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WORK RULES, FEATHERBEDDING, AND PARETO-OPTIMAL UNION-MANAGEMENT BARGAINING

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ABSTRACT

The recent literature on the economic behavior of unions is dominated by a controversy over whether or not bargaining is Pareto optimal. If unions care about employment as well as wages, efficient bargains between unions and management "should" involve both these variables rather than only wages. In fact, explicit bargaining over employment levels is virtually unknown. There is, however, implicit bargaining over employment in the form of rules concerning the labor/capital ratio, job assignment, work speeds, and the like. This paper examines a model of "semi-efficient" bargaining in which the union and the firm bargain over wages and various types of work rules. The results are compared to the outcomes that are associated with fully efficient bargaining (i.e., over wages and the level of employment) and bargaining solely over wages. Of particular interest is the case in which the union and the firm mutually consent to "featherbedding" agreements (requiring the hiring of workers with zero marginal product). The major conclusion of the paper is that the outcome of collective bargaining is different in the case of negotiations over work rules and wages than in both the cases of fully efficient bargaining and of bargaining solely over wages. In general, however, the outcome of this "partially efficient" bargaining process is closer to the outcome of bargaining solely over wages than to that associated with fully efficient bargaining over both wages and employment.

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1. The Issues

In the burgeoning literature on the behavior of trade unions[1] there is considerable controversy about, among other things, what unions and management bargain about. The conventional approach is to specify that the union and the firm first negotiate a contract specifying the wage level and structure that will be in effect for a specified period of time. The firm is then free to set the values of employment and the other inputs so as to maximize profit. To the extent that the union cares about employment as well as wages, the union's bargaining position will depend in part on its perception of the elasticity of labor demand.[2] An alternative approach is based on the recognition that a bargaining outcome that lies on the labor demand curve will not be Pareto optimal. If the union receives utility from both employment and wages in excess of opportunity cost, certain combinations of a reduction in the wage and an increase in employment off the demand curve can make both the firm and the union better off. The contract curve between the wage and the employment level that is derived from efficient bargaining is less negatively sloped than the demand curve and may, indeed, be vertical or upward-sloping.

Which of these approaches, the demand curve model or the contract curve model, is more accurate has important macroeconomic implications (see Hall and Lilien and MacDonald and Solow). The two models also have different implications concerning the efficiency losses associated with unionism. With bargaining over both wages and employment the effect of higher union wages is essentially a reduction in monopoly profit; if the equilibrium is on the demand curve (as in Johnson and Mieszkowski), union gains cause a small decline in GNP but are primarily at the expense of nonunion workers. The relative validity of the two hypotheses is also crucial to an understanding of what unions are all about, a question of interest primarily to labor economists (but not without public policy implications). Accordingly, there have been some attempts to test the implications of the two approaches (Ashenfelter and Brown, Carruth and Oswald, and MaCurdy and Pencavel) for specific unions.

For the contract curve model to be superior to the demand curve model, it must be true that management and unions generally bargain --either directly or indirectly -- over employment. In fact, the level of employment is almost never the subject of explicit negotiation in collective bargaining (see Oswald (1984)). The usual reason given for this (see Farber (1985) and Ashenfelter and Brown) is that an agreement on employment must be made conditional on something, and the employer, who usually has better information about current product demand and the like, has a strong incentive to cheat. If the union suspects cheating, it will obviously be reluctant in future negotiations to trade off wages for empty promises of employment above profit-maximizing levels, and it will choose to bargain only over wages -- the demand curve model.

On the other hand, **indirect** bargaining over employment is fairly common in the U.S. and other developed countries.[3] First, the minimum number of workers assigned to each machine or operation is sometimes the subject of labor-management negotiations. Employment is then equal to the negotiated labor/capital ratio times the amount of capital the firm chooses to use. In the extreme, an agreement could specify that the firm must hire more workers per machine than can conceivably be productive, which is described as "featherbedding" ("overmanning" in the U.K.). Second, unions and management often bargain over work intensity -- the pace of work, the number of different functions each worker can be ordered to perform, the number and length of coffee breaks, and so forth. For a given demand for "efficiency units" of labor, the level of employment will be inversely related to how intensely the firm is allowed to make its employees work. Compliance with agreements over the capital/labor ratio and the pace of work are also, unlike the total volume of employment contingent on the state of product demand, fairly easily monitored.

This paper is concerned with the implications of Pareto-efficient bargaining over certain variables that determine employment indirectly as well as wages. Is there a presumption that the negotiated capital/labor ratio will be higher than it would be if the firm could set its value unilaterally? Will work intensity be higher or lower under unionism? To what extent does the outcome with bargaining over the labor/capital ratio and/or work intensity resemble the outcome of an efficient bargain over employment and wages? Under what circumstances does efficient bargaining yield an outcome of featherbedding? These are rather obvious questions to a labor economist, but they have not been addressed in the literature in a straightforward manner. (An unstraightforward approach to some of these issues is Tauman and Weiss.) The plan of the remainder of the paper is as follows: Section 2 reviews the distinction between the demand curve and contract curve models; Section 3 examines the case of efficient bargaining over the capital/labor ratio; Section 4 looks at featherbedding; Section 5 investigates the determination of work intensity with and without efficient bargaining; and Section 6 contrasts profit sharing agreements with models of fully efficient bargaining over employment. Section 7 summarizes the main conclusions.

2. Demand Curve and Contract Curve Models

Although the distinction between the demand curve (DC) and contract curve (CC) models of bargaining outcomes is fairly well-known,[4] it is useful to set out their basic results for purposes of comparison with the work restrictions models presented subsequently.

First, a monpolistic firm hires N homogeneous workers (who work an exogenously fixed number of hours over the unit of time) and rents K units of capital to produce output level Q. The production function exhibits constant returns in N and K, and it is assumed initially that its elasticity of capital-labor substitution is positive and finite. The profit equation for the firm is

$$(1) \quad \pi = V(Kf(N/K)) - WN - rK,$$

where V is revenue as a function of output, W the wage rate the firm has negotiated with the union, and r the rental price of machinery. By the DC model, the firm and the union first determine W in collective bargaining negotations, and then the firm chooses N and K to maximize profit given the negotiated value of W. This implies that $\partial\pi/\partial N = V'f' - W$ and $\partial\pi/\partial K = V'[f-zf'] - r$ are both set equal to zero. The labor/capital ratio (z) is determined from the single equation in which the ratio of the marginal products of labor and capital equal the ratio of their prices, $f'/(f - zf') = W/r$, and $-\partial(\log z)/\partial(\log W) = \sigma$, the elasticity of labor/capital substitution. The effect of a change in W on the level of capital input is then found by taking the logarithmic total derivative of either of the first order conditions and solving for d(log K) to obtain

$$(2) \quad \frac{\partial(\log K)}{\partial(\log W)} = \alpha(\sigma-\epsilon),$$

where $\alpha = f'z/f$ is the employment elasticity of output and $\epsilon = -1/(V''Q/V')$ is the inverse of the absolute elasticity of marginal revenue with respect to quantity of output.[5] Since $N = zK$, the absolute wage elasticity of labor demand is

$$(3) \quad \eta = - \frac{\partial(\log N)}{\partial(\log W)} = a\epsilon + (1-a)\sigma.$$

This is, of course, analogous to the Hicks wage elasticity of demand in a competitive industry.

There is much less agreement on what the union strives to accomplish through collective bargaining. It has become quite common to assume that the utility of "the union" is a general function of the negotiated wage, employment, and the alternative wage (W_a) available to union members. For the purposes of this paper it is convenient to assume that the union utility function takes the form

$$(4) \quad R = (W-W_a)^{\beta}N, \; \beta > 0.$$

$W - W_a$ is the rent of the individual union worker -- the difference between the union wage and that of a relevant comparison group of (presumably nonunion) workers. One special case of (4) is that of $\beta = 1$, collective rent maximization, which is the most common assumption in the literature. More generally, the union cares relatively more about wages or employment as $\beta \gtrless 1$. A second important special case is that in which the union cares **only** about wages, $\beta=\infty$. This would arise if, for example, there were a strict seniority system governing layoffs and the median union member neither perceives any danger of losing his job nor cares about the welfare of less senior workers. $\beta=\infty$ is also implicit in the "institutionalist" bargaining models of Ashenfelter and Johnson and Farber (1977) in which the union leadership can only agree to a wage level at least as large as that anticipated by rank-and-file union members.

Holding R constant, the reduction in wages that the union would accept for a unit increase in employment is determined from

$$(5)\quad \left(\frac{dW}{dN}\right)_{\bar{R}} = -\frac{1}{\beta}\left(\frac{W-W_a}{N}\right),$$

which is negative for $W > W_a$ and $\beta < \infty$. If the union had complete power in the context of a DC bargaining process, it would set W so as to maximize R subject to the firm's labor demand function. It would, in this circumstance, continue to raise W so long as $\beta > \eta(W-W_a)/W$ unless profit becomes zero and the firm is in danger of shutting down.

The problem with the DC model is that at any initial negotiated wage both the union and the firm could be made better off by an appropriate agreement to reduce W and increase N. The iso-profit curve for the firm is given by

$$(6)\quad \left(\frac{\partial W}{\partial N}\right)_{\bar{\pi}} = \frac{V'f'-W}{N}.$$

In Pareto-efficient bargaining, the firm and the union will trade off wages and employment such that the slopes of the iso-profit and iso-rent curves are equal. Equating (6) with (5), the marginal revenue product of labor in the contract curve (CC) model is set equal to a weighted average of the negotiated and alternative wage rates:

$$(7)\quad V'f' = W\left(1 - \frac{1}{\beta}\right) + W_a\,\frac{1}{\beta}.$$

This, along with the marginal condition for capital, $V'(f-zf')=r$, allows one to derive the slope of the contract curve. First, the proportionate effect of W on the labor capital ratio is

$$(8) \quad \frac{\partial(\log z)}{\partial(\log W)} = -\sigma \frac{W(\beta-1)}{W(\beta-1)+W_a},$$

which is $\gtrless 0$ as $\beta \gtrless 1$. The next step is to derive $\partial(\log K)/\partial(\log W)$ by substituting (8) into the total logarithmic derivative of the marginal condition for capital. Then, since $d(\log N) = d(\log z) + d(\log K)$, it follows that

$$(9) \quad \frac{\partial(\log N)}{\partial(\log W)} = -\eta \frac{(1+\mu)(\beta-1)}{\beta+\mu(\beta-1)},$$

where η is the absolute elasticity of demand in the DC model (see (3)) and $\mu=(W-W_a)/W_a$ is the negotiated effect of the union on the relative wage rate. If $\beta > 1$, which means that the union cares relatively more about wages than employment, the contract curve has a negative slope. It is less negative than in the DC model unless $\beta = \infty$ (the union cares only about wages), in which case the CC model degenerates to the DC model. When the union cares more about employment than wages ($\beta < 1$), the contract curve has a positive slope.

It is useful for subsequent purposes to calculate labor's share of total cost, $s=Wz/(Wz+r)$. To do this, note that the condition for profit maximization with respect to K can be rewritten as $V'f = V'f'z+r = W(1-1/\beta) + W_a/\beta+r$. $V'f'z$ equals (7) multiplied by z, so $a = f'z/f = W_*z/(W_*z+r)$, where W_* is the weighted average of W and W_a given by (7). The resultant labor cost share in the CC model is then easily found to be

$$(10) \quad s = \frac{a\beta(1+\mu)}{\beta+\mu(\beta+a-1)},$$

and the labor/capital ratio is

$$(11)\quad z = \frac{\alpha}{1-\alpha}\,\frac{r}{W_*}$$

$$= \frac{\alpha}{1-\alpha}\,\frac{r}{W_a}\,\frac{\beta}{\beta - \mu(1-\beta)} \ .$$

It is straightforward to show that $s>\alpha$ and $z>(\alpha/(1-\alpha))r/W$, their profit-maximizing values, if $\beta<\infty$ and $\mu>0$.

3. Efficient Bargaining Over the Labor/Capital Ratio

For the reasons discussed in Section 1, bargaining over W and N may not be feasible, but in many instances unions bargain over the nature of the production function. One fairly common practice is for the union and the firm to bargain over the number of workers who must be assigned to each machine. Such an agreement is fairly easily monitored, for the contract specifies that if a particular machine is used over a certain period it must have X workers "manning" it.[6] In contrast to the DC and CC models of the preceding section, the union and the management first jointly determine W and z, and then the firm sets K (and hence N = zK) so as to maximize profit. This model (LC, for labor/capital) is identical in form to the CC model except that z rather than N is determined in the bargaining process.[7] The interesting questions concern how the outcome -- in terms of the value of z and the relation between N and W -- compare with the DC and CC models.

To derive the contract curve for this model, it is first necessary to see how the negotiated values of W and z influence the firm's demand for capital, for this will be taken account of in the bargaining process. The profit function, (1), may be rewritten as $\pi=V(Kf(z)) - [Wz+r]K$, and the condition for maximum profit, conditional on the negotiated values of W and z, is

$$(12)\quad \frac{d\pi}{dK} = V'(Kf(z))f(z) - [Wz+r] = 0,$$

subject to the second-order condition that marginal revenue declines with Q. Differentiating logarithmically and solving for d(log K), the effects of changes in W and z on K are

$$(13)\quad d(\log K) = -\epsilon s d(\log W) - (\alpha+(s-\alpha)\epsilon)(\log z).$$

s=Wz/(Wz+r), labor's share of total cost, can no longer be assumed to equal α.

The next step is to derive the iso-profit and iso-utility functions for the two parties. The first of these is analogous to its equivalent in the CC model.

$$(14)\quad \left(\frac{dW}{dz}\right)_{\bar{\pi}} = \frac{V'f'-W}{z}$$

or, in proportional terms,

$$(15)\quad \left(\frac{d(\log W)}{d(\log z)}\right)_{\bar{\pi}} = -\frac{s-\alpha}{s}.$$

The second result is obtained by substituting (Wz+r)/f for V' and multiplying both the numerator and the denominator by z/(Wz+r), and it gives the proportion by which the firm would require W to change in order to increase z by a certain proportion. Given the utility function of the form of (4), the union must formulate its position with respect to W and z with consideration to how the firm will vary K in response to variations in z and W. The slope of the union's iso-utility curve is

$$(16)\quad \left(\frac{d(\log W)}{d(\log z)}\right)_{\bar{R}} = - \frac{1 + \frac{\partial(\log K)}{\partial(\log z)}}{\beta\frac{W}{W-W_a} + \frac{\partial(\log K)}{\partial(\log W)}}$$

$$= - \frac{1 - \alpha - (s-\alpha)\epsilon}{\beta\frac{W}{W-W_a} - s\epsilon},$$

which makes use of (13). It should be pointed out that s must be less than the smaller of $\beta(W/(W-W_a))/\epsilon$ and $\alpha+(1-\alpha)/\epsilon$ in order for the union's indifference curve in W-z space to be downward-sloping. A sufficient condition for both parties to be willing to move off the demand curve by increasing z is that the slope of $(d(\log W)/d(\log z))_{\bar{R}} < 0$ at $s=\alpha$. This requires that $\beta(1+\mu) > \mu\alpha\epsilon$.

An efficient contract over W and z will be such that the tradeoffs between the two variables for the firm and the union are equated, as with point A in Figure 1. Setting (15) equal to (16) and solving for s, the resultant labor's share of total cost is seen to be

$$(17)\quad s = \frac{\alpha\beta(1+\mu)}{\beta+\mu(\beta+\alpha-1)},$$

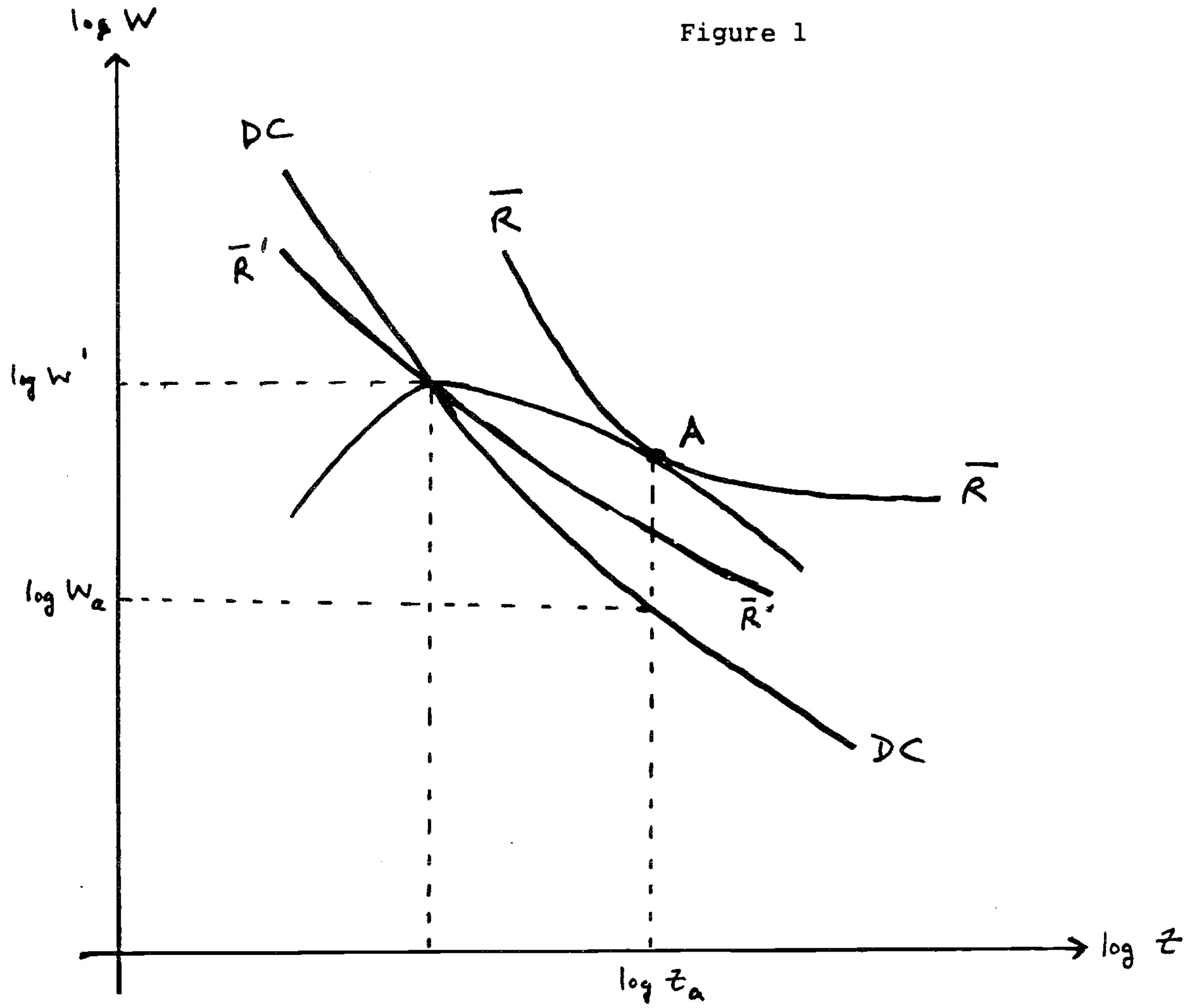
and the negotiated labor/capital ratio is

$$(18)\quad z = \left(\frac{\alpha}{1-\alpha}\right)\left(\frac{\beta}{\beta-\mu(1-\beta)}\right)\left(\frac{r}{W_a}\right).$$

These are precisely the same values that obtain in the "fully Pareto-optimal" bargaining under the CC regime (see (10) and (11)).

The interesting question is the difference in the models concerning the relation between employment and the negotiated wage. This is most clearly seen by examining the special case of rent maximization (β=1). The elasticity of labor demand in the DC model is $\eta=\alpha\epsilon+(1-\alpha)\sigma$, and the contract curve in the

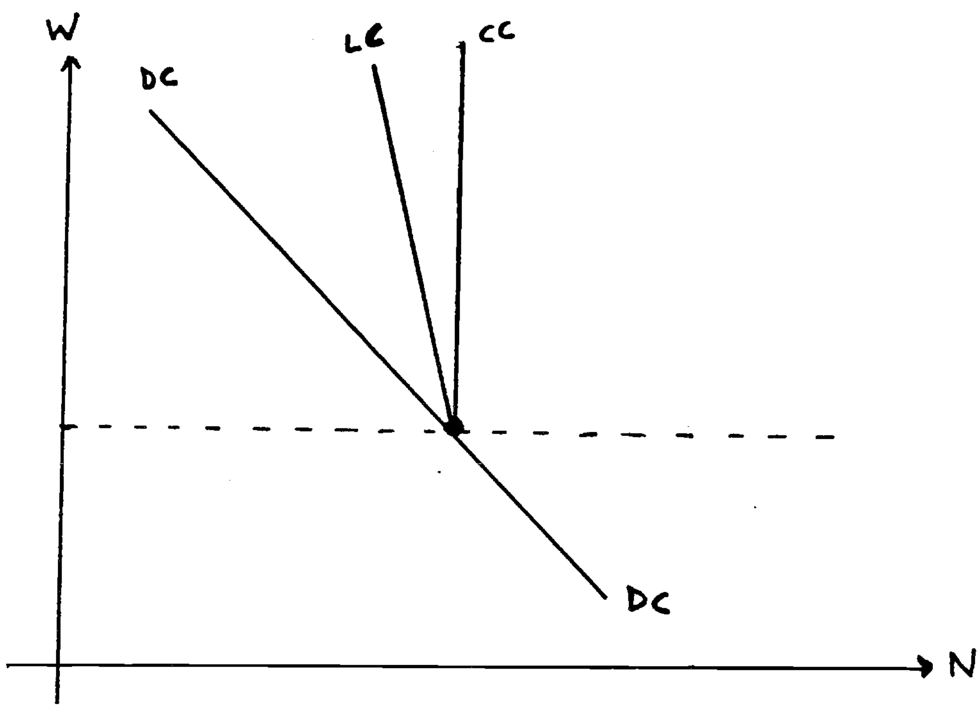
Figure 1



CC model is zero in this case. In the LC model, z equals its nonunion value and is independent of W, so, since N=zK, the absolute elasticity of N with respect to W equals $-\partial(\log K)/(\partial \log W)$, which, by (13), is $s\epsilon$. For small values of μ, s is approximately equal to α, so the elasticity of N with respect to W in the LC model equals its value in the DC model less the capital-labor substitution component, $(1-\alpha)\sigma$. As μ gets large, $s-\alpha=\alpha(1-\alpha)\mu/(1+\alpha\mu)>0$, and the absolute wage elasticity of employment in the LC model rises. However, it is less than η if $\mu<\sigma/\alpha(\epsilon-\sigma)$, which is likely over the plausible range of the parameters. The observed relation between N and W for the three models for the rent maximization case is depicted geometrically in

Figure 2. The curve for LC model is the closer to that for the CC model the larger is the proportion of η accounted for by capital-labor substitution. For a low value of the elasticity of substitution and/or small fraction of capital cost to total cost, the LC model yields essentially the same result as the DC model.

Figure 2



The general result concerning the relation between employment and the negotiated wage is

$$(19) \quad -\frac{\partial(\log N)}{\partial(\log W)} = \frac{1+\mu}{\beta+(\beta+a-1)\mu}\,[\beta\eta-(1-a)\sigma].$$

For $\beta=\infty$ (maximization of the net wage rate), this reduces to η, and the LC model (as well as the CC model) degenerates to the DC model. In the neighborhood of $\mu=0$, the absolute slope of the N-W relation for the LC model is between those of the other two models so long as β is finite. The N-W relation has a positive slope at $\mu=0$ if $\beta<(1-\alpha)\sigma/\eta$ (compared to $\beta<1$ in the CC model).

An interesting variant of the LC model is based on the assumption that unions and management bargain over workers per unit of output rather than per machine.[8] The collective bargain sets $q=N/Q$ and W efficiently, and the firm sets Q and K so as to maximize profit. The results of this model are **identical** to those of the LC model, the demonstration of which is left to the interested reader.

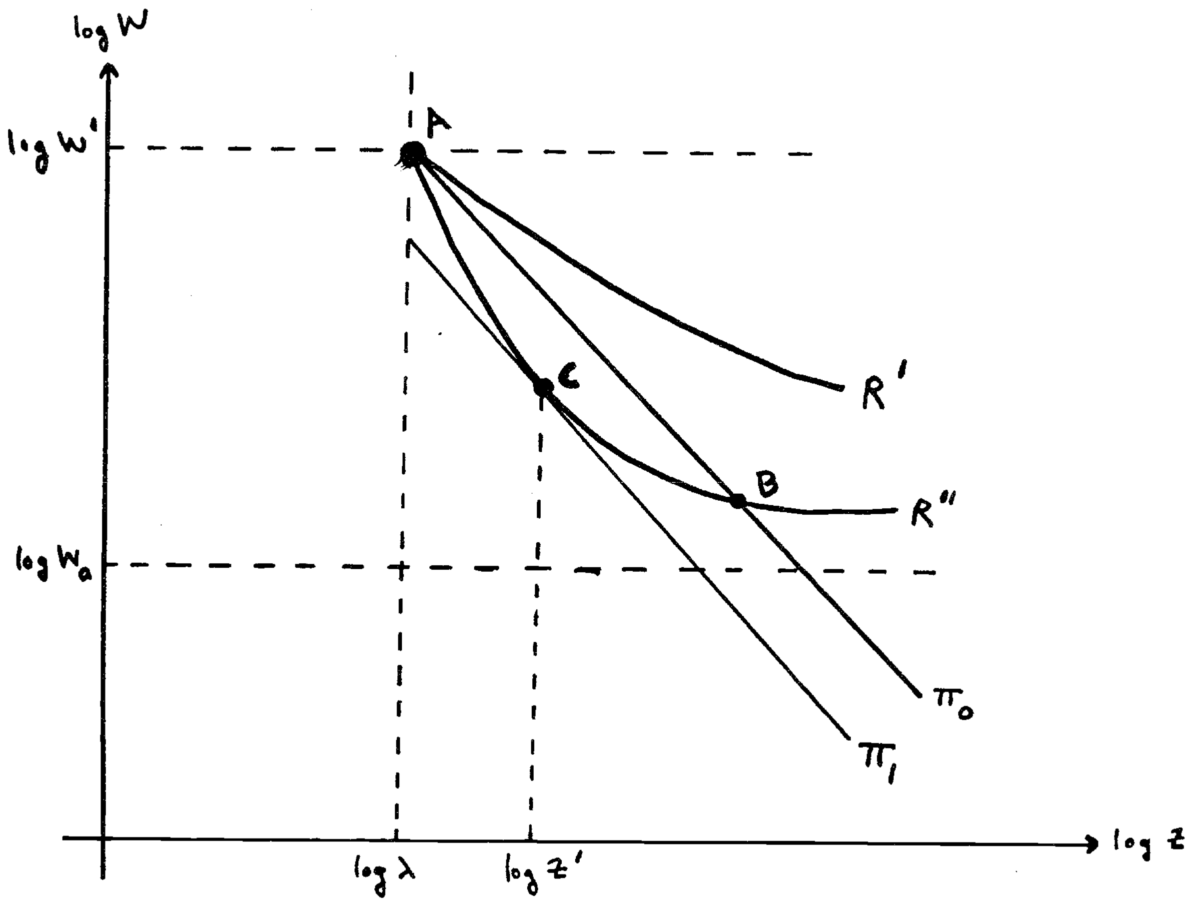
4. Efficient Featherbedding

An important implication of both the CC and LC models is that, given that both parties have the requisite information concerning technological possibilities, they will agree on a capital/labor ratio that makes full use of all workers hired. There is no "featherbedding" in the sense that a fraction of the work force of the firm will have literally nothing to do. Instead, an "efficient" contract will be "inefficient" in the sense that management would **prefer** to use a more capital-intensive technology but, given the bargaining process, they do the best they can with the negotiated z. In, for example, the case of rent maximization ($\beta=1$), the advent of a union with a negotiated wage above the initial W_a would mean that the firm would want to increase the capital intensity of its production process. Under the LC model, however, the firm and the union agree to retain the original technology,[9] so the firm can only minimize the damage of the imposed wage increase by reducing K, N, and Q by the same proportion (roughly $\alpha\bar{\epsilon}$ times the wage increase). Under the CC model, the firm and the union agree that the employment level will stay at its original level, so the firm maximizes profit by renting the same K and selling the same Q at the same price (so all union gains come at the expense of profit rather than consumers).

The conclusion of the LC model concerning the absence of featherbedding depends crucially on the assumption that there exists an infinite number (or, at least, several) technologies available to the firm. Suppose, however, that there is only **one** technology in the relevant range. Output is a linear function of the number of machines in use (K) subject to the constraint that each machine be operated by no fewer than λ workers. There is no increase in output associated with setting z above λ, so the iso-profit curves (in terms of logarithms) have a slope of -1 for $z>\lambda$ (set $\alpha=0$ in (15)). This means that in order for the firm to agree to "overmanning" ($z>\lambda$), the union must be willing to reduce wages by one percentage point for each percentage point increase in the labor/capital ratio. The rate at which the union is willing to sacrifice wages for employment is seen by (16) to be $(d(\log W)/d(\log z))_{\bar{R}} = -(1-s\epsilon)/(\beta((1+\mu)/\mu)-s\epsilon)$. In order for the union and the firm to agree to a featherbedding arrangement, it must be true that at $z=\lambda$ (i) the union's indifference curve is downward-sloping (which requires that $s\epsilon$ be less than one) and (ii) $-(d(\log W)/d(\log z))_{\bar{R}}>1$. The second of these conditions requires that $\beta<\mu/(1+\mu)$, which means that the union must place a much greater weight on employment than wages in its utility function for featherbedding to be mutually advantageous.

The geometry of the featherbedding story is shown in Figure 3. Assume that the initial equilibrium is at point A, with W=W' and $z=\lambda$. If the union's indifference curve were like R' (as would be the case with, for example, rent maximization), there would be no incentive for the firm and the union to bargain over z, and featherbedding would not occur. If, however, β were sufficiently small that the union's indifference curve were very steep at $z=\lambda$, as is true for R", there will be featherbedding. Both the firm and the union are indifferent between points A and B, and the firm would have higher profits with the same level of utility for the union at point C. Obviously a mutually agreeable bargain over z and W can be struck that yields a higher level of utility to the union than R" and a profit level between π_0 and π_1.

Figure 3



It is worth stressing that the conditions under which both sides will agree to the existence of featherbedding are rather stringent. First, there cannot be a more labor intensive technology available in the relevant range, for it will always pay both parties to move to it rather than force the firm to hire useless labor. Second, the workers represented by the union cannot be a large share of the total cost of the firm (for $s\epsilon$ must be < 1; otherwise the union's indifference curve may be upward sloping). Third, the range of bargaining outcomes must be such that the workers are receiving very large rents (high values of μ). Fourth, the union will only push for featherbedding when employment is valued much more than wages (a value of β much less than one). This would be most likely for a union representing workers for whom demand has fallen, say due to an exogenous technical innovation. Two examples of unions that meet these criteria are those representing railroad firemen and newspaper typographers. Industrial unions, which represent all production workers in a firm would, by this model, be less likely to bargain for blatantly unproductive work rules.

5. Bargaining Over Work Intensity

A second way in which unions and management can bargain indirectly over employment is by jointly determining the pace or intensity of work. This may involve the speed of the assembly line, the number of tasks each worker can be told to perform, the number and length of coffee breaks, and a myriad of other nitty-gritty issues.[10] One way to represent this is to assume that the firm's output is a linear homogeneous function of capital and efficiency units of labor services,

$$(20) \quad Q = kf\left(\frac{bN}{K}\right),$$

where f has the usual properties and b is an index of the intensity of work that is either mandated by management or negotiated in collective bargaining. An increase in b, of course, plays a role in the firm's productive function that is similar to labor augmenting technical change in models of economic growth.

Before investigating how b might be treated in the context of union-management bargaining, it is first necessary to specify how work intensity would be determined in the absence of unionism. An increase in work intensity -- at least beyond a certain low level below which workers are bored -- presumably lowers the overall attractivness of a job and requires a compensating differential. Let the utility level associated with a particular job be a function of the wage rate and work intensity, say $U=U(W,b), U_W>0$, and $U_b<0$.[11] For the set of jobs requiring a given set of human capital characteristics, the market utility level is U^a, so a firm's choice of W and b is constrained by the fact that U(W,b) must equal U^a. This means that an increase in the firm's work intensity requires that the wage must rise by $dW/db=-U_b/U_W$. In proportionate terms, $\partial(\log W)/\partial(\log b)=\gamma$, where γ is the ratio of the absolute elasticity of utility with respect to work intensity to the elasticity of utility with respect to consumption. γ should increase with b, reflecting the rising marginal disutility of bad working conditions relative to the marginal utility of consumption.

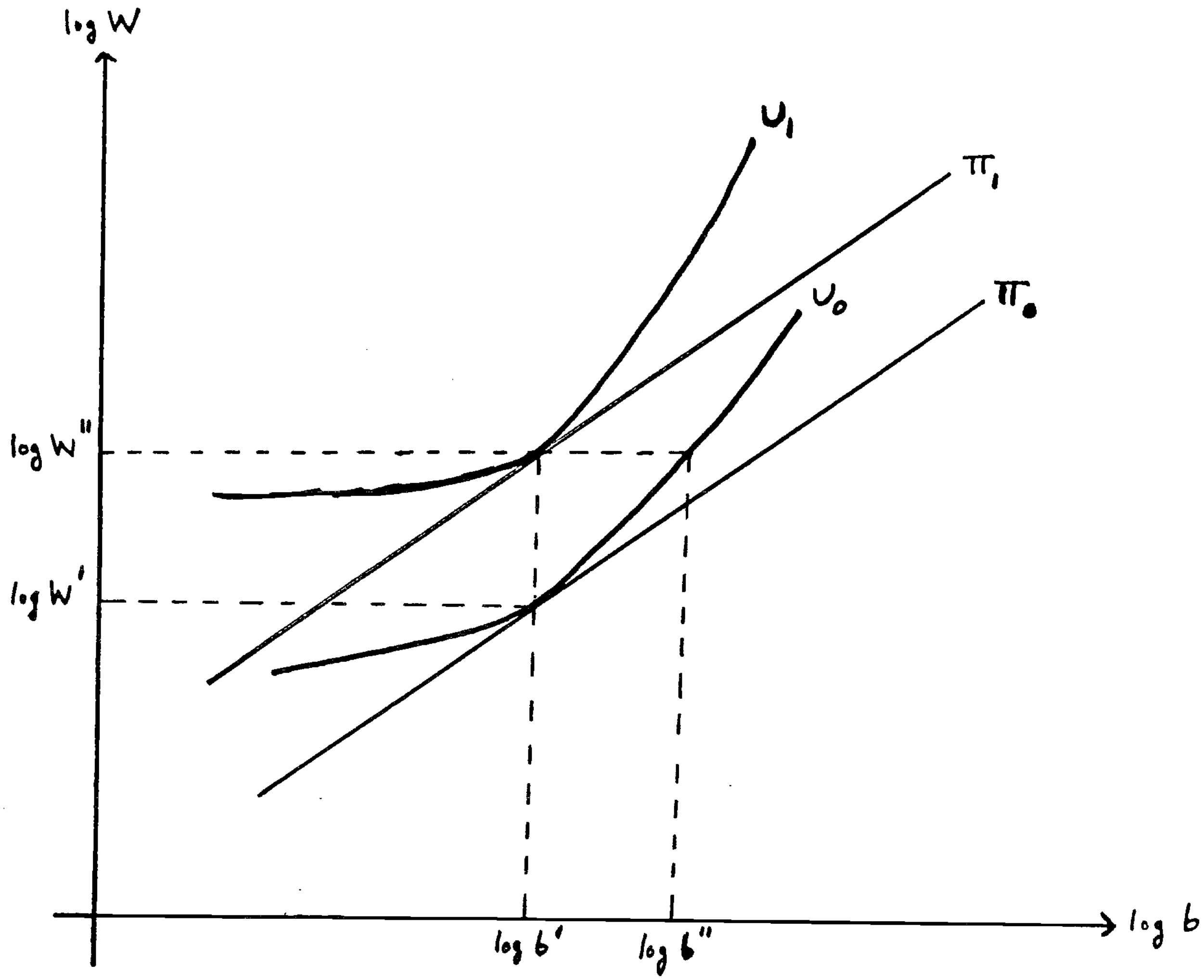
The profit equation is now (1) with the modification embodied in (20). Its total derivative with respect to employment, the wage, and work intensity is

$$(21)\quad d\pi = (V'bf'-W)Nd(\log N) - WNd(\log W) + V'bf'Nd(\log b).$$

For a nonunion firm, the coefficient on d(log N) is zero, so the firm chooses b such that $\gamma=1$. This is illustrated in Figure 4. Given that the market utility level is U_0, the firm maximizes profit by setting work intensity at b' and the wage at W'.

An increase in the market utility level, reflecting higher average real wage rates in the economy due to technical progress, can cause the equilibrium

Figure 4



level of work effort in the nonunion sector to increase or decrease depending on whether the positive substitution effect is greater or less than the absolute value of the (presumably negative) income effect.[12] For purposes of contrasting the determination of b in collective bargaining with that in nonunion situations, however, it is useful to **assume** that the equilibrium value of b is independent of the wage level. (Otherwise, the role of bargaining in determining b becomes confounded with the effects of the union on utility per worker.) The most straightforward way to do this is to specify that (a) the utility is additively separable in W and b and (b) the elasticity of utility with respect to W is constant. With the (unnecessary but expositionally convenient) additional assumption that the marginal utility of income is constant, the utility function becomes $U=W\phi(b)$, where $\gamma=-\phi'b/\phi$ and $d\gamma/db>0$.

How will work intensity compare with its nonunion value if it is subject to bargaining between the union and the firm? First, it is clear that there **must** be an explicit bargain over (or a very clear implicit understanding about) the value of b if the union is to be able to improve the welfare of its members. Suppose this were not so and the determination of work intensity (like the values of N and K) is considered a "management prerogative." Then, if the initial bargain solely over wages yields an increase from W' to W" (see figure 4), the firm will increase intensity from b' to b", thus leaving the utility of each worker at the nonunion level. The firm, of course, suffers a slight decrease in profit due to the wage increase, but, by making its employees work harder, the firm minimizes the damage caused by the union.

To analyze bargaining over work intensity, the union's preferences must be modified to reflect the disutility associated with work intensity. The analogue of (4) is

$$(22)\quad R = (W\phi(b) - U_a)^{\beta}N,$$

where U_a is the alternative (nonunion) utility level available to union members. β is, as in Section 2, an index of the relative importance to the union of individual utility versus employment. The logarithmic total derivative of (22) is

$$(23)\quad d(\log R) = d(\log N) + \beta \frac{W\phi}{W\phi - U_a} d(\log W) - \beta \frac{W\phi}{W\phi - U_a} \gamma d(\log b).$$

The nature of an efficient bargain between the firm and the union depends on which variables are "on the table." First consider the case in which there is bargaining over N, W, and b, the equivalent of the CC model investigated in Section 2. The proportionate tradeoffs of N and b for W from the iso-profit and iso-utility curves are seen by (21) and (23) to be

$$\left[\frac{\partial(\log W)}{\partial(\log N)}\right]_{\bar{\pi}} = \frac{V'bf' - W}{W} \qquad \left[\frac{\partial(\log W)}{\partial(\log N)}\right]_{\bar{R}} = -\frac{W\phi - U_a}{\beta W\phi}$$

$$\left[\frac{\partial(\log W)}{\partial(\log b)}\right]_{\bar{\pi}} = \frac{V'bf'}{W} \qquad \left[\frac{\partial(\log W)}{\partial(\log b)}\right]_{\bar{R}} = \gamma$$

By setting the rates of substitution of employment for wages equal for both parties, the marginal revenue product of labor in contract equilibrium is seen to be

$$(24) \quad V'bf' = W(1-\frac{1}{\beta}) + W_a \frac{\phi(b_a)}{\phi(b)} \frac{1}{\beta},$$

where $\phi(b_a)=U_a/W_a$. Notice that if the bargained level of work intensity remains at its nonunion level, $\phi(b_a)=\phi(b)$, and (24) reduces to (7). In general, however, it will not be true that $b=b_a$. Let $\mu=(U-U_a)/U_a$ be the proportionate impact of the bargaining outcome on individual utility. This implies that the ratio of the marginal revenue product to the negotiated wage in contract equilibrium is

$$(25) \quad \frac{V'bf'}{W} = 1 - \frac{1}{\beta}\frac{\mu}{1+\mu},$$

which is less than one unless the union cares nothing about employment ($\beta=\infty$) or if the union has no success in bargaining ($\mu=0$). Equating the two rates of substitution of work intensity for wages, the value of b in contract equilibrium is set such that γ is less than one. Since γ increases with b, the negotiated level of work effort is less than b_a.

The reason for this result is that as part of the efficient bargain the firm must agree to hire more workers than it would choose if it were free to maximize profit. The loss in profit due to decreasing b is related to the value of the marginal product of labor, but, since this must be artificially low, it is relatively less costly for the firm to make concessions with respect to work intensity than would be true if N were at the discretion of management. Referring to Figure 4, the value of d(log W)/d(log b) is less than one for $\mu>0$, so the iso-profit curve is tangent to the iso-utility curve R" at a value of work intensity less than b".

Now assume that the firm and the union bargain only over W and b, the equivalent of the DC model in Section 2. The union must now take account of the effect of variations in both W and b on employment. It is straightforward to show that

$$(26)\quad d(\log N) = -\eta d(\log W) + (\eta-1)d(\log b),$$

where $\eta=\alpha\epsilon+(1-\alpha)\sigma$. An increase in work intensity raises or lowers N as $\eta \lessgtr 1$. The firm is free to maximize π with respect to N, so V'bf'=W and $(d(\log W)/d(\log b))_{\bar{\pi}}=1$. The tradeoff between W and b for the union is now

$$(27)\quad \left(\frac{\partial(\log W)}{\partial(\log b)}\right)_{\bar{R}} = \frac{\beta \frac{W\phi}{W\phi-U_a}\gamma - \eta + 1}{\beta \frac{W\phi}{W\phi-U_a} - \eta}$$

$$= \frac{\beta \frac{1+\mu}{\mu} \gamma - \eta + 1}{\beta \frac{1+\mu}{\mu} \gamma - \eta} .$$

Assuming $\mu>0$ and $\beta<\infty$, the value of this at $\gamma=1$ is greater than one, implying that both the union and the management can increase their welfare by an appropriate reduction in both W and b. The solution value of γ in this case is $1-\frac{1}{\beta}\frac{\mu}{1+\mu}$, which is exactly what it is in the situation in which there is bargaining over N as well as W and b. (This is analogous to the result in Section 2 that the solution for the labor/capital ratio is identical in the CC and LC models.) Not surprisingly, for the case in which there is efficient bargaining over W, b, and z, the solution value of b follows the same rule.[13]

The results for models in which there is efficient bargaining with respect to work intensity suggest that, to the extent that unions derive utility from employment as well as wage rents (i.e., $\beta<\infty$), unions and management will always agree to lower work intensity levels below those that would maximize individual utility. Three points are worth stressing.

First, the conclusions of this section are based on the implicit assumption that the monitoring of an agreement concerning work intensity is easy and costless. It is in fact not difficult to see how the day-to-day fulfillment of agreements on number of functions performed per worker, washup time, and the like could lead to differences in interpretation and conflict. The management has, as in the CC model, an incentive to cheat on any agreement about b, for it can still retain its workers because they are receiving wages in excess of opportunity cost. To the extent that firms can cheat, one would expect to observe b close to or greater than b_a, whereas a carefully monitored agreement on intensity would make b less than b_a.[14]

Second, unlike the model of bargaining over the labor/capital ratio, the LC model, bargaining over work intensity is not a device for moving toward the outcome associated with fully efficient bargaining over employment as well as wages. For the case in which there is bargaining over W and b, for example, the absolute proportional effect of a wage increase on employment will be greater or less than η as the labor demand elasticity is $\gtrless 1$.

Third, an important assumption underlying the results concerning work intensity in this section is that workers receive some utility from a lower b holding the wage constant. Consider, however, a dimension of work intensity (such as the width of a paintbrush) that does not require greater effort on the part of workers. Union insistence on a lower value of b in such a case is a form of featherbedding, a contractual obligation by the firm to pay for unnecessary labor. This is represented in the present model by assuming that b can take any value up to some maximum (or "normal") level and that γ is zero in the relevant range. An efficient bargain restricting b below its maximum level can be struck only if the union is willing to accept a decrease in wages proportionately greater than the reduction in b. This requires that (27) with $\gamma=0$ exceed one, which means that $\beta>\mu/(1+\mu)$. This is the condition for featherbedding to be mutually agreeable in the case of bargaining over the labor/capital ratio with $\sigma=0$; indeed, it is the same model.

Finally, to this point it has been assumed that each worker is employed for a fixed number of hours per unit of time. There is no reason, however, why the union cannot bargain over hours per worker per period (h) as well as wages and on other variables like z and $\bar{b}$. Assume that individual utility is an increasing function of both consumption and leisure, say $U=\psi(wh,-h)$. Given freedom to choose hours, h will satisfy $W\psi_1-\psi_2=0$. Without fixed costs per employee, the profit equation is $\pi=V(Kf(hN/K))-whN-rK$, and the firm is indifferent between any combination of N and h such that their product equal the profit-maximizing level.[15] The union's utility function is now $R=(\psi-\bar{U})^{\beta}N$, and, since the firm does not care what h is, the union can set hours unilaterally. As with the work intensity model, the solution for the labor supply model is identical when there is bargaining over W and h and N, z, or nothing else. This solution is

$$(28)\quad \frac{\psi_2}{\psi_1} = w\left[1 - \frac{\mu}{\beta(1+\mu)E_1^{\psi}}\right],$$

where E_1^{ψ} is the elasticity of utility with respect to consumption and $\mu=(\psi-\bar{U})/\bar{U}$. This implies that, given the utility level of individual union members, hours of work will always be less than each union member would choose freely at the negotiated wage rate so long as $\mu>0$ and $\beta<\infty$. This result, of course, is analogous to that for the intensity model.

6. Profit-Sharing

The results to this point indicate that negotiations over the labor/capital ratio and/or work intensity do **not** yield outcomes that are fully consistent with the CC model. After the bargain over wages and the other variable(s), the incentive of the firm is to maximize profit, and, in the absence of a **direct** agreement concerning the level of employment, the firm's decisions will not maximize union utility. This suggests that it may be in the interest of the union to insist on profit-sharing with the firm so that both sides benefit mutually from post-bargaining decisions.

Assume that (as in increasing number of unionized industries in the U.S.) there is profit-sharing. The firm retains (1-t) of total profit, given by (1), and each worker receives W+y, where y is his share of profits, $t\pi/N$. The union and the firm first negotiate the value of the wage and t, the share of total profit to be distributed to workers, and then the management is free to set employment and capital so as to maximize net profit subject to the negotiated values if W and t (work intensity is assumed to remain constant). Since the firm's objective is the maximization of $C=(1-t)\pi$, employment is not affected by t and the absolute elasticity of employment with respect to the negotiated wage is η as in the DC model. Since $\partial\pi/\partial W=-N$, the slope of the iso-profit curve is

$$(29)\quad \left(\frac{\partial(\log W)}{\partial t}\right)_{\bar{C}} = -\frac{\pi/N}{(1-t)W}.$$

The objective of the union is maximization of (4) with W+y replacing W, and the slope of its iso-utility curve is

$$(30)\quad \left(\frac{\partial(\log W)}{\partial t}\right)_{\bar{R}} = -\frac{\beta\pi/N}{\beta(1-t)W+(\beta-1)t\frac{\pi}{N}\eta-\eta(W-W_a)}.$$

An efficient bargain over W and t yields an outcome such that (29) and (30) are equal. This implies that

$$(31)\quad (\beta-1)t\frac{\pi}{N} - (W-W_a) = 0.$$

Let $W+y=(1+\mu)W_a$, where μ is now the union relative wage effect including the profit sharing payment. The solution wage rate conditional on the union's success in bargaining is

$$(32)\quad W = \frac{W_a}{\beta}[\beta-\mu(1-\beta)].$$

This implies that for $\mu>0$ the negotiated wage will be $\gtrless$ the alternative wage as $\beta\gtrless 1$. Since the labor/capital ratio and employment are determined on the basis of the negotiated wage, employment under profit sharing will be identical to that in the CC model (see (11)).

The interesting question raised by this model is why profit sharing in unionized monopolistic industries is not more common (see Remus for evidence on its frequency in different countries). First, the firm may not want to open its books to union representatives who would tend to question certain expenditures (e.g., the level of management salaries). Second, the incentives for the firm to cheat (i.e., engage in "creative accountancy") are enormous, and this would, as in the original CC model, instill reluctance in union members to give up tangible wage rents for something requiring faith in management's integrity.[16] Third, to the extent that, as in many monopolistic industries, profits vary greatly over the business cycle, risk averse workers may prefer a certain W to an uncertain y. Finally, as with the CC model, the median union member may not care much about the employment of others, in which case β is large and a given rent will be realized mainly from W rather than y.[17]

7. Summary and Overview

This paper has investigated, from the viewpoint of conventional static economic theory, some of the implications of situations in which unions and management bargain over working conditions as well as wages. The primary motivation for considering this topic was the dispute in the literature concerning whether or not the relation between wages and employment in unionized firms reflects Pareto-efficient bargaining, but questions such as why restrictions on effort and featherbedding exist are interesting in themselves.

There are four main conclusions:

First, if unions and management bargain indirectly over employment by negotiating the value or the labor/capital ratio or person-hours per unit of output, the resultant level of employment is between the outcomes of a fully efficient bargain (informed bargaining over employment and wages) and a conventional bargain solely over wages. The wage elasticity of employment in this situation is approximately equal to the Hicks formula at a zero elasticity of substitution. Labor is fully utilized at the technology that would prevail if there were no union wage premium.

Second, featherbedding (the hiring of totally unproductive labor) will be an outcome of collective bargaining only if there does not exist a technology appropriate to nonunion wages and if the union values employment much more highly than wage rents. It is difficult to see how a featherbedding agreement could exist for a long period of time (except in Britain, where nothing ever changes), for it is not in the interests of younger union members to replace older ones as they die off.

Third, efficient bargaining over work intensity yields the result that the contract will specify a slower pace of work than would be chosen by an individual bargain between each worker and the firm. At the same time, the existence of a wage premium for union workers provides the firm with a great incentive to cheat by trying to make its employees work harder. Since, ceteris paribus, value added in the firm depends positively on actual work intensity, the result that unions sometimes increase and sometimes decrease productivity (see Freeman and Medoff) is not surprising.

Fourth, a system of profit sharing in which there is efficient bargaining over both wage rates and the share of profit allocated to workers will yield the fully Pareto efficient outcome with respect to employment. This result, however, is mostly of theoretical interest, for, whatever the reasons, profit sharing agreements are still fairly uncommon.

It should be stressed that all of the interesting departures from the conventional demand curve equilibrium model results depend crucially on the union placing a value on employment relative to individual wage rents. If the union cares only about rents except in crisis situations (a hypothesis advanced long ago by Cartter), bargaining will generally be uni-dimensional and the efficient bargaining controversy moot.

Footnotes

[1]For a perceptive summary of this literature see Farber (1984).

[2]A rigorous exposition of the conventional approach is provided by Oswald (1982).

[3]For a lucid discussion of various union practices affecting employment indirectly, see Chapter 7 of Rees. Allen provides a lengthy discussion of restrictive work practices in the construction industry. In 1976 21 percent of union workers were covered by contractual provisions specifying "crew size" (9 percent in manufacturing and 33 percent in nonmanufacturing). These Bureau of Labor Statistics data refer to large contracts ($\geq$ 1000 workers) but do not include the railroad and airline industries, in which this practice is very common. A particularly lucid taxonomy of various restrictive work practices in Britain (where, following the classic film, "I'm All Right, Jack," they are a fine art) is found in the Royal Commission on Trade Unions.

[4]See, in particular, Ashenfelter and Brown, MaCurdy and Pencavel, Farber (1984), Pencavel, Oswald (1984), and Abowd.

[5]If the product demand function has a constant-price elasticity ($>$ 1), ϵ is that elasticity.

[6]Monitoring problems would arise when radically different technology becomes available. Then the union has less than full information about technological parameters and is likely to be (justifiably) suspicious of any explanations put forward by management.

[7]Two early papers, by Simler and Hartman, investigated some aspects of the LC model geometrically. See also the paper by Weinstein.

[8]For a historical discussion of this practice in the British shoe industry in the early 1900s see Fox.

[9]For $1<\beta<\infty$, the capital intensity of the production process is increased but not by as much as the firm's engineers would like; for $\beta<1$ the negotiated z would increase.

[10]For descriptions of many such practices in a wide range of industries in the U.S. -- and a claim that they have become less prevalent during the recessionary 1980s, see "A Work Revolution in U.S. Industry," **Business Week**, May 16, 1983.

[11]Recall that it has been assumed that hours of work are assumed to be fixed. Otherwise, hours of labor supply would be an argument in the utility function.

[12]The problem is very similar to that of determining the sign of the uncompensated wage elasticity of labor supply.

[13]In the case of the general individual utility function, the solution of the bargaining problem must satisfy

$$-\frac{U_2}{U_1} = \frac{W}{b}\left[1 - \frac{\mu}{\beta(1+\mu)\delta}\right],$$

where δ is the elasticity of U with respect to W. This implies that, if $\mu>0$ and $\beta<\infty$, b is always less than the level that would be chosen in individual bargains given that utility level.

[14]The evidence on whether work intensity is in fact higher or lower in the union than in the nonunion sector is rather thin. The results of Duncan and Stafford appear to indicate that certain dimensions of b are higher for union workers. To answer the appropriate question for present purposes satisfactorily, however, one must control much more thoroughly than could Duncan and Stafford for type of job to remove the possibility that the union dummy variable is simply correlated with onerous jobs.

[15]The formulation is more interesting and realistic when fixed costs per worker, say ωN, are included. Then the firm is willing to pay the worker to increase hours beyond the utility-maximizing level implied by satisfaction of the individual's marginal condition. The results with this complication, however, are not qualitatively different from the simpler model.

[16]Hoerr reports a large increase in the use of profit sharing in the U.S. -- most notably in the auto industry -- during the early 1980s. This may, however, be attributable to a desire of the relevant companies and union leadership to reduce μ, an action necessary because of increased international competition, without incurring the wrath of militant union members.

[17]Weitzman haas argued persuasively that a comprehensive profit-sharing system similar to the above would have superior macroeconomic properties to those of the equivalent of the DC model. The main drawback to its adoption, in his view, is the fact that most of its benefits are external to the incumbent workers in the firm. To use Weitzman's example, if the typical UAW worker at GM does not feel threatened by job loss (and derives no utility from the welfare of other workers), i.e. β is large, that union will not push for public policies to bring about voluntary profit-sharing.

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