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WAGE BARGAINING WITH A PRICE-SETTING FIRM

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ABSTRACT

This paper examines the introduction of monopolistic competition into wage bargaining models: in addition to capital-labour substitution, we also consider a cost-push effect. The right-to-manage model requires strong restrictions on the objective functions and leads to problematic conclusions because the wage claims of the union are generally not compatible with the mark-up requirement contained in the firm's price equation. In the efficient bargaining model, the union negotiates also the employment level, which gives it a way of extracting part of the monopoly rent: the firm's commitment to an efficient wage-employment combination forces it to follow a pricing rule such that part of the surplus is transferred to the union.

INTRODUCTION

Over the last few years, a lot of work has been done on the analysis of non-competitive wage formation. Institutional set-ups in which there is bargaining between firms and workers have emerged as the most adequate analytical framework. This has led many authors to study trade union models (see Oswald (1985) for a survey) and, at a more abstract level, the underlying game-theoretical foundations of bargaining theory (see Binmore (1987) and Binmore, Rubinstein and Wolinski (1986)).

In traditional union models, firms are assumed to be price-takers on the goods market. This introduces an uneasy gap between the non-competitive structure of wage formation and a competitive determination of goods prices. Indeed, we believe that price-taking is not a satisfactory approxima-

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tion and that the introduction of other models of firm behaviour on the goods market can improve the understanding of wage bargaining. In particular, 'the assumption of perfect competition in the goods market might be replaced by monopolistic competition in order to give aggregate demand a more prominent role' (Van der Ploeg (1987)).

Accordingly, this paper is devoted to the application of wage bargaining models to a case where the firm, in addition to choosing its factor inputs, also chooses a profit-maximizing price rule. In this way, wage and price formation and their interaction can be studied within a unified model. The framework is one of monopolistic competition, in which the firm produces a single good which is an imperfect substitute for the goods produced by its competitors.

The introduction of monopolistic competition into a wage bargaining model allows us to study the behaviour of the union and the firm when they take into account the two main channels by which real wages can affect employment: in addition to the supply-side effect where an increase in the wage encourages capital-labour substitution, we also consider a demand-side effect where the cost-push consequences of a wage increase shift consumption away from the firm's good. The purpose of this paper is to show how the introduction of demand-side considerations in employer-union bargaining affects the results about wage and price formation.

1. THE MODEL

The union has a utility function $U(w/P, L)$ where w is the money wage, P is the aggregate price level, and L is employment. As emphasized by Pencavel (1985), there are good reasons for supposing that the union's objective function is defined over real wages and employment, but we know little about the exact form of the function. We thus keep the formulation as general as possible. Let ϕ_w and ϕ_L be the positive partial elasticities of the utility function with respect to the first and second argument. Their ratio ϕ_w/ϕ_L can be seen as an indicator of the union's relative preference for wages compared to employment,[1] and will be an important parameter later on.

The firm is assumed to be profit-maximizing and to operate in a monopolistically competitive environment. It sells an output Q at price p using amounts of labour L and capital K. The user cost of capital is r. $Q(L, K)$ is a CES production function with an elasticity of substitution σ between inputs and with constant returns to scale.[2] As in traditional monopolistic

[1] Indeed, this ratio can be calculated as the marginal rate of substitution between w and L times (w/L).

[2] The constant returns assumption, although restrictive, is standard in most of the literature and is a good benchmark to start the analysis.

competition models, the demand for the firm's product is a fraction of aggregate demand determined by the relative price. Let ε be the elasticity of the demand to the firm's relative price. P is considered as exogenous by the firm and the union.

The literature contains mainly two approaches to wage bargaining: 'efficient' bargaining and 'right-to-manage' bargaining. As is well known, they correspond to different assumptions about the structure of the bargaining game, and they yield different outcomes. In Sections 2 and 3, we introduce price-making behaviour into each model and assess the results in terms of price and wage formation. In Section 4, we compare the two models and summarize the conclusions.

2. THE RIGHT-TO-MANAGE APPROACH

In the general case (see e.g. Nickell and Andrews (1983)), workers act as if the wage-employment pair were constrained from the start to be on the labour demand schedule. This amounts to negotiating a real wage and giving to the firm the right to manage its employment level. Therefore, the firm determines its reaction function $L(w/p)$ (step 1), bargains with the union over the wage (step 2) and then sets the level of employment unilaterally from its labour demand schedule (step 3). Here, since the firm is a price-maker, step 1 also includes the determination of an output price reaction function.

Step 1: Firm's Profit Maximization

The firm determines its reaction functions by maximizing real profits:[3]

$$\max_{L,K}[Q(L,K)\,p\{Q(L,K)\} - wL - rK]/P$$

where $p(Q)$ is the inverse of the demand function. The first-order conditions are:

$$Q_L = \frac{\varepsilon}{\varepsilon+1}\left[\frac{w}{p}\right] \quad \text{and} \quad Q_K = \frac{\varepsilon}{\varepsilon+1}\left[\frac{r}{p}\right]$$

Using the properties of the CES function, we obtain the following equations which can be solved for K, L, Q and p:

[3] Note that we deflate profits with the aggregate price level. This may be seen to reflect the assumption that the firm's share-holders are interested in the overall purchasing power of their dividends.

$$A = Q/L = f(Q_L) = f\left[\frac{\varepsilon}{\varepsilon+1}\frac{w}{p}\right], \ \varepsilon_{A\cdot w/p} = \sigma > 0 \tag{1}$$

$$B = Q/K = g(Q_K) = g\left[\frac{\varepsilon}{\varepsilon+1}\frac{r}{p}\right], \ \varepsilon_{B\cdot w/p} = \sigma > 0 \tag{2}$$

$$Q = Q(K, L) = [\tau L^{(\sigma-1)/\sigma} + (1-\tau)\, K^{(\sigma-1)/\sigma}]^{\sigma/(\sigma-1)}$$

with

$$\varepsilon_{Q\cdot L} = \alpha, \ \varepsilon_{Q\cdot K} = 1-\alpha, \ \alpha = \tau A^{(1-\sigma)/\sigma} \tag{3}$$

$$Q = Q(p), \ \varepsilon_{Q\cdot p} = \varepsilon < -1 \tag{4}$$

Equation (3) is the production function and equation (4) is the goods demand function. Equations (1) and (2) implicitly contain the firm's price-making equation:

$$p = \frac{1}{1-\text{Lerner}}\cdot(w/A + r/B) \tag{5}$$

where Lerner is the usual Lerner index $(-1/\varepsilon)$. This is a very standard result. By contrast, the analysis of wage determination requires much more careful discussion.

Step 2: Wage Determination

The firm and the union now determine the money wage w, knowing the reaction functions defined above. The basic framework is a non-cooperative model of alternating offers, but its outcome can be approached by the cooperative Nash bargaining solution (see Binmore, Rubinstein and Wolinski (1986)). Interpreting the fall-back levels as the income streams of each player during a dispute, let us assume a zero fall-back utility level for the union, meaning essentially that there are no strike payments. For the firm, the real fall-back profit is $(\Omega - rK)/P$, where $\Omega > 0$ is an exogenous reference level and rK is the total user cost of capital.

We use the asymmetric Nash bargaining solution in which union power is measured by the exogenous parameter b, with $0 \le b \le 1$. Recent research in the game-theoretical foundations of the Nash solution has shown that this parameter can be interpreted as the relative reaction speed of the firm compared to the union.[4]

[4]The most straightforward interpretation is provided by Sutton (1986): the reaction speed of, say, player 2 measures the time during which player 1 can commit himself not to accept the previous, less favourable proposal. Thus, the smaller the reaction speed of the firm, the more impatient the union is.

The two parties carry out the following programme:

$$\max_{w} b \ln U\left[\frac{w}{P}, L(w)\right] + (1-b)\ln\left[\frac{p(w)\,Q(w) - wL(w) - \Omega}{P}\right]$$

whose first-order condition is:

$$w = \left[\frac{b[1-\Omega R](\phi_w + \phi_L \varepsilon_{L\cdot w}) + (1-b)(\varepsilon_{p\cdot w} + \varepsilon_{Q\cdot w})}{b(\phi_w + \phi_L \varepsilon_{L\cdot w}) + (1-b)(1+\varepsilon_{L\cdot w})}\right] Ap$$

where $\Omega R = \Omega/(p \cdot Q)$ is the reference level expressed as a share of total receipts. After solving equations (1)–(4) for elasticities,[5] we obtain:

$$w = \left[\frac{b[1-\Omega R][\phi_w + \phi_L\{(\varepsilon+\sigma)\alpha - \sigma\}] + \alpha(1-b)[1+\varepsilon]}{b[\phi_w + \phi_L\{(\varepsilon+\sigma)\alpha - \sigma\}] + (1-b)[1 - \sigma + \alpha(\varepsilon+\sigma)]}\right] Ap \qquad (6)$$

This solution can be compared with the one obtained in the case of a price-taking firm:[6]

$$w = \left[\frac{[1-\Omega R](\phi_w - \sigma\phi_L)}{\phi_w - \sigma\phi_L + (1-\mathrm{b})/\mathrm{b}}\right] Ap \qquad (7)$$

The terms between brackets in equations (6) and (7) measure the labour share $\mathrm{LS} = w/A/p$. We of course require that LS be non-negative. To ensure a bargaining solution we also need the firm's profit to be larger than or equal to its fall-back level. This implies $\mathrm{LS} \leq 1 - \Omega R$. The condition $0 \leq \mathrm{LS} \leq 1 - \Omega R$ requires restrictions on the parameters. The parameters are of three types: technology (σ), union's preference (ϕ_w, ϕ_L) and union power (b). The restrictions on σ and (ϕ_w, ϕ_L) for a given b are developed in the Appendix.

A sufficient condition for $0 \leq \mathrm{LS} \leq [1 - \Omega R]$ is that $\sigma < 1$ and that ϕ_w/ϕ_L be above some lower bound ϕ^* defined in the Appendix. Both in the monopolistic and in the purely competitive case, we need to impose restrictions on the utility elasticities ϕ_w and ϕ_L. These restrictions amount to putting a lower bound on the union's relative preference for wages compared to employment. With a price-taking firm, ϕ_w/ϕ_L must be larger than σ. With monopolistic competition, ϕ_w/ϕ_L must be larger than ϕ^*, which is more restrictive because $\phi^* > \sigma$. This can be explained as follows: since the elasticity of labour with respect to the wage is larger when we include the demand-side effect through monopolistic competition, the trade-off between wages and employment is more severe for the union. The cost in terms of employment of an increase in the wage is higher, so

[5] Note that $\varepsilon_{L\cdot w} = (\varepsilon+\sigma)\alpha - \sigma$, $\varepsilon_{P\cdot w} = \alpha$, and $\varepsilon_{Q\cdot w} = \alpha\varepsilon$.
[6] In that case, the elasticities reduce to $\varepsilon_{L\cdot w} = -\sigma$, $\varepsilon_{P\cdot w} = 0$, and $\varepsilon_{Q\cdot w} = 0$.

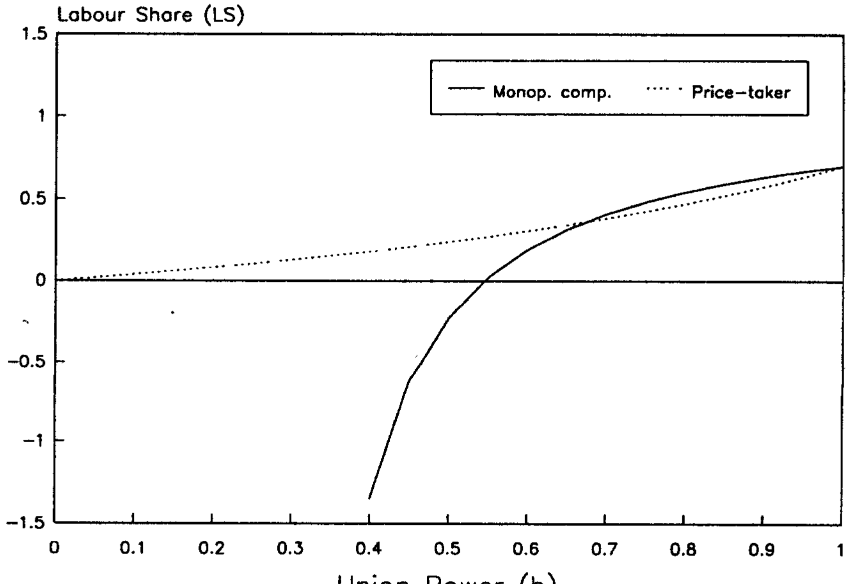

Fig. 1. Right-to-manage bargaining

that the union must give even more preference to wages for the labour share to be reasonable.

For given values of σ and ϕ_w/ϕ_L, we need to impose a condition on b in the monopolistic competition case: in fact, the denominator of (6) can be zero for some value of b between 0 and 1. Therefore, in the price-making case, union power must be 'large enough' to ensure $0 \leq \mathrm{LS} \leq 1-\Omega R$. This is illustrated in Figure 1 for specific values of the parameters ($\phi_w=0.7$, $\phi_L=0.3$, $\varepsilon=-1.5$, $1-\Omega R=0.7$, $\sigma=0.5$, $\alpha=0.6$): b must exceed 0.55.

The crucial point is the following: the introduction of a demand-side effect through price-making behaviour increases the elasticity of employment with respect to the wage. In order to get a reasonable solution for the bargained labour share in the right-to-manage framework when $\sigma<1$, we must

1. introduce a condition on union preferences which is more restrictive than in the case of a price-taking firm;
2. introduce a lower bound on union power.[7] To observe the emergence of a bargaining process with a firm which has monopoly power on its segment of the goods market, one needs to have a union which is sufficiently powerful.

[7] Such a restriction poses with urgency the problem of characterizing the determinants of b, i.e., of the relative reaction speeds of the two parties. This is still a very much open issue in the game-theoretic literature. See in particular Sutton (1986).

Step 3: Resolution of the Model

From the price equation (5), we know that the labour share LS is $((1+\varepsilon)/\varepsilon)-\mathrm{KS}$, KS being the capital share. Using this result in equation (6), we see that the model breaks down if the term between brackets in (6) is constant and that some parameter has to be made to adjust in order for (5) and (6) to be compatible. Two examples can be used to illustrate this:

- If $b=1$ (monopoly union), the union uses equation (6) to determine the wage on its own. Thus $\mathrm{LS}=(1-\Omega R)$ and pure profits disappear. Unless the exogenous reference level adjusts, ε has to be infinite for the price equation to hold. The conclusion follows: when there is a monopoly union, the firm cannot have a monopoly in its good market.
- If we were to look for a parallel between our results and the model of Layard and Nickell (1987), the term between brackets in (6) would have to be an inverse function of the rate of unemployment. This would be so for instance if all parameters were constant except for union power b which would have to be negatively related to unemployment.[8] In that case, the classic 'battle of the mark-ups' result would follow: the confrontation between the price equation and the wage claims would determine the non-accelerating inflation rate of unemployment (NAIRU).

Accordingly, when the firm has monopoly power on its segment of the goods market, the right-to-manage framework may lead to:

1. a breakdown of the negotiation if all parameters are fixed, or
2. if the adjusting parameter is unemployment, a 'battle of the mark-ups' which has already been stressed by some authors.

3. THE EFFICIENT BARGAINING APPROACH

In efficient bargaining models, the firm and the union bargain jointly over the wage and the employment level. This model was first developed by Leontief (1946) and popularized by McDonald and Solow (1981). They assume that even though employment is not explicitly specified in contracts, it is implicitly agreed that the firm will choose an efficient level of employment rather than a point on labour demand. The outcome is a Nash equilibrium located on the contract curve. It is 'efficient' in the sense that there exists no deviation which is Pareto-improving. As we will see, we have here the inverse pattern compared to the right-to-manage model:

[8] This is by no means obvious, upon analyzing the underlying game-theoretical arguments given in Binmore *et al.* (1986) and Fehr (1990).

wage determination is simple and straightforward, while employment and price determination calls for detailed comments.

Wage Determination

In our version of the efficient bargaining model, there are two steps. In step 1, the firm determines a reaction function related to the optimal capital stock. We obtain equation (2) which together with equations (3) and (4) yields the system to be solved. In step 2, the union and the firm determine wage and employment, taking into account the reaction function computed in step 1. The bargaining function is:

$$\max_{w,L} b \ln U\left[\frac{w}{P}, L\right] + (1-b)\ln\left[\frac{p\{Q(L)\}\,Q(L) - wL - \Omega}{P}\right]$$

The first-order condition for the wage is:

$$w = \frac{b\phi_w(1-\Omega R)}{b\phi_w + (1-b)}\, pA \tag{8}$$

This equation is much simpler than (6): if ϕ_w and ΩR are constant, the optimum wage is indexed on the firm's price and on labour productivity, i.e., the elasticity of the wage with respect to average labour productivity is unity. The labour share is always an increasing function of union power. No specific restrictions are needed to ensure a reasonable solution.

An important property of the efficient bargain is that it imposes no condition on union power for the labour share to be non-negative. The clarity of the efficient bargaining solution is well illustrated by Figure 2.

Employment and Price Determination

The first-order condition for labour is:

$$\mathrm{d}Q/\mathrm{d}L = \frac{\varepsilon}{\varepsilon+1}\left[\frac{w}{p} - \frac{b\phi_L}{(1-b)}\,\frac{(pQ - wL - \Omega)}{pL}\right]$$

The marginal productivity computed here is not conditional on a given capital stock: it incorporates the movements of the capital stock which are given by the reaction function (2). To get the marginal productivity of labour at a fixed capital stock, we must use the results[9] of step 1:

$$\mathrm{d}Q/\mathrm{d}L = Q_K K_P P_Q Q_L + Q_L = ((1-\alpha)(1+\sigma/\varepsilon)+1)\, Q_L$$

[9] From profit maximization with respect to the capital stock, we know that $\varepsilon_{K\cdot P} = \varepsilon + \sigma$.

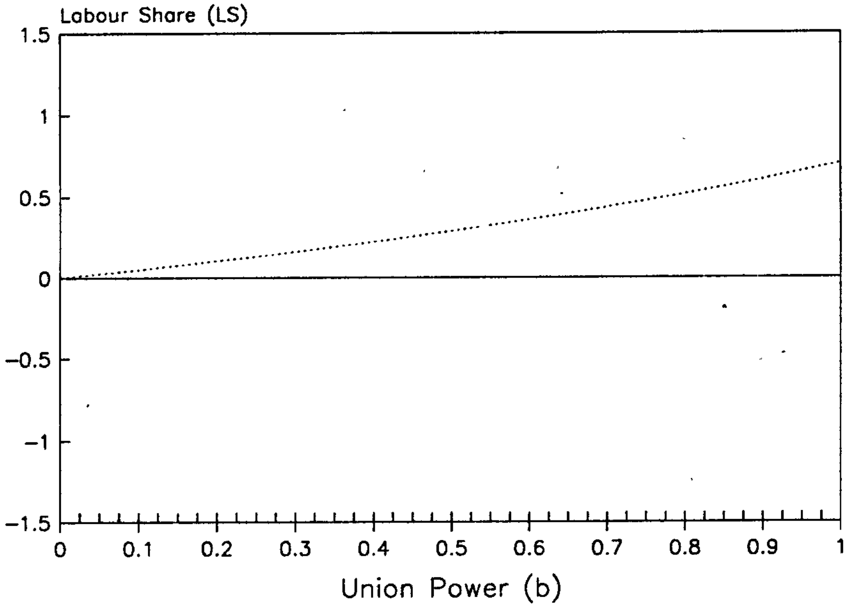

Fig. 2. Efficient bargaining

Letting $X=(1-\alpha)(1+\sigma/\varepsilon)+1$, we find a condition comparable to equation (1):

$$Q/L=f(Q_L)=f\left[\frac{\varepsilon}{\varepsilon+1}\left[\frac{w}{p}-\frac{b\phi_L}{(1-b)}\frac{(pQ-wL-\Omega)}{pL}\right]\frac{1}{X}\right] \tag{9}$$

This equation shows labour productivity as following real labour cost, but corrected for the net profit per worker weighted by union power. This implies the well-known result that optimal employment is higher with efficient bargaining. To find the price equation underlying (9) and (2) we use Euler's theorem, and obtain the following result:

$$p=\frac{1}{1-\text{Lerner}}\left[\frac{w}{A}+\frac{1}{(b\phi_L+1-b)}\left[b\phi_L\frac{\Omega}{Q}+X(1-b)\frac{r}{B}\right]\right] \tag{10}$$

with Lerner $=\dfrac{-(1-b)\{X(1-\varepsilon)-\varepsilon\}}{\varepsilon(b\phi_L+1-b)}$

This price equation can be compared with (5):

— The unit cost of capital r/B has been replaced by a weighted sum of the unit fall-back reference level Ω/Q and of the unit cost of capital.

— The Lerner index, which measures the monopoly power of the firm (i.e. the relative difference between output price and marginal cost), contains some elements in addition to the elasticity of demand: as $\mathrm{d\,Lerner}/\mathrm{d}b<0$, union power tends to decrease the monopoly power of the firm. The contract between the firm and the union contains an implicit cause about employment which forces the firm to reduce its output price in order to increase the demand for its good. This pressure on the price increases if union preference towards employment rises since $\mathrm{d\,Lerner}/\mathrm{d}\phi_L<0$, showing that union preferences in addition to union power are a crucial determinant of the firm's degree of monopoly. The result obtained here has to be confronted with the existing literature about monopoly power and unionism.

Monopoly Power and Unionism

(1) Let us first consider the general influence of unions on price determination. Kalecki (1939) develops an argument implicitly based on firm-level wage bargaining: the degree of monopoly of the firm is lessened by unionism because the increase in wages is not fully passed on to prices due to a competitive constraint. The firm hesitates to increase its price in response to a local wage claim. In our model, we have a different mechanism: the firm accepts to lower its price in order to honour its contract about the level of employment. Cowling and Waterson (1976) consider the effect of unionization on the mark-up, but introduce it only at the estimation stage as an additional variable which is not incorporated in their initial theoretical model. Our model provides a sound rationalization for this incorporation.

(2) Let us look next at the variables used to capture the influence of unions. Most empirically oriented industrial economics models (see also Cowling and Molho (1982)) have used proxies of 'union power' such as membership, proportion of days lost, etc. According to the approach of efficient bargaining we have developed, these empirical studies should include a proxy of the relative impatience of both parties[10] (determining b) and a proxy of the union's preference towards employment. It is not clear that the usual proxies are accurate reflections of either parameter.

With respect to the literature on monopoly power, we thus have the result that with efficient bargaining, the traditional Lerner index is

[10] This is actually a quite complex problem, and we have no pretense here of giving a full answer. One could think of including variables such as the perishability of output and the size of strike fund. According to the recent literature on bargaining games, however, these variables should rather be considered as entering the parties' fall-back levels (see Barth (1989) and Fehr (1990)). Thus the only way to link them up with the relative impatience parameter would be to make b a function of the fall-back utility levels themselves. This might be arguable in economic terms but has not, to the best of our knowledge, been derived in the theoretical literature.

corrected downwards for union power and for the elasticity of union utility with respect to employment: both these factors lessen the firm's monopoly power. This can give a firmer theoretical grounding to the empirical analysis of price-cost margin determination under unionism.

4. COMPARISON AND CONCLUSIONS

This paper has examined two models of wage bargaining introducing explicitly a monopolistically competitive firm. These two models give very contrasted results.

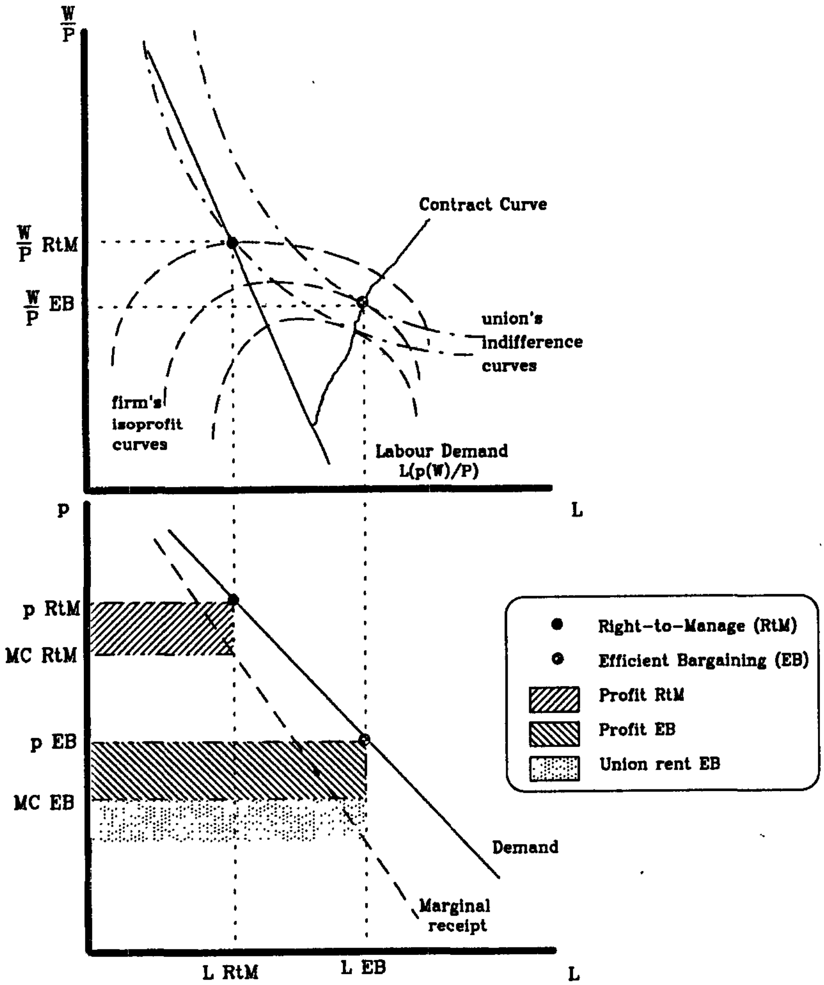

Fig. 3. Right-to-manage and efficient bargaining with a Leontief production function

The right-to-manage model leads to problematic conclusions because the wage claims of the union are generally not compatible with the mark-up requirement contained in the firm's price equation: the union is not able to extract any part of the monopoly rent that accrues to the firm. Moreover, it has to be powerful enough and to give strong preference to wages in order to be able to negotiate.

In the efficient bargaining model, the union negotiates also the employment level, which gives it a way of extracting part of the monopoly rent: indeed, the firm's commitment to an efficient employment level forces it to follow a pricing rule such that part of the surplus is transferred to the union.

The rent extraction argument can be illustrated graphically in the simple case of a Leontief technology. Figure 3 shows on the top the usual way of representing the difference between right-to-manage (equilibrium located on the labour demand) and efficient bargaining (equilibrium located on the contract curve). We add on the bottom the figure determining the pricing-rule. In the right-to-manage case, we find the usual mark-up while with efficient bargaining, the marginal cost is too high compared to the actual price; the difference between this marginal cost and the marginal cost that should have prevailed to be consistent with the price in a simple monopoly case is a rent that the union is able to extract. The subtraction of this rent from monopoly profit has been agreed upon by both parties during the negotiation so that the claims are by construction compatible.

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APPENDIX

Restrictions for $0 \leq \mathrm{LS} \leq 1 - \Omega R$ *in* (7)

As b and ΩR are always between 0 and 1, we need only to impose $\phi_w/\phi_L > \sigma$.

Restrictions for $0 \leq \mathrm{LS} \leq 1 - \Omega R$ *in* (6)

(A) Conditions to have $\mathrm{LS} \geq 0$

— let us compute the value of ϕ_w/ϕ_L for which the numerator of (6) is zero:

$$\phi^* = s - \alpha(\varepsilon + \sigma) - \alpha\left[\frac{(1-b)[1+\varepsilon]}{b[1-\Omega R]\phi_L}\right] \tag{A}$$

— Let us compute the value of σ for which the denominator of (6) is zero:

$$\sigma^* = \left[\frac{b[\phi_w + \phi_L \varepsilon\alpha] + (1-b)[1+\alpha\varepsilon]}{(1-\alpha)[1-b+b\phi_L]}\right] \tag{B}$$

The conditions to have $LS \geq 0$ are:

(1a): the numerator of (6) is ≥ 0 and the denominator is > 0, i.e.:

$$\phi_w/\phi_L \geq \phi^* \text{ and } \sigma < \sigma^*$$

or (1b): the numerator of (6) is ≤ 0 and the denominator is < 0, i.e.:

$$\phi_w/\phi_L \leq \phi^* \text{ and } \sigma > \sigma^*$$

Because $\phi_w \geq \phi_L \phi^*$ as in condition (1a), σ^* in (B) becomes:

$$\sigma^* \geq 1 - \left[\frac{\Omega R\alpha[1+\varepsilon]}{(1-\alpha)[1-\Omega R]}\right] > 1 \tag{C}$$

(B) Conditions to have $LS \leq [1-\Omega R]$
Let us compute the value of σ for which $LS = [1-\Omega R]$

$$\sigma^{**} = 1 - \left[\frac{\Omega R\alpha[1+\varepsilon]}{(1-\alpha)[1-\Omega R]}\right] > 1 \tag{D}$$

The conditions to have $LS \leq [1-\Omega R]$ are:

(2a): the denominator of (6) is > 0:

$$\sigma < \sigma^* \text{ and } \sigma < \sigma^{**}$$

or (2b): the denominator of (6) is < 0:

$$\sigma > \sigma^* \text{ and } \sigma > \sigma^{**}$$

Comparing equations (C) and (D), we see that $\sigma^* \geq \sigma^{**}$. Let us write the two conditions together:

$0 \leq LS \leq 1 - \Omega R$ if

$$\sigma_w/\phi_L \geq \phi^* \text{ and } \sigma < \min(\sigma^*, \sigma^{**}) = \sigma^{**}$$

or

$$\phi_w/\phi_L < \phi^* \text{ and } \sigma > \max(\sigma^*, \sigma^{**}) = \sigma^*$$

Comments

If σ is above a certain limit $\sigma^* > 1$ we must put an upper bound ϕ^* on the union's relative preference for wages ϕ_w/ϕ_L to have $0 \leq LS \leq 1 - \Omega R$: the substitutability between L and K is so high that the union should not give too much preference to wages if we want to avoid a negative labour share.

If σ is below a certain limit $\sigma^{**} > 1$, we must put a lower bound ϕ^* on the union's relative preference for wages ϕ_w/ϕ_L.

A sufficient condition for $0 \leq \mathrm{LS} \leq [1 - \Omega R]$ is $\sigma < 1$ and $\phi_w/\phi_L \geq \phi^*$. In that case, we see from equation (A) that $\phi^* > \sigma$. Therefore, if $\sigma < 1$, the competitive case if less restrictive than the price-making case as it requires only $\phi_w/\phi_L \geq \sigma$.

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