\alpha_3$ and the long-run response by $\alpha_3(1-\alpha_0-\alpha_1)$.

3. Grubb-Jackman-Layard

$$\hat{w} - \hat{w}_{-1} = \gamma + \alpha(\hat{p} - \hat{w}_{-1}) + \beta U + \delta t,$$

where $w$ = money wage, and $p$ = consumer price index. The (short-run) response of the (consumption) real wage is measured by $-\beta/\alpha$.

4. Grubb

$$\hat{w} - \hat{w}_{-1} = \gamma + \alpha(\hat{p} - \hat{w}_{-1}) + \beta U + \gamma(\log w - \log p - \log x)_{-1} + \varepsilon t,$$

where $x$ = trend productivity. The short-run response of the (consumption) real wage to unemployment is $\beta/\alpha$, and the long-run response $-\beta/\delta$. The short-run response to changes in the wedge is approximated by $\delta/\alpha$.

5. Gordon

$$\hat{w} = \alpha_0 \hat{x} + \alpha_1 D_1 \Delta \hat{x}_{-1} + \alpha_2 D_2 \Delta \hat{x}_{-2} - \alpha_3 \hat{p} + \alpha_4 Q + \alpha_5 \theta + \alpha_6 D_3,$$

where $\hat{x}$ = long-run productivity trend, $\Delta \hat{x}_1$ and $\Delta \hat{x}_2$ are the difference from the overall long-run productivity trend during 1973-78 and 1979-85 respectively, $D_1$ and $D_2$ are dummy variables, $Q$ = output gap and
$D_3 =$ incomes policy or union militancy dummy. The (short-run response) of the (consumption) real wage is measured by $-\alpha_4$ (provided that $\alpha_3 = 1$ and invoking Okun's law), the (short-run) response to the wedge by $\alpha_5$, and the (short-run) responses to the productivity decline by $-\alpha_1$ and $-\alpha_2$.

6. Coe and Gagliardi

\[ \hat{w} = \alpha_0 + \alpha_1 \hat{p} + \alpha_2 U + \alpha_3 Z, \]

where $Z =$ a vector of other variables. The (short-run) response of the (consumption) real wage to unemployment is measured by $\alpha_2$ (provided that $\alpha_1 = 1$).
Appendix D: The simulated model

(1) Production

Each of 64 identical industries has a CES production function

$$Y_i^E = AK_i^E + (1 - A)L_i^E,$$  \hspace{1cm} (A.1)

where $Y_i$ = output of industry $i$, $K_i$ = capital employed, and $L_i$ = labor employed. $1/(1-E) = \sigma$ is the elasticity of substitution between labor and capital. The capital stock in each sector is fixed, so that $K_i = 1.0$.

(2) Consumption

All consumers have a utility function with nested CES structure, with five levels, and elasticities of substitution $\theta_1$ (at the most aggregated level) to $\theta_5$ (at the least aggregated level).

Thus if consumption of good $j$ at level $i$ is $x(i,j)$ we can write

$$x(i,j) = \left[ x(i+1,2j-1)^{(\theta_i-1)/\theta_i} + x(i+1,2j)^{(\theta_i-1)/\theta_i} \right]^{\theta_i/(\theta_i-1)}$$  \hspace{1cm} (A.2)

for $i = 1, 2, 3, 4$, and $j = 1, 2 \ldots 2^{i-1}$. At the lowest level (5), we have four goods in each group so that

$$x(5,j) = \sum_{k=1}^{4} x(6,4j+1-k)^{(\theta_5-1)/\theta_5}$$  \hspace{1cm} (A.3)

for $j = 1, \ldots 16$.

$x(1,1)$ is the individual's consumption of the most aggregated good, and his utility is a constant elasticity function

$$u(x) = \frac{1-\alpha}{[x(1,1)]^{1-\alpha}}$$  \hspace{1cm} (A.4)
x is the vector of basic goods consumed, i.e. \( x = (x(6,1), \ldots , x(6,64)) \).

\( \alpha \) is the individual's relative risk aversion, which we set equal to 2.0.

This value falls within the range found in empirical studies of union behavior (0.8 - 4.0 in the studies by Carruth and Oswald 1985, Farber 1978, and Forslund 1985).

Each worker has only wage income if employed. If unemployed, he receives an unemployment benefit and may enjoy leisure, the sum of which is equivalent to getting a real wage rate \( rw_f \), where \( r = 0.57 \) and \( w_f \) is the real wage at full employment.

Total nominal demand in the economy is set to \( M = 64 \). The total demand for goods in the economy is equivalent to that of a representative consumer with money income \( M = 64 \), facing the price vector \( P \), and with the utility function above.

(3) Union Behavior

In each industry, the labor union cares about the utilitarian function

\[
U^i = L_i v(W_i/P) + (\bar{L}_i - L_i) \bar{v}, \quad i = 1, \ldots , 64, \tag{A.5}
\]

where \( P(P) \) is the price index that can be derived from the direct utility function above, \( v(W_i/P) \) the utility of a worker with real wage income \( W_i/P \), \( \bar{v} \) the utility associated with unemployment benefits, and \( \bar{L}_i \) the labor force available to union \( i \), which we set equal to 1.0, since for the whole economy we assume that \( \bar{L} = \sum_{i=1}^{64} \bar{L}_i = 64 \).

(4) Equilibrium with monopoly unions

For an arbitrarily given vector of money wage rates \( W \) there exists an equilibrium price vector \( P \) such that (i) demand for each good maximizes the
utility function given $P, x = 64 = M$; (ii) supply of each good equals demand, i.e. $x(6, i) = Y_i, i = 1, \ldots, 64$; and (iii) the marginal product of labor in each industry equals the real product wage, from which follows that $L_i = L(W_i / P_i)$. The elasticity of labor demand with respect to the product real wage in sector $i$ is $\varepsilon_i = -\sigma / (1 - s_{L_i})$, where $s_{L_i}$ is the share of labor costs in total production value, i.e. $s_{L_i} = W_i L_i / P_i Y_i$. We calibrate the model so that $s_{L_i} = 0.7$ at full employment for all $i$, and set $\sigma = 0.33$. Hence $\varepsilon_i = 1.1$ at full employment, which is within the range found in recent multi-country studies (cf., e.g., OECD 1985, and Newell and Symons 1985, 1987).

When each union acts independently it chooses a money wage which maximizes its utility, taking as given all other unions' money wages. In general we can write the price of each good as a function of the wage vector, i.e. $P_i = P_i(W)$. Hence the first order condition is

$$
\frac{dU}{dW_i} = (v^i - \overline{v}) \frac{dL_i}{dW_i} + L_i \frac{dv^i}{dW_i} = 0,
$$

(A.6)

where $v^i = v(W_i / P_i), dL_i / dW_i = \varepsilon_i (1 - a_{iL}) L_i / W_i, dv^i / dW_i = 64 (1 - \alpha) (1 - \Sigma s_k a_{kL}) v^i / W_i, a_{kL} = d\log P_k / d\log W_i$, and $s_k$ the budget share of good $k$ in total consumption, i.e. $s_k = P_k x_k / M$. Because all sectors and unions are assumed to be alike, the prices, the money wage, output and employment in each sector will be the same.

Cooperating unions maximize the unweighted sum of utilities of unions in the group. For example, in the case with two cooperating unions, $i$ and $j$, union $i$ will choose its money wage so that $\phi_i = dU^i / dW_i + dU^j / dW_i = 0,$ where $dU^i / dW_i$ is given by (A.6), and

$$
\frac{dU^j}{dW_i} = (v^j - \overline{v}) \frac{dL_j}{dW_i} + L_j \frac{dv^j}{dW_i}.
$$

(A.7)
where \( v^j = v(W^j/P) \), \( dL^j/dW^1 = - \varepsilon j a_j L_j/W^1 \), \( L_j = L(W^j/P_j) \) and \( dv^j/dW^1 = \frac{64}{(1-\alpha)(\sum_k a_{jk})v^j/W^1} \). An identical condition \( \phi_j = \frac{dU^j}{dW^j} + \frac{dU^i}{dW^j} = 0 \) applies for union \( j \). If \( \frac{dU^j}{dW^1} > 0 \) at the wages \( W^1 = W^j \) that maximize the utility of the two unions when they act independently, it follows that \( \phi_1 = \phi_j > 0 \). Stability conditions then ensure that both wages must be raised in order to fulfill the first order conditions (Calmfors and Drifflill 1988).

The sign of \( dU^j/dW^1 \) depends on how the cross employment effect (the first term) compares with the cross effect on real incomes (the second term). The first effect is larger, the larger \( a_{ji} = d\log P_j/d\log W_i \), which depends upon how close substitutes the two goods are.

Alternatively, because of the symmetry assumptions we can also regard the optimization problem when two unions cooperate as one of choosing the same money wage \( W^1 = W^j \) for both, so as to maximize the utility of each individual union. The ensuing first-order condition \( dU^i/dW^1 + dU^i/dW^j = 0 \) is equivalent to \( dU^i/dW^1 + dU^j/dW^1 = 0 \), and the reasoning becomes identical.

(5) Wage setting with bargaining

Employers in industry \( i \) are assumed to care about a function of real profits \( V(\pi^i/P) \) where \( \pi^i = P^i Y^i - W^i L^i \). \( V \) is taken to have the same constant elasticity form as consumers' utility,

\[
V^i = V(\pi^i/P) = \frac{[\pi^i/P]^{1-\alpha}}{1-\alpha} \quad (A.8)
\]

where again \( \alpha = 2.0 \).
When industries bargain jointly, both unions and employers maximize the unweighted sum of their utilities. For instance, if they each cooperate in groups of \( J \), we assume that in the group (consisting of industries 1 to \( J \)), money wage rates \( W_1 \) to \( W_J \) are set (taking all other money wages as given) so as to maximize the product of utility gains

\[
\sum_{j=1}^{J} \left[ U_j^J - jU^0 \right] \cdot \left[ \sum_{j=1}^{J} V_j^J - jV^0 \right],
\]

where \( V^0 \) = utility of profits during a conflict (set to 0.010)
\( U^0 \) = union utility during a conflict (set equal to the utility derived if all workers receive unemployment benefits).

The equilibrium involves the first order condition for money wage \( i \)

\[
\frac{V_j^J - V^0}{U_j^J - U^0} = \frac{\sum_{j=1}^{J} dv_j^J/dW_i}{\sum_{j=1}^{J} du_j^J/dW_i}.
\]

The new element compared to the earlier analysis is that we must now also evaluate \( \sum_{j=1}^{J} dv_j^J/dW_i \). In the case of two employer associations, \( i \) and \( j \), we have for money wage \( W_i \) that

\[
\sum_{j=1}^{2} dv_j^J/dW_i = dv_1^J/dW_i + dv_2^J/dW_i,
\]

where

\[
\frac{dv_1^J}{dW_i} = \frac{\pi_i \cdot a_{ii} - s_{Li}}{PW_i \cdot 1 - s_{Li}} - \frac{64}{\sum_{k=1}^{64} s_k a_{ki}},
\]

\[
\frac{dv_2^J}{dW_i} = \frac{\pi_j \cdot a_{ij}}{PW_i \cdot 1 - s_{Lj}} - \frac{64}{\sum_{k=1}^{64} s_k a_{ki}}.
\]

To the extent that \( dv_j^J/dW_i > 0 \) at the wages which maximize the Nash product at separate bargaining, the effects via the employer side tend to raise wages with cooperation for the same reasons as above. The sign of
\( dV^j/dW^*_i \) depends on how the positive cross effect on money profits (the first term) compares with the negative effect on their real value (the second term). The first effect is larger, the larger is \( a_{ji} = d\log P_j/d\log W_i \). Because of the symmetry assumptions we can again make the alternative interpretation that the same money wages are set for a group of sectors, so as to maximize the Nash product for an individual sector.

(6) Government expenditure and unemployment benefits financed by a proportional income tax

When we assume a proportional income tax in simulation 8 the budget balance condition \( \sum (\bar{L} - \bar{L}_i)b = t \sum P_i Y_i/P_i \) is fulfilled, where \( b = \) unemployment benefit fixed in real terms and \( t = \) the tax rate.

Individual workers and employers' utility now depends on the after-tax value of wages and profits. The utility of a worker, with money wage \( W_i \) is now \( v(W_i(1-t)/P) \). When unions set wages in this case, they take into account that endogenous tax changes drive a wedge between pre-tax and after-tax money wage increases.