in product demand do not necessarily influence the level of employment. If it is below $n_1$, the firm will recruit. If it is above $n_0$, then there will be layoffs. And for as long as $n$ lies between $n_1$ and $n_0$, employment will be inert.

While employment is determined exactly as in (12), the wage is indeterminate within set limits. Just where it will fall within these limits must depend on the relative bargaining strengths of the firm and the union and, as such, lies beyond the scope of this paper. However, two specific aspects of the question merit comment.

First, as we have seen, the wage may lie above or below the marginal revenue product of labor. And whether it is above or below depends on $n$ as well as on bargaining power.

Second, it is relatively easy to extract from the general results obtained previously the implications for extreme cases. For example, the labor managed firm can be regarded as one in which the union has overwhelming bargaining strength to the extent that it can always squeeze profits down to the level $P(e_2)$. In this special case, then, it follows from the general result that:

(i) If $x(n) < y(n)$ then $w = n = w$, and $\epsilon = \frac{w}{n}$.

(ii) If $x(n) > y(n)$ then $w = \epsilon = \frac{x(n)}{n}$, and $\epsilon = \frac{y(n)}{P(e_2) / n}$.

The labor managed firm represents the extreme case of union power. However, as noted in the introduction, the results in this paper can instead be interpreted in a context in which there is no union. All this requires is, first, that the difference $n_1 - n_0$ be attributed to bidding costs (broadly interpreted to include search and training) and, second, that wages be determined (actually or as if) through a collective bargaining process. With this interpretation, the model is similar to that postulated by Oh [4] in his early attempt to explain the inelasticity of employment to product demand. And in this spirit it can be concluded that inertia in labor markets is not necessarily caused by restrictive practices but can also be explained by recruitment or training costs. And, in either case, the fact that there is inertia does not imply that wages are high or low relative to the marginal revenue product of labor but only that they are less flexible than marginal productivity theory would suggest.

References


A MODEL OF WAGE CONTRACT BARGAINING WITH IMPERFECT INFORMATION AND STRIKES

CHRISTINE E. BLAIR and ANTHONY P. RODRIGUES*

I. Introduction

This paper presents a model of bargaining and strike activity based on rational behavior and incomplete information. We assume that both the union and the firm have private information about their own position and that both parties diagnose their optimal wage when making wage offers. Both the firm and the union bargain to extract information about the other's position.

Our model formally describes the effects of bargaining on some costs in Akerlof and Shoven [3]. We include costs of prestrike bargaining and of bargaining during strike as well as a measure of expected costs of negotiating a suboptimal contract. The model features uncertainty on both sides of bargaining and allows negotiations to occur during both the current contract and subsequent strike or layoff. These are realistic extensions of the incomplete information literature on bargaining as presented in Hayes [1] and Tracy [4].

II. Wage Offers

The basis of wage offers in our model are the union's labor supply and the firm's labor demand which are:

\[ l^* = e^*(w - p) + \alpha \]

\[ l^* = e^*(w - p) + \beta. \]

The model is in log-linear form. Both labor supply, $l^*$, and labor demand, $l^*$, are functions of the real wage. The supply and demand elasticities are $e^*$ and $e^*$, respectively. Following Mauro [3], private information is incorporated into the model through $\alpha$, known only by the union, and $\beta$, known only by the firm. The term $\alpha$ might represent union tastes while $\beta$ might represent technology.

*Federal Deposit Insurance Corporation, Washington D. C. and Fordham University, Bronx, New York, respectively.
In each round of negotiations, both the union and the firm present wage offers. We assume that the nominal wage is jointly determined from the offers in the final round of negotiations. Employment during the contract is determined either by rationing or by labor demand. We also assume that both the union and the firm wish to achieve the market clearing wage, \( w^* \), which will be

\[
    w^* = p - (\alpha - \beta)(e^d - e^s).
\]

If the parties did not disguise their wage offers and there were no private information, the wage \( w^* \) would be chosen by both parties. The existence of private information alone creates a situation where one round of bargaining would be sufficient to infer the missing information. Since each party may benefit at the other’s expense if complete information about the other’s position were available, we assume that both parties disguise their estimate of the market clearing wage before presenting their wage offers. With both imperfect information and disguised wage offers, several rounds of negotiation are necessary to obtain low variance estimates of the private information.

Wage offers presented by the union and firm in each round of negotiations are based on their expectations of the market clearing wage given their current information. Only the union’s behavior is discussed below because the firm’s problem is formally equivalent. The union and firm have prior distributions for the private information of the other party. We assume that these distributions are publicly known, normal, and independent. Initial public information also includes \( e^d, e^s \), and the price level \( p \). The union’s initial information set is \( I_{0u} = \{e^d, e^s, \alpha, \beta\} \). The union’s expected optimal market clearing wage is

\[
    E[p|I_{0u}] = p - \alpha e^d + \beta e^s,
\]

where \( \beta = E[p|I_{0u}] \), the mean of the union’s prior distribution for \( \beta \), and \( \theta = 1/(e^d - e^s) \).

The firm disguises its offer with a similar random term, \( \epsilon \). Both \( \mu \) and \( \epsilon \) are assumed to have normal distributions with zero means and publicly known variances \( \sigma^2_\mu \) and \( \sigma^2_\epsilon \).

After each round of bargaining, the information sets of the union and firm are augmented by the additional information contained in the wage offers: For the union, the updated information set becomes

\[
    I_{n+1} = \{e^d, e^s, \alpha, \beta, \theta, \epsilon_n\},
\]

where \( \epsilon_n = w_n - p + \theta E[p|I_{n-1}] = \beta \theta + \epsilon_n \). Here \( w_n \) is the firm’s wage offer and \( E[p|I_{n-1}] \) represents the firm’s expectation of \( p \) given information \( I_{n-1} \), available after \( n - 1 \) rounds.

Both parties use Bayesian theory to update their estimates of the other party’s unknown information. The union’s expectation of the firm’s private information is

\[
    E[\beta|I_n] = (n \sigma^2_\epsilon e^s + \sigma^2_\beta)/(n \sigma^2_\epsilon e^s + \sigma^2_\beta + \sigma^2_\epsilon e^d),
\]

where \( \sigma^2_\beta \) is the variance of the unknown information. The conditional variance of the unknown information is

\[
    \sum_{n} E[\beta|I_n] = \sigma^2_\beta (\sigma^2_\epsilon e^d + \sigma^2_\epsilon e^s)^{-1}.
\]

As \( n \) goes to infinity, the posterior mean will approach \( \beta \). The longer the union negotiates, the better its prediction of the market clearing wage. However, if negotiating is costly, the union and firm will not bargain indefinitely.

III. Costs of Contract Negotiation

The total number of negotiation rounds is \( n = b + s \). In this expression, \( b \) is the length of pre-contract expiration bargaining and \( s \) is the strike length, measured by the number
either all strike or all precontract expiration bargaining with strike more likely the smaller is \( c_n \) or the larger is \( r \).

First, consider the case where the union wishes to strike exclusively. The solution for strike length, \( s \), will set (3) to zero subject to \( b = 0 \). This equation may be solved for positive \( s \) as long as

\[
e_n + c_n \leq Ke_0(1 - e^{-sT'})/(\sigma^2) + Ke_0(1 - e^{-sT})/\sigma^2
\]

(4)

The first term on the right hand side of (4) is the reduction in inefficiency cost over the life of the contract due to the initial round of negotiation. The second term represents the reduction in cost from postponing the inefficiency cost one period. Thus, the union would choose to strike as long as the benefits to the first round of striking exceeds the costs.

Comparative statics analysis shows that increases in either the cost of negotiation, \( c_n \), or the cost of strike, \( c_s \), decrease the optimal strike length. An increase in contract length, \( T' \), increases the desired strike length. An increase in the cost of deviating from the optimal wage, \( K \), increases the optimal strike length as does an increase in the noise in the firm's wage offers, \( \sigma^2 \).

These results may change if the union optimizes subject to the firm's behavior. The union's original decision will not be affected either by the firm's desire to bargain before the current contract ends or by the union's desire to lockout for less time than the union's unconstrained optimal strike length. If the firm wishes to negotiate for a longer period, or if the union after the contract has expired than the cost minimizing choice is to strike for \( s' \) periods.

The second case to consider is where the union's optimal choice is bargaining prior to contract expiration. The optimal length of bargaining is derived by setting equation (2) to zero with \( s = 0 \). The optimal amount of prestrike negotiation is positive as long as

\[
e_n < Ke_0(1 - e^{-sT})/(\sigma^2)
\]

(5)

This will hold as long as the reduction in inefficiency costs associated with the first round of negotiation exceeds the cost of negotiation.

Comparative statics analysis shows that an increase in the cost of prestrike negotiation unambiguously reduces the desired amount of bargaining. An increase in the cost of not achieving the optimal wage, \( K \), leads to an increase in the desired amount of bargaining. An increase in either contract length, \( T' \), or in the noise in the firm's wage offers, \( \sigma^2 \), increases the optimal amount of bargaining.

If the firm's behavior, the union may modify its optimizing decision to bargain prior to contract expiration. There are two possible types of firm behavior: First, the firm may wish to negotiate for a period, \( n' \), longer than the union. If \( n' \) is long enough that the present discounted cost of the first period of bargaining is greater than the present discounted cost of the last period of strike, the union's cost minimizing decision is to strike exclusively. If \( n' \) is short, the cost minimizing decision is to bargain for the length of time required by the firm. The optimal strike length will be zero.

Second, the firm may wish to negotiate for a shorter time than the union. The union's optimal choice is a combination of pre-expiration bargaining and strike. The total length of negotiations will be less than the amount of time the union wished to spend in pre-expiration bargaining.

We have not explicitly discussed the firm's optimization decision in this section. Since the problems of the union and firm are formally identical our discussion above would also apply to the firm.

Equilibrium

In this section we outline the determination of negotiation duration when each party (union and firm) makes its decision conditional on the behavior of the other party. There are four possible outcomes:

First, the unconstrained optimal decisions for both parties are exclusively pre-expiration negotiations. In this case the party with the longer desired negotiation period will be willing to strike. The party with the shorter desired period of negotiations is willing to match the other party's negotiation period, however. We observe negotiations beginning early enough prior to contract expiration to accommodate the party with the longest desired negotiation period.

Second, the unconstrained optimizing decision of the union is to strike while the optimum for the firm is pre-contract expiration negotiation. In this situation the firm cannot force the union to negotiate. The firm must determine its desired period of negotiations during a strike. The actual amount of post-expiration negotiations will be determined by the party with the longer desired strike or lockout period.

Third, the firm's unconstrained optimum is lockout while the union's unconstrained optimum is pre-expiration negotiations. The union must determine its desired period of post-expiration negotiation. As in the second case, the actual amount of post-expiration negotiation is determined by the party with the longer desired negotiation period. Although we have not proven this, our presumption is that the firm will determine the length of negotiations in this case while the union would for the second case.

Finally, the unconstrained decision of the union is to strike and the firm's decision is to lockout. Since the party with the shorter post-expiration negotiation period cannot force the other to change, the length of strike or lockout in this case is determined by the party that wishes to negotiate the longest after the contract expires.

This discussion shows that strikes or lockouts may occur even when each party is completely aware of the behavior of the other. As long as one party wants to strike or lockout a work stoppage occurs.

V. Extensions

We are currently developing several extensions of the model. Some are outlined below:

Contract length could be determined by this model if we assumed that the union and firm have a joint fixed time horizon. Contract length could be endogenous without a fixed time horizon if we allowed \( a \) and \( b \) to be time dependent.

Although we have specified that negotiations after contract expiration may only occur during a lockout or strike, this is not required by our model. Presumably if work continued after contract expiration the \( e_n \) terms for each party would be lower. Post-contract negotiation would be more likely in this case. To incorporate that possibility fully, the \( e_n \) term must also measure inefficiency losses to operating under the old contract.

We have assumed that the cost per period of negotiation is constant. This may not be completely realistic for either unions or firms. Union members may experience decreasing costs if they take other jobs during a strike. This may increase the propensity of the union to strike. The firm's costs per period of strike or lockout may increase over time as revenues run out. This would decrease the likelihood of firms wishing to lockout.

VI. Conclusion

We presented a model wage bargaining between a union and firm was valuable because risk allowed each party to gather information about the other. The model makes detailed
predictions about the extent of contract negotiation observed. In some cases information gathering can be valuable enough that a strike or lockout is optimal behavior.

References

LABOR SUPPLY, VOLUNTARY WORK, AND CHARITABLE CONTRIBUTIONS IN A MODEL OF UTILITY MAXIMIZATION

WEI-CHIAO HUANG and SUBHASH C. RAY

I. Introduction

Research interest in the economics of charity has grown significantly in recent years. Because of its apparent inconsistency with self-interest, many people have looked for some rational explanation for charitable behavior. Also because of its importance as a source of funds for a wide variety of public services, charitable giving and its implication for tax policy and revenue have received considerable attention from public finance economists.

In respect of the economic rationality of personal philanthropy, Boulding [2] and Vickery [9] were among the first of the modern economists to suggest that individual’s welfare depend on levels of consumption of unrelated individuals as well as their own consumption. Becker [1] integrated this kind of utility interdependence into a formal model of choice and derived some empirical implications of philanthropy. More recently Phillips [7] used Becker’s household production approach and developed a complete model of charitable giving motivated by self-interest.

The focus of attention in most discussions of charitable giving and its implication for tax policy has been on the efficacy of income-tax deductibility of charitable contributions. Much less attention has been directed to the donation of time and talent as opposed to monetary contributions to charitable organisations. Nonetheless the amount of voluntary service in the economy is of great significance, and it is conceivable that donations of time and money are considered simultaneously in individuals’ decision-making process. Further, voluntary work and labor supply (i.e., work for pay) compete with each other in the individual’s time-allocation decision. Therefore one must recognize the underlying systematic relationship

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†Survey estimates by Morgan et al. [8] indicate that over six billion hours of time per year are given to charitable organizations.