# FEASIBLE BARGAINING RANGES ASSOCIATED WITH UNION - FIRM POWER

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## 1. Introductiou

Numerous attempts have been made to systematize the relationship between management and labor in a collective bargaining situation. These models of the bargaining process have been approached through different techniques ranging from game theory [1,7], to more simplistic graphic approaches to the bargaining process [4,5]. One of the more prominent models, suggested by Cartter and Marshall [3] identifies that the bargaining process is influenced by union and firm preference paths for wage employment combinations under conditions of labor demand expansion and contraction.

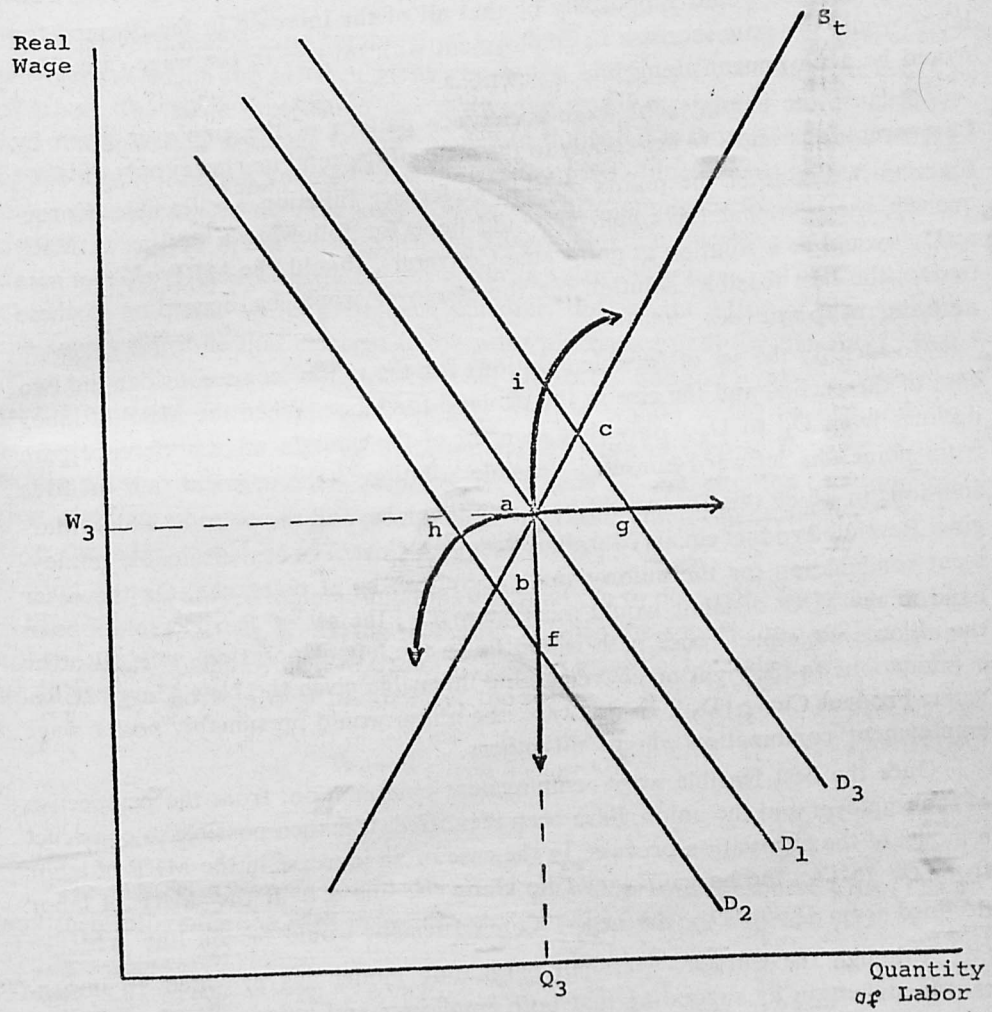
The purpose of this paper is to identify the bargaining ranges associated with changing labor demand conditions and also associated with variation in the degree of union power relative to management. By modifying the Cartter - Marshall model to permit firm wage preferences to be consistent with the assumption of profit maximization, the feasible negotiation ranges are identified.

## 2. The Cartter - Marshall Model

This model is shown graphically in Figure 1. Beginning from an initial situation at the intersection of Marginal Revenue Product (MRP) curve, $D_1$ and the total market supply of labor curve, $S_t$, the impact of various demand conditions on the bargaining process is illustrated. As the MRP of labor declines, from $D_1$ to $D_2$, the union is characterized as having a wage preference path indicated by the curved line segment **a h**. This segment illustrates the principle that as the demand for labor declines initially, the union would prefer greater decreases

in employment relative to wage decreases. This reflects the expectations that it is relatively difficult to regain contract wage decreases once they have been permitted. On the other hand, as the MRP of labor rises, say from $D_1$ to $D_3$,

Figure 1




the union would initially prefer all of the increase in demand to generate higher wages with very little increase in the amount of employment. This preference path is indicated by line segment **a i**, thus a different set of wage employment

tradeoffs would be expected to exist for demand increase situations as compared to demand decrease situations.

The firm is likewise characterized in the Cartter - Marshall model as having a kinked set of preferences. In Figure 1 as the MRP of labor declines from $D_1$ to $D_2$, the firm's alleged preference would be for all of the decrease in demand to generate lower wages with no reduction in employment. This is given by line segment **a f.** On the other hand, as the MRP of labor rises from $D_1$ to $D_3$, the firm's preference would supposedly be that all of the increase in the demand for labor would generate increase in employment with no rise in the wage rate. This would be a movement along line segment **a g.**

Because the employment wage preference pattern of the employer given by **f a g** except for point «**a**» lies totally to the right of the total market supply of labor function $S_t$, none of the points on this preference function are feasible. Consequently, the best that the employer could hope for following a decline in MRP to $D_2$, would be a solution at point «b». Conversly, should the MRP of labor rise to $D_3$, the best feasible solution for the employer would be, according to these authors, at point «c».

To identify the set of feasible solutions for the union let us consider the two case of the decline and the rise in the demand for labor. When the MRP of labor declines from $D_1$ to $D_2$, only that segment of the union's wage preference path from point «h» leftward contains feasible solutions. The segment **a h** involves solutions in which the firm would be hiring labor beyond the point at which Marginal Revenue Product equals Marginal Resource Cost. The best attainable employment combination for the union would, therefore, be at point «h». On the other hand, if the MRP of labor would increase to $D_3$, the set of feasible solutions in the union's wage preference path would lie to the left of point «**i**» with all other combinations to the right of «i» remaining infeasible given the New Marginal Revenue Product Curve ($D_3$). In this case, the union would presumably prefer wage employment combination «**i**» to all others.

Once the best feasible wage - employment combination, from the perspective of the employer and the union, have been identified, it is then possible to construct a model of the negotiation process. In the case of an increase in the MRP of labor from $D_1$ to $D_3$, the bargain would lie along the line **c i.** If the MRP of labor declined from $D_1$ to $D_2$, the negotiation settlement would lie on line **h b**[3].

Although the Cartter - Marshall bargaining model has provided an important contribution by suggesting that both employers and unions may have kinked wage preferences, unfortunately the model has two weaknesses. First, the relationship between the union wage preference path and the market supply function is not recognized. Second, the analysis of the optimum feasible wage - employement combination for the firm is restricted only to the case, where the market is perfect-

ly competitive. Hence, in Figure 1, the point identified by Cartter and Marshall as the optimum feasible point «b», is far from the profit maximizing employment - wage combination for the firm. This would not generally represent the best feasible combination for a firm possessing some degree of monopsony power.

## 3. The Nature of Labor Supply in a Unionized Labor Market.

The profit maximizing combination for the firm will occur at the level of employment at which the MRP of labor equals the Marginal Resource Cost (MRC) of labor. The basic problem in identifying the profit maximizing wage - employment combination resulting from a change in the MRP is determining the nature of the supply of labor function and the related MRC function facing the firm. If there were no union, then the supply of labor, for example, in Figure 1, would be $S_t$. But when the union exists, then the supply function may be the same as the union's wage preference path. If the union is sufficiently powerful that it always obtains some point on its preference schedule, then as the MRP of labor shifts, the supply schedule that emerges is the wage preference path for the union. That is, in Figure 2, when the MRP shifts from $D_3$ o $D_4$ and to $D_5$, the equilibrium points obtained (if the union always gets what it wants) would be «b» and «c» respectively. When the MRP shifts from $D_3$ to $D_2$ and then to $D_1$, the equilibrium points are «d» and «e» respectively. In such as case of union total domination, the firm observes that if it wanted to increase employment from $Q_5$ to $Q_6$ then the wage would have to rise from $W_3$ to $W_4$.

Given this kinked supply function, it is possible to determine the shape of the related MRC function. Referring to Figure 3, when the supply function is evaluated for levels of employment less than $Q_4$, the average cost of labor can be approximated by a portion of a parabola of the form,

$$W = W_3 - c_1 \ (Q_4 - Q)^2$$

$$\text{for all } Q \leq Q_4$$

The MRC can then be obtained by first obtaining Total Resource Cost (TRC) and then differentiating with respect to the quantity of labor supplied (Q).

Thus, $$TRC = W_3Q - c_1QQ^2_4 + 2c_1Q^2Q_4 - c_1Q^3$$

$$MRC = \frac{d(TRC)}{dQ} = W_3 - c_1Q_4^2 + 4c_1QQ_4 - 3c_1Q^2$$

$$\text{for all } Q \leq Q_4.$$

Likewise, for quantities of labor supplied, grater than $Q_4$ but less than $Q_7$, the average cost of labor can be approximated by a portion of a different parabola,

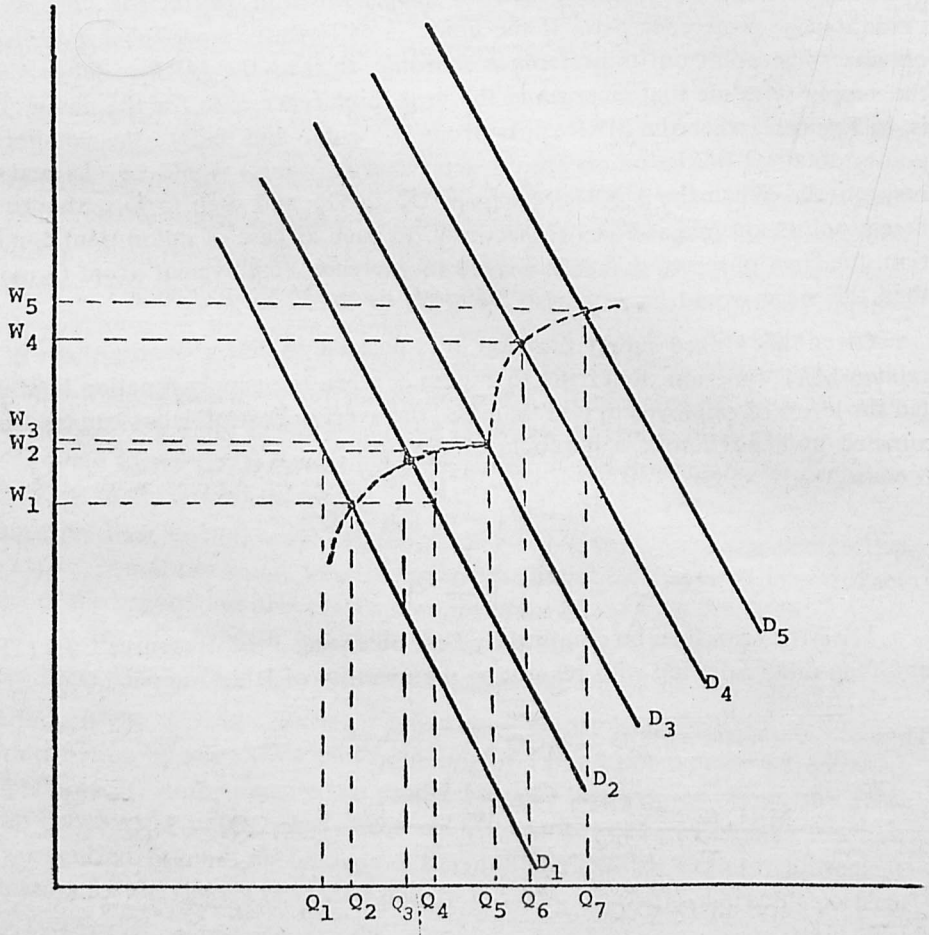
$$W = W_6 - c_2 (Q_7 - Q)^2.$$

The related MRC function is given by,

$$MRC = \frac{d(TRC)}{dQ} = W_6 - c_2 Q_7^2 + 4c_2 Q Q_7 - 3c_2 Q^2$$

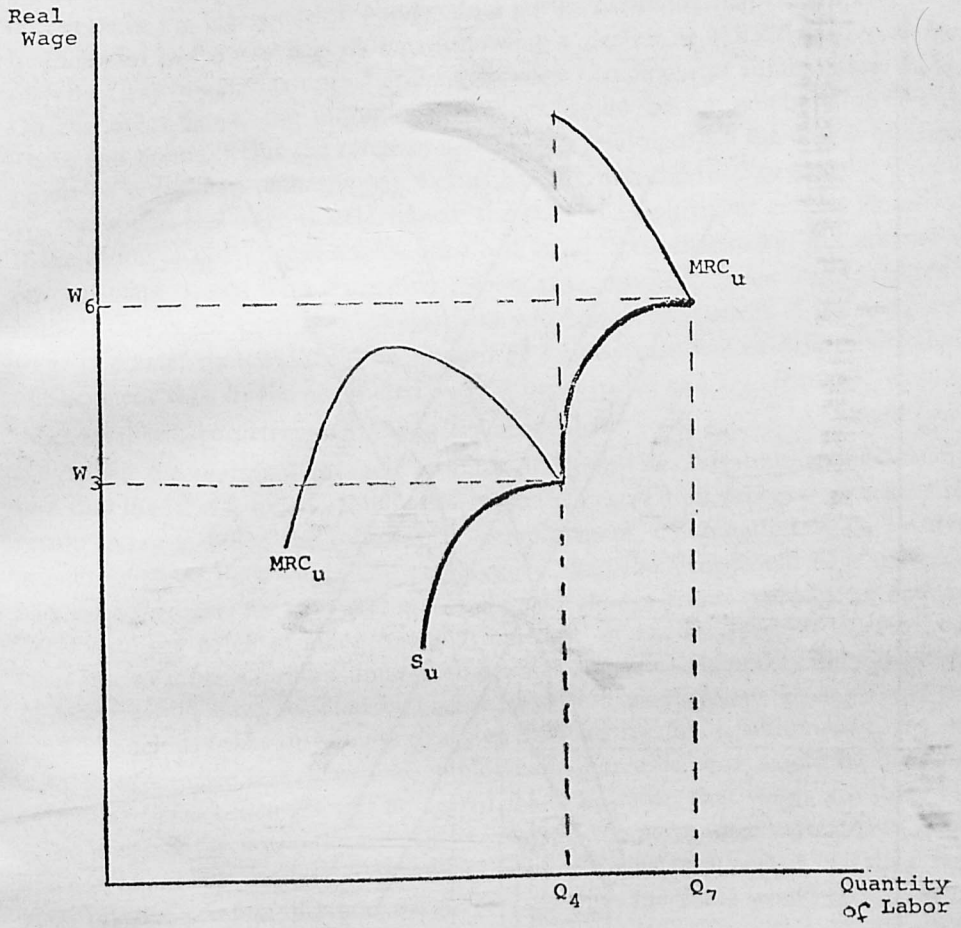
for all $Q \leq Q_7$ and $Q > Q_4$.

Figure 2



The graphic form of these marginal functions is shown in Figure 3. Of course the specific form of the wage preference path will vary from firm to firm and therefore, the specific algebraic approximation will also vary. However, the general shape of the MRC curve and its relation to the wage preference path will be retained.

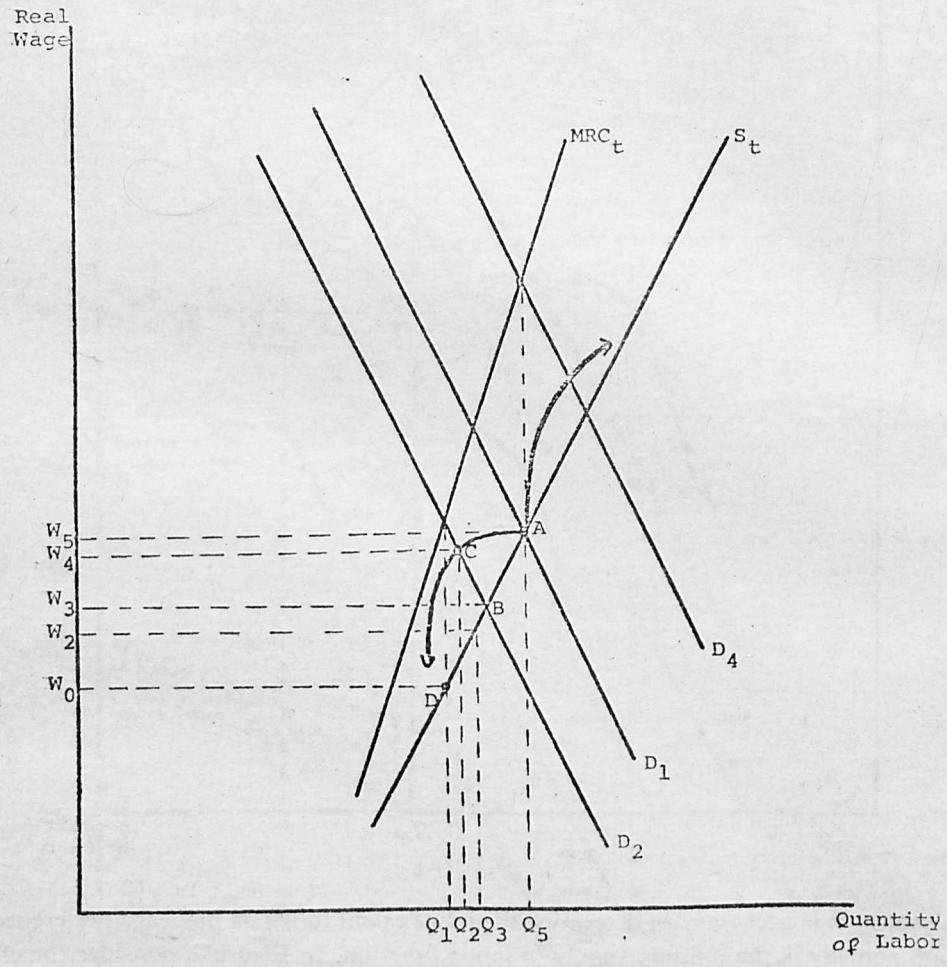
Figure 3




Now it is necessary to determine the exact extent to which the wage preference path actually is the union's supply of labor function. In Figure'2, consider the effects of a shift in the MRP of labor from $D_3$ to $D_2$. Let us now suppose that the negotiated wage is $W_1$. Once this wage is established, the firm would maximize its profits by employing quantity of labor $Q_4$. This quantity wage combination

would result in a higher total wage bill. However, employment level $Q_4$ the union would prefer wage $W_2$. Therefore, if the firm did expand employment to $Q_4$, then the next bargaining period, barring further changes in the MRP of labor or other factors, the firm could expect the wage to rise to $W_2$ (once again assuming that the union is dominant). This situation would be subobtimal for both the union and the firm since as a result, employment would fall to $Q_3$ after the new settlement. Thus, even if the wage were negotiated at $W_1$, the firm would be reluctant

Figure 4




to expand employment out to its MRP at that wage, and also, the union would not be willing to permit the firm to maintain higher employment at the negotiated

wage. In this circumstance, therefore, the wage preference path does reasonably represent the supply of labor function obtainable to the firm.

## 4. Firm Wage Preferences in a Firm Dominated Negotiation

We now proceed to consider the determination of the employer's preferences to changing MRP of labor. Two cases will be considered. In this section, the employer is assumed to dominate the negotiation processes, while in the next section, the union is assumed to dominate. Figure 4, shows the effects of increases and decreases in the marginal revenue product curves assuming that the firm is totally dominant in the new negotiations following a decline in MRP from $D_1$ to $D_2$, then the firm would maximize its profits at wage - employment combination $W_0$ $Q_1$. On the other hand, the union's preferences would be for combination $W_4$ $Q_2$, These two points define the range of solutions depending upon the degree of actual power of union and management. Let us assume that the final negotiated wage is $W_2$. Now that the wage is determined, the level of employment can be identified. If the union is not very powerful, then it is most likely that it will not attempt to prevent employment from exceeding the amount indicated by its wage preference path. If this is the case, then employment will be $Q_3$. In general, if the negotiated wage is greater that $W_3$, then the amount of employment will be determined along line segment **B C.** If the negotiated wage is between $W_3$ and $W_0$, then the employment level will be determined along segment **D B.**

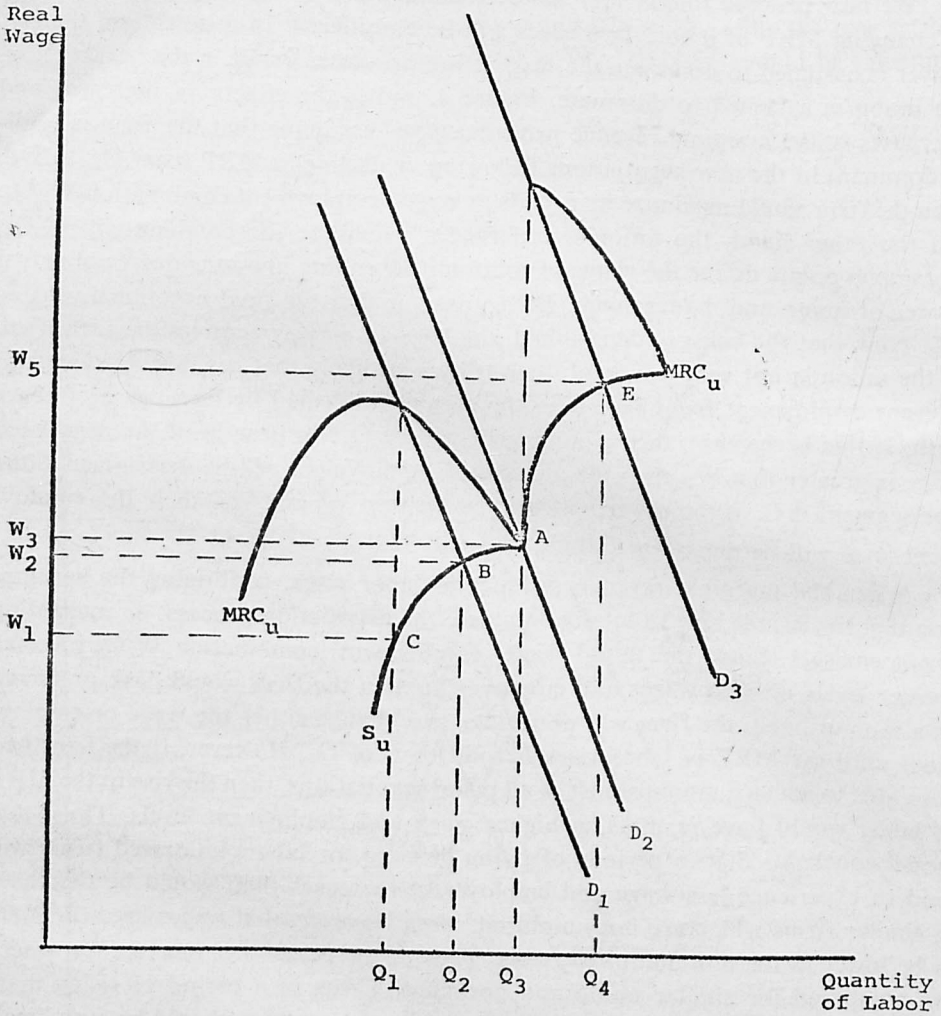
When the marginal revenue product of labor rises, continuing the assumption that the firm is able to totally dominate the negotiation process, an interesting result emerges. Since the initial wage - employment combination $W_5Q_5$ involves greater levels of both wages and employment than the firm would have preferred as a monopsonist, the firm will not attempt to change either the wage or employment until the MRP of labor rises beyond that of $D_4$. However, if the firm had been able to act as a monopsonist in all prior negotiations, then the rise in the MRP of labor would have resulted in higher wage and employment levels. Thus, this model concludes that in periods of rising demand for labor, unionized firms will tend to experience less wage and employment increases than would be the cases in similar firms which are not unionized. Note however, that wages are still likely to be lower in the non-unionized firms. Thus, if the percentage increases in wages are compared for similar union and non-union firms in a period of rising marginal revenue product of labor, the percentage wage increases would be even smaller for the union firms.

## 5. Firm Wage Preferences in a Union Dominated Negotiation

Figure 5, illustrates the second case in which negotiations are assumed to be

totally dominated by the union. In this circumstance, the supply of labor and the MRC curves are those derived in Figure 3. If the marginal revenue product of

Figure 5




labor declines from $D_2$ to $D_1$, then the union would prefer wage employment combination $W_2Q_2$. The firm on the other hand, would prefer combination $W_1Q_1$. Both of these combinations lie along the union's wage preference path and are therefore, feasible assuming that the union dominates the negotiations. Clearly, if the union had exact knowledge of the nature of the new MRP curve ($D_1$) then

it would force negotiations to point B. However, such perfect knowledge is generally unavailable, particularly for the union. Thus, the firm (assuming it is aware of its own MRP function), might succeed in convincing the union that point C is the best that it can do. If the firm succeeds, then it will be maximizing its profits subject to the supply of labor curve determined by the union's wage preference path. Furthermore, it will not extend its employment out to the MRP curve ($D_1$) because to do so would result in a substantial rise in the wage rate (above $W_2$) at the next negotiation. It may be concluded that depending upon the degree of union knowledge of the firm's MRC curve, the final negotiated wage - employment combination will lie on segment **C B.**

When the MRP of labor rises from $D_2$ to $D_3$, just as was illustrated in the preceding section, the firm will attempt to retain its current employment and wage combination $W_3Q_3$. Only if the MRP expands beyond $D_3$, will the firm find it to its advantage to increase wage and employment (continuing the assumption that all negotiations are in accordance with the union's preferences). However, if the union has perfect knowledge then, it will attempt to increase wages and employment to combination $W_5Q_4$. Therefore, depending upon the amount of union knowledge, the final negotiated wage-employment combination will lie on segment **A E.**

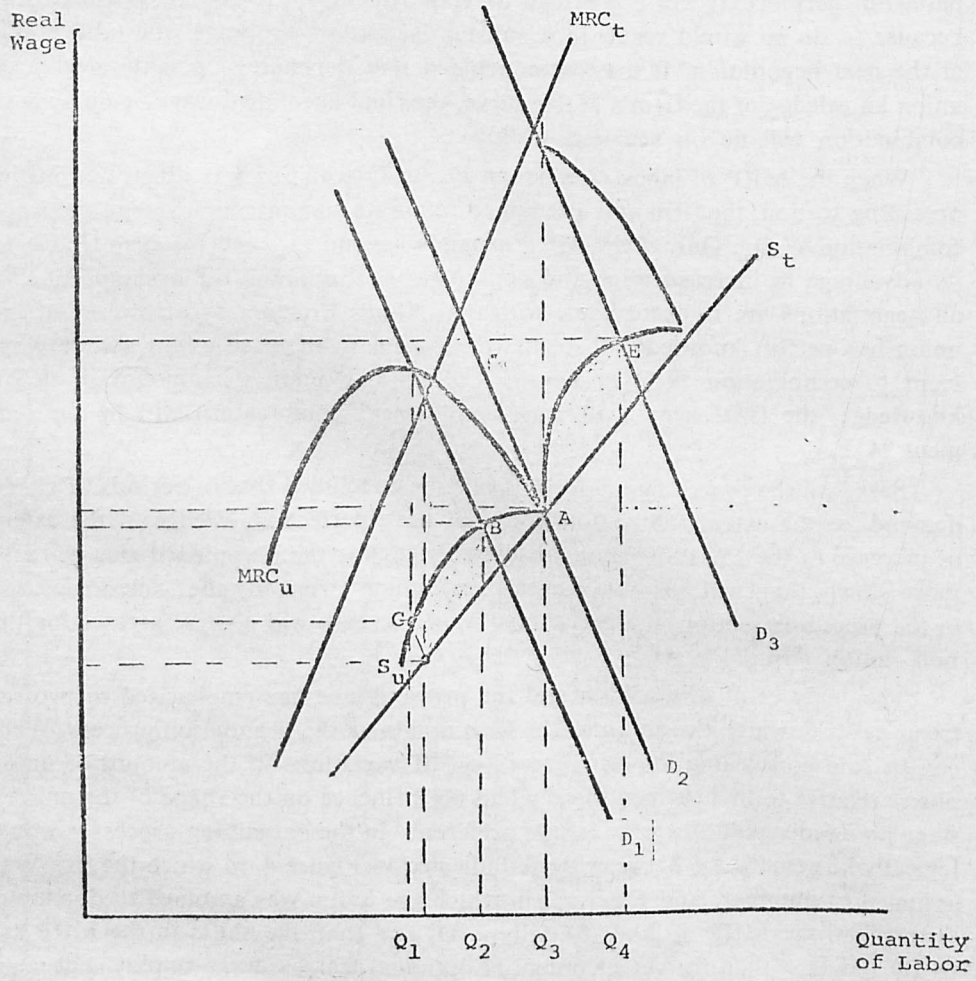
Based on the preceding analysis, it may be concluded that in periods of rising demand, to the extent that union does not have perfect knowledge of the extent of increase in the MRP of labor, absolute wages for the unionized firms will rise more slowly than will absolute wages in nonunion firms. By the same logic used in the preceding section, the percentage wage increase will also be greater for the non - union firms.

The analyses of this section and the previous one has emphasized to two extreme cases in which the union or the firm dominate the negotiation process. What can be said concerning intermediate cases? If variations in the amount of union power relative to management power had no influence on the shape of the union's wage preference path, then the firm's preference in the bargaining processes would logically lie somewhere between those indicated in Figure 4, in which the firm was assumed to dominate and Figure 5, in which the union was assumed to dominate. Given that, the MRP of labor initially is $D_2$ and that the shifts in the MRP are to $D_1$ and $D_3$, then the set of potential optimum feasible wage-employment combinations for the firm are shown in the shaded areas of Figure 6. However, this analysis is limited in that as the power of the union declines, the wage preference path of the union is likely to shift.

One of the critical factors influencing the shape of the union's wage preference path is the extent to which the union is able to maintain its power in the presence of unemployment. When the union obtains a settlement that lies along the wage preference path above or below point «A» in Figure 5, some amount of umemploy-

ment is a result. For example, as the MRP declines from $D_2$, at first unemployment rises very rapidly per decrease in the wage due to the shape of the wage preference

Figure 6




path. The primary force that causes the path to eventually turn down permitting greater wage reductions and lower unemployment rates is pressure from union members. If the union is strong, it can hold up under pressure from its members to reduce unemployment. However, the weaker the union is the more rapidly will its wage preference path drop off in response to declines in the demand for labor. The same logic applies to conditions of increasing labor demand except in this

case, the pressure to reduce unemployment primarily from workers seeking to become members of the union.

Concluding, we discuss the effect of changes in the elasticity of supply on the size of the bargaining range. According to Cartter and Marshall, during a period of increasing MRP, if the market supply of labor becomes more inelastic, the range of feasible solutions to negotiations will be reduced. This conclusion is based on their presumption that the feasible range of negotiations must lie between the union's wage preference path and the market supply of labor function along the firm's MRP curve. However, it is most unlikely that the market supply of labor function could shift without influencing shape and position of the union's wage preference path. If the market supply curve becomes more elastic, then as wages rise, the spread between the wage preference path and the market supply of labor curve becomes even greater resulting in greater unemployment. This greater pressure should cause the union's wage preference path to become greater in slope at a lower level of employment. The opposite will be the case in circumstances of declining MRP of labor.

## 6. Conclusion

The feasible negotiation ranges in the presence of differential union - management power, were identified. Depending upon the degree of relative union power, the nature of the labor supply and MRC was found to vary resulting in variation in the firm's optimum feasible wage — employment combination. Generally, the more imbalanced the relative power ratio, the smaller will be the size of the bargaining range. Also, the more imperfect the union's information concerning the marginal revenue product of labor, the larger the bargaining range.

It is suggested, however, that Cartter and Marshall errored in suggesting that the size of the bargaining range is affected by the degree of total market supply elasticity.

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