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Centralized Bargaining, Efficiency Wages, and Flexibility

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Abstract

The main focus of the "wage bargaining" literature has been on the factors promoting real wage flexibility at the macro level. This paper, in contrast, examines the microeconomic issues of wage bargaining. More specifically, this paper appraises the following questions: (a) what are the conditions under which a firm prefers decentralized to centralized bargaining?, (b) what are the characteristic features of firms which prefer decentralized to centralized bargaining?, and (c) has the proportion of firms which prefer decentralized bargaining increased over time? These questions are examined in an efficiency wage model with insider-outsider features. This paper provides useful theoretical insights for understanding the issues involved in shifting from centralized to decentralized wage bargaining.

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	<u>Contents</u>	<u>Page</u>
I.	Introduction	1
	1. The Basic Model	5
	2. Unions and Insider-Power	7
	3. Comparing the Two Bargaining Systems	9
	4. The Political Economy of "Transition"	11
	5. Simulations	12
	6. Conclusion	16
	Tables	
	1. Upper and Lower Limits for Centralized Bargaining	14
	2. Percentage of Firms which Prefer Centralized Wage-Fixing	15
	Appendix I.	
	Proof that $H'_\lambda(v) > 0$, $\partial Y/\partial v > 0$, and $\partial \Pi/\partial v > 0$	18
	Figures	
	1. Firm's Optimal Decision Problem (Perfect Competition)	8a
	2. Firm's Optimal Decision Problem (Bargaining)	10a
	2. Threshold for Centralized Bargaining Majority	16a
	References	20

Summary

Until now, the "wage bargaining" literature has focused primarily on macroeconomic outcomes. This paper, in contrast, examines the micro-economic issues of wage bargaining, which have received scant attention to date. Specifically, the paper uses an efficiency wage model with insider-outsider features to appraise the following questions: (a) under what conditions is centralized wage bargaining more profitable than decentralized bargaining for an individual firm? (b) what are the characteristic features of firms which prefer decentralized to centralized bargaining? and (c) has the proportion of firms which prefer decentralized to centralized bargaining been increasing or decreasing over time?

The paper provides useful theoretical insights into the issues involved in shifting from centralized to decentralized wage bargaining in the Swedish case. It concludes that (a) both high-technology and low-technology firms will increase their profitability by shifting from centralized to decentralized bargaining; (b) firms in the "intermediate" technology range may not benefit by moving from centralized to decentralized bargaining; and (c) given the recent shift to more flexible work practices that characterize the "post-Fordist" environment, more firms may prefer decentralized wage bargaining. That is, the pressure to decentralize wage bargaining as evidenced recently in Sweden, may be based on objective criteria. Simulations are carried out to illustrate and reinforce these theoretical results.



I. Introduction

There is by now a large body of theoretical literature on the implications of different types of trade union for economic performance. Some of the well-known studies are, Schott (1984), Bruno and Sachs (1985), Calmfors and Horn (1985 and 1986), Driffill (1985), Söderström (1985), Calmfors and Driffill (1988), Soskice (1990), and Hoel (1991). The primary focus of this literature has been on *macroeconomic* outcomes. More specifically, the main issue addressed in this literature is the relationship between the level of wage bargaining and the level of employment in the economy. This has naturally led to a comparative analysis of the factors which determine the real wage rate under centralized and decentralized bargaining.

Does centralized wage bargaining promote relatively higher levels of employment? The answer turns out, not surprisingly, to be dependent on the assumptions underlying the models used in this literature. Nevertheless, the broad picture which emerges indicates that centralized bargaining is in general more conducive for achieving real wage moderation.

Let us provide a brief overview of the essential results in this literature. Bruno and Sachs' well known work looked for an explanation for the better employment record of the corporatist countries in the post-oil shock period. They argued that centralized bargaining was informationally better placed for responding to macroeconomic shocks with real wage moderation. The more formal literature which appeared at about the same time--Calmfors and Horn (1985 and 1986), Driffill (1985), and Söderström (1985)--was, however, ambiguous about the advantages of centralized bargaining. The main focus of this literature was on the interaction between the unions and the government in the context of accommodation policies. The central argument is as follows. Decentralized unions consider government accommodation policies to be exogenous. However, under centralized bargaining, government accommodation policies must be considered endogenous. Hence, when governments are explicitly wedded to a policy of full employment, centralized unions have an incentive to push up the real wage rate in a static setting. This constricts private sector employment at the expense of public sector employment. However, this particular result does not necessarily hold in a dynamic setting. The outcome depends crucially on the structure of the game between the unions and the government, for instance, on who moves first (see Pohjola (1985)) and the time horizon under consideration. The results also depend on factors such as "credibility", "commitment" and "reputation".

The more recent literature has focused on how externalities influence wage determination under different institutional settings (Calmfors and Driffill (1988) and Hoel (1991)). Let us first consider the case of *price* externalities. Suppose that prices are determined endogenously. Then, any given money wage increase secured by a decentralized union will raise its real wage proportionately more than its product wage; under centralized bargaining, however, real wages and product wages move roughly in

proportion. That is, centralized bargaining internalizes the *price externalities* of decentralized bargaining. As a result the centralized union is more restrained in its wage claims.

Consider next the case of exogenously given prices. In this case, the price externality ceases to be operational. Any money wage increase raises both real and product wages in the same proportion for both types of union. Nevertheless, even when prices are exogenous, centralized bargaining may still have an advantage over decentralized bargaining for achieving real wage moderation. There are two reasons for this. The first derives from the well-known fact that centralized bargaining internalizes the *fiscal externalities* of decentralized bargaining, that is, the centralized union is unable to pass on the burden of funding unemployment benefits to anybody else. The second, which has received insufficient attention in the literature, is related to intertemporal considerations. This argument is as follows. A decentralized union contemplating a wage increase views the total unemployment pool as exogenous. Consequently, it can push for higher wages without significantly reducing the displaced workers' probability of securing future re-employment. However, under centralized bargaining the total unemployment pool must be considered endogenous. A real wage increase secured by an encompassing centralized union will increase the total pool of the unemployed. This obviously reduces the probability of securing a job in the future for displaced workers belonging to this union. 1/ That is, as soon as dynamic considerations are invoked, there are strong reasons to presume real wage moderation under centralized bargaining.

This overview indicates the exclusive concern of the wage bargaining literature with the issue of *macro-flexibility*. The question which is constantly posed in this literature is, "under what conditions is the average real wage sufficiently flexible to guarantee high levels of employment in the economy"? This question, while no doubt important, ignores many of the micro-level issues. The micro-level problem in wage bargaining is concerned with the following set of questions: (a) under what condition is centralized wage bargaining more profitable than decentralized bargaining for an individual firm? (b) what are the characteristic features of firms which prefer centralized to decentralized bargaining? and (c) has the proportion of firms which prefer centralized to decentralized bargaining been increasing or decreasing over time? The main aim of this paper is to provide answers to all these questions. Finding the right answers to these questions is especially important when institutional changes, such as shifting from centralized to decentralized bargaining are currently being contemplated.

The Swedish experience with solidaristic bargaining (centralized bargaining plus wage equalization) provides a particularly useful context

1/ See Hoel (1991) for a slightly different version of the same argument.

for analyzing these microeconomic issues. 1/ Centralized bargaining of the Swedish variety (henceforth referred to simply as centralized bargaining) provides the ideal theoretical contrast to decentralized bargaining: flexibility for individual firms is at a minimum under centralized bargaining of this type. 2/ The Swedish case is a useful anchor point for our analysis for yet another reason. While there is very little theoretical work which addresses the micro-aspects of centralized bargaining, the Swedish Employers' Confederation (SAF) has attempted to come to grips with some of these problems. The SAF commissioned two economists, Jonsson and Siven (1986), to study the problems which individual firms face under centralized bargaining. Jonsson and Siven's arguments on this issue are based on intuitive rather than theoretical reasoning. Their main point is that centralized bargaining is unprofitable and inefficient for individual firms. It is argued that centralized bargaining precludes individual firms from using the wage rate as an incentive device for motivating workers to achieve higher levels of productivity. Centralized bargaining also hinders the proper matching of jobs and workers. Firms in high technology sectors are prevented from offering higher wages to attract the more skilled workers. Jonsson and Siven therefore conclude that centralized bargaining is a major source of inefficiency for individual firms. Their policy recommendation is to increase wage differentials by decentralizing wage bargaining.

Jonsson and Siven's case seems to make intuitive sense. However, both empirical studies on wage differentials and recent developments in efficiency wage theory suggest that the relationship between wage differentials and efficiency is far more complex than portrayed in Jonsson

1/ See Freeman (1988) and Rowthorn (1992) for a discussion of the relationship between centralized bargaining and wage dispersion. Rowthorn's paper extends the Calmfors-Driffill model to include wage dispersion. The focus of this paper is, however, again on macroeconomic outcomes. The impact of efficiency wage considerations for individual firms under solidaristic bargaining is not taken up for analysis.

2/ In practice, of course, individual firms do have some flexibility in the Swedish system due to "wage drift". However, we abstract from this factor for the purpose of the theoretical analysis.

and Siven's study. 1/ The actual wage differentials generated under decentralized wage determination can be conceptually separated into two components. The first component is the compensation paid for differences in skill, ability and intensity of work. This corresponds closely to Jonsson and Siven's conception of wage differentials--it has a functional role. However, the second component of wage differentials has no functional justification. It arises simply as a consequence of some form of "insider-power" and manifests itself as pure "industry" or pure "establishment" effects under all types of decentralized wage determination. 2/ It is well known that such wage differentials are not only inefficient, but also welfare-reducing (See Stiglitz (1985)).

We now have a paradoxical situation to contend with. Decentralized bargaining generates wage differentials which are functionally necessary. However, it also generates non-functional wage differentials in the form of "firm" and "industry" effects. Centralized bargaining, in contrast, overcomes "insider power" in particular activities and may drastically reduce "firm" and "industry" effects. 3/ But centralized bargaining may simultaneously preclude the emergence of functionally necessary wage differentials. Therefore, the preference between centralized and decentralized bargaining for the individual firm will depend upon the relative importance of these two components of wage differentials. Intuitively, it is obvious that those firms which find it profitable to pay high wages to motivate their workers should prefer decentralized bargaining. However, firms which are subject mainly to non-functional "insider-effects" should be better off with centralized bargaining. This intuition, however, needs to be developed in a more precise way. We tackle this problem in an efficiency wage framework which incorporates some of the features of the

1/ Some of the important papers dealing with wage differentials are: Dickens and Katz (1987), Krueger and Summers (1987 and 1988), Murphy and Topel (1987), Gibbons and Katz (1989), and Brown and Medoff (1989). These studies indicate that there are large differences in wages for seemingly similar workers. Such differences are pervasive at all levels--companies, firms and industries--even after controlling for human capital variables and a variety of job characteristics. While most of these studies are primarily concerned with American data, these results also hold for many other countries as well. However, Sweden is somewhat of an exception to the rule. "Industry" and "establishment" effects are minimal in Sweden and most of the wage differences can be accounted for by differences in the quality of labour and working conditions (See Edin and Zetterberg (1989)). For a theoretical treatment of the relationship between wage differentials and effort, see Ramaswamy and Rowthorn (1991).

2/ "Insider-power" is not strictly dependent on the existence of unions; however, firm or industry level unions may well enhance "insider-power" see Lindbeck and Snower (1988).

3/ This follows automatically from our earlier definition of centralized bargaining. See Edin and Zetterberg (1989) for the empirical evidence.

insider-outsider theory. This latter feature enables us to bring unions formally into the efficiency wage setting.

The efficiency wage framework complicates certain conventional beliefs about centralized bargaining. In particular, the Rehn-Meidner argument that centralized bargaining benefits high technology firms at the expense of the low technology firms need not necessarily hold any more. For instance, because of efficiency wage considerations, some high technology firms may find it optimal to pay considerably more than the average wage so as to elicit above average effort from their workers. Consequently, such firms may be better off under decentralized bargaining. The question of what type of firms will actually be better off under decentralized bargaining will depend upon the exact nature of the effort-wage relationship. The model developed in this paper helps to provide a precise answer to this complex question. The formal part of this paper is organized as follows. We use the results of the efficiency wage model set out in Ramaswamy and Rowthorn (1991) to derive the equation of the firm's iso-profit contours and obtain the profit maximizing condition under perfect competition. We then show how the equilibrium condition is altered by the explicit introduction of unions into this picture. Our formal framework provides precise answers to the microeconomic issues of wage bargaining set out earlier.

1. The basic model

Our formal model is based on the efficiency wage framework set out in Ramaswamy and Rowthorn (1991). We assume that all workers are identical, though the amount of effort they perform may vary. The production function for any given firm is as follows:

$$Y = F(E^{1/\lambda}L) \quad (1)$$
$$F, F' > 0; \quad F'' < 0.$$

where Y , E , L denote output, effort, and labor respectively. ^{1/} The parameter λ denotes the "damage potential" of workers in the firm concerned, the lower the value of λ , the greater is the damage that workers may cause by reducing effort. The value of λ may vary across firms, but is assumed to be constant for any given firm. Profits are given by

$$\Pi = Y - WL \quad (2)$$

For given E and W , profits are maximized when $\frac{\partial \Pi}{\partial L} = 0$. That is,

^{1/} In our original paper we assumed a production function of the form $y = f(E L^\lambda)$. This is mathematically equivalent to the function shown in equation (1).

$$W = \frac{\partial Y}{\partial L} = E^{1/\lambda} F' (E^{1/\lambda} L) \quad (3)$$

Rearranging (3) and taking the inverse, we obtain

$$E^{1/\lambda} L = (F')^{-1} (WE^{-1/\lambda}) \quad (4)$$

Define the following:

$$e = \log E \quad (5)$$

$$w = \log W \quad (6)$$

$$v = e - \lambda w \quad (7)$$

Then, from the above definitions, we obtain,

$$\exp \left[\frac{-v}{\lambda} \right] = WE^{-1/\lambda} \quad (8)$$

Substituting (8) in (4), we obtain

$$E^{1/\lambda} L = (F')^{-1} \left[\exp \left[\frac{-v}{\lambda} \right] \right] \quad (9)$$

Denote the right hand side of this equation by $H_\lambda(v)$. Then,

$$E^{1/\lambda} L = H_\lambda(v) \quad (10)$$

We can now express output and profits as a function of v . Substituting (9) and (10) in (1) and (2), we get,

$$Y = F [H_\lambda(v)] \quad (11)$$

and

$$\Pi = F [H_\lambda(v)] - \exp \left[\frac{-v}{\lambda} \right] H_\lambda(v) \quad (12)$$

It is easy to show that $H'_\lambda(v) > 0$, $\frac{\partial Y}{\partial v} > 0$ and $\frac{\partial \Pi}{\partial v} > 0$. (See Appendix for proofs).

It is clear from equations (11) and (12) that the iso-product and iso-profit curves are defined by

$$v = \text{constant}$$

which can be written as,

$$e = \text{constant} + \lambda w \tag{13}$$

Let us now take up the workers' side of the problem. Workers are assumed to be identical. The utility of employed workers is a function, $u(E,W)$, of the effort they perform and the wage rate. All unemployed workers receive social security benefit and enjoy utility equal to u_0 . This benefit is financed by a lump-sum tax on profits.

Consider a perfectly competitive system in which no insider power at all is exercised. All wage differentials are then in compensation for differences in effort. All employed workers must have the same utility as each other and also as the unemployed, i.e.

$$u(E, W) = u_0$$

For any given u_0 , this defines a functional relationship between E and W . Without loss of generality we can write this relationship in logarithmic form:

$$\log E = g(\log W)$$

That is,

$$e = g(w); \tag{14}$$

We shall assume that $g, g' > 0; g'' < 0$.

It is now easy to determine the optimum wage. Consider a firm with a production function given by equation (1) and an effort function given by (14). The firm maximizes profits at the point where the relevant iso-profit curve is tangent to the effort curve, as shown in Figure 1.

Note that logarithmic scales are used in Figure 1. Hence, the iso-profit curves are linear with slope λ . The firm maximizes profit at the tangency point P and the optimum wage for the firm is given by inverting the equation $g'(w) = \lambda$.

2. Unions and insider-power

Insider rents may arise from a variety of causes. Even in the absence of trade unions the existence of hiring, firing and training costs may give "insiders" an advantage over outsiders. With the result that employed workers enjoy higher utility than the unemployed. The effect of trade

unions on insider rents is complex. Under decentralized bargaining, industry or firm-level unions may exploit their advantage to increase insider rents still higher than the level arising naturally from transactions costs and the like. Under centralized bargaining, however, the "encompassing" central union, for reasons outlined earlier, may act in just the opposite way and hold wages down, thereby reducing insider rents.

To illustrate the contrast between these two situations we shall make the following assumptions. For any given level of effort, under decentralized bargaining all workers receive a constant proportionate mark-up over the perfectly competitive wage rate. Mathematically, this can be expressed by an effort function of the form:

$$e = g(w - \delta) \quad (15)$$

Note that e and w are the log effort and log wage respectively. Equation (15) implies that, for any given amount of effort, insider-power provides the workers with approximately δ per cent extra in wages as compared to the perfectly competitive wage rate. ^{1/} Thus, δ measures the level of insider-rent. We assume that δ corresponds to the relative and absolute profitability constraints outlined in Lindbeck and Snower (1988).

We have argued that, under centralized bargaining, the encompassing union may act so as to reduce insider rents. To highlight this effect, we shall assume that insider-rents are eliminated completely under centralized bargaining. This is an extreme assumption, but it substantially simplifies the exposition without sacrificing anything fundamental. ^{2/} In the present model, where labor is homogeneous, the assumption of zero insider-rents implies that all employed workers have the same utility as each other and as the unemployed. Hence, for each worker, the relationship between effort and wages under centralized bargaining satisfies equation (14), which is derived on the assumption of zero insider-rents.

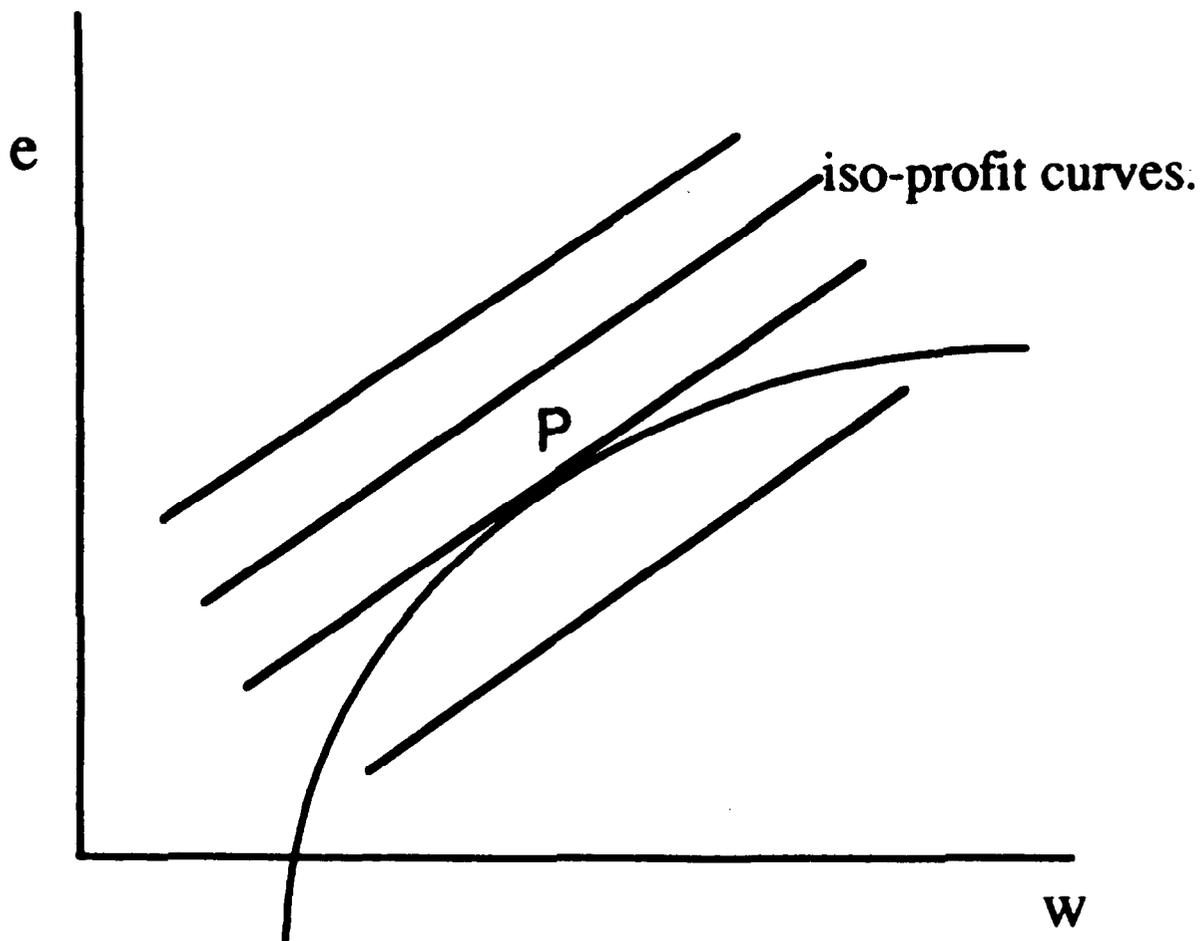
We shall also assume that the centre sets a uniform wage across the entire economy such that $\log \text{wage} = w_c$. Since insider rents are zero, all employed workers must enjoy the same utility, and hence they must all perform the same amount of effort in return for their uniform wage. Denote the log of this uniform effort by e_c . Then from equation (14) it follows that:

^{1/} Equation (15) implies that under decentralized bargaining insiders receive a proportionate mark-up over the competitive wage equal to $\exp(\delta) - 1$. For plausible values of the mark-up, this expression is approximately equal to δ .

^{2/} In this paper we do not investigate the precise conditions under which insider-rents are zero under centralized bargaining. This will certainly be the case if, for example, firms are permitted to hire and fire workers at will and there are no transactions costs in doing so.

Figure 1

Firm's Optimal Decision Problem (Perfect Competition)



$$e_c = g(w_c) \quad (16)$$

In the present model, the attraction of centralized bargaining to employers is its ability to reduce the level of insider-rents. Hence, for any given effort level, the wage rate will be lower than under decentralized bargaining. However, this benefit is bought at a cost. Firms can no longer choose their own wage rate in accordance with their individual circumstances and cannot vary wages to elicit an optimal supply of effort.

3. Comparing the two bargaining systems

Let us now compare how individual firms, defined by given values of the parameter λ , fare under the two bargaining systems. Our aim is to provide a precise answer to our first question: "under what condition is centralized bargaining more profitable than decentralized bargaining for an individual firm?".

Consider the case of centralized bargaining. Equation (7) now taken the form,

$$v_c(w_c, \lambda) = g(w_c) - \lambda w_c \quad (17)$$

Substituting (17) in (12) gives the expression for profits under centralized bargaining:

$$\Pi_c(w_c, \lambda) = F[H_\lambda(v_c(w_c, \lambda))] - \exp\left[\frac{-v_c(w_c, \lambda)}{\lambda}\right] H_\lambda(v_c(w_c, \lambda)) \quad (18)$$

Under decentralized bargaining, equation (7) takes the form,

$$v_d(w, \lambda) = g(w - \delta) - \lambda w \quad (19)$$

Profits are given by:

$$\Pi_d(w, \lambda) = F[H_\lambda(v_d(w, \lambda))] - \exp\left[\frac{-v_d(w, \lambda)}{\lambda}\right] H_\lambda(v_d(w, \lambda)) \quad (20)$$

To maximize profits under decentralized bargaining, a firm with parameter λ sets w equal to $w_d(\lambda)$, where

$$w_d(\lambda) = \arg \max_w \Pi_d(w, \lambda) \quad (21)$$

The firm obtains higher profits under centralized bargaining if

$$\Pi_c(w_c, \lambda) > \Pi_d[w_d(\lambda), \lambda] \quad (22)$$

Whether this inequality is satisfied depends on the value of λ . The precise conditions for this to be so are illustrated in Figure 2.

The broken line in Figure 2 indicates the position of the effort curve under decentralized bargaining when insider-power operates. With centralized bargaining, every firm is at the point $P = (w_c, e_c)$. From this point, there will normally be two tangents to the curve $e = g(w - \delta)$. ^{1/} We shall denote their slopes by λ_l and λ_h , where $\lambda_l < \lambda_h$.

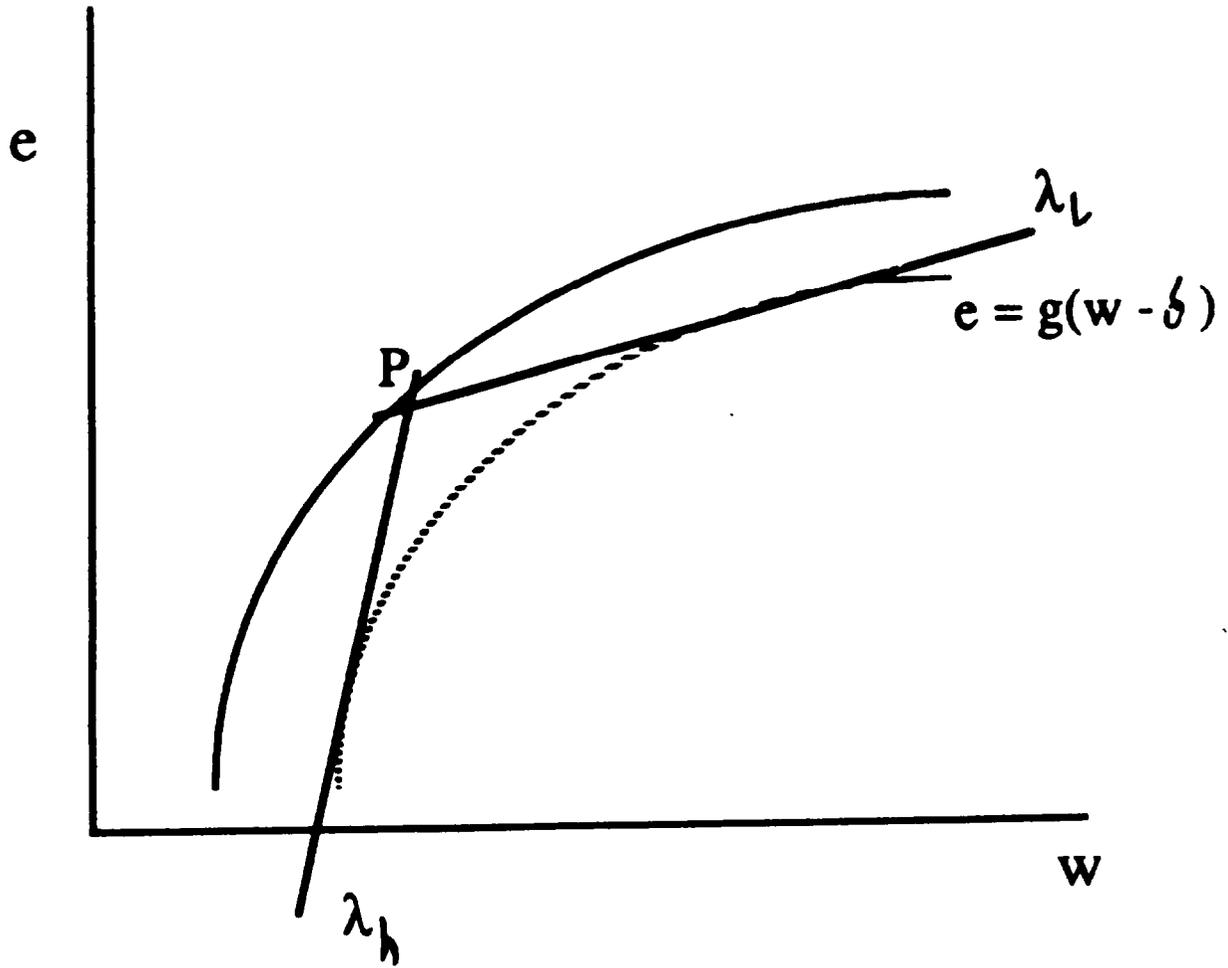
We can now answer our first question. Consider a firm with parameter λ . The iso-profit curve through P will have slope λ . Suppose $\lambda_l < \lambda < \lambda_h$. Under these conditions, the iso-profit curve through P will fail to intersect the insider-effort curve indicated by the broken line in Figure 2. This implies that the profits available at P will be greater than at any point on the insider-effort curve, and hence greater than under decentralized bargaining. The intuition for this result is straightforward. Centralized bargaining is preferred by those firms for which the gain from eliminating insider rents outweighs the loss of flexibility involved in centralized wage setting. Conversely, a firm will obtain higher profits under decentralized bargaining if $\lambda < \lambda_l$ or $\lambda > \lambda_h$.

Firms which prefer decentralized bargaining fall into two groups: those with very low or very high values of λ . Consider a firm with $\lambda < \lambda_l$. Firms in this category are highly sensitive to variations in effort from their workers. Such firms prefer decentralized bargaining because it allows them to pay considerably higher than average wages to obtain a greater than average supply of effort. It is, of course, true that part of the additional wages will be absorbed by insider rents, but this loss will be more than offset by the extra effort supplied - which is crucial for firms with a low λ . At the other end of the spectrum, there may be firms with $\lambda > \lambda_h$. Firms in this category prefer decentralized bargaining so they can set a very low wage. This will obviously reduce the supply of effort. But this does not matter very much because firms in this category can easily compensate for low effort by employing more workers. The lower wage more than offsets any resulting fall in effort. Finally, centralized bargaining

^{1/} If δ is sufficiently small there will always be two tangents since the curve $g(\bullet)$ is strictly concave. If δ is large and $g(\bullet)$ flattens out rapidly to the right of P_l then the right hand tangent may not exist. Even in this case, however, the analysis in the rest of the paper remains valid with $\lambda_l = 0$.

Figure 2

Firm's Optimal Decision Problem (Bargaining)



is more profitable for firms with intermediate values of λ . For firms in this category, the lack of freedom to set their own wage is of less importance than the reduction of insider-rent which centralized wage-fixing provides. There are obvious parallels with the "rules" versus "discretion" debate. In terms of our analysis, one group of firms is better off when it has the "discretion" to devise its own wage policy. The other group, in contrast, gains when there are "rules". This "rule", which is given by the exogenously determined centralized wage, provides the firm with the "credibility" to ward off insider-power.

4. The political economy of "transition"

It is clear from the above discussion that in economies with centralized wage bargaining institutions, the pressure to decentralize wage bargaining will come from firms at both ends of the spectrum. Firms which are highly sensitive to effort variations will prefer a shift to decentralized bargaining. These firms will wish to set very high wages. The same is also true of firms which are highly insensitive to effort variations. These firms will want to shift over to decentralized bargaining so that they have the freedom to set very low wages. An interesting question that crops up at this stage is whether the proportion of firms which want to shift from centralized to decentralized bargaining has increased over time. An answer to this question is important for gauging the "objective" factors at work in the pressures for decentralization evidenced recently in countries such as Sweden.

Our analysis of this particular problem is theoretical rather than empirical. We have just shown formally that when there is a diversity of firms, some will gain from centralized bargaining, but that others will lose. The proportion of firms in each category depends on the statistical distribution of λ 's and on the boundaries λ_l and λ_h . The latter, in turn, depend on δ which indicates the amount of insider-rent eliminated by centralized bargaining. Suppose the distribution of λ 's is given by the density function $\phi(\lambda)$, where

$$\int_0^{\infty} \phi(\lambda) d\lambda = 1 \quad (23)$$

The proportion of firms which obtain relatively higher profits under centralized bargaining is given by the integral CEN, where,

$$\text{CEN} = \int_{\lambda_l}^{\lambda_h} \phi(\lambda) d\lambda \quad (24)$$

For any given w_c , the parameter λ_l (λ_h) is a decreasing (increasing) function of δ . Hence, the larger is δ , the greater is the integral CEN and the larger the proportion of firms which benefit from centralized bargaining. In contrast, the greater is the dispersion of λ s, the smaller

is the integral CEN for any given λ_l, λ_h . Other things being equal, the greater is the diversity of firms, the smaller is the proportion of firms which prefer centralized bargaining.

In spite of the highly abstract nature of our model, it is interesting to see the implications of recent developments in work organization for the behavior of CEN through time. A number of recent studies have suggested that new developments in production technology and work organization have led to an increasing diversity in the motivational requirements of firms. This is associated with the transition from so-called "Fordist" to "post-Fordist" methods of production. In the present model, such developments would have the effect of reducing CEN. Let us examine this point in some detail. "Fordism" refers to a highly integrated corporate structure, producing standardized products with dedicated machinery. "Fordist" methods of production are characterized by relatively similar effort requirements across different sectors. "Post-Fordism", in contrast, is said to be characterized by a more supple organizational structure, using variable equipment, which can be switched quite easily from the production of one model to another. This form of organization is said to have become increasingly important since the middle of the 1970s. ^{1/}

One of the distinctive features of "post-Fordist" methods of production is the much greater diversity between firms. This is manifested, for instance, in terms of the diversity in the effort requirements of different firms. Under post-Fordism the levels of initiative and motivation expected from workers varies a lot between firms. Consequently, firms require a much greater degree of flexibility and individuality in devising their own wage and incentive schemes. Within the framework of our model, such a development would imply a higher dispersion of λ 's and, hence, a reduction in CEN. Thus, the proportion of firms which find centralized bargaining more profitable is likely to decrease with the growing importance of "post-Fordist" activities. This argument suggests there may be an "objective" basis for the pressure to decentralize wage bargaining evidenced recently in countries such as Sweden.

5. Simulations

We shall now present the results of some simulations which both illustrate and reinforce the theoretical arguments presented above. These simulations are based on the following assumptions.

Effort: The supply of effort under perfect competition is given by

$$e = a + b \log w \quad (i)$$

where, $e = \log E$, $w = \log W$ and $a, b > 0$.

^{1/} See Piore and Sabel (1984), Aoki (1986), Piore (1986), and Milgrom and Roberts (1990). See Elliasson et. al (1990) for some evidence of such a transition in Sweden.

Production: Output for any given firm is given by the production function

$$Y = c(E^{1/\lambda}L)^\theta \quad (ii)$$

where, $0 < \theta < 1$ and $c > 0$. Note that c is assumed to be the same for all firms.

Diversity of Firms: The diversity of firms is specified by the statistical distribution of λ . It is assumed that $\log \lambda$ has an uniform distribution with mean zero and standard deviation σ . This implies that λ has a median equal to 1.

Normalization: The parameter c is chosen to ensure that total employment with a perfectly competitive labor market is equal to 1. This is defined as "full employment".

Centralized Bargaining: Under centralized bargaining there is a uniform wage rate w_c . The resulting supply of effort is given by equation (i) and hence $e_c = a + b \log w_c$. It is assumed that w_c is set so as to make total employment = 1.

Decentralized Bargaining: Under decentralized bargaining firms set their own wage rate. The supply of effort is given by:

$$e = a + b \log(w - \delta) \quad (iii)$$

where, δ specifies the level of insider-rent under this type of bargaining.

Parameter Values: Within the constraints specified above, the simulation results reported below are independent of the values of a and θ . The simulations assume that $b = 1$ and examine the effects of varying σ and δ .

Table 1 reports the values of λ_l and λ_h for various values of δ , given that $\sigma = 30\%$. It also shows the percentage of firms with $\lambda < \lambda_l$, $\lambda > \lambda_h$ and $\lambda_l < \lambda < \lambda_h$. Firms in the first two categories get higher profits under decentralized bargaining, whilst firms in the last category secure higher profits under centralized bargaining. As δ is increased, the percentage of firms which prefer centralized bargaining rises. With $\delta = 2.0\%$, only 37.7% of the firms gain from centralized bargaining. But with $\delta = 10.0\%$, some 86.3% prefer centralized bargaining. As expected, the simulation shows that centralized bargaining is preferred by a greater number of firms when insider-power is higher.

Table 2 shows the percentage of firms which prefer centralized bargaining when both δ and σ are varied. The picture is again straightforward. Higher values of δ make centralized bargaining more attractive for any given firm. This is reflected in the higher values of the entries as we move to the right of the matrix in Table 2. On the other hand, as σ is increased, the diversity of firms increases and the percentage

Table 1. Upper and Lower Limits for Centralized Bargaining

δ	λ_l	λ_h	% of firms with $\lambda < \lambda_l$	% of firms with $\lambda > \lambda_h$	% of firms with $\lambda_l \leq \lambda \leq \lambda_h$
0.0	0.95	0.95	45.0	55.0	0.0
2.0	0.79	1.17	27.4	35.0	37.7
4.0	0.74	1.29	20.7	25.7	53.6
6.0	0.70	1.39	15.8	18.2	66.1
8.0	0.67	1.49	11.7	11.6	76.7
10.0	0.65	1.59	8.2	5.4	86.3
12.0	0.63	1.69	5.0	0.1	94.9
14.0	0.61	1.79	2.4	0.1	97.5

Note: σ measures the dispersion of firms' effort requirements. δ measures the level of insider-rent under decentralized bargaining. Both parameters are measured in percent.

Table 2. Percentage of Firms which Prefer Centralized Wage-Fixing

δ σ	0.0	2.0	4.0	6.0	8.0	10.0	12.0
0.0	0.0	100.0	100.0	100.0	100.0	100.0	100.0
10.0	0.0	100.0	100.0	100.0	100.0	100.0	100.0
20.0	0.0	57.0	82.0	97.0	100.0	100.0	100.0
30.0	0.0	38.0	54.0	66.0	77.0	86.0	95.0
40.0	0.0	27.0	39.0	48.0	56.0	63.0	69.0
50.0	0.0	21.0	30.0	37.0	43.0	48.0	53.0

Note: σ measures the dispersion of firms' effort requirements. δ measures the level of insider-rent under decentralized bargaining. Both parameters are measured in percent.

of firms preferring flexibility becomes greater. This is reflected in the declining values of the entries as we move down Table 2.

Figure 3 plots the combinations of δ and σ for which exactly half the firms prefer centralized bargaining. Points in the South-East of this diagram are characterized by a high σ and a low δ . Such combinations correspond to "post-Fordism" and ensure that a substantial majority of firms prefer decentralized bargaining. Points in the North-West of the diagram are characterized by a low σ and a high δ . Such combinations correspond to "Fordism" and ensure that most firms prefer centralized bargaining. In this diagram, a shift from the North-West to the South-East represents a shift from "Fordism" to "post-Fordism". The simulations show that this increases the percentage of firms which prefer decentralized bargaining.

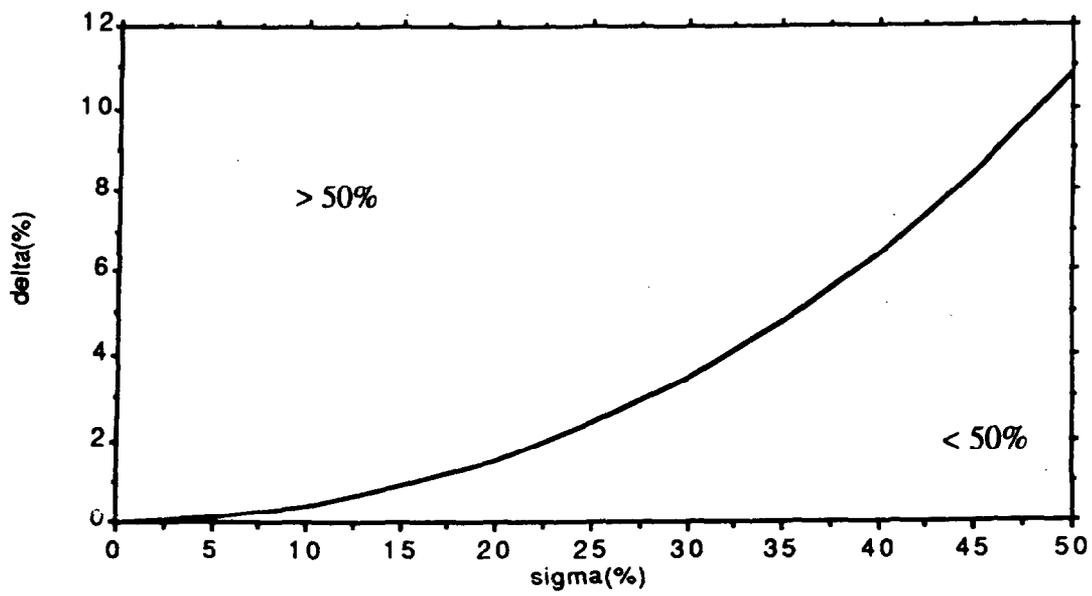
6. Conclusion

This paper has examined an issue which has received scant attention in the theoretical labor economics literature, namely, how do individual firms fare under different wage bargaining institutions. Previous attempts to come to grips with this problem have lacked an adequate theoretical foundation. For instance, the Rehn-Meidner argument that centralized bargaining of the Swedish variety benefits the high productivity firms at the expense of the low productivity ones may not necessarily hold once efficiency wage considerations are invoked. Likewise, Jonsson and Siven's argument that centralized bargaining is definitionally inefficient for all types of firms is also unsatisfactory. It ignores the fact that decentralized bargaining can give rise to substantial insider-rents which are not functionally justifiable. This paper has provided a formal framework, combining the efficiency wage and insider-outsider models, for coming to grips with these complex microeconomic issues of wage bargaining.

We have shown that when firms are heterogenous, some will find centralized bargaining more profitable, while others obtain higher profits under decentralized bargaining. How any particular firm fares under different wage bargaining institutions depends on the parameter λ , where λ denotes the degree of damage potential. Our paper shows that a firm will prefer decentralized bargaining if λ is either very low or very high. When λ is low, the firm's output is highly sensitive to variations in effort. Firms in this category will prefer decentralized bargaining because it gives them the flexibility to pay wages well above the average. At the opposite end of the spectrum, when λ is high, the firm's output is insensitive to variations in effort. Firms in this category will prefer decentralized bargaining because it allows them to set a very low wage. It is the firms with intermediate values of λ which find centralized bargaining more profitable. For these firms, the lack of freedom to set their own wage is more than offset by the reduction of insider-rents which centralized wage-fixing may offer. There are obvious parallels here with the "rules" versus "discretion" argument. Some firms do well under "discretion", while others are better off with "rules".

Figure 3.

Threshold for Centralized Bargaining Majority



Finally, this paper has helped to illuminate the issues involved in shifting from centralized to decentralized bargaining. We have argued that new developments in production technology and work organization--the so-called transition from "Fordism" to "post-Fordism"--may increase the proportion of firms which find decentralized bargaining relatively more profitable. "Post-Fordist" firms require a much greater degree of individuality and flexibility in devising their own wage schemes. This development may be a significant factor behind the pressure to decentralize wage bargaining evident recently in countries such as Sweden.

Proof that $H'_\lambda(v) > 0$, $\partial Y/\partial v > 0$, and $\partial H/\partial v > 0$

(i) $H'_\lambda(v) > 0$

$$H_\lambda(v) = (F')^{-1} \left[\exp \left(\frac{-v}{\lambda} \right) \right]$$

Thus,

$$F'(H_\lambda(v)) = \exp \left(\frac{-v}{\lambda} \right)$$

Differentiating w.r.t. v :

$$F'' \cdot H'_\lambda = -\frac{1}{\lambda} \exp \left(\frac{-v}{\lambda} \right)$$

$$\therefore H'_\lambda = -\frac{\frac{1}{\lambda} \exp \left(\frac{-v}{\lambda} \right)}{F''}$$

Since $F'' < 0$ it follows that $H'_\lambda > 0$.

Q.E.D.

(ii) $\partial Y/\partial v > 0$

$$Y = F[H_\lambda(v)]$$

$$\frac{\partial Y}{\partial v} = F' \cdot H'_\lambda$$

Since $F' > 0$, $H'_\lambda > 0$ it follows that $\partial Y/\partial v > 0$.

Q.E.D.

(iii) $\partial\Pi/\partial v > 0$

$$\begin{aligned}\Pi &= Y - WL \\ &= F\left(E\frac{1}{\lambda}L\right) - E\frac{1}{\lambda}LF'\left(E\frac{1}{\lambda}L\right) \\ &= F(H_\lambda(v)) - H_\lambda(v)F'(H_\lambda(v))\end{aligned}$$

Differentiating w.r.t. v :

$$\begin{aligned}\frac{\partial\Pi}{\partial v} &= F' H'_\lambda - H'_\lambda \cdot F' - H_\lambda \cdot F'' H'_\lambda \\ &= -H_\lambda F'' H'_\lambda\end{aligned}$$

Now $H_\lambda = E\frac{1}{\lambda}L > 0$, $F'' < 0$ and $H'_\lambda > 0$. Hence $\frac{\partial\Pi}{\partial v} > 0$.

Q.E.D.

References

- Aoki, M. (1986), Horizontal Versus Vertical Information Structure of the Firm, *The American Review*, December, Vol. 76, No. 5, pp. 971-83.
- Brown, C. and Medoff, J. (1989), The Employer Size-Wage Effect, *Journal of Political Economy*, Vol. 97, No. 5, pp. 1027-59.
- Bruno, M. and Sachs, J.D. (1985), *The Economics of Worldwide Stagflation*, Basil Blackwell.
- Calmfors, L. and Horn, H. (1985), Classical Unemployment, Accommodation Policies and the Adjustment of Real Wages, *Scandinavian Journal of Economics*, Vol. 87, No. 2, pp. 234-61.
- Calmfors, L. and Horn, H. (1986), Employment Policies and Centralized Wage-Setting, *Economica*, August, Vol. 53, pp. 281-302.
- Calmfors, L. and Driffill, J. (1988), Bargaining Structure, Corporatism and Macroeconomic Performance, *Economic Policy*, April, No. 6, pp. 14-61.
- Driffill, J. (1985), Macroeconomic Stabilization Policy and Trade Union Behavior as a Repeated Game, *Scandinavian Journal of Economics*, Vol. 87, No. 2, pp. 300-26.
- Dickens, W.T. and Katz, L.H. (1987), Inter-Industry Wage Differences and Theories of Wage Determination, *Harvard Institute of Economic Research*, Discussion Paper No. 1324.
- Edin, P.A. and Zetterberg, J. (1989), Inter-Industry Wage Differentials: Evidence from Sweden and a Comparison with the United States, *Trade Union Institute for Economic Research*, Stockholm, September, Working Paper No. 71.
- Eliasson, G. et. al., (1990), *The Knowledge Based Information Economy*, The Industrial Institute for Economic and Social Research, Stockholm.
- Freeman, R.B., (1988), Labour Market Institutions and Economic Performance, *Economic Policy*, April, pp. 64-80.
- Gibbons, R. and Katz, L. (1989), Does Unmeasured Ability Explain Inter-Industry Wage Dispersion, *Massachusetts Institute of Technology*, Working Paper No. 543.
- Hoel, M. (1991), Union Wage Policy: The Importance of Labour Mobility and the Degree of Centralization, *Economica* May, Vol. 58, pp. 139-54.

- Jonsson, L. and Siven, C.H., (1986), *Why Wage Differentials?* Swedish Employers' Confederation, Norstedt.
- Krueger, A.B. and Summers, L.H. (1987), Reflections on the Inter-Industry Wage Structure in Lang, K. and Leonard, J.S. (ed.), *Unemployment and the Structure of Labour Markets*, Basil Blackwell.
- Kreuger, A.B. and Summers, L.H., (1988), Efficiency Wages and the Inter-Industry Wage Structure, *Econometrica*, March, Vol. 56, No. 2, pp. 259-93.
- Lindbeck, A. and Snower, D.J. (1988), *The Insider-Outsider Theory of Employment and Unemployment* MIT Press.
- Milgrom, P. and Roberts, J., (1990), The Economics of Modern Manufacturing: Technology, Strategy and Organization, *The American Economic Review*, June, Vol. 80, No. 3, pp. 511-28.
- Murphy, K.M. and Topel, R.H. (1987), Unemployment, Risk and Earnings: Testing for Equalizing Wage Differences in the Labour Market, in Lang, K. and Leonard, J.S. (ed.), *Unemployment and the Structure of Labour Markets*, Basil Blackwell.
- Piore, M.J., (1986), Perspectives on Labour Market Flexibility, *Industrial Relations*, pp. 146-66.
- Pohjola, M. (1985), Comment on Driffill, "Macroeconomic Stabilization Policy and Trade Union Behavior as a Repeated Game", *Scandinavian Journal of Economics*, Vol. 87, No. 2, pp. 332-34.
- Piore, M.J. and Sabel, C.F. (1984), *The Second Industrial Divide*, Basic Books Inc. New York.
- Ramaswamy, R. and Rowthorn, R.E. (1991), Efficiency Wages and Wage Dispersion, *Economica*, November, Vol. 58, pp. 501-14.
- Rowthorn, R.E., (1992), Centralization, Employment and Wage Dispersion, *The Economic Journal*, May, Vol. 1, No. 102, pp. 506-23.
- Schott, K. (1984), *Policy, Power and Order*, New Haven.
- Söderström, H.T. (1985), Union Militancy, External Shocks and the Accommodation Dilemma, *Scandinavian Journal of Economics*, Vol. 87, No. 2, pp. 335-51.

Soskice, D. (1990), Wage Determination: The Changing Role of Institutions in Advanced Industrialized Countries, *Oxford Review of Economic Policy*, Winter, Vol. 6, pp. 36-61.

Stiglitz, J. (1985), Equilibrium Wage Distributions, *Economic Journal*, September, Vol. 95, pp. 595-618.