FIEF STUDIES IN LABOUR MARKETS AND ECONOMIC POLICY

TRADE UNION BEHAVIOUR, PAY BARGAINING AND ECONOMIC PERFORMANCE

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PART II

Bargaining Structure and Economic Performance

10

Introduction

The structure of collective bargaining differs dramatically among advanced industrial societies. In Japan, most organized workers belong to company unions. If American employers had been successful in the 1920s, most organized workers in the United States would also belong to company unions. Instead, American unions in the private sector are organized along a mixture of craft and industrial lines with wages usually but not always set at the firm level. In Germany, industrial relations are dominated on the union side by sixteen industrial unions with jurisdiction over blue-collar workers, white-collar workers, and even Civil Servants within their sector. Wage-bargaining for each broad industry occurs primarily at the regional level. In one way wage-bargaining has been even more centralized in the Nordic countries of Finland, Sweden, and Norway for most of the post-war period. Centralized wage agreements negotiated by the national confederations of unions and employers have typically covered all private-sector workers at the national level. In another way bargaining in the Nordic countries is less centralized in that blue-collar, white-collar, and professional union confederations bargain separately.

In recent years, economists have begun to recognize that such differences in the structure of bargaining may have important effects on the outcome of labour negotiations and on aggregate economic performance. Indeed, the extent to which bargaining occurs by craft, by firm, by industry, or at the national level and the consequences that follow has grown from a topic that concerned mostly specialists in comparative industrial relations to

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become an important issue in economics, political science, and sociology during the past fifteen years. The main reason for this increased interest in the structure of bargaining among scholars outside the Nordic countries was the challenge posed by the divergence of macro-economic performance among advanced industrial societies since the mid-1970s. As different countries responded to the same external shocks with very different combinations of unemployment, inflation, and real wage reductions, much research has focused on national differences in the institutional structure of collective bargaining, in particular on the centralization of bargaining.

Nordic scholars have an additional reason to investigate the economic impact of different bargaining structures. Not since the 1930s has the structure of bargaining in the Nordic countries been in such flux. The systems of highly centralized bargaining that have dominated wage-setting in Sweden, Norway, and Finland since the Second World War have come under great pressure to decentralize in the 1980s. The biggest change has occurred in Sweden where representatives of Swedish employers in the SAF have underscored their opposition to centralized wage-setting by dismantling their capacity to bargain at the national level (Myrdal 1991). In all of the Nordic countries, the increased utilization of profit-sharing and other incentive schemes in compensation packages as well as the greater importance of locally bargained wage drift as a share of total wage growth have raised questions concerning the ability of central bargainers to control wage growth (Elvander 1988; 1989). Thus, the question of whether unions and employers should seek to rebuild the post-war centralized bargaining system or encourage the present trend towards greater decentralization is of immediate concern to unions and employers in the Nordic region.

Answers to the question of how the structure of bargaining affects economic performance have proven to be highly controversial. On the one hand, economists and, increasingly, policy-makers share a belief in the superiority of decentralized price-determination over all forms of centralized price-setting, whether by governments or by collective bargainers. In labour markets, as in other markets, competition and price- (i.e. wage-) flexibility are considered to be good things. To the extent that centralized bargaining reduces competition among workers and diminishes the sensitivity of wages to local conditions of demand and supply in the labour market, the argument runs, economic performance is impaired.

On the other hand, extensive cross-national research has linked centralized bargaining with superior aggregate economic performance along a variety of dimensions. The centralization of bargaining first appeared as an explanatory variable in studies of strike frequency. As early as 1960, Arthur Ross and P. T. Hartman observed that 'the union structure most conducive to the elimination of industrial conflict is a unified national movement with strongly centralized control' (1960: 66). More recent studies by Douglas Hibbs (1978), Walter Korpi and Michael Shalev (1980), and Martin Paldam and Peder Pedersen (1984), among others, have reproduced Ross and Hartman's finding.

Associated with low strike rates is a willingness to co-operate with voluntary incomes policies. Bruce Headey (1970) was the first to demonstrate the association between centralized bargaining and the successful implementation of voluntary wage controls. After surveying all instances of voluntary incomes policies among thirteen Western democracies since the Second World War, Headey concluded that union co-operation was contingent upon two factors: (1) the participation of Left parties in government, and (2) the centralization of wage-bargaining. More recent work by Gary Marks (1986) using a larger set of countries over a longer period of time reaches the same conclusion.

By the 1980s, some index of the centralization of bargaining, either standing alone or as a component of a broader index of something called 'corporatism', was being widely used in studying cross-national differences among OECD countries in the responsiveness of wages to rising unemployment and slowing growth since 1974.[1] The basic argument underlying most of this research

[1] Corporatism is a label much used in political science that eludes rigorous definition. Philippe Schmitter (1974; 1977), who may be credited with introducing the concept in modern social science, defined corporatism as a system of interest representation that is dominated by a small number of encompassing, vertically integrated, centralized organizations. Others, such a Gerhard Lehmbruch (1977; 1979), define corporatism in terms of an intermingling of private and public realms with public policies being negotiated with private interest groups and private decisions being subject to the intervention of public authorities. Yet others, such as Peter Katzenstein (1985) or Newell and Symons (1987), include a commitment by the unions to social harmony and co-operation with employers as part of the definition.

is that the benefits of wage moderation are public goods to an important extent. In the words of the OECD: 'unless wage bargaining is highly centralized, individual unions can rationally hope that an improvement in their real wages can be achieved at the expense of profits and hence employment elsewhere in the economy' (1977: 159). Therefore, centralized bargaining moderates union wage demands. In turn, real wage moderation is widely viewed as the key for regaining low rates of unemployment and inflation and high rates of investment and growth. Thus centralized bargaining is associated with superior economic performance, usually measured in terms of unemployment and inflation. Although the details differ, this is the basic conclusion of numerous empirical studies: Mark Lutz (1981), Wolfgang Blaas (1982), David Cameron (1984), Michael Bruno and Jeffrey Sachs (1985), John McCallum (1983; 1986), Ezio Tarantelli (1986), Charles Bean, Richard Layard, and Stephen Nickell (1986), A. Newell and J. S. V. Symons (1987), Carlo Dell'Aringa and Manuela Lodivici (1990), Richard Jackman (1990), Richard Jackman, Christopher Pissarides, and Savvas Savouri (1990), and David Soskice (1990), among others. Thus either the conventional economic wisdom in favour of decentralized wage-setting is wrong when applied to unionized labour markets, or the empirical studies are flawed.

Indeed, these empirical claims regarding the superiority of centralized bargaining have been challenged. (Only the relationship between centralization and the frequency of industrial conflict remains uncontroversial.) Bernhard Heitger (1987) suggested that the macro-economic benefits of wage-restraint are more than offset by the micro-economic costs of rigid (and, in Heitger's view, overly egalitarian) relative wages that centralized wage-setting produces. Lars Calmfors and John Driffill (1988) and Richard Freeman (1988) have argued that the relationship between centralization and economic performance is hump-shaped rather than monotonic. In their view, countries with both very decentralized wage-setting and highly centralized wage-setting have done better than those in an intermediate position. Peter Lange and Geoffrey Garrett (1985), Garrett and Lange (1986), Alexander Hicks (1988), and Michael Alvarez, Garrett, and Lange (1991) find that countries with centralized unions and social democratic governments, as well as countries with decentralized unions and conservative governments, have done relatively better

than countries with one but not the other. Göran Therborn (1987) goes further in arguing that only social democratic governance matters as far as unemployment is concerned. The empirical association of centralized bargaining and low unemployment is a spurious result, according to Therborn, of the high correlation of centralized bargaining and social democratic governance.

Moreover, all of the empirical studies suffer from a number of difficulties. The most notable problem comes from the measurement of the key independent variable: union centralization. While there is consensus that wage-setting in Austria, Norway, and Sweden is (or was in the case of Sweden) highly centralized while bargaining in the United States and Canada is decentralized, many countries are ranked quite differently in different studies. Switzerland, to cite one example, is judged as highly centralized by Bruno and Sachs (1985), moderately centralized by Headey (1970), and very decentralized by Calmfors and Driffill (1988). The outstanding economic performance of Japan, with its system of enterprise unions, is often displayed as presenting strong evidence in favour of the advantages of decentralization. Yet Tarantelli (1986), G. Brunello and S. Wadhwani (1989), and Soskice (1990) claim that wage-setting in Japan is closely synchronized and even centralized in an informal way. A different problem is that few of the studies control for the influence of unions over wages. It seems more appropriate to view the United States in the 1980s as an example of a competitive labour market rather than as a case of decentralized bargaining (Paloheimo 1990). The set of advanced industrial societies is small enough so that removing or reclassifying a few cases can alter the qualitative conclusions.

Given the small number of cases and the large number of factors that plausibly affect economic performance, the credibility of empirical evidence on the advantages or disadvantages of centralized wage-setting depends on the strength of the theory explaining the results. Thus, we have chosen to concentrate in this review on what economic theory has to say.[2] We start, in

[2] See Pohjola 1989 and Tyrväinen 1989 for complementary reviews of the empirical and theoretical literature on centralized bargaining and economic performance. The recent book by Richard Layard, Stephen Nickell, and Richard Jackman contains both theoretical and empirical work that is highly relevant for our topic. Unfortunately we are unable to comment on their work in this review since our paper was completed before the book was published.

Chapter 11, with a review of what can be learned about the impact of bargaining structure from models in which the union is assumed to be able to set wages as it chooses, subject to the constraint that the level of employment (or investment) is chosen by employers. Such models are really models of union aspirations rather than bargaining outcomes. Thus, in Chapter 11 we focus attention on how centralization might affect the militancy or moderation of the unions' wage demands. In section (a), we review briefly the literature on union objectives in bargaining and present the standard, simple model of union wage-setting. In the simplest model with no externalities, exogenous prices, and a single type of labour, centralization has no effect on the unions' optimal wage. In the remainder of Chapter 11, we show how altering these assumptions changes that conclusion. In section (b) we allow wages to affect consumer prices. In section (c) we consider the case with multiple types of labour. Various externalities stemming from union concerns with relative wages and aggregate unemployment are the subject of section (d). The impact of the level of centralization on union preferences regarding the trade-off between wages and employment is discussed in section (e). We end Chapter 11 by considering the question of centralized versus decentralized wage-setting from the point of view of employers when the quality of labour depends on the wages that are paid.

In Chapter 12 we shift from models of the unions' (or employers') optimal wage to models of bargaining. Here we study ways in which centralization affects wage-bargaining holding union aspirations constant. We begin in section (a) with a brief overview of co-operative and non-cooperative bargaining models. In (b) we study the actual degree of centralization that exists in mixed systems of the Nordic variety where centralized wage-setting is followed by supplementary bargaining at the local level. In section (c) we discuss the often noticed but little studied effect of centralization on the frequency of industrial conflict. The subject of sections (d) and (e) is wage-bargaining and profit-sharing. The essential insight is that bargaining at the firm level constitutes a type of profit-sharing that is absent from bargaining at the industry or national level, and that profit-sharing differs from fixed wage contracts in a variety of ways. Profit-sharing has effects on workers' willingness to expend effort on the job

(section (d)) and the firms' willingness to hire more workers (section (e)). In section (f) we relax the assumption that the number of firms is fixed in order to analyse the effects of centralized and local bargaining on entry and exit of firms, or, equivalently, on the building of new plants and the shutting down of older ones.

In Chapter 13 we turn from the economic to the political consequences of centralized bargaining systems. By political consequences, we mean the types of conflicts engendered by centralized wage-setting within the union movement and the employers' associations. Such conflicts matter because they threaten the long-run sustainability of centralized wage-setting institutions. Chapter 14 concludes the essay.

11

Wage Demands by Unions and Employers

(a) Models of Union Behaviour

In order to study theoretically how the bargaining structure affects union wage demands, we need to say something about the unions' objectives in collective bargaining.[1] Unfortunately, there is no consensus regarding the appropriate maximand for unions comparable to the standard assumption of profit maximization for firms. Many answers to the question of what unions maximize have been suggested, including wages, aggregate rents, a general function of wages and employment, the utility of the decisive union voters, union dues, and the salary of top union leaders among others. The most basic question, however, is whether union behaviour is consistent with any coherent aggregate preference ordering. On the one hand, to model unions as organizations that seek to maximize union dues or leaders' salaries subject to the constraint that union members will quit if the costs of membership exceed the benefits neglects the real impact of internal democracy on union behaviour. On the other hand, the theoretical literature on voting has demonstrated that the outcome of elections is almost never equivalent to the maximization of some aggregate objective function when heterogeneous voters face choices along more than one dimension.[2] Thus the microfoundations for modelling a democratic union as a unitary actor whose behaviour can be studied as the solution of an optimization problem are easily challenged.

Nevertheless, it is essential in theoretical work that unions be assumed to maximize something. Moreover, the status of theories of union behaviour is not really so different from the theory

[1] See Farber (1986) for a relatively recent review of the literature on union objectives, including attempts to study union objectives empirically.

[2] Douglas Blair and David Crawford (1984) were perhaps the first to point out the relevance for studies of union behaviour of the general non-existence of voting equilibria when choices are multi-dimensional.

of the firm. Just as it is common to assume that shareholders are homogeneous in ways that matter for the firms' optimal behaviour, so modellers of unions almost always assume that union members differ along a single dimension at most. In addition, both union leaders and firm managers are commonly, although not always, assumed to be perfect agents of their constituents. In the theory of the firm, this leads to the assumption of profit maximization in the static case. In the theory of the union, this leads to the assumption that unions, in the static case, maximize a welfare function that depends on the wage of its members and the employment level in the sector the union covers. Denoting the union wage by w and the relevant employment level by L, unions are commonly assumed to maximize some variant of

$$u = u(w, L) \text{ with } \frac{\partial u}{\partial w} > 0 \text{ and } \frac{\partial u}{\partial L} \geq 0. \tag{1}$$

The unions' welfare is assumed to depend positively on the wage since a higher wage always benefits union members holding employment constant. Whether greater employment benefits union members holding the wage constant depends on whether or not union members are securely employed. If lay-offs are assumed to occur strictly by seniority and union members are assumed to vote according to their myopic self-interest, then the union would only care about the wage as long as more than half of the union membership remained employed. However, if the laid-off workers leave the union, union members with average seniority in the first period would have below-average seniority in the second (Farber 1986). Moreover, lay-offs rarely occur strictly according to seniority as union members who lose their job at one plant seldom have the right to take the job of a union member with less seniority at another plant. Thus, a majority of union members may feel threatened by lay-offs at union unemployment levels well below 50 per cent.

The debate over whether or not unions care about employment is intertwined with another debate over what union contracts cover. One convention, represented by Andrew Oswald (1982; 1985), among many others, is to assume that the labour agreement covers wages alone, with employment set by the firm in

accordance with profit maximization. In this approach, the union maximizes $u(w, L)$ as given in equation (1) subject to the constraint that employment is given by the firms' demand for labour: $L = L(w)$ with $L'(w) < 0$. The other convention, represented by George De Menil (1971) and Ian McDonald and Robert Solow (1981), among others, assumes that both wages and employment levels are negotiated. This case can be represented by assuming that the union maximizes $u(w, L)$ subject to the constraint that the firms' profits, π, do not fall below some minimum value, or $\pi(w, L) \geq \pi_0$. In short, a contract that only covers the wage would produce outcomes along the demand-for-labour curve while a contract that covers both wages and employment might be expected to be located on the contract curve between the union and firms. Wasily Leontief (1946) was the first to point out that these two curves never coincide when the union cares about employment.

The most common argument in support of the assumption that contracts cover both wages and employment is that rational bargainers should seek to exploit all gains from trade. If the labour agreement does not cover both wages and employment, there exists another agreement that could make both union members and employers better off. The most common argument against this assumption is the observation that, in practice, union contracts rarely specify the employment level.

Neither argument is convincing. Against the claim that rational bargainers will not choose a point on the demand-for-labour curve, one can argue that (*a*) outcomes on the demand-for-labour curve are efficient from the bargainers' point of view if the union only cares about the wage (Oswald 1987), and (*b*) contracts off the demand-for-labour curve may not be incentive-compatible when firms have private information (Farber 1986). On the other hand, the fact that union contracts do not generally specify employment levels is not persuasive as union contracts do frequently cover work-rules that limit the firms' discretion to alter the capital–labour or the labour–output ratio. In such cases, the contract may force employers to choose higher levels of employment than they would like at the prevailing wage even though employment is not fixed explicitly (Hall & Lilien 1979). When major unions in the United States were asked to accept roll-backs in their contracts in the 1980s, the relaxation of work rules was high on the employers' list of demands.

One aspect of this question that has not been recognized in the literature is the relevance of the level at which bargaining occurs. Labour contracts that might implicitly cover employment by specifying work rules cannot be negotiated at the national level. Indeed, work rules must be negotiated at the plant level unless the industry is relatively homogeneous. Thus one way that decentralized bargaining can differ from centralized bargaining is in the scope of the labour agreement.

We will not pursue this possible difference, however. In order to illuminate other differences among bargaining levels, it helps to hold the coverage of union contracts constant. Thus we will assume throughout that firms choose the level of employment unilaterally, whether the contract is negotiated locally or nationally. Moreover, there is little of substance that is lost. The effect of bargaining over employment as well as wages can be illustrated in a model where firms alone set employment when there are hiring and firing costs, as we illustrate in Chapter 12.

Formally, then, the optimal union wage is modelled as the solution to

$$\max_{w} u(w, L(w)). \tag{2}$$

We will assume for most of Chapter 11 that $(\partial u/\partial L)$ is strictly positive and that the solution is given by the first-order condition

$$\frac{\partial u}{\partial w} + \frac{\partial u}{\partial L} L'(w) = 0. \tag{3}$$

What does this simple model tell us about wage demands in centralized versus decentralized bargaining systems? Consider the simplest possible case where all product prices are exogenous, i.e. given by the world market, so that w represents both the real and nominal wage. Assume, in addition, that there is a fixed number of firms in the economy, each with the same labour demand function $L(w)$. Thus $L(w)$ reflects the trade-off between wages and employment for the aggregate economy, as well as for any fixed subsector of the economy. Under these conditions, it is

clear that the unions' optimal wage demand is independent of the degree of centralization.

(b) Endogenous Product Prices

The assumption that wages have no effect on product prices may be accurate for many industries in small open economies, but not for all. Where wage increases are passed on to prices to some extent, the unions' optimal wage is no longer independent of the level of centralization. This topic has been studied by Calmfors and Driffill (1988), Jon Strand (1989), and Michael Hoel (1991) in the context of a closed economy model in which both wages and prices are endogenous. The central result of this work is that the relationship between wages and bargaining level is hump-shaped, with both very decentralized and highly centralized bargaining systems producing greater wage restraint than bargaining systems in between.

To illustrate this result, we adopt the formulation of Hoel (1991). As before, we assume that there is a fixed number of firms with identical production functions. Product prices, however, are now assumed to be endogenously determined. Now we must distinguish between nominal and real wages. Let p be the product price of the industry under consideration. We assume that the price can be written in reduced form as a function of the nominal wage in the industry, w, and nominal wages elsewhere in the economy, denoted w^*:

$$p = p(w, w^*) \tag{4}$$

Similarly, product prices elsewhere in the economy, denoted p^*, are given by

$$p^* = p^*(w, w^*) \tag{5}$$

It is assumed that

$$\frac{\partial p}{\partial w}\frac{w}{p} \equiv \eta \in [0, 1] \quad \text{and} \quad \frac{\partial p^*}{\partial w}\frac{w}{p^*} \equiv \eta^* \leq \eta.$$

An increase in w raises p, or leaves p unchanged as a special case, i.e. $\eta \geq 0$. It is also clear that a rise in w cannot have a larger impact in other sectors than in the sector with the wage increase, i.e. $\eta^* \leq \eta$. In the hypothetical case of a one-sector economy, we have $\eta = \eta^*$. More realistically we have $\eta^* < \eta$ when η is positive. It is not obvious whether a wage increase in one industry raises or lowers prices in other industries. If industries produce products that are complements in consumption, then an increase in w that produced an increase in p would reduce p^*. Thus, η^* could be either positive or negative.

Employment, as before, is a function of the real product wage $L = L(w/p)$. Workers' consumption possibilities, however, are a function of nominal wage divided by the consumer price index. The consumer price index, denoted p^c, is a function of prices throughout the economy:

$$p^c = p^c(p, p^*) \quad \text{with} \quad \frac{\partial p^c}{\partial p}\frac{p}{p^c} \equiv \theta \in [0, 1] \quad \text{and} \quad \frac{\partial p^c}{\partial p^*}\frac{p^*}{p^c} = 1 - \theta. \tag{6}$$

This last equation embodies the condition that a proportional increase of all prices increases the consumer price index by the same proportion.

We assume that wages are determined as the non-cooperative equilibrium of a wage-setting game among unions. That is, in equilibrium every union's wage is optimal given the wages chosen by other unions. Thus the problem facing each union is

$$\max_w u\left(\frac{w}{p^c(p(w, w^*), p^*(w, w^*))}, L\left(\frac{w}{p(w, w^*)}\right)\right). \tag{7}$$

In a symmetric equilibrium where $w = w^*$ and $p = p^* = p^c$, the first-order condition for (7) can be written as

$$\frac{\partial u}{\partial w/p^c}[1 - (\theta\eta + (1 - \theta)\eta^*)] + \frac{\partial u}{\partial L}L'(w/p)(1 - \eta) = 0 \tag{8}$$

or

$$\frac{\partial u}{\partial w/p^c} + h\frac{\partial u}{\partial L}L'(w/p) = 0 \tag{9}$$

where

$$h = \frac{1 - \eta}{1 - (\theta\eta + (1 - \theta)\eta^*)}. \tag{10}$$

The second-order conditions for a maximum imply that the optimal w is a negative function of h.

From (10), it can be seen that h is the ratio of two elasticities. The numerator of h is the elasticity of the real product wage with respect to the nominal wage chosen by the union. The denominator is the corresponding elasticity of the real consumption wage. It follows from $\eta^* \leq \eta$ that the denominator cannot be smaller than the numerator, which implies that $h \leq 1$. The important difference here between different degrees of centralization is the ability of each union to increase its real consumption wage without an equivalent increase in the real product wage in its sector. Since a rise in the real product wage reduces employment, the union wants this wage to increase as little as possible. If $h < 1$, each union can raise its real consumption wage proportionately more than the real product wage in its sector, resulting in a higher equilibrium real wage (in both senses) than it would have demanded had prices been exogenous.

Table 11.1 presents a comparison of how h, and therefore w and L, depends on the degree of centralization. Consider first the case of price-taking firms and wage-setting at the level of the firm. The wage in any single price-taking firm has a negligible effect on product prices, which implies that $\eta = \eta^* = \theta = 0$. In this case it follows from (10) that $h = 1$. In other words, the case of price-taking firms with decentralized wage-setting is identical to the case with exogenous prices. The interpretation is straightforward. It doesn't matter whether or not prices actually are exogenous. What matters is that each union perceives prices as independent of its own wage.

Consider next the opposite extreme, the case of perfectly

TABLE 11.1 *Wages and the Level of Wage-Setting*

Level of wage-setting	Price-taking firms	Monopolistic competition
Firm	$\theta = 0$	$\theta = 0$
	$\eta = \eta^* = 0$	$\eta > \eta^* = 0$
	$h = 1$	$h < 1$
Industry	$\theta \in (0, 1)$	$\theta \in (0, 1)$
	$\eta > \eta^*$	$\eta > \eta^*$
	$h < 1$	$h < 1$
Nation	$\theta = 1$	$\theta = 1$
	$h = 1$	$h = 1$

centralized wage-setting where $\theta = 1$. From $\theta = 1$, it follows immediately from (10) that $h = 1$ whatever the relationship between η and η^*. Thus the cases of complete decentralization and complete centralization give the same outcome. The reason is that in both cases each union bears the full consequences of a higher nominal wage itself. With wage-setting at the firm level, prices are perceived as fixed since firms are price-takers by assumption. With wage-setting above the firm level, the union chooses the nominal wage taking into consideration the effect of the nominal wage on prices. But since the industry real product wage and the real consumption wage are equal when bargaining is fully centralized, the outcome is unchanged.

With wage-setting at an intermediate level, the wage usually affects the product price of the sector the union belongs to, or $\eta > 0$. Since $\eta^* < \eta$ and, in this case, $\theta < 1$, we have $h < 1$. Wage-setting at an intermediate level thus produces higher wages and lower employment than wage-setting at either the firm or national level. The intuition behind this result is that each union knows that any increase in its nominal wage will increase its product price to a greater extent than it will raise the cost of living. This reduces the negative employment effects of an increase in the real consumption wage. Each union, in other words, is able to pass some of the cost of a wage increase on to others through the price effect, rather than bearing all of the cost itself in the form of lower employment. When all unions behave like this, however, the consequence is higher real product and real consumption wages and lower employment than would result from either highly decentralized or highly centralized wage-setting.

Consider now the case of imperfect competition where each firm faces a downward sloping demand curve. The qualitative result for the comparison of fully centralized wage-setting with wage-setting at an intermediate level remains the same as in the case of perfect competition. However, wage-setting at the level of the firm is no longer equivalent to wage-setting at the national level. With imperfect competition, a rise in the wage paid by a firm is to some extent passed on to prices, i.e. $\eta > 0$. In this case, firm level wage-setting produces higher real wages than nationwide wage-setting, a result first derived by Cahuc (1987). The interpretation is similar to the case of industry-level wage-setting. With monopolistic competition, the firm-level union knows that if

it raises its wage, the wage increase will to some extent be passed on to the price of the firm's product. This reduces the negative employment effect of the wage increase. As in the case of intermediate-level bargaining, the end result is higher wages and lower employment than unions would have chosen if they chose wages jointly.

To summarize the results so far, with exogenous prices, complete centralization or firm-level wage-setting with price-taking firms, a union that raises its nominal wage affects its sector's real product wage and its real consumption wage in the same proportion. With intermediate-level wage-setting or with fully decentralized wage-setting under conditions of imperfect competition, a nominal wage increase raises the real product wage of its sector proportionately less than its real consumption wage. Since the benefits of higher wages come from the real consumption wage while the costs of higher wages come from the real product wage, the gap between the two induces the union to choose higher nominal wages. When all unions do the same, both prices and real wages are higher and employment is less than unions would choose had they been able to co-ordinate their wage demands.

(c) Substitutes and Complements in Production

A second way in which the simple model of section (a) is unrealistic is in the assumption that each product is made with the labour of a single union. Final products, in general, depend on many different types of labour that are often represented by different unions. Firms frequently bargain directly with more than one union. This is particularly true in industries and countries where blue-collar workers are organized in craft unions or in competing industrial unions. In large metalworking firms in Britain, for example, it is not unusual for the work-force to be represented by 15–20 unions (Bratt 1986). Even in countries like Norway and Sweden where non-competing industrial unions are the rule, there are separate unions for blue-collar, white-collar, and professional workers.

In addition, firms depend on the labour of workers they do not directly employ. Payments for goods and services bought from

other domestic producers may comprise a substantial part of a firm's production costs. The manufacturing sector depends on the outputs of workers in utilities and transportation. The cost of new investment depends on the price of capital goods and new construction. The cost of government services depends on wages in the public sector. According to the comment by Stephen Nickell (Calmfors & Driffill 1988: 52), labour costs average only 20 per cent of revenues at the firm level in Great Britain yet wages and salaries constitute 70 per cent of value added at the national level.

When products are produced by workers divided into multiple unions, the unions' optimal wage depends on the level of centralization even when final product prices are fixed in world markets. Wage-setting by multiple types of workers organized in separate unions was first studied by Sherwin Rosen (1970), but the topic received relatively little attention until recently. Oswald (1979) examined the existence of equilibria in an economy with multiple unions. Henrik Horn and Asher Wolinsky (1988) and Tor Hersoug (1985) studied the question of the optimal division of workers into separate unions (from the workers' point of view) and highlighted the critical distinction between complements and substitutes in production.

Matti Pohjola (1984) and Michael Wallerstein (1990) studied the impact of decentralized versus centralized bargaining with different types of labour within a differential game framework. Here we illustrate their basic results using the simpler static framework adopted by Oswald (1979).

Let there be k unions whose labour is used in production. The product price is assumed to be exogenous (i.e. determined by the world market). The interdependence of the k unions can be represented in reduced form by letting the demand for labour for each union be a function of all k wages: $L_i = L_i(w_1, \ldots, w_k)$.[3] With decentralized wage-setting, union 1's problem is

[3] If the profit of the firm is written as $\pi = pF(L_1, \ldots, L_k) - \Sigma w_i L_i$ where $F(L_1, \ldots, L_k)$ is the production function with k types of labour, the first-order condition for employment of members of the ith union is $(\partial F/\partial L_i) = (w_i/p)$ which gives $L_i = L_i(w_i, L_1, \ldots, L_{i-1}, L_{i+1}, \ldots, L_k)$. Doing the same for all k unions, one can use the k equations to eliminate the variables $(L_1, \ldots, L_k)$ from the right-hand-side and write $L_i = L_i(w_1, \ldots, w_k)$ as in the text.

$$\max_{w_1} u_1(w_1, L_1(w_1, \ldots, w_k)) \tag{11}$$

with the first-order condition

$$\frac{\partial u_1}{\partial w_1} + \frac{\partial u_1}{\partial L_1}\frac{\partial L_1}{\partial w_1} = 0. \tag{12}$$

The second-order condition for a maximum implies that the left-hand-side of (12) is a negative function of w_1.

If, in contrast, the k wages were chosen jointly to maximize some collective welfare function V that depends positively on the welfare of each of the k unions, the collective choice is given by the solution to the problem

$$\max_{w_1,\ldots,w_k} V(u_1(w_1, L_1(w_1, \ldots, w_k)), \ldots, u_k(w_k, L_k(w_1, \ldots, w_k))). \tag{13}$$

The first order condition for (13) that corresponds to (12) is

$$\frac{\partial V}{\partial u_1}\left[\frac{\partial u_1}{\partial w_1} + \frac{\partial u_1}{\partial L_1}\frac{\partial L_1}{\partial w_1}\right] + \sum_{i=2}^{k}\frac{\partial V}{\partial u_i}\frac{\partial u_i}{\partial L_i}\frac{\partial L_i}{\partial w_1} = 0 \tag{14}$$

The terms $(\partial V/\partial u_i) > 0$ represent the weight given to each union in the aggregate welfare function. As long as unions care about employment of their own members or $(\partial u_i/\partial L_i) > 0$, it can be seen from (14) that the effect of centralization depends on the impact of the first union's wages on the demand for the labour of members of other unions: $(\partial L_i/\partial w_1)$

While $(\partial L_i/\partial w_i)$ is negative for all i, the terms $(\partial L_j/\partial w_i)$ for $i \neq j$ may have either sign. If $(\partial L_j/\partial w_i) > 0$, the two unions are said to be substitutes in production. A higher wage for union i induces the firm to employ more members of union j. On the other hand, if $(\partial L_j/\partial w_i) < 0$, the two unions are said to be complements. A higher wage for one reduces the firm's demand for the labour of the other. In this case, the two unions are supplying complementary labour in the sense that the productivity of each is enhanced for the presence of the other. Horn and Wolinsky (1988) argued that workers who are substitutes have an incentive to organize into a single union since, by uniting, they increase their ability to strike effectively. In contrast, workers who are complements increase their joint bargaining power by remaining in separate unions, since the cost to the firm of separate strikes

exceeds the cost of a strike by the two groups simultaneously. If the division of workers into unions reflects choices made to maximize bargaining power, members of separate unions would be complements rather than substitutes in production.

To simplify the exposition, consider the case with identical and symmetrical unions such that $\partial L_i/\partial w_i = \partial L/\partial w$ and $\partial L_i/\partial w_j = \partial L/\partial w^*$ for all $i, j = 1, \ldots, k$ with $i \neq j$. Suppose, in addition, that a centralized wage-setting chooses wages to maximize the average welfare of the k unions, or equivalently when k is fixed, the sum of the unions' welfare: $V = \Sigma u_i$. In this case, the optimal wage for the k unions bargaining jointly is given by

$$\frac{\partial u}{\partial w} + \frac{\partial u}{\partial L}\left[\frac{\partial L}{\partial w} + (k-1)\frac{\partial L}{\partial w^*}\right] = 0 \tag{15}$$

In contrast, the non-cooperative equilibrium of decentralized wage-setting is given by equation (12) without subscripts:

$$\frac{\partial u}{\partial w} + \frac{\partial u}{\partial L}\frac{\partial L}{\partial w} = 0 \tag{16}$$

Since the left-hand-side of (16) is a negative function of the wage, the optimal wage with centralized wage-setting is lower than the non-cooperative equilibrium of decentralized wage-setting if members of different unions are complements (i.e. if $(\partial L/\partial w^*) < 0$). If workers are substitutes (i.e. if $(\partial L/\partial w^*) > 0$), centralization would raise the unions' wage demands.

When one union's wage affects other unions' wage and employment possibilities, it is apparent that decentralized wage-setting differs from centralized wage-setting. When different unions are substitutes in production, each union's wage increase raises the demand for the labour supplied by other unions. A centralized wage-setter that internalized this benefit would want to raise wages above the decentralized equilibrium. More commonly, one union's wage increase reduces the demand for the labour supplied by other unions. In this case, centralized wage-setting would reduce wage demands below the equilibrium wage demanded by unions acting independently.

This result appears to strengthen the case for highly centralized bargaining and weaken the case for very decentralized bargaining. A better interpretation, in our opinion, is that it is incorrect to think that bargaining systems can be arrayed along

a single dimension of centralization. Union members can be divided into separate organizations in a variety of ways with differing consequences for the effects of decentralized wage-setting. A decentralized bargaining system comprised of company unions, as in Japan, is quite different from a decentralized bargaining system comprised of multiple craft and competing industrial unions, as in the United States or Great Britain.

There are at least two dimensions of centralization that ought to be distinguished in empirical work but never are. The first dimension is whether wages are set at the level of the plant, enterprise, industry, or nation. The second dimension is whether workers in different types of jobs bargain jointly or separately. Putting the two together, one obtains something like Table 11.2. As one moves vertically down the table, the relationship between wage demands and centralization is likely to be hump-shaped according to both the model with endogenous final prices and the model with different types of labour. In terms of the endogenous price model, industry-level wage-setting maximizes the extent to which the cost of a wage increase can be passed on to others as a price increase. In terms of the model with different types of labour, workers doing similar jobs at different plants or enterprises in the same industry are typically substitutes while workers in different industries are more likely to be complements. But as one moves horizontally across the table, the relationship between the militancy of wage demands and centralization is monotonically declining as workers in different types of jobs are most often complements.

TABLE 11.2 *Dimensions of Centralization*

Levels of wage-setting	Each type bargains separately	All types bargain jointly
Plant	Complete decentralization	Company unions
Enterprise		
Industry	Craft unions	Industrial unions
Nation		Complete centralization

(d) Other Externalities in Wage-Setting

There are a number of different possible externalities in wage-setting that can be captured by writing the unions' maximand as

$$u = u(w, L(w), z(w, w^*)) \tag{17}$$

where z is some variable that depends on wages elsewhere in the economy, w^*, as well as wages in the plant. For example, observers of industrial relations have long claimed that workers care about wage differentials in addition to wage levels. Economists often go to great lengths to avoid adding a concern with relative income as an argument in workers' utility functions, for both good and bad reasons.[4] The more freedom one has to make *ad hoc* adjustments to workers' utility, the easier it is to demonstrate any conclusion one wants. At the same time, the simplifying assumption that workers care only about their own income (and leisure) that is made for analytic convenience should not be mistaken for reality. Workers may strive for status as well as income and status may depend on relative income. Or workers may be concerned with notions of fairness that are derived from comparisons with what others are paid (Elster 1989).

Suppose, for whatever reason, that union members care about how much they are paid relative to other workers in addition to the standard concerns with wage levels and employment security. Then z in (17) could be written as $z = w/w^*$ with $(\partial u/\partial z) > 0$. If all unions try to increase their wage relative to the wages of others, none will change position (provided their relative bargaining strength has not changed). Wages will increase, however, and unemployment will rise. According to this reasoning, centralized wage-setting reduces wages by inhibiting the fruitless struggle of each group to raise its wage more than the others.

[4] Not all economists have ignored workers' concern with relative wages. See Oswald 1979; Gylfason & Lindbeck 1984; and Uddén-Jondal 1989; 1990, for formal analyses of the consequences of envy on wage-setting.

A different interpretation of z centres on aggregate unemployment. Union members care about the aggregate rate of unemployment to the extent that they face some positive probability of losing their job. Every additional job-searcher reduces the likelihood that other job-seekers will find work (Mortensen 1986). Even union members who considered their jobs secure would care about aggregate unemployment to the extent that government expenditures to support the unemployed result in higher taxes on employed workers (Jackman 1990; Holden & Raaum 1989). In either case we might interpret z as the economy-wide rate of unemployment with $(\partial u/\partial z) < 0$. With local wage-setting, $(\partial z/\partial w)$ is close to zero. As the coverage of the labour agreement expands, $(\partial z/\partial w)$ increases implying a lower optimal wage.

A third interpretation of z is the probability of having a social democratic government. Union members would care about the party in power to the extent that social democratic governments are more likely than bourgeois governments to adopt policies that favour union members. Union leaders may care about the party in power because they have close personal links with the social democratic party leadership. According to this argument, it is the government, not the unions, that takes responsibility for aggregate unemployment. The unions, however, care about the survival of the government if it is social democratic. In this case, centralized wage-setting reduces wage demands relative to decentralized wage-setting under social democratic governments but not under bourgeois governments, as argued by Lange and Garrett (1985) and Garrett and Lange (1986).

All of these externalities have a similar implication: with centralized bargaining, wage-setters internalize the impact of the wage agreement on relative wages and/or aggregate unemployment which leads them to moderate their wage demands. Of course, it is unrealistic to think that a centralized union confederation has the capacity accurately to assess all of the externalities in wage-setting and choose the optimal national wage schedule. Yet, if all externalities point in the same direction, centralized union negotiators may indeed be satisfied with lower wage levels than would be the outcome of decentralized wage-bargaining.

(e) Change of Preferences

So far, we have not yet systematically considered the possibility that local unions and centralized confederations might have different objectives. Yet recent work that emphasizes the importance of insiders versus outsiders in the theory of union behaviour points to an important difference between decentralized and centralized bargaining that stems from the way centralization affects the definition of insiders.

To examine this topic we drop the assumption that $(\partial u/\partial L)$ is strictly positive for all levels of L. It is more reasonable to assume, as in the insider–outsider model, that the willingness of a union to accept a lower wage for greater employment depends on the extent to which current union members are unemployed. In an expanding industry where the demand for labour exceeds the current union membership, union members have little reason, apart from altruism, to restrain their wage demands to enable employment to grow even faster. On the other hand, in a declining industry where union members face lay-offs, the union may well sacrifice wage gains to reduce or halt the employment decline. The effect of the size of the union relative to the demand for labour on union behaviour can be represented by writing the union's objective function as

$$u = u(w, \max(M - L, 0)) \tag{18}$$

where M is the union's current membership and L is the demand for labour (Oswald 1987; Wallerstein 1987). Equation (18) implies that the union's indifference curves are downward sloping where $L < M$ but flat for $L \geq M$ as illustrated by the curves ABC and $A'DE$ in Figure 11.1. If the demand-for-labour curve is represented by the line LL, the optimal wage is w and union members are fully employed.

The line between insiders and outsiders may depend on the level of bargaining. For the local union, the distinction seems clear. Insiders are current members of the local union. If, after some time, unemployed union members leave the union and new employees do not join the union immediately (or are not considered full members by the union at first), then the union's current membership is given by past employment in the plant.

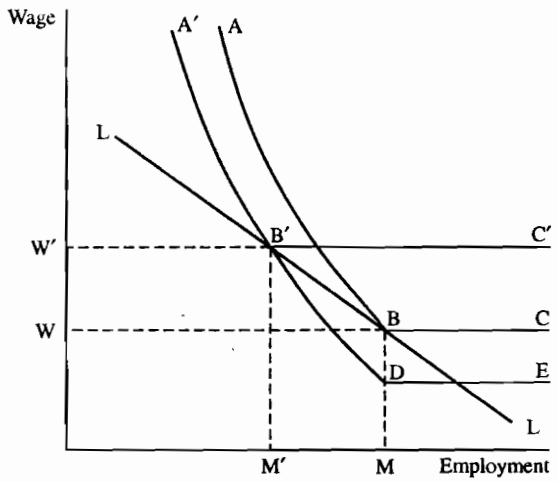

FIG. 11.1 The Number of Insiders and Union Preferences of Wages and Employment

Let the time it takes unemployed workers to quit the union be equal to the time it takes new employees to become union members. Then L and M in the case of decentralized bargaining are given by

$$L = L^i \quad \text{and} \quad M = L^i_{-t} \tag{19}$$

where L^i is employment in plant i and t is the amount of time it takes for the unemployed to quit and the newly employed to join.

An important implication of equation (19) is that there is hysteresis in unemployment: the current equilibrium unemployment level depends on the past level of unemployment (Gottfries & Horn 1986; Blanchard & Summers 1987; Lindbeck & Snower 1988). An unforeseen decline in demand that causes lay-offs lasting for more than t periods reduces the union membership and thus reduces the threshold employment level above which the union only cares about wages. An unforeseen increase in demand for more than t periods has the opposite effect of increasing union membership and raising the union's sensitivity to unemployment.[5]

[5] The symmetry of increases and declines in demand is a consequence of the assumption that the time it takes new workers to become union members equals the time it takes laid-off workers to leave the union. See Lindbeck & Snower 1988 for a discussion of symmetrical and asymmetrical hysteresis.

The distinction between insiders and outsiders is less clear at the national level. According to Tor Hersoug, Knut Kjær, and Asbjørn Rødseth (1986), the central Norwegian trade union confederation (LO) has no statistics on unemployed members and no way of deriving such statistics from official sources. Thus it is the national unemployment rate that enters in the LO's calculations of the employment consequences of its wage demands. More generally, we propose the following general formulation for national wage-setting:

$$L = \sum_i L^i$$

$$M = \sum_i L^i_{-t} + \gamma_1\left(N_{-t} - \sum_i L^i_{-t}\right) + \gamma_2(N - N_{-t}) \quad \text{with}$$

$$1 \geq \gamma_1 \geq \gamma_2 \geq 0 \tag{20}$$

The first term of the second line, ΣL^i_{-t}, is the current union membership. The second term, $N_{-t} - \Sigma L^i_{-t}$, consists of older workers who have not been employed for t periods. The third term, $N - N_{-t}$, consists of new workers who have just entered the work-force. The measure M is based on the idea that the central union does not only care about whether its core members are employed or not. Some weight is also placed on the job opportunities of unemployed older members and new workers who have not yet become members of the union.

Even if the central union did not care at all about the second two groups of workers, i.e. $\gamma_1 = \gamma_2 = 0$, centralized wage-setting might differ from decentralized wage-setting. Unemployment is always distributed unevenly. Some industries continue to grow while others decline. On the one hand, national bargainers would be more sensitive to unemployment confined to a few industries than would local negotiators elsewhere in the economy. On the other hand, national bargainers may be less sensitive than would local negotiators in the declining industries. Which effect would be stronger is not clear.

In practice, $1 = \gamma_1 > \gamma_2 > 0$ seems to be a more accurate characterization of the preferences of central wage-setters in the Nordic countries. The national confederations care equally about

unemployment of members and non-members, $\gamma_1 = 1$, if only because it may be difficult for the central confederation to distinguish the two groups as Hersoug, Kjær, and Rødseth argue. The central confederations also seem to care to a lesser extent about new entrants in the labour market, $\gamma_2 > 0$, perhaps because of the political ties between the leadership of the blue-collar union confederation and the social democratic party. Thus, for a variety of reasons, centralized bargainers appear to have a broader definition of insiders than local bargainers. A broader definition of insiders, in turn, leads directly to a greater willingness to reduce wage demands for greater employment.

This is illustrated in Figure 11.1. Let the number of insiders be M' for local bargaining, but M for centralized bargaining, perhaps because there are lay-offs in other plants. Indifference curves of the central bargainers are given by ABC or $A'DE$ as before. The indifference curve for the local union is $A'B'C'$, however. With LL as the demand for labour, the central bargainers would choose the wage of w while local bargainers would set the wage at w'. The fact that centralized bargainers have a broader constituency than decentralized bargainers increases the sensitivity of centralized wage-setting to unemployment.

(f) Efficiency Wage Considerations

Throughout the discussion, our attention has been focused exclusively on the unions' wage demands. The implicit assumption in most of the literature is that employers only benefit from centralized wage-setting to the extent that centralization moderates union wage demands. If unions lost their influence over wages, it is usually thought that all rationales for centralized wage-setting disappear. Recent work, however, on decentralized and centralized wage-setting incorporating the effect of wages on productivity by Hoel (1989*a*) and Rødseth (1990) suggests that the centralization of wage-setting might reduce wage levels and increase employment even if wages were unilaterally set by employers instead of unions.

The basic premiss of a wide class of efficiency wage models is that workers' efficiency, denoted e, is a positive function of their wage relative to wages and employment possibilities elsewhere.

If, for any reason, the efficiency of labour is affected by the wage, then employers may find it optimal to pay wages higher than the market-clearing level. Let the firm choose both employment and the wage rate. Then the firm's decision can be written as

$$\max_{w,L} R(e(w)L) - wL \tag{21}$$

where $R(\cdot)$ is the firm's revenues. In the case of an interior solution, the first order conditions are

$$R'(eL) - w/e = 0, \tag{22}$$

$$R'(eL)\frac{de}{dw} - 1 = 0. \tag{23}$$

Let $\lambda(w) \equiv (de/dw)(w/e)$ be the elasticity of workers' efficiency with respect to the wage. Then equations (22) and (23) can be combined to give

$$\lambda(w) - 1 = 0 \tag{24}$$

as the basic optimality condition in the efficiency wage model. The second order condition for a maximum implies that $(d\lambda/dw) < 0$.

There are many possible reasons why e might depend on w.[6] For example, a higher relative wage might lower turnover and thus reduce the costs associated with finding and training new workers (Calvo 1979). Or a higher relative wage increases the loss associated with being fired and thus may reduce shirking on the job (Calvo & Wellisz 1978; Shapiro & Stiglitz 1984; Bowles 1985). In either case, what matters is the difference or, more conveniently, the ratio between a worker's current wage w and what a worker would obtain if he or she quit or were fired. We assume for convenience that the probability of finding another job after a separation is equal to one minus the aggregate rate of unemployment. Workers' expected income after a separation can then be written as $\mu w^* + (1-\mu)bw^*$ where w^* is, as before, the wage level elsewhere, b is the replacement ratio (the percentage of wage income that is replaced by unemployment benefits), and μ is the employment rate (one minus the rate of unemployment).

[6] See Akerlof & Yellen 1986 for a collection of papers that describe the relationship between wages and productivity in many different ways.

Thus, we have

$$e = e\left(\frac{w}{w^*[\mu + (1-\mu)b]}\right) \quad \text{with} \quad e'(\cdot) > 0 \tag{25}$$

as the equation representing the dependence of efficiency on wages.

Workers' outside opportunities, the denominator in equation (25), is exogenous from the point of view of each employer. Therefore, the elasticity of efficiency with respect to the wage in the case of decentralized wage-setting is

$$\lambda^D = \frac{we'/e}{w^*[\mu + (1-\mu)b]} \tag{26}$$

which firms set equal to one by (24). As each employer tries to raise wages relative to others, none succeeds but the aggregate wage level and rate of unemployment increase until (24) is satisfied.

With centralized wage-setting, all wages are raised together. When $w = w^*$, both terms drop out of the expression for e in (25). At the same time, centralized employers would take into consideration the effect of higher wages on unemployment: $\mu = \mu(w)$ with $\mu'(w) < 0$. As Michał Kalecki (1943) argued, employers benefit from higher unemployment to the extent that it increases the 'threat of the sack'. Calculating the elasticity of workers' efficiency with respect to centrally set wages evaluated at the optimal wage in the decentralized equilibrium, one obtains

$$\lambda^C = \lambda^D\left[\frac{\mu(1-b)}{\mu(1-b)+b}\right]\left(\frac{-w\mu'}{\mu}\right). \tag{27}$$

This last equation can be simplified further, assuming a fixed number of identical firms. Let ξ be the elasticity of the demand for efficiency units of labour.[7] Then

$$\left(\frac{w\mu'}{\mu}\right) = \xi(1-\lambda) - \lambda = -1 \tag{28}$$

since, in the decentralized equilibrium, $\lambda = 1$ by equation (24). Therefore, we have

[7] Let $G(w/e) \equiv R'^{-1}$ be the demand for efficiency units of labour eL. Then $\xi \equiv (wG'/eG)$.

$$\lambda^C = \lambda^D\left[\frac{\mu(1-b)}{\mu(1-b)+b}\right] < \lambda^D. \tag{29}$$

Thus $\lambda^C - 1 < 0$ when evaluated at the decentralized equilibrium wage. To achieve the optimum of $\lambda^C = 1$ (provided there is only one wage level that satisfies this condition), the wage must be reduced since $(d\lambda/dw) < 0$ by the second-order condition. A centralized confederation of employers would therefore set lower wages through a national agreement than would be chosen by each employer separately. Total profits increase with centralization: the direct gain to employers of avoiding the attempt by each to raise wages above wages elsewhere outweighs the indirect loss of decreased discipline due to lower unemployment. To the extent that unions also care about efficiency or turnover (short-term workers are harder to recruit in the union), the same model could be applied when the union sets the wage as well.

12

Bargaining Models of Wage-Setting

(a) Models of Bargaining over Wages

In reality, unions rarely set wages unilaterally. Neither do firms in the unionized sector of the economy. The labour contract is the result of a bargaining process in which the two sides must reach an agreement. To write, as we sometimes did, of the resulting wage was a convenient shorthand for the wage that would result if firms were forced to accept the unions' demands (or if unions were forced to accept the firms' demands). Thus the models developed in the previous chapter should be viewed as studies of bargaining goals rather than as studies of the actual outcome of bargaining. These models are useful as models of the effect of the bargaining structure on the unions' willingness to exercise self-restraint and on the firms' desire to hold down wages.

Nevertheless, many aspects of wage-setting cannot be understood without a model of the bargaining process. The basic problem in collective bargaining is how the quasi-rents that are inherent in the employment relationship should be divided between workers and employers. The first question to be studied is the relationship, if any, between the level of centralization and the division of the surplus. An important related question is the extent to which mixed systems where wage increments or drift are negotiated locally after a base wage is set centrally are really centralized at all.

The question of how the structure of bargaining affects the surplus to be bargained over is as important as the question of how bargaining structure affects the way the surplus is divided. This leads to two separate issues of efficiency. The first is the efficiency of the bargaining process itself or the ability of bargainers to reach agreement without engaging in strikes or lockouts. The second issue, perhaps the most important, concerns

the impact of the centralization of bargaining on decisions regarding other variables that are not bargained over.

In the previous chapter, we adopted an exceedingly simple assumption about bargaining—that the wage is set unilaterally—in order to examine in greater detail the wage level unions or firms would prefer. In this chapter we simplify the assumption regarding the unions' objectives in order to study the effects of the bargaining process in different bargaining systems. We assume throughout this section that unions seek to maximize the wage (or the wage minus the disutility of labour) received by employed union members. Therefore, the models that follow are models of how the level of bargaining affects economic performance independently of its effects on the unions' willingness to accept wage restraint or on the firms' optimal wage policy.

The bargaining problem has been fruitfully studied in both co-operative and non-cooperative game theory. The first approach, inaugurated by John Nash (1950), was to consider bilateral bargaining as a co-operative game. The distinctive assumption of co-operative games, that binding agreements are feasible, seems appropriate in the context of bargaining over a legally enforceable labour contract. Nash defined the bargaining problem as consisting of a set of feasible agreements and a pair of disagreement pay-offs specifying what each side would obtain in the absence of an agreement. The problem is to determine what agreement will be reached.

Nash's method was axiomatic. He presented a list of axioms that a reasonable solution should satisfy and then proved that the axioms uniquely determined a particular solution. Nash assumed that the solution must be both individually and collectively rational. That is to say, the agreement must be no worse for each than no agreement and Pareto optimal. A third axiom, highly questionable but common to most of co-operative bargaining theory, is that the agreement should not depend on interpersonal comparisons of utility, although the solution depends on each side's attitude towards risk (Roth 1979). Nash added a fourth axiom, called independence of irrelevant alternatives, that states that if two games share the same pair of disagreement pay-offs, if the feasible set of one game is contained inside the feasible set of the other, and if the solution of the bigger game is attain-

able in the smaller game, then both games must have the same solution. These axioms are sufficient to determine a unique solution with a very simple mathematical structure.

Let R represent the revenue of the firm. Temporarily ignoring fixed costs, we can write the profits of the firm as $\pi = R - wL$ where w is the union wage. Let the disagreement pay-offs be written $\bar{u}$ for the union and $\bar{\pi}$ for the firm. Then the generalized Nash bargaining solution is found by solving the problem

$$\max_{w}(w-\bar{u})^{\alpha}(R-wL-\bar{\pi})^{1-\alpha} \quad \text{with} \quad \alpha \in [0,1] \tag{1}$$

which yields

$$w = \alpha\left[\frac{R-\bar{\pi}}{L}\right] + (1-\alpha)\bar{u} \tag{2}$$

as the wage. Thus the solution has the reasonable form of a weighted average between the best the union could hope to obtain, i.e. a wage such that $\pi = \bar{\pi}$, and the worst, $\bar{u}$. Nash originally added another axiom of symmetry that fixed $\alpha = 1/2$. It is more common in the literature to interpret α as a measure of bargaining power that can take any value from zero to one. Many other co-operative solutions to the two-person bargaining problem based on different sets of axioms have since been proposed, but Nash's solution remains the most commonly used.[1] Moreover, almost all solutions produce the same wage equation (2) for this simple bargaining problem.

According to co-operative game theory, the outcome is determined by the set of feasible agreements, R, the disagreement pay-offs, $\bar{u}$ and $\bar{\pi}$, and the measure of bargaining power, α. Thus we would like to know how each is affected by the level of centralization. However, co-operative bargaining solutions either assume $\alpha = 1/2$ or treat α as exogenous. Neither is satisfactory. In addition, there is an ambiguity in the definition of $\bar{u}$ and $\bar{\pi}$ that becomes apparent once the model is applied. In the absence of an agreement, are workers on strike or are they working at other, possibly non-union, jobs? Should $\bar{u}$ be set equal to strike support or the competitive wage?

[1] See Roth 1979 and Kalai 1985 for surveys of the different co-operative solutions to the two-person bargaining problem.

These gaps in co-operative bargaining theory have, to some extent, been filled by the newer non-cooperative approach developed by Ingolf Ståhl (1972) and Ariel Rubinstein (1982). The essence of the non-cooperative approach is to write an explicit representation of the negotiation process as an extensive-form game and look for the equilibrium. The advantage of such an approach is that the solution is derived from optimizing behaviour rather than from a set of axioms that may or may not appeal to the reader's intuitions. Moreover, the non-cooperative approach, by forcing the modeller to be explicit about who can do what and when, opens up the study of the effect of such things as the sequence of moves on the outcome. On the other hand, the disadvantage of the non-cooperative approach is that the outcome is generally sensitive to small changes in arbitrary assumptions regarding the minutiae of the bargaining process. The price of greater explicitness is less generality.

Nevertheless, recent advances in non-cooperative bargaining theory have been valuable and widely adopted in models of wage negotiations. Rubinstein modelled the bargaining process as an extensive-form game in which the opposing sides make alternating offers.[2] Each side is restricted to making one offer every other period. After an offer is made, the opponent can either accept or reject. If the offer is accepted the game ends and the agreement is implemented immediately. If the offer is rejected, then the one rejecting the offer makes the next offer after a delay of one period. The game continues in this way until an offer is accepted. Rubinstein assumed, critically, that waiting is costly. In the bargaining model we consider here, both sides are assumed to discount future pay-offs over an infinite horizon.

The principle of subgame perfection states that players cannot bind themselves to take future actions that they would prefer not to take once the future arrives. Put another way, subgame perfect equilibria are equilibria supported by credible threats. It is not clear that the restriction of subgame perfection is always reasonable. Sometimes actors do seem to commit themselves to follow through on threats that would injure themselves as well as their opponent in order to obtain an advantage in bargaining. However, Rubinstein demonstrated that the restriction to

[2] See Sutton 1986 for a good introduction to the Rubinstein bargaining model.

subgame perfect equilibria of his extensive-form game resolved the conundrum-blocking development of a non-cooperative approach to bargaining: it produced a unique solution.

Avner Shaked and John Sutton (1984) provided an intuitive description of the solution by starting with each side's optimal strategy. Suppose it is the union's turn to make an offer. What should the union demand? One plausible answer is that the union should ask for as much as possible without asking for so much that the firm would gain by turning the offer down. Write the lowest wage the firm can hope to obtain in the next round, when it will be the firm's turn to make the offer, as w_F. Then the highest wage the firm would not reject in the present round, w_U, is the wage that leaves the firm indifferent between accepting or rejecting and obtaining w_F one period later. If the discount factor used by the firm is $\delta_F \in (0,1)$, then, with an infinite horizon, the highest union offer the firm will accept is given by

$$\frac{1}{1-\delta_F}(R - w_U L) = \tilde{\pi} + \frac{\delta_F}{1-\delta_F}(R - w_F L). \tag{3}$$

The left-hand side of (3) is the current value of the firm's profits at the wage w_U. The right-hand-side is the similar sum when the firm must endure a disagreement for one period and then obtain the profits associated with the wage w_F.

But how should w_F be determined? When it is the firm's turn to make the offer, similar reasoning suggests that the firm will offer to pay as low a wage as possible without offering a wage so low that the union is better off rejecting the offer. If the best the union can obtain when it makes the offer is w_U, the best the firm can do is to offer the wage given by

$$\frac{1}{1-\delta_U} w_F = \tilde{u} + \frac{\delta_U}{1-\delta_U} w_U \tag{4}$$

where $\delta_U \in (0,1)$ is the discount rate of the union. Since the game is identical every time the union makes an offer, equations (3) and (4) can be combined to yield

$$w_U = \left[\frac{1-\delta_F}{1-\delta_U\delta_F}\right]\left(\frac{R-\tilde{\pi}}{L}\right) + \left[\frac{\delta_F(1-\delta_U)}{1-\delta_U\delta_F}\right]\tilde{u} \tag{5}$$

as the solution when the union makes the first offer. The union cannot do better than offer w_U in the first period and the firm cannot do better than accept the offer.

According to (5), the union gets an arbitrary advantage by being designated as the first mover, since the firm must pay the cost of disagreeing for one period before it can make a counter-offer. This first-mover advantage disappears, however, as the time interval between offers goes to zero. Rewriting the discount factors as $\delta_F' = (1 + (\rho_F/\Delta))^{-\Delta t}$ and $\delta_U' = (1 + (\rho_U/\Delta))^{-\Delta t}$ where Δ is the time between offers and taking the limit as $\Delta \to 0$, one obtains $w_U = w_F = w$ with w given by

$$w = \left(\frac{\rho_F}{\rho_F + \rho_U}\right)\left(\frac{R-\tilde{\pi}}{L}\right) + \left(\frac{\rho_U}{\rho_F + \rho_U}\right)\tilde{u}. \tag{6}$$

Comparing (6) with (2), it can be seen that the non-cooperative approach provides an interpretation of the measure of bargaining strength α. According to (6), bargaining strength is a function of the relative impatience of the two sides to reach an agreement. The less impatient the union is relative to the firm, the larger the share of the pie the union receives and vice versa. There does not seem to be a general reason why the impatience of either the unions or firms should vary with the level of centralization. This implies that centralization does not affect α. If centralization affects the distribution of the firm's revenues between profits and wages, it must be because centralization alters the disagreement pay-offs.

The non-cooperative model also has strong implications regarding the interpretation of $\tilde{\pi}$ and $\tilde{u}$. It is clear from (3) and (4) that $\tilde{\pi}$ and $\tilde{u}$ should be interpreted as the income received by the firm and the union during a conflict.[3] The 'outside options', the wage workers could get at other jobs and the profits the firm could obtain by hiring new workers, has no impact on the

[3] More precisely, $\tilde{\pi}$ and $\tilde{u}$ are the income that would be received by the firm and the union during the bargaining process before an agreement is reached. Recent work has raised the question of what happens if the game is expanded to include the choice of strike or continue to work whenever an offer is rejected. The troubling answer is 'almost anything'. See Haller & Holden 1990 and Fernandez & Glazer 1991.

solution other than as constraints (Sutton 1986).[4] In order to attract workers, firms must pay at least as much as their workers can obtain elsewhere. Similarly, in order to maintain their jobs, the union cannot reduce profits so far that the firm would be better off shutting down the plant. In local bargaining, the outside options may be binding for less productive firms. With more centralized bargaining, the constraints are unlikely to bind, and the outside options are unlikely to influence the outcome of wage negotiations.

Thus centralization primarily affects the sharing of the pie in so far as centralization alters the conflict pay-offs of the two sides. Our earlier discussion of complements and substitutes is relevant here. The uniting of substitutes increases the share the union can obtain by reducing $\bar{\pi}$. When groups are substitutes, the cost to the firm of a joint strike is more than the sum of the costs of separate strikes by each. When groups are complements, the cost of a joint strike is less than separate strikes. Unions usually prefer industry unions to separate company unions since workers in different firms in the same industry are substitutes in production.

Once an industry-wide union exists, employers often prefer industry-wide bargaining. Strikes against one firm at a time are more costly to the firm (since it loses business to its competitors) and less costly to the union (since the local can obtain strike support from the rest of the union) than would be a strike against all at once. Thus industry-level bargaining has frequently been sought by employers in order to reduce the union's bargaining power.

(b) Two-Tiered Bargaining

It is impossible to have centralized wage-bargaining without supplementary local bargaining. Some issues, like working conditions inside the plant, are inherently local. Even wage scales need to be adjusted according to local needs. Thus all centralized bargaining systems depend on supplementary local bargaining, if only over the implementation of the central agreement. The more centralized the negotiations over the base agreement, the more details must be left to be settled in subsequent local bargaining. At the local level, however, talks over implementation of the central agreement easily blend together with bargaining over additional wage increases. Local unions have bargaining power and it is unreasonable to expect such power to remain unused. In fact, wage increases above the central agreement, or wage drift, have comprised from one- to two-thirds of total wage growth in the Nordic countries since 1970 (Flanagan 1990). In Norway, wage drift has been as high as 80 per cent of aggregate wage growth in recent years (Rødseth & Holden 1990). Since local bargainers get the last word in the sense that local negotiations occur after the central agreement is settled, the actual degree of centralization attained in the Nordic countries, or anywhere else, is unclear. Does a central agreement imply central control over the total wage increase? The answer depends on whether or not industrial action is restricted at the local level.

To demonstrate this, consider local bargaining in a two-tiered system. The centrally negotiated wage, denoted q, is settled first and taken as given in local negotiations. Let d be wage drift, or wage increases obtained in local bargaining. The final wage is then $w = q + d$.

We examine first the case where strikes are allowed in local bargaining. Striking workers are not paid by the firm, of course. Although striking workers generally receive strike benefits, the benefits come from their own funds unless the strike is subsidized from outside. Central confederations that provide strike support do not allow locals to draw upon the funds whenever they wish. Thus union locals that are free to strike must supply their own funds. Here we assume that neither side receives outside support during a strike. Thus, the pay-offs when strikes are permitted are

$$\pi = \begin{cases} R - (q+d)L & \text{if there is an agreement} \\ 0 & \text{if there is a strike} \end{cases} \tag{7}$$

for the firm, and

$$u = \begin{cases} q + d & \text{if there is an agreement} \\ 0 & \text{if there is a strike} \end{cases} \tag{8}$$

for the union. Applying the bargaining solution (2), we have

$$d = \alpha(R/L) - q \tag{9}$$

[4] Erling Barth (1991) has shown that the wage is a function of both the outside and inside options when it is known that either the union or the firm will have to terminate the conflict when its strike funds are exhausted.

as the expression for drift. The final wage is independent of the centrally negotiated wage (as long as all agreements including $d<0$ are possible). Smaller increases at the central level are offset exactly by larger increases at the local level. Central negotiations, in such a system, are a ritual without real impact on the economy.

However, this is not an accurate description of centralized bargaining in either Sweden or Norway. In both countries, the main agreement between the unions and the employers' association contains an industrial peace clause that forbids unions from calling strikes or go-slow actions (and forbids employers from calling lock-outs) as long as the central agreement is in force. This does not mean that locals have no credible threats in local bargaining. Workers may engage in work-to-rule actions where they follow work instructions in a pedantic way, decline to work overtime, and generally refuse to co-operate with the firm. The work environment legislation of the 1970s gave local unions new powers to disrupt production by refusing to overlook minor infractions of the law. In addition, the increased use of autonomous work groups gives workers greater control over production and hence more ways of reducing productivity without ceasing to work, at least nominally. Employers are generally unable to take locals to court for breaking the peace clause, or to reduce workers' pay during such actions, because it is difficult to prove that the peace clause has been broken.[5]

During a work-to-rule action, workers receive the centrally negotiated wage q while firms suffer a loss of output. We will assume that work-to-rule actions reduce output by the proportion θ, where $0<\theta<1$ (Moene 1988). Then the pay-offs in local bargaining under an industrial peace constraint are

$$\pi = \begin{cases} R-(q+d)L & \text{if there is an agreement} \\ \theta R - qL & \text{if there is a conflict} \end{cases} \tag{10}$$

for the firm, and

$$u = \begin{cases} q+d & \text{if there is an agreement} \\ q & \text{if there is a conflict} \end{cases} \tag{11}$$

[5] See Moene 1988 for an investigation of other forms of industrial action at the local level. For other models of wage drift, see Holmlund 1986; Holden 1988; 1989; 1990; Holmlund & Skedinger 1990; and Andersen & Risager 1990.

for the union. Substituting these pay-offs in equation (2), we get

$$d = \alpha(1-\theta)(R/L) \tag{12}$$

as the outcome of local bargaining with a work-to-rule threat.

According to equation (12), drift is independent of the centrally set wage. Every increase or decrease of the centrally negotiated wage is passed on to the final wage (Holden 1989). When strikes are forbidden at the local level, wage drift adds a constant sum to whatever is obtained in central negotiations. The main impact of local bargaining in this case is to set a floor on wage growth to the extent that the centrally negotiated wage growth cannot be negative.[6] In two-tiered bargaining systems, the degree of centralization depends on the extent to which industrial action at the local level is restricted once the central agreement is signed. Our central result here is that if central negotiators prefer a lower wage than would result from local bargaining for any of the reasons elaborated in Chapter 11, central bargainers can restrain overall wage growth by negotiating a smaller increase at the central level provided the central bargain is backed up by an industrial peace clause.

(c) The Frequency of Industrial Conflict

One of the striking conclusions of Rubinstein's bargaining model is that the equilibrium is efficient in the sense that nothing is lost through conflict. Although the division of the pie is determined by the relative costs of delay, the equilibrium strategies entail an acceptance of the first offer that is made. This seems to leave the occurrence of strikes or lock-outs to random mistakes or

[6] The implication of (12) that drift is independent of the centrally negotiated wage increase is supported by econometric studies of Norwegian data by Steinar Holden (1989; 1990) and Asbjørn Rødseth and Holden (1990). The conclusions of studies of drift in other Nordic countries are more mixed. Robert Flanagan (1990) finds that drift is independent of the centrally negotiated wage in Norway, Sweden, and Denmark but not in Finland. Tyrväinen (1989) also concludes that drift in Finland partially offsets central wage increases. Bertil Holmlund and Per Skedinger (1990) and Douglas Hibbs and Håkan Locking (1991) find that drift partially offsets centrally negotiated wage increases in Sweden as well, but their study is confined to a single industry. All studies agree that the central agreement does influence the final wage in that drift does not fully offset centrally negotiated increases.

deviations from purely rational behaviour. Indeed, John Hicks (1963) argued that no theory of bargaining founded on rational behaviour with a unique solution could ever explain strikes, since both sides could then predict the outcome and agree to it without a costly conflict.

Yet the conclusion that industrial conflict is essentially random is belied by the fact that the frequency of strikes appears to follow predictable patterns (Kennan 1986). One of the most striking empirical regularities is the strong negative correlation between industrial conflict and the centralization of bargaining, as the following quote from Hibbs (1976: 1049) indicates:

> Simple calculation of strike volume for each type of bargaining system leaves no doubt that during the postwar period the average level of strike activity covaried with the degree of centralization: mean man-days lost per 1000 wage and salary workers are 425, 172 and 67 for decentralized, centralized and highly centralized systems, respectively.

Moreover, the effect of centralization on strike frequency can be observed over time within single countries as well as cross-nationally. Norway and Sweden were among the world's most strike and lock-out-prone countries during the inter-war years before collective bargaining was centralized. In the post-war period of centralized bargaining, in contrast, the frequency of industrial conflict in Norway and Sweden was among the lowest observed anywhere (Ingham 1974). With the recent decentralization of bargaining in Sweden, the frequency of strikes has risen again.

The usual way out of the Hicks paradox is to expand the bargaining model to include private information held by one side or both.[7] The most plausible candidate is the information that each firm gathers about the demand for its output. The difficulty that private information creates is easy to understand. Suppose the firm is hit by a sudden decline in demand. If the decline in demand was common knowledge, the union would adjust its expectations accordingly and contract negotiations would be no harder than usual. But if the firm notifies the union that conditions have worsened, will the firm be believed? After all, the union knows that it is in the firm's interest to say that conditions have worsened, even if they haven't. Whether demand is falling or rising, the firm always has an incentive to be pessimistic in its message to the union. Knowing this, the union discounts any message from the firm that is not costly for the firm to transmit. One mechanism whereby firms might credibly communicate a worsening of conditions is to lay workers off. Another way is to endure a strike. In fact, the empirical evidence indicates that lay-offs and strikes are substitutes at the firm level in the sense that strikes (in the USA) are procyclical (Kennan 1986). One can speculate that lay-offs are generally used to communicate during downturns in demand. Strikes are more likely to occur during expansions when the union suspects that conditions are better than the firm says they are.

This leads to the following simple explanation of the relationship between centralization and industrial conflict. There is a clear asymmetry in the information available to a firm, and the information held by the union. The existence of an asymmetry in the information held by an association of employers at the industry level and an industrial union is less obvious. The union can do its own studies of the demand for an industry's output. At the national level, the existence of any asymmetry of information is even less likely. The national confederation of trade unions has access to the same information about the state of the aggregate economy as the national confederation of employers. In Norway, for instance, both sides receive the same government reports prepared by the Bureau of Statistics. As a consequence, centralized bargaining rarely fails to come to agreement without conflict.

[7] The theoretical and empirical literature on strikes is reviewed in Kennan 1986.

(d) Local Bargaining as Revenue-Sharing: The Choice of Effort

All wage bargaining entails a sort of profit-sharing. The higher the firm's profits, the more the union is able to take out in wages. When profits are low, unions must settle for lower wage growth or lower employment (or a combination of the two). At the local level, wage bargaining is a form of profit-sharing between a firm and its work-force. At higher levels, the profits that are shared are aggregated over an industry or an entire economy. Unless a firm is large relative to the bargaining unit, the wage contract will not be sensitive to *its* profits. Only at the local level, therefore,

will the implicit profit-sharing affect the firm's and unions' decisions regarding variables outside the wage agreement. Three variables seem particularly important: workers' effort on the job, employment, and investment.

We start with workers' effort. It is often argued that profit-sharing has a negligible impact on individual incentives to work harder in all but the smallest plants.[8] Some aspects of work effort, however, are decided collectively. This is particularly true of the adoption of new techniques that increase productivity but demand greater effort on the part of the work-force. It is the part of effort that is collectively determined that we are interested in here.

Following the efficiency wage framework, we assume that labour input can be written as eL, where e is the efficiency of labour: $R = R(eL)$ with $R'(eL) > 0$ and $R''(eL) < 0$. For simplicity, we assume that employment is fixed with $L = 1$. Rather than assume e is determined by relative wages adjusted for employment, as we did before, here we consider e to be a matter of choice. Workers, we assume, care about both wages and their effort. Beyond some level of effort, work is unpleasant. Let effort be measured such that $e = 1$ is the level of effort that workers will expend without requiring compensation. Without loss of generality, then, we can limit our attention to $e \geq 1$.

For convenience we adopt the particularly simple specification of workers' pay-offs of

$$u(w, e) = \begin{cases} w - v(e) & \text{if there is an agreement} \\ 0 & \text{if there is a strike} \end{cases} \tag{13}$$

where $v(1) = 0$, $v'(e) > 0$ and $v''(e) \geq 0$ for $e > 1$. Again we assume there is no outside strike support. Note that striking workers lose w but save the disutility of effort $v(e)$. Profits are given by $\pi = R(e) - w$ when an agreement is reached and zero in the case of conflict. To ensure an internal solution, we assume that $R'(1) > v'(1)$. Applying the bargaining solution of equation (2), we have

[8] This is frequently referred to as the $1/n$ problem. See the essays collected in Blinder 1990 for discussions and empirical tests of the relationship between profit-sharing and productivity.

$$w = \alpha R(e) + (1 - \alpha)v(e) \tag{14}$$

as the expression for the wage in the case of decentralized bargaining. Incorporating (14), the pay-offs for the union and the firm upon signing the labour contract with local bargaining can be written as

$$u = \alpha[R(e) - v(e)] \tag{15}$$

$$\pi = (1 - \alpha)[R(e) - v(e)]. \tag{16}$$

These last two equations display the similarity of local wage-bargaining and profit-sharing.

There are three plausible assumptions that can be made about the choice of effort. The first is that effort, in the sense of new techniques or the reorganization of work, is bargained over at the local level. The other two alternatives are that effort is set unilaterally by either the local union or the firm. As can be easily seen from (15) and (16), all three assumptions result in the same first-order condition for effort:

$$R'(e) = v'(e). \tag{17}$$

Effort is set at the collectively optimal level where the marginal increase in revenue equals the cost whether effort is set by the union, the firm, or through bargaining. With local bargaining, the union internalizes the full costs and benefits of effort, and so does the firm.[9]

In the case of centralized bargaining, we assume that the employers' association seeks to maximize aggregate profits while union pay-offs are unchanged. Assuming there are n firms, the same wage equation (2) specifies a tariff wage of

$$q = \alpha \frac{1}{n} \sum R(e) + (1 - \alpha)v(e). \tag{18}$$

The tariff wage reflects the average productivity of the entire sector (or economy). If the firm is small relative to the bargaining unit, the tariff wage is exogenous from the point of view of local bargainers.

[9] This strong result depends critically on the strong assumption made about workers' preferences. It does not hold for more general specifications of preferences over wages and effort.

In this case there is maximal disagreement over effort between employers and workers. If the local union controls effort, effort would set close to the minimal level $e = 1$. The benefits of greater effort are shared by all through centralized bargaining while the costs are borne by local workers alone. The result is suboptimal effort and reduced welfare for all. In contrast, employers, if they could, would increase effort as much as possible subject to the constraint that the firm be able to attract sufficient labour. Only if the level of effort is specified in the labour contract can the optimal effort be obtained with centralized bargaining. If bargaining is centralized at the industry level, effort may be bargained over to some extent. But centralization at the national level makes bargaining over effort impossible beyond the setting of minimal standards that apply in all industries.

Yet centralized bargaining on the national level is typically accompanied by supplementary bargaining on the local level. The model of two-tiered bargaining is the relevant model for unions that receive drift in addition to the central wage. We consider the case of two-tiered bargaining when strikes at the local level are prohibited. In the present context, it is natural to model the work-to-rule action as equivalent to working with minimal effort, or $e = 1$. Thus, for the firm, we have the pay-offs

$$\pi = \begin{cases} R(e) - (q + d) & \text{if there is an agreement} \\ R(1) - q & \text{if there is a conflict.} \end{cases} \tag{19}$$

For the union we have

$$u = \begin{cases} q + d - v(e) & \text{if there is an agreement} \\ q & \text{if there is a conflict.} \end{cases} \tag{20}$$

In this case, local bargaining results in wage drift of

$$d = \alpha[R(e) - R(1)] + (1 - \alpha)v(e). \tag{21}$$

Given a tariff wage of q and drift given by (21), profits are equal to

$$\pi = (1 - \alpha)[R(e) - v(e)] + \alpha R(1) - q \tag{22}$$

while the union receives

$$u = \alpha[R(e) - v(e)] - \alpha R(1) + q. \tag{23}$$

As can be seen immediately, effort will be set at the collectively optimal level regardless of who chooses, exactly as in the case with firm-level bargaining.

Thus, mixed bargaining systems, unlike purely centralized bargaining systems, do not distort the decision over the level of effort. Local bargaining, even if conducted under a peace clause, gives workers a stake in the performance of their firm and thus increases workers' willingness to accept higher effort. At the same time, the more effort workers exert, the greater the threat of withdrawing co-operation during a work-to-rule action. In this way, the employer shares the cost of effort, as well as the benefit. The importance of local bargaining in providing a reward for greater effort on the job is a strong argument against proposals to cap or eliminate drift in centralized bargaining systems.

(e) Local Bargaining as Revenue-Sharing: Employment and Investment

Local bargaining as a form of profit-sharing also affects decisions regarding employment and investment. To examine bargaining structure and employment, we consider a model with a fixed number of identical firms in which the capital stock and work effort are given. Revenue depends on employment: $R = R(L)$ with $R(L) \geq 0$, $R'(L) > 0$ and $R''(L) < 0$. Unions continue to maximize their wage minus the disutility of work $u = w - v$ where v is now a positive constant. Firms, as always, maximize profits.

The traditional right-to-manage model says that firms choose employment along the demand-for-labour curve where profits are maximized for a given wage, or:

$$R'(L) = w. \tag{24}$$

Equation (24) is appropriate when the firm is small compared to the bargaining unit. In that case, each firm considers the wage to be exogenous and optimally adjusts employment. But if the firm is large in relation to the bargaining unit, as is the case with decentralized bargaining, then firms might not ignore the way that current employment influences future wage bargains.

According to our standard equation for local negotiations, the wage is given by

$$w = \alpha \frac{R(L)}{L} + (1-\alpha)v \tag{25}$$

as long as the lower bound is not binding. With wages set according to (25), profits are

$$\pi = (1-\alpha)[R(L) - vL]. \tag{26}$$

If employers choose L to maximize (26), they would set employment according to the condition

$$R'(L) = v < w. \tag{27}$$

With local bargaining, employers can lower the wage by raising employment and thereby lowering output per worker. Since v may well be less than the competitive wage, local bargaining can lead to a full employment, suction equilibrium where employers' desire to expand is constrained by the supply of labour similar to the equilibrium of Weitzman's (1983; 1984) share economy.[10] Local unions may have sufficient power to block expansions of employment that reduce their wages, but at least employers would desire to hire more workers with local wage-bargaining than with centralized bargaining.

Equation (27) implies, however, that firms are employing more workers than they would like at their current wage. It is often argued that this is not an equilibrium in that firms could increase profits by laying off workers and returning to their demand-for-labour curve as soon as the wage contract is signed and wages are fixed. What this argument ignores is that there will be new negotiations in one or two years. If the firm cannot suddenly expand its work-force just before the next round of bargaining begins, the wage in the future will be influenced by the level of employment chosen in the present.

This can be presented with a simple model by writing the intertemporal problem facing the firm as

[10] The equivalence of local wage-bargaining and profit-sharing is investigated in greater detail in Moene 1986. See Raaum 1990 for a similar conclusion regarding local bargaining and employment in a model where wages are set unilaterally by the union.

$$\max_{L_t} V = \sum_{t=0}^{\infty} \delta^t [R(L_t) - w_t L_t i] \quad \text{with} \quad \delta \in [0,1]. \tag{28}$$

We assume that the wage is set in a collective agreement negotiated at the beginning of every period. We assume, in addition, that the level of employment can only be altered once each period, immediately after the wage has been set. Thus w_t is fixed when L_t is chosen, but the choice of L_t affects w_{t+1}:

$$w_{t+1} = \alpha \frac{R(L_t)}{L_t} + (1-\alpha)v. \tag{29}$$

With w_t determined by (29), the first order condition for L_t is

$$R'(L_t) - w_t - \alpha\delta \frac{L_{t+1}}{L_t}\left[R'(L_t) - \frac{R(L_t)}{L_t}\right] = 0 \tag{30}$$

If we assume a steady state with $L_t = L_{t+1}$ for all t, equations (29) and (30) together imply

$$R'(L) = \left[\frac{\alpha(1-\delta)}{1-\alpha\delta}\right]\frac{R(L)}{L} + \left[\frac{1-\alpha}{1-\alpha\delta}\right]v. \tag{31}$$

If $\delta = 0$, then equation (31) reduces to the (24) where the firm chooses a point on the demand-for-labour curve. The more firms care about the future, i.e. the higher is δ, the higher the firms' preferred level of employment. If $\delta = 1$, equation (31) reduces to (27).

According to this model, decentralized wage-setting is equivalent to centralized wage-setting only when firms have an extremely short time horizon. Otherwise, local bargaining increases employment.[11] In this way, the debate over whether or not employment is covered in the labour agreement or set by the firm that has occupied so much of the literature has been misguided. When bargaining is centralized at the national level, agreements covering employment are infeasible. Even at the industry level, agreements over manning rules and the like are difficult if work practices differ among plants. Thus with national wage contracts

[11] Hoel 1989*b* examines this question in greater detail in a model where the firm can change employment at any time, but it must pay hiring and firing costs. In his model, local bargaining induces firms to hire more workers than centralized bargaining when marginal hiring costs go up sharply as the number of workers who are hired increases.

and, we suspect, with most industry-level contracts, firms set employment taking the union wage as given. When bargaining is decentralized, in contrast, employment may be set off by the demand-for-labour curve, whether or not employment is set by the firm or covered indirectly by negotiations over work rules and the like. What matters fundamentally is the level of bargaining, not the coverage of the labour agreement.

We still have to analyse the impact of two-tiered bargaining on employment. From equation (12), we have $d = \alpha(1-\theta)(R/L)$ as the expression for drift. Profits, then, are equal to

$$\pi = R(L) - (q+d)L = [1-\alpha(1-\theta)]R(L) - qL \tag{32}$$

from which we get

$$R'(L) = \frac{q}{1-\alpha(1-\theta)} \tag{33}$$

as the first order condition for employment. From equation (33) it is not obvious how to compare the firms' demand for labour under two-tiered bargaining as opposed to either decentralized or purely centralized bargaining. In fact, the mixed bargaining case produces a demand for labour that is in between the two pure cases.

To demonstrate this, we need to show that the right-hand-side of (33) is greater than v but less than $w = q + v$. Under the assumptions of this subsection, the final wage is the same whatever the level of bargaining. Therefore, we can use equation (25) to write

$$q = w - d = \alpha\frac{R(L)}{L} + (1-\alpha)v - d = \alpha\theta\frac{R(L)}{L} + (1-\alpha)v. \tag{34}$$

From (34) it is straightforward to calculate that $q[1-\alpha(1-\theta)]^{-1} > v$. To see that $q[1-\alpha(1-\theta)]^{-1} < q+v$, note that $q + d < (R/L)$ or

$$q < [1-\alpha(1-\theta)]\frac{R(L)}{L} \tag{35}$$

or

$$\left[\frac{\alpha(1-\theta)}{1-\alpha(1-\theta)}\right]q = \left[\frac{1}{1-\alpha(1-\theta)} - 1\right]q < \alpha(1-\theta)\frac{R(L)}{L} = d. \tag{36}$$

Thus, equations (34) and (36) imply

$$v < \frac{q}{1-\alpha(1-\theta)} < q + d = w. \tag{37}$$

For the determination of effort, two-tiered bargaining was equivalent to purely local bargaining. This is not the case for the demand-for-labour. Two-tiered bargaining results in a demand for labour that is less than the labour demand with purely local bargaining but more than the demand for labour with purely centralized bargaining.

A third important aspect of the performance of centralized versus decentralized bargaining is the impact of collective bargaining on investment. Here the standard results are exactly the opposite of what we found in the case of employment (Grout 1983; Hoel 1990; Moene 1990). Investment in fixed capital increases the cost to the firm of a work stoppage and therefore increases the union's bargaining power. Since, with local bargaining, firms know that greater fixed costs increase their vulnerability to the threat of a strike, firms invest less.

Let us add capital (K) to the model, with $R = R(K, L)$ and $C(K)$ as the cost of capital. All investment we assume is fixed in the sense that once the capital is installed, it has no other use. A strike or lock-out stops production, but it does not eliminate the cost of the capital equipment. Formally, with fixed investment we have

$$\pi = \begin{cases} R(K,L) - wL - C(K) & \text{if there is an agreement} \\ -C(K) & \text{if there is a strike.} \end{cases} \tag{38}$$

With decentralized bargaining, the wage is given by $w = \alpha(R/L) + (1-\alpha)v$, as before, assuming the union is sufficiently powerful to raise the wage above the competitive level. Thus profits equal

$$\pi = (1-\alpha)[R(L,K) - vL] - C(K) \tag{39}$$

upon conclusion of the wage agreement. It is apparent from (39) that local bargaining raises the implicit cost of capital by the multiple $(1-\alpha)^{-1}$, holding employment constant. In contrast, centralized bargaining does not raise the implicit cost of capital to the firm, in so far as the wage agreement is independent of any one firm's investment decisions.

One cannot conclude that local bargaining will reduce investment, however, because local bargaining may increase employ-

ment which raises the productivity of capital. Whether local bargaining results in more or less investment than centralized bargaining depends on such aspects of the environment as the industry's demand curve and the supply constraints for capital and labour inputs. The most that can be said that is generally true is that the capital–labour ratio is lower with local bargaining than with centralized bargaining since decentralization lowers the implicit cost of labour and raises the implicit cost of capital. These issues are pursued further in the next section in a model where investment is studied in the form of the entrance of new firms or the building of new plants.

(f) Entry and Exit

Until now, we have assumed that the number of firms (or plants) was fixed and that all firms shared the same technology. Yet much of the dynamic of capitalist economies is due to the continual entrance of new firms and the failure of existing firms. Expansions are marked by the building of new plants; contractions by the closure of old ones. Entry and exit alter more than the quantity of labour and capital employed. New entrants often bring new techniques, while departing firms leave behind the most efficient. In this way, both entry and exit change the mix of firms in the industry and increase average productivity. In this section, we investigate the way in which the pace of both entry and exit is affected by the level of bargaining.

In order to capture the effect of entry and exit on productivity and average wages, we need a model with heterogeneous firms. The very simplest such model consists of just two types: high-productivity and low-productivity firms, denoted by subscripts H and L respectively. For simplicity, we assume that all changes in capital and labour employed are due to entry or exit. Employment per plant of either type is fixed at $L=1$. Non-labour costs of production C_i, which may differ between types, are also fixed at the plant level.[12] Profits are given in each type of firm by

[12] Many of these assumptions can be relaxed without altering the results. Moene and Wallerstein (1992) consider a model with variable employment within each plant. The model examined in Moene and Wallerstein 1991*a* contains an infinite number of firm types, each corresponding to a point on a line segment.

$$\pi_i = p\beta_i - w_i - C_i, \quad \text{for} \quad i=H,L, \quad \text{with} \quad \beta_H > \beta_L. \tag{40}$$

The term β_i is the quantity produced by a plant of type i. Let the number of high-productive firms be n_H and the number of low-productive firms be n_L. Throughout we assume that the price is independent of the output of any individual firm but dependent on the aggregate output of the n_H+n_L firms:

$$p = p(n_H\beta_H + n_L\beta_L) \quad \text{with} \quad p'(\cdot)<0. \tag{41}$$

In comparing different levels of bargaining, it is useful to use a competitive labour market as a benchmark. In the competitive case, all employers pay the same wage

$$w_H = w_L = r \tag{42}$$

where r is the lowest wage that employers can pay and still attract sufficient labour. Since the disutility of effort plays no role in this section, we set $v=0$ to simplify the notation. Assuming that firms must continue to pay the costs C_i during a labour conflict, local wage-bargaining produces a wage of

$$w_i^{LB} = \max(\alpha p\beta_i, r). \tag{43}$$

Here we include workers' outside option as a lower bound on possible wage settlements.[13] Note that with local bargaining, more productive firms pay higher wages, assuming that $w_H > r$.

We assume that wage-bargaining at the industry level sets a uniform wage for all firms. If negotiators for employers seek to maximize total profits in the industry, industry-level bargaining produces a wage of

$$w_H^{IB} = w_L^{IB} = w^{IB} = \max\left(\alpha p\frac{n_H\beta_H + n_L\beta_L}{n_H+n_L}, r\right). \tag{44}$$

We assume throughout that the union at the industry level is powerful enough to affect the wage, or $w^{IB} > r$.

Equations (40) to (44) can be used to represent several dif-

[13] There is also an upper bound for the wage given by the constraint that $\pi \geq 0$. Implicit in (43) is the assumption that if one starts with a sufficiently high price such that $w_i = \alpha p\beta_i$, and then lets the price fall, the lower bound binds before the upper bound. This is equivalent to assuming that $r > (\alpha/(1-\alpha))C_i$. If $r < (\alpha/(1-\alpha))C_i$, the upper bound binds first and workers' wage would be given by $w_i = \min(\alpha p\beta_i,\ p\beta_i - C_i)$. The choice is arbitrary and inconsequential for the results.

ferent kinds of industrial structure. In the first kind we consider, the supply of high productivity firms is limited. The size of the industry is determined by entry and exit of less productive firms. Thus, n_H is fixed and n_L is endogenous. We assume that the more-productive firms are more profitable than the less-productive firms, or $p\beta_H - C_H > p\beta_L - C_L$. Since, as long as this condition is satisfied, nothing depends on $C_H \neq C_L$, we might as well let $C_H = C_L = C$. Second, we assume that demand is high enough relative to the supply of more-efficient firms that some less-efficient firms can profitably enter in a competitive labour market, or $p(n_H\beta_H)\beta_L - r - C > 0$. Third, we assume that the potential supply of less-productive firms is greater than demand, so that free entry implies that the profits of the less-efficient firms are driven to zero, or

$$p(n_H\beta_H + n_L\beta_L)\beta_L - w_L - C = 0. \tag{45}$$

The more-productive firms, within this industry structure, receive Ricardian rents.

This case could be interpreted as an industry with a mature technology and some industry-specific factor of production that cannot be expanded without a reduction in quality. Such a factor of production could be a rich vein of ore, an advantageous location, superior skills acquired through 'learning by doing,' managerial expertise, or simply a successful company culture. Alternatively, this model can be viewed as a model of a declining industry in which capacity exceeds demand. As demand shrinks, the least-productive firms are the first to close.

The comparison of a competitive labour market, local bargaining, and industry-wide wage-bargaining can be summarized as follows:

$$w_H^{LB} \gtrless w^{IB}, \tag{46}$$

$$w^{IB} > w_L^{LB} = r, \tag{47}$$

$$p^{IB} > p^{LB} = p^C, \tag{48}$$

$$n_L^{IB} < n_L^{LB} = n_L^C, \tag{49}$$

where the superscripts IB, LB, and C represent industry bargaining, local bargaining, and the competitive case respectively. That $w^{IB} > r$ is an assumption. That $w_L^{LB} = r$ follows from free

entry of less-productive firms. If less-productive firms could pay wages above r, they would be earning positive profits.[14] Entry of additional firms would then drive the price down until both the constraint $w_L^{LB} \geq r$ and the constraint $\pi_L \geq 0$ are binding. Equations (48) and (49) follow from the zero-profit condition for less-productive firms. From equation (45) we know that $(dp/dw_L) = (1/\beta_L) > 0$. Thus, $p^{LB} = p^C$ since $w_L^{LB} = r$ and $p^{IB} > p^{LB}$ since $w^{IB} > w_L^{LB}$. The negative relationship between price and total output implies that the number of less-efficient firms must decline as the price increases.

In general we cannot tell whether w^{IB} is higher or lower than w_H^{LB}. Both cases may apply depending on the bargaining power of the union. If the union is weak (if α is low enough) industry-wide bargaining leads to a wage close to r and a price close to p^C. In this case (43) and (44) imply that $w_H^{LB} > w^{IB}$ since the average labour productivity is higher in the high productivity firms than in the industry as a whole. If the union is strong (if α is high enough), industry-wide bargaining produces a wage sufficiently high to keep all less-productive firms out of the market. In this case (43) and (44) imply that $w_H^{LB} < w^{IB}$ since the average productivity is the same in the two cases while the price p is higher with industry bargaining.

With a fixed supply of more-efficient firms, the price is determined by the zero-profit condition for the less-efficient firms. The more-efficient firms receive Ricardian rents. In this environment, industry-level bargaining has the textbook effects of raising the price, reducing employment, and increasing average productivity by driving some of the less-productive firms out of the market. The union pushes the industry up its demand curve and captures some of the monopoly rents. Note that the more-efficient firms also obtain a share of the monopoly rents as $d\pi_H/dw = (\beta_H/\beta_L) - 1 > 0$. With both employers and employees in the less efficient firms receiving their outside option, the gains from industry-level bargaining are paid for by consumers.

In contrast, local bargaining is very similar in its effects to a competitive labour market. Free entry drives the union wage

[14] This statement follows from the assumption that the constraint $w_L \geq r$ binds before the constraint $\pi_L \geq 0$ binds. If the zero profit constraint binds first, then the results are the same provided one assumes that less-efficient firms continue to enter as long as $\pi_L \geq 0$.

down to the competitive wage in the less-efficient firms. Since the less-efficient producers determine the price, no monopoly rents result from wage bargaining. The only difference unionization makes is that workers in more-efficient firms are able to obtain a share of the Ricardian rents. The only losers from local bargaining are the owners of the more-efficient firms who are forced to share the rents with their workers.

An alternative, equally interesting industry structure can be represented by the opposite assumption that the number of less efficient firms n_L is fixed while the number of more efficient firms n_H is endogenous. The interpretation of this case is that new state-of-the-art plants embodying the latest technological advances are more efficient than plants built in the past. The assumption that the entrants would be the most productive seems appropriate for a growing industry with a developing technology.

To obtain an equilibrium with both types of firms in the market, we must have $C_H > C_L$. This last condition can be justified by the nature of investment in new plants. Let $C_L = C$ and $C_H = C + I$ where I is the cost of new investment. Once a plant is built and equipped, the cost I is sunk. Thus firms will continue to operate existing plants as long as revenues cover the labour and non-labour operating costs $w + C$. Before building, however, firms will not invest unless revenues will cover all costs $w + C + I$.[15] Firms that enter earn quasi-rents on their sunk costs. Free entry implies, however, that the more-productive firms earn zero profits *ex ante*:

$$p(n_H\beta_H + n_L\beta_L)\beta_H - w_H - (C + I) = 0. \tag{50}$$

In the case of an expanding industry with embodied technical change, the comparison of a competitive labour market, firm-level bargaining and industry-level bargaining can be summarized by the equations:

$$w_H^{LB} > w^{IB} > r, \tag{51}$$

[15] This is a simplified static representation of a necessarily dynamic story. See Moene and Wallerstein 1991*b* for an explicitly dynamic version in which both the number of less-efficient types and the number of more-efficient types are endogenous.

$$w^{IB} \gtrless w_L^{LB} \geq r, \tag{52}$$

$$p^{LB} > p^{IB} > p^C, \tag{53}$$

$$n_H^{LB} < n_H^{IB} < n_H^C, \tag{54}$$

From the zero-profit condition (50) and equations (43) and (44) which determine the bargaining wage in the two cases, we can write

$$p^{LB}\beta_H(1-\alpha) = p^{IB}\beta_H\left(1 - \alpha\frac{\bar{\beta}}{\beta_H}\right) \tag{55}$$

where $\bar{\beta} = (n_H\beta_H + n_L\beta_L)/(n_H + n_L)$ is the average labour productivity in the industry as a whole. Since $\bar{\beta}/\beta_H < 1$, (55) implies that $p^{LB} > p^{IB}$ (equation 53). If the price is higher with local bargaining, the number of entrants must be lower (equation 54) and the wage received in the high-productivity firms must be higher (equation 51). Since $\beta_L < \bar{\beta}$ but $p^{LB} > p^{IB}$, w_L^{LB} may be either higher or lower than w^{IB}. Moreover, wages in the less-productive firms are not necessarily driven to the competitive level since the constraint $\pi_L \geq 0$ may be binding before the number of high-productivity firms has increased so much that $w_L^{LB} = r$.

To summarize both industry structures considered above, the most important feature is that local bargaining is sensitive to local conditions. That, in fact, is among the chief virtues claimed by its supporters. Sensitivity to local conditions means that fewer less-efficient plants are driven out of business compared to centralized wage negotiations. The other side of the coin is that wages are sensitive upwards in the most efficient plants. This implies that fewer more-efficient firms enter. Industry-level bargaining forces less-efficient plants to shut down at a faster rate but local wage-bargaining creates a higher entry barrier for more-efficient plants. The ranking of bargaining levels in terms of social efficiency thus depends on the relative importance of allowing less-productive firms to remain in operation versus lowering the obstacles that keep firms from investing in new plants and equipment.

13

Conflicts over the Level of Bargaining

So far in our discussion, we have investigated the impact of different levels of bargaining on aspects of economic performance such as employment, investment, or productivity. Our focus has been on the social efficiency of different bargaining systems. Even if we had unambiguous results, however, it is not clear to whom we should submit our recommendations. Bargaining systems cannot be imposed by force in a democratic society. The level of bargaining is itself bargained over by unions and employers or employers' organizations. In bargaining over the level of bargaining, both sides presumably seek the same objectives that drive wage-bargaining: higher wages and security for workers, higher profits for firms. The optimal bargaining level from the point of view of some measure of aggregate economic performance may not be optimal from the point of view of unions or employers. Understanding the aggregate economic consequences of different levels of bargaining is only half the problem. The other, less-studied half is understanding the process of bargaining over the bargaining level.

Conflicts over the level of bargaining occur among unions and among employers as well as between unions and employers' associations. We will discuss two types of conflict that occur continually in mixed bargaining systems like those found in the Nordic countries for most of the post-war period: conflict over local bargaining rights and conflict over the allocation of wage increases among sectors in the central agreement. We ignore, for lack of space, the types of conflict that predominate in less-centralized systems, such as the competition among different unions to represent the same group of workers. The fact that conflict is often less visible in decentralized systems does not mean that the conflict in decentralized systems is any less intense.

(a) Conflict over Local Bargaining Rights

One of the perennial conflicts in centralized bargaining systems concerns local bargaining rights. Workers may care about other workers' drift because they care about other workers' final wage for all the reasons discussed in Chapter 11. In addition, workers care about others' drift because other workers' drift affects the central agreement and their own final wage. To show this, we continue with the last model of an industry with two types of firms: high-productivity firms with output of β_H and low-productivity firms that produce β_L. Workers' final wage is equal to the centrally negotiated wage q, which is the same for all, and drift d_i, which varies with each firm's productivity. We assume that the negotiators for the employers seek to maximize total industry profits, while union negotiators at the central level seek to maximize the average wage. Formally, we can characterize industry-level bargaining by the pay-offs

$$\pi = \begin{cases} \Sigma n_i[p\beta_i - (q + d_i) - C_i] & \text{if there is an agreement,} \\ -\Sigma n_i C_i & \text{if there is a strike} \end{cases} \tag{1}$$

for employers and

$$u = \begin{cases} q + (\Sigma n_i d_i / \Sigma n_i) & \text{if there is an agreement,} \\ 0 & \text{if there is a strike} \end{cases} \tag{2}$$

for the union. Equations (1) and (2) imply that central negotiators anticipate the outcome of subsequent bargaining at the local level when setting the base wage.

The outcome of central bargaining, according to our standard formula, is the tariff wage

$$q = \alpha p\left(\frac{n_H\beta_H + n_L\beta_L}{n_H + n_L}\right) - \left(\frac{n_H d_H + n_L d_L}{n_H + n_L}\right). \tag{3}$$

According to (3), the tariff wage consists of the share α of the industry's average revenues minus the average anticipated drift. Increases in drift reduce the tariff wage. If we consider the final wage of workers in the sector j, where j can be either H or L and $k \neq j$, we have

$$w_j = \alpha p\left(\frac{\Sigma n_i\beta_i}{\Sigma n_i}\right) + \left(\frac{n_k}{\Sigma n_i}\right)(d_j - d_k). \tag{4}$$

The wage for workers in each sector is an increasing function of their own drift and a decreasing function of the drift received by workers in the other sector, holding n_H and n_L constant. Moreover, if we consider matters from the point of view of an individual local union, this effect is amplified. Each group of workers receives the full benefit of an increase in their drift, while the cost in terms of a lower tariff wage is borne by all. From the point of view of an individual local, increasing its wage drift as much as possible is a dominant strategy. If output in local conflicts can be reduced from β_i to $\theta\beta_i$, we have as before that $d_i = (1-\theta)\alpha p\beta_i$. If θ was chosen by each local independently, all locals would choose $\theta = 0$ and bargaining would be fully decentralized.

There are numerous externalities, many of which are discussed in Chapter 11, that can be invoked to argue that unions are caught in an n-person prisoners' dilemma where the stable decentralized solution is Pareto inferior. Holden and Raaum (1989) characterize centralization as a Pareto optimal equilibrium of an iterated n-person prisoners' dilemma supported by trigger strategies. Yet a simpler solution seems more realistic. The unions can sign a legally binding collective agreement. The feasibility of making binding commitments does not seem to be an important issue.

Centralized bargaining, therefore, entails a collective choice of $\theta > 0$ for all locals enforced by labour courts. But a common constraint on all only eliminates the conflict over local bargaining rights when firms are equally productive. If firms differ in terms of productivity, conflicts of interest within the union over local bargaining rights are still present. Let there be a restriction on legal industrial action at the local level for all, formalized by the assumption that output in local conflicts can only be reduced by a common value of θ such that $d_i = (1-\theta)\alpha p\beta_i$. Inserting this in the expression for the total wage $q + d_j = w_j$, $j = H, L$, given by (4) we obtain

$$w_j = \frac{\alpha p}{\Sigma n_i}[\Sigma n_i\beta_i + n_k(1-\theta)(\beta_j - \beta_k)] \qquad (5)$$

assuming that $w_j \geq r$. Holding the price of output constant, workers in the high-productivity sector benefit from a relaxation of the constraints on local bargaining rights or a lower θ since

$\beta_H - \beta_L > 0$. For workers in the low-productivity sector, a lower θ leads to a lower final wage. Workers in low-productivity firms do best when drift is disallowed altogether or $\theta = 1$.

This conflict between workers in high-productivity and low-productivity firms may be attenuated in industry bargaining by the effect of θ on the price of output. If the domestic industry faces a downward sloping demand curve, then the union can increase the price of output and create monopoly rents by lowering θ in the case of an expanding industry or raising θ in the case of a declining industry. The higher price of output, a benefit for all workers who remain in the industry, may or may not outweigh the distributional effect on those potentially harmed by higher or lower drift. The lower the elasticity of demand, the sharper the conflict over local bargaining rights. Conflict over local bargaining rights is even sharper in bargaining systems that are centralized at the national level. If national level bargainers determine an optimal final wage, w^*, in line with the models of Chapter 11, then the central agreement will set the tariff wage to be the target wage minus average drift, or $q = w^* - (\Sigma n_i d_i / \Sigma n_i)$. When bargaining is centralized at the national level, conflict over local bargaining rights is a zero-sum game among workers.

(b) The Instability of Centralized Bargaining

The conflict over constraints on drift is only one of many conflicts that may exist among workers in centralized bargaining systems. There is conflict over the wage differential received by workers with high levels of education, or workers who work under harsh conditions, or workers who work in the private sector. With centralized bargaining, there are at least two bargains that must be struck. The explicit bargaining is between unions and employers. However, there is another bargain that must be concluded among the unions over the distribution of allowable wage increases. One might add a third bargain among employers. Unlike the bilateral bargaining between the unions and the employers' confederation, the bargaining within the unions (and among employers) is multilateral. The possibility of forming various coalitions creates instabilities that are not present in the bilateral case.

Let the outcome of bargaining among unions be characterized by a standard characteristic function with transferable utility, where $v(S)$ represents the total that could be obtained by the coalition S and $v(N)$ represents the total pay-off obtainable by the grand coalition of all unions. We assume that centralized bargaining is efficient in the strong sense that the characteristic function is strictly superadditive:

$$v(S_1) + v(S_2) < v(S_1 \cup S_2) \tag{6}$$

for all non-intersecting S_1 and S_2. Let the pay-offs to each union be denoted by x_i. The core is defined to be the set of pay-offs $x_1, x_2, \ldots, x_n$ such that

$$\sum_{i \in N} x_i = v(N), \quad \text{and} \tag{7}$$

$$\sum_{i \in S} x_i \geq v(S) \quad \text{for all } S \subset N. \tag{8}$$

Centralized bargaining can be efficient in the strong sense of equation (6), yet be unstable in the sense that no allocation satisfying equations (7) and (8) exists.

Suppose the core does exist, a yet stronger assumption. Then the wage bill specified in the central agreement can be allocated among unions in such a way that no subset of unions could do better by bargaining separately. Leif Johansen (1982) argued, however, that the core requires excessively acquiescive behaviour on the part of actors to be a realistic solution concept in many circumstances. An allocation of $v(N)$ is in the core as long as no subset of actors can do better by withdrawing. More typically, Johansen argued, actors demand what they could obtain outside the grand coalition plus a share of the surplus they create by joining.

Thus what we will call the Johansen core is defined to be an allocation of pay-offs to individuals $x_1, x_2, \ldots, x_n$ that satisfies

$$\sum_{i \in N} x_i = v(N), \quad \text{and} \tag{9}$$

$$\sum_{i \in S} x_i \geq v(S) + \lambda_S[v(N) - v(S) - v(N \backslash S)] \quad \text{for all } S \subset N. \tag{10}$$

According to (10), each group S demands what it could get outside the grand coalition, $v(S)$, plus the fraction λ_S of the surplus it brings to the coalition by joining, $[v(N) - v(S) - v(N \backslash S)]$. Note that the ordinary core is defined by equations (9) and (10) with $\lambda_S = 0$. It is clear that as the aggressiveness of the actors increases, that is as λ_S rises, the Johansen core may be reduced. Indeed, the Johansen core cannot possibly exist unless $\lambda_S + \lambda_{N \backslash S} \leq 1$. Otherwise the demands for shares of the surplus are incompatible.

How should the weights λ_S be determined? One natural way is to think of the λ_Ss as being the product of bargaining between the coalition S and its complement $(N \backslash S)$ over sharing the surplus. That is, coalition S threatens to leave the bargaining table and bargains with the remaining players over how to share the surplus should it remain. In this case, we have $\lambda_S + \lambda_{N \backslash S} = 1$.

Under these conditions, the Johansen core is almost always empty. Equations (9) and (10) imply

$$\sum_{i \in N \backslash S} x_i \leq v(N \backslash S) + (1 - \lambda_S)[v(N) - v(S) - v(N \backslash S)]. \tag{11}$$

But if $(1 - \lambda_S) = \lambda_{N \backslash S}$, then equations (10) and (11) imply that the inequality signs must be replaced by strict equality:

$$\sum_{i \in S} x_i = v(S) + \lambda_S[v(N) - v(S) - v(N \backslash S)] \quad \text{for all } S \subset N. \tag{12}$$

Equations (9) and (12) constitute a set of $2^n - 1$ equations to determine n variables $x_1, x_2, \ldots, x_n$. A solution will not exist except in very special circumstances. In general, it is impossible to obtain a centralized agreement that is 'renegotiation proof'. All possible allocations leave some group worse off than they could be if they withdrew from the grand coalition and bargained over the terms of rejoining.

Thus, even if all unions (or all employers) could obtain a higher level of welfare with centralized bargaining than they could by bargaining separately, it may still be impossible to distribute the gains from centralized bargaining in a way that maintains co-operation. Of course, the lack of a solution reflects the weakness of the theory of n-person bargaining rather than the

impossibility of wage-setting at the national level.[1] National-level wage-bargaining did exist in Sweden for four decades, and it exists still in Norway and Finland, albeit in attenuated forms. If we have devoted much more space to the economic consequences of centralized bargaining than to the political conflicts over the level of bargaining, it is because the politics of bargaining are so poorly understood.

[1] There are many solution concepts in co-operative game theory that could be applied, but all suffer from the defect of assuming that the solution is Pareto optimal. Thus they are of little help in studying when Pareto optimal solutions are obtained and when they are not.

14

Conclusion

The literature on collective bargaining consists of a multiplicity of models, each with a different focus and, seemingly, a different conclusion. Robust conclusions that are not contradicted by some other plausible specification of the problem are difficult to find. In this respect, the literature on collective bargaining is similar to other topics in the field of industrial organization. This is discouraging, but it is better to recognize the diversity of results than to make claims as if economic theory had a clean, simple implication regarding the costs and benefits of different bargaining structures.

It is also disconcerting, after covering such a variety of topics, to list what has been left out. One of the most important is the effect of bargaining level on wage dispersion. The reduction of wage differentials is among the most visible effects of centralized bargaining in the Nordic countries (but not in Austria).[1] The economic effect of an egalitarian wage structure is highly controversial. Claims that larger wage differentials are needed to provide adequate individual incentives must be balanced against contrary claims that narrow wage differentials within the firm promote co-operation among workers and higher productivity.[2]

Also missing is a discussion of the level of bargaining and inflation.[3] In this essay we have followed the theoretical literature, though not the empirical literature, and focused exclusively on real models in which monetary policy has no role to play. This leads to another omission, namely the interaction of union wage-

[1] See Freeman 1988; Rowthorn 1989*a*; 1989*b*; and Kalleberg and Colbjørnsen 1990 for empirical studies of centralization and wage dispersion. Theoretical studies have been done by Byoung Heon Jun (1989); Wallerstein (1990); and Moene and Wallerstein (1991*c*).

[2] It should be noted that managers' preference for a less egalitarian wage structure is as self-serving as the preference of unions representing low-paid workers for a more egalitarian wage structure.

[3] For studies of the inflationary consequences of mixed bargaining systems, see Holden 1991*a*; 1991*b*; and Nymoen 1991.

setters and government policy-makers.[4] Implicit in this literature is a claim that centralized wage-setting differs from local bargaining because centralized wage-setters take into account the likely policy response of the government to the unions' pay demands. This topic is large and diverse enough to warrant a review of its own.

The literature we did cover does yield a simple, albeit not very exciting, answer to our central question regarding the effect of the degree of centralization on economic performance: It depends. Fortunately, we can say something about what it depends upon. The effect of centralization depends on the industry, the way workers are divided into separate unions and the measure of performance. It matters whether the industry is expanding or declining, or whether firms on the margin of entry or exit are the most productive or the least productive. It also matters whether centralization implies the joining of different types of workers, or the same type of worker in different firms. Finally, it matters whether one is concerned about employment, investment, productivity growth, or equality.

That the effect of centralization depends upon the structure of the industry and the way unions are organized implies a certain scepticism regarding the empirical studies of centralized versus decentralized bargaining that have been done so far. If industry structure matters, then the appropriate test for at least some of the effects of centralization is at the industry, not national, level. If the way workers are divided into unions matters, then one-dimensional indices of centralization are misleading. Countries rank differently along different dimensions of centralization.

Most of the existing indices try to rank countries on a scale that goes from firm-level to industry-level to national-level bargaining. By this measure, Japan is the most decentralized, the United States a little more centralized, the UK a bit above the United States, Germany more centralized than the UK, and Norway and pre-1983 Sweden the most centralized of all. A different measure would rank countries on a scale that goes from every occupation in a separate union to all occupations bargaining jointly. Now the ranking would have the UK as the most decentralized, the

[4] See, among others, Sampson 1983; Calmfors and Horn 1986; Gylfason and Lindbeck 1986; and the papers collected in *Scandinavian Journal of Economics*, 87 (1985). Rødseth 1991 presents a recent appraisal of this literature.

United States a little more centralized, Sweden and Norway in the middle, and Germany and Japan as the most centralized of the six. Should the Japanese case be used as an illustration of the advantages of decentralization or centralization? Clearly we should stop talking about centralization in the singular and analyse the different dimensions of centralization separately.

Finally, whether different dimensions of centralization are beneficial for economic performance depends on the aspect of performance under consideration. Both local bargaining or two-tiered bargaining in which local bargaining adds an increment to a centrally negotiated wage provide incentives for workers to work hard on the job. Bargaining systems without local bargaining do not. Thus concern with effort argues in favour of local bargaining or mixed systems in which central and local bargaining are combined.

With regard to capital formation, however, the results are exactly the reverse. Local bargaining discourages investment as workers at the local level obtain a share of the productivity increase that investment creates. Unfortunately, not all good things go together. Local wage-bargaining as a form of profit-sharing induces the efficient use of inputs whose costs are paid continually, like effort on the job. Local wage-bargaining as a way of sharing current profits but not prior costs, induces too little use of inputs whose costs are sunk, like new plant and equipment. The best bargaining system for capital formation may be the worst for workers' effort. If one is ultimately concerned with, say, per capita GDP, then one's evaluation of different bargaining systems depends on one's assessment of the relative importance of investment in new plant and equipment versus inducing greater effort on the job in the process of economic growth.

The most prominent concern in the literature is with unemployment and it is regarding unemployment that the theoretical results are most diverse. If unions set the wage, if there is one union for each final product, and if prices are sensitive to the quantity of domestic output, then the relationship between centralization and unemployment is hump-shaped with either highly centralized or fully decentralized systems superior to intermediate levels of centralization. If unions set the wage, if there are multiple unions engaged in producing each final

product, and if final product prices are fixed in world markets, there is a monotonic relationship with unemployment lower the higher the level of centralization. If unions set the wage, if there is one union per product, if prices are fixed, and if unions care about relative wages or the aggregate rate of unemployment, then highly centralized bargaining entails the lowest unemployment. Highly centralized bargaining also produces the lowest unemployment if wage-setting is driven by union protection of insiders, or by efficiency wage considerations. In contrast, decentralized bargaining produces the lowest unemployment when the wage is set by a process of bargaining between workers who want the highest wage possible and employers provided employers determine employment unilaterally. Thus, in regard to unemployment, there are arguments in favour of both firm-level bargaining and national-level bargaining.

One way to summarize these conflicting results regarding centralization and employment is to distinguish between those arguments that rely on union weakness and those that rely on union co-operation. The advantage of local bargaining in terms of employment depends on the ability of employers to lower the wage by increasing employment. If unions are powerful enough at the local level to prevent employers from increasing the number of insiders, local bargaining would result in less, not more, employment than centralized bargaining. Similarly, the advantage of decentralized bargaining when prices are affected by wage costs disappear if unions are strong enough to organize on an industry basis and obtain the monopoly rents created as an industry moves up its demand curve.

On the other side, the advantages of centralized bargaining depend on real co-operation among the different unions. Centralized bargaining lowers unemployment if unions can agree on how to spread the wage increase among themselves. In the absence of internal agreement among the unions, bargaining that appears to be centralized can become a form of multilateral bargaining that is not centralized at all.

In the presence of strong, cohesive unions, a mixed system of centralized bargaining over the base wage and subsequent firm-level bargaining under a peace clause may be the best compromise between divergent concerns. On the one hand, workers' effort on the job appears to be increasingly important in light of

current trends toward more flexible specialization and work organization described by Michael Piore and Charles Sabel (1984). Thus the cost of industry-level or even national-level bargaining without subsequent bargaining at the level of the enterprise may be high. On the other hand, the large difference between labour costs at the level of the firm and labour costs at the level of the national economy points to the existence of a sizeable externality in wage-setting where a substantial part of the costs of wage increases are borne by workers in other unions and other firms.

Separate bargaining by different groups of workers within the firm reduces economic performance on all dimensions. But co-operation among workers divided into blue-collar, white-collar, and professional confederations has proven to be difficult to achieve in the Nordic countries. Indeed, the greatest weakness of national-level bargaining is the difficulty of attaining a consensus among the unions who compete with each other as well as with employers.

The alternative approach, apparently favoured by Swedish employers, is to rely instead on union weakness. The risk with this strategy is that unions would remain strong enough to block the advantages of local bargaining. The danger is that the Nordic countries might lose the advantages of centralized bargaining without obtaining the advantages of decentralized bargaining.

the unemployment insurance, the legal bargaining monopoly of unions for non-members as well for many issues, the legal rights for non-organized labour and firms with non-organized workers, etc. Institutional changes that weaken relative union strength in bargaining are also likely to have profound effects on the political strength of unions. In my view, this may not be a bad thing in a society like the Swedish one, where corporatist influences on policy-making have been strong.

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Index