UNCERTAINTY AND WAGE BARGAINING*

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1. Introduction

It is frequently said that wage bargaining is a kind of isolated exchange or bilateral monopoly, so that the solution is not unambiguous. In many wage bargainings, however, the labor union negotiates only the level of wages with the firm under a given employment. This is different from the general features of isolated exchange or bilateral monopoly where both bargaining units treat not only the price of a commodity but also the volume of transaction. In addition it is possible that strikes are taken place in the process of wage bargaining.

When the labor union asserts a wage increase, it is not certain whether the firm will accept the increase or not. It is possible for the union to strike work in order to attain its requirement, but it is also uncertain whether it is able or not to obtain the wage incerase from the firm by this means.

At the same time, when the firm's proposed wage increase is different from the union's assertion, it is uncertain for the firm whether the union will accept the proposal or not. In addition it is also uncertain for it how long the union will strike work. Therefore wage bargaining will proceed under uncertainty for both the labor union and the firm.

Taking into account uncertainty, we shall analyze the process of wage bargaining in this paper. We shall assume, for the sake of simplicity, that both the labor union and the firm are risk-neutral, respectively. That is, we assume the former determines its requirement of wage increase so as to maximize its expected gain from the wage increase, and the latter decides its answer so that it may minimize its expected loss from the wage increase.

We shall show that wage bargaining will reach a solution through soft bargaining, in which the union does not take strikes into practice, or hard bargaining, where it does strikes.

2. Target Function of Labor Union

Suppose a labor union is intending to ask the firm for a wage increase that employs members of the union. We can suppose three possibilities when the union claims a certain increase of wages, w, to the firm. The first is such a case that the firm accepts the claim

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without a positive period of strike, i. e., with zero period of strike. The second is a case where the union can realize its claim by means of a positive period of strike. In this case, it should spend some amounts of cost for strike. Let us denote strike cost per member of the union by c. Then the union's gain per member will be $(w-c)$ in this second case. The third is a case where the union cannot realize w, even if it strikes work for some period. In this case it will suffer a loss by c. Suppose the union subjectively judges that the first case will occur with probability q. Then the second and third cases will appear with probability $(1-q)$. Let us suppose furthermore that it is estimated that the second case will be taken place with probability r when the union will strike work during some period under a given $(1-q)$. We assume

Assumption 1 :

q and r are independent from each other.

Then, the first case will occur with probability q, the second case with probability $(1-q)r$, and the third case with probability $(1-q)\cdot(1-r)$.

If the union asks for zero increase of wages, then it can obtain it with probability 1, so that $q(0)$ will be equal to unity. When the wage increase is raised, q will be diminished, reaching zero at a positive wage increase, w_1. And we can suppose that the larger w is, the greater the rate of decrease of q becomes. Thus we suppose

Assumption 2 :

$$q=q(w)\,; \quad q(0)=1,\ q(w)=0 \ \text{ for } \ w\geqq w_1,\ q'(w)<0 \ \text{ for } \ 0\leqq w<w_1,$$
$$q'(w)=0 \ \text{ for } \ w\geqq w_1,\ q''(w)>0 \ \text{ for } \ 0\leqq w<w_1.$$

On the other hand, under a given w, therefore, under a given q, probability r will be increased when period of strike, S, is lengthened. Therefore we assume

Assumption 3 :

$$r=r(S)\,; \quad r(0)=0, \quad r'(S)>0 \ \text{ for } \ 0\leqq S, \quad r''(S)<0 \ \text{ for } \ 0\leqq S.$$

With regard to the union's strike cost c, we assume

Assumption 4 :

$$c=c(s)\,; \quad c(0)=0, \quad c'(S)>0 \ \text{ for } \ 0\leqq S, \quad c''(S)>0 \ \text{ for } \ 0\leqq S.$$

We suppose that the union is risk-neutral, so that it maximizes the following expected gain function with respect to w and S.

$$(1) \quad W=q\cdot w+(1-q)\cdot r\cdot(w-c)-(1-q)\cdot(1-r)\cdot c$$
$$=[q+(1-q)\cdot r]\cdot w-(1-q)\cdot c.$$

Now, the first order condition of maximization of W with respest to S under a given w is

$$(2) \quad \frac{\partial W}{\partial S}=(1-q)\cdot r'w-(1-q)\cdot c'=0.$$

From this equation we obtain

$$(3) \quad w=\frac{c'}{r'}.$$

Therefore, optimal S is independent from q, and it will change as follows when w increases ;

$$(4)\quad \frac{dS}{dw}=\frac{(r')^2}{c''r'-r''c'}.$$

$(r')^2$ and $(c''r'-r''c')$ are positive for $0\leqq S$. Therefore dS/dw is positive for $0\leqq S$.

Next, let us differentiate dS/dw with respect to w. Then we obtain

$$(5)\quad \frac{d^2S}{dw^2}=[2r'r''(c''r'-r''c')-(c'''r'-c'r''')(r')^2]/(c''r'-r''c')^2.$$

We may assume that the absolute value of $(c'''r'-c'r''')\cdot(r')^2$ is relatively small. Then

$$(6)\quad \frac{d^2S}{dw^2}<0 \quad \text{for} \quad 0\leqq S.$$

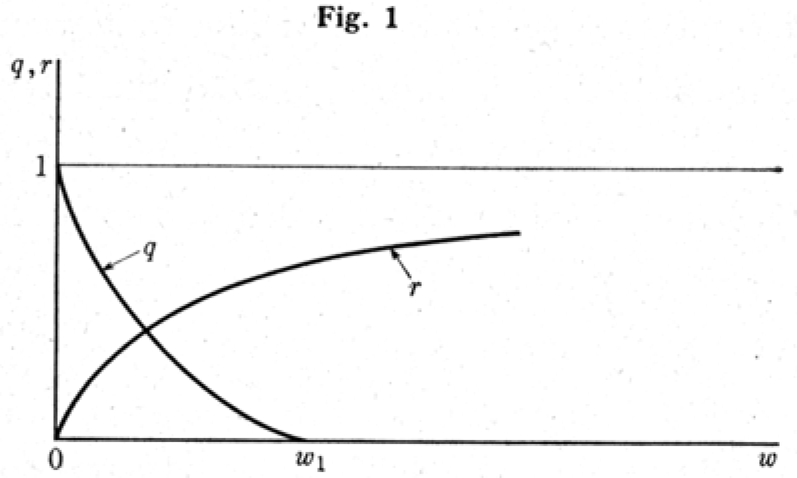
Thus we can obtain

$$(7)\quad r[S(w)]=0 \quad \text{for} \quad w=0,$$

$$(8)\quad \frac{dr}{dw}=\frac{dr}{dS}\cdot\frac{dS}{dw}>0 \quad \text{for} \quad 0\leqq w,$$

$$(9)\quad \frac{d^2r}{dw^2}=\frac{d^2r}{dS^2}\cdot\left(\frac{dS}{dw}\right)^2+\frac{dr}{dS}\cdot\frac{d^2S}{dw^2}<0 \quad \text{for} \quad 0\leqq w.$$

Fig. 1



Now we get Fig. 1. Because $\underset{w,S}{\text{Max}}\ W=\underset{w}{\text{Max}}\ \underset{S}{\text{Max}}\ W$, and optimal S is a function of w, we can suppose that the union will decide the level of w so as to maximize

$$(10)\quad W=[q(w)+(1-q(w))\cdot r(w)]\cdot w-[1-q(w)]\cdot c(w)$$

with respect to w. The first term of right-hand side of equation (10) is the union's gross expected gain, and the second term is its expected cost. Denote $(q+(1-q)r)$ by Q. Then the marginal gross expected gain is expressed by

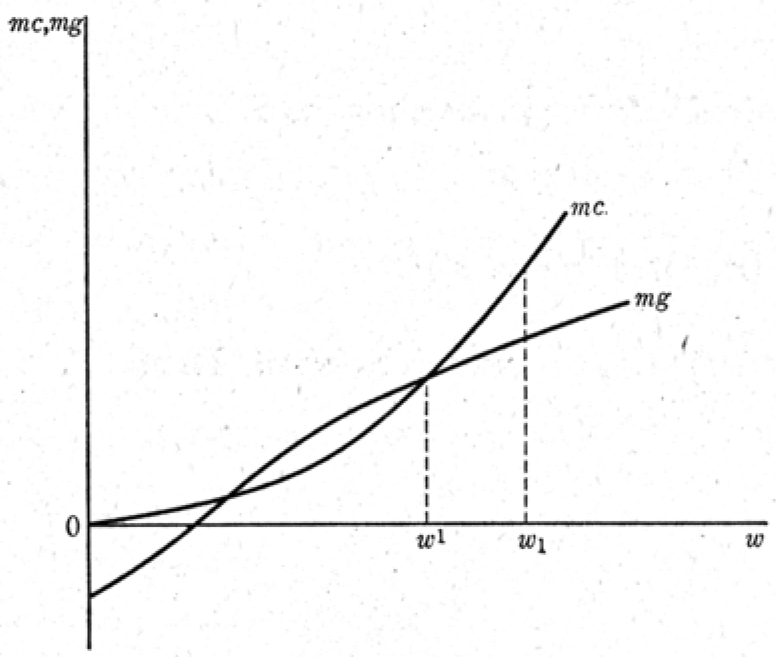
$$(11)\quad \frac{d(Qw)}{dw}=Q\left(\frac{dQ}{dw}\cdot\frac{w}{Q}+1\right),$$

where

$$(12)\quad \frac{dQ}{dw}=(1-r)q'+(1-q)r'\frac{dS}{dw}.$$

Because $\lim_{w\to 0} q=0$, $\lim_{w\to 0} q'<0$, and $\lim_{w\to 0} r=0$, dQ/dw will take a negative value, when w approaches to zero. Therefore the elasticity $(dQ/dw)\cdot(w/Q)$ will be negative at a small value of w. And if its absolute value is greater than unity, then the marginal gain will be negative. Thus it is possible that the marginal gain is negative in the neighborhood of $w=0$. However q and q' are zero, respectively, at $w=w_1$, so that the elasticity of Q with respect to w, therefore, the marginal gain, should be positive at $w=w_1$. In addition, Q is nothing but r in the range of $w \geqq w_1$, and r is an increasing function of w. Thus we obtain the marginal gain curve, mg, as shown in Fig. 2.

Fig. 2



On the other hand, the marginal expected cost is

$$(13)\quad \frac{d[(1-q)c]}{dw}=-q'\cdot c+(1-q)\cdot c'\cdot\frac{dS}{dw}.$$

This marginal expected cost is zero at $w=0$. If w is greater than zero, q' is negative, and c, $(1-q)$, c', and dS/dw are all positive, so that it should be positive. And when w is equal to or greater than w_1, it is nothing but $c'\cdot dS/dw$, which is, we suppose, an increasing function of w. Thus the marginal expected cost curve, mc, will bebave, for instance, as shown in Fig. 2. An optimal point for the labor union will be reached at w^1 in Fig 2.

3. Target Function of Firm

What target function does the firm have, which faces a wage bargaining? Suppose that when the firm answers a certain wage increase, v, to the union, the probability is p that the latter will accept v. Then $(1-p)$ is the probability that the union strikes work.

Now, let us denote the probability that a strike is taken place for some positive period, S, under a given $(1-p)$, by $f(S|v)$. Then

$$(14)\quad \int_0^\infty f(S|v)\,dS=1.$$

If the union strikes work, the firm will suffer losses. For it cannot sell its output because of the strike, so that it is not able to obtain profits, which would be realized if there did not occur the strike. In addition, it will have to spend some costs under the strike. Denote costs per member of the union due to strike by b. We may assume

Assumption 5:

$b=b(S),\quad b'>0,\quad b''>0,\quad b(0)=0.$

When the firm shows its answer of v to the union, its expected total cost due to wage bargaining, V, is

$$(15)\quad V=pv+(1-p)\int_0^\infty b(S)f(S|v)\,dS.$$

Let us denote the mean of S by $\bar{S}$, and its standard deviation by σ, i. e.,

$$(16)\quad \int_0^\infty Sf(S|v)\,dS\equiv\bar{S},$$

and

$$(17)\quad \int_0^\infty (S-\bar{S})^2 f(S|v)\,dS\equiv\sigma^2.$$

$\bar{S}$ and σ take given values under a certain magnitude of v. We may suppose that when v increases, $\bar{S}$ will become smaller. In addition, we assume that the variation coefficient of $S, (\sigma/\bar{S})$, remains constant even if $\bar{S}$ does change. That is,

Assumption 6:

$$\bar{S}=\bar{S}(v), \quad \bar{S}'<0, \quad \bar{S}''>0, \quad \bar{S}(0)=0, \quad \sigma/\bar{S}=\text{const.}$$

Develop $b(S)$ in the neighborhood of $\bar{S}$ to get

$$(18) \quad b(S) \doteqdot b(\bar{S}) + (S-\bar{S}) \cdot b'(\bar{S}) + (1/2) \cdot (S-\bar{S})^2 \cdot b''(\bar{S}).$$

Therefore we obtain

$$(19) \quad \int_0^\infty b(S) f(S|v) dv \doteqdot b(\bar{S}) + (1/2) \cdot b''(\bar{S}) \sigma^2.$$

On the other hand, for sufficiently small θ we have

$$(20) \quad b[(1+\theta)\bar{S}] \doteqdot b(\bar{S}) + \theta \bar{S} b'(\bar{S}).$$

From equations (19) and (20) we can determine such a value of θ that

$$(21) \quad b[(1+\theta)\bar{S}] = \int_0^\infty b(S) f(S|v) dS.$$

Namely, we get

$$(22) \quad \theta = \frac{1}{2}\left[\frac{b''(\bar{S})}{b'(\bar{S})}\bar{S}\right]\left(\frac{\sigma}{\bar{S}}\right)^2.$$

Thus, the firm's expected cost V is expressed by

$$(23) \quad V = p \cdot v + (1-p) \cdot b[B\bar{S}],$$

where

$$(24) \quad B = 1 + (1/2) \cdot (b''(\bar{S})/b'(\bar{S})) \cdot \bar{S} \cdot (\sigma/\bar{S})^2 > 0,$$

and we suppose B is a constant.

Now we may assume the following about p;

Assumption 7:

$$p = p(v), \quad p'>0, \quad p''>0, \quad p(0)=0.$$

The firm will determine the level of v so as to minimize V. V is composed of two factors. The first is its expected wage increase cost, $p\,v$. The marginal expected wage cost is positive except at $v=0$, and an increasing function of v, because

$$(25) \quad \frac{d(pv)}{dv} = p'v + p = p\left(p'\frac{v}{p}+1\right) \quad \begin{cases} =0 & \text{for} \quad v=0, \\ >0 & \text{for} \quad v>0, \end{cases}$$

and

$$(26) \quad \frac{d^2(pv)}{dv^2} = p''v + 2p' > 0.$$

The second factor is its expected strike cost, $(1-p) \cdot b(B\bar{S})$. The marginal expected strike cost is negative, and is increasing at least in the neighborhood of $v=0$, since

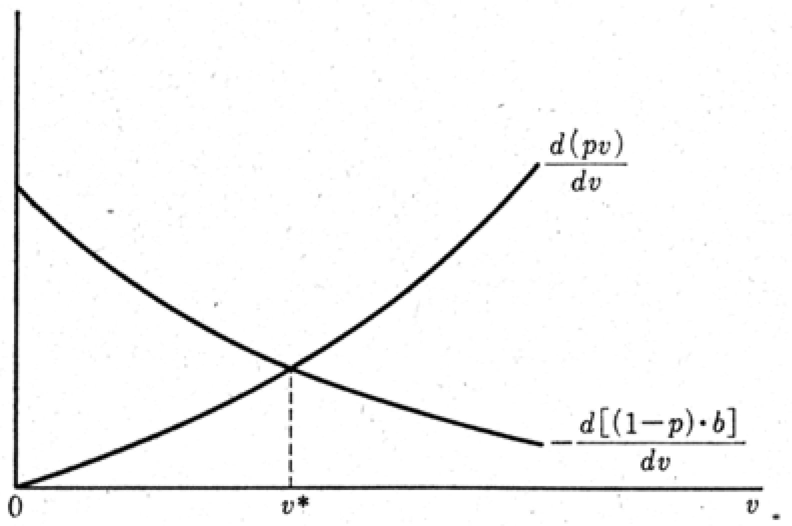
$$(27) \quad \frac{d[(1-p) \cdot b(B\bar{S})]}{dv} = -p' \cdot b(B\bar{S}) + (1-p) \cdot b'(B\bar{S}) B \frac{d\bar{S}}{dv} < 0 \quad \text{for} \quad v \geqq 0,$$

and

$$(28)\quad \frac{d^2[(1-p)\cdot b(B\bar{S})]}{dv^2} = -p''\cdot b(B\bar{S}) - 2p'\cdot b'(B\bar{S})B\frac{d\bar{S}}{dv} + (1-p)\cdot b''(B\bar{S})B^2\left(\frac{d\bar{S}}{dv}\right)^2 + (1-p)\cdot b'(B\bar{S})B\left(\frac{d^2\bar{S}}{dv^2}\right).$$

In the right-hand side of equation (28) other terms than the first one are all positive, and the first term is zero at $v=0$. Thus we obtain Fig. 3, where the firm's optimal v will be v^*.

Fig. 3



4. Rules for Wage Bargaining

Wage bargaining could bring about strikes in its process. In order to analyze the process including strikes, we should here make clear rules of wage bargaining. After the union shows its claim to the firm, such a situation could occur that it likes to prefer rather a greater wage increase to its last claim because of changes in conditions brought about by the process of wage bargaining. But the union will be restricted by its past bahavior in the process of bargaining. Therefore, we suppose that the union cannot ask for a higher increase of wages than its last claim. In this sense the union's claim is not reversible. With respect to the firm, we suppose also the same kind of irreversibility.

Rule 1:

The union does not ask for a greater wage increase than in the last request at each stage of wage bargaining. Similarly the firm does not answer a smaller wage increase than in the last proposal at each stage of wage bargaining.

Next, when the union receives an answer to its claim from the firm, it should decide its attitude towards the answer. How will it decide this?

Suppose that after it showed its claim of w^1 to the firm, it has received the firm's answer of v^1 less than w^1. Then it has already known that $q(w^1)$ is equal to zero. Therefore its expected gain under the optimal period of strike corresponding to w^1 will be $[r(w^1)\cdot w^1 - c(w^1)]$. As we shall discuss later, the value of q will be changed in the process of wage bargaining. It seems important in this case to distinguish the following three cases;

$$(29)\quad v^1 < W^1 \leqq \operatorname*{Max}_w W,$$

$$(30)\quad W^1 \leqq v^1 < \operatorname*{Max}_w W,$$

and

$$(31)\quad W^1 \leqq v^1 = \operatorname*{Max}_w W,$$

where W^1 denotes $[r(w^1)\cdot w^1 - c(w^1)]$. Let us denote w which maximizes W by w^*. Then w^* could be equal to or greater than w^1, or less than w^1. When the union faces equation (29), and w^* is greater than w^1, it cannot propose w^* to the firm because of **Rule 1.** And its expected gain under the original claim w^1, i, e., W^1, is greater than v^1. Therefore it will choose either to ask for w^1 again or to strike. But if w^* is less than w^1 under equation (29), it will be better for the union to demand w^* to the firm.

Secondly, in the case of equation (30) it will choose to accept v^1 if $w^* \geqq w^1$, and prefer to ask the firm for w^* if $w^* < w^1$.

Thirdly, in the case of equation (31) it will accept v^1 whether w^* is less than w^1 or not. Thus we get

Rule 2:

The labor union chooses either to accept v^1 *or to ask* w^* *or to claim* w^1 *again or to strike according to Table* 1.

Table 1: Choice of Labor Union

	$w^* \geqq w^1$	$w^* < w^1$
$v^1 < W^1 \leqq \underset{w}{\text{Max}}\ W$	w^1 or strike	w^*
$W^1 \leqq v^1 < \underset{w}{\text{Max}}\ W$	v^1	w^*
$W^1 \leqq v^1 = \underset{w}{\text{Max}}\ W$	v^1	v^1

On the other hand, suppose that after the labor union claimed at first w^1, and the firm answered v^1 which is less than w^1, the former asks the firm w^2, which is less than w^1 but greater than v^1. The probabilistic relationship between q and v will be changed, because it is certain for the firm that w^2 is accepted by the union. Under this new probabilistic relationship the value of $\{p(v^1)v^1 + [1-p(v^1)] \cdot b[B \cdot \bar{S}(v^1)]\}$ and that of $\underset{v}{\text{Min}}\ \{pv + (1-p)\,b(B\bar{S})\}$ will be changed. Denote the former by V^1 and the latter by $\underset{v}{\text{Min}}\ V$. Then we can distinguish the following five cases;

(32) $V^1 \geqq w^2 > \underset{v}{\text{Min}}\ V$,

(33) $V^1 > w^2 = \underset{v}{\text{Min}}\ V$,

(34) $w^2 > V^1 > \underset{v}{\text{Min}}\ V$,

(35) $w^2 > V^1 = \underset{v}{\text{Min}}\ V$,

(36) $w^2 = V^1 = \underset{v}{\text{Min}}\ V$,

In the case of equation (32) the firm will accept w^2 if $v^* < v^1$, where v^* denotes v minimizing V, because it cannot assert v^* owing to **Rule 1.** And if $v^* > v^1$, it will asnwer v^* to the union.

Secondly, if the firm faces the situation of equation (33), it will accept w^2 whether v^* is less than or greater than v^1, because the expected cost under v^1 is greater than w^2.

Thirdly, the firm will persist in v^1 if $v^* < v^1$, and answer v^* to the union if $v^* > v^1$, in the case of equation (34).

Forthly, under equation(35) it will adhere to v^1, which is equal to v^* in this case.

Table 2: Choice of Firm

	$v^* < v^1$	$v^* = v^1$	$v^* > v^1$
$V^1 \geqq w^2 > \underset{v}{\text{Min}}\ V$	w^2	—	v^*
$V^1 > w^2 = \underset{v}{\text{Min}}\ V$	w^2	—	w^2
$w^2 > V^1 > \underset{v}{\text{Min}}\ V$	v^1	—	v^*
$w^2 > V^1 = \underset{v}{\text{Min}}\ V$	—	v^1	—
$w^2 = V^1 = \underset{v}{\text{Min}}\ V$	—	w^2	—

Fifthly, it will accept w^2 in the case of equation (36), because the expected cost under v^*, which equals to v^1 here, is also equal to w^2.

Thus we obtain **Rule 3** about the firm's decision.

Rule 3:

The firm will choose either to accept w^2 *or to propose* v^1 *or* v^* *according to Table* 2.

Finally in the process of wage bargaining there could occur such a situation that both the union and the firm propose the same claim or answer again and again. In such a case we may suppose that the union will strike to find a way out of the stalemate. Therefore we postulate

Rule 4:

The labor union strikes work, if it receives a same answer again from the firm.

5. Soft Bargaining

Now we are able to analyze the process of wage bargaining. We distinguish two types of bargaining. The first is such a case where bargaining proceeds without strikes. We shall call this soft bargaing. The second is the process of bargaining, which contains strikes, and we shall call it hard bargaining. Let us first investigate the proceess of soft bargaining.

It is not the firm but the labor union that seeks to incresase wages. Therefore, at first, the labor union proposes a wage increase to the firm to start wage bargaining.

Step 1:

The union determines a wage increase w^1 so as to maximize its expected gain W given in equation (10), presenting it to the firm.

Step 2:

The firm will investigate a wage increase v^1 which will minimize V given in equation (23), after it received the union's request w^1. In this case, if it answers w^1 to the union, it is sure that the union will accept the answer. Therefore

(37) $p(v)=1 \quad \text{for} \quad v \geqq w^1.$

If dV/dv is always negative in the region of $0 \leqq v < w^1$ under this probability, the firm will accept w^1, so that wage bargaining will end up. And if the firm's optimal increase of wages, v^1, is less than w^1, it will show v^1 to the union as its first answer.

Step 3:

When the firm shows its answer v^1 ($<w^1$) to the union, the latter will investigate to accept v^1 or not in the light of its target function. In this case the probability q will be changed, because it is certain at this time that the firm will accept at least v^1. Therefore

(38) $q(w)=1 \quad \text{for} \quad 0 \leqq w \leqq v^1.$

Generally speaking, we may say that $q(w)$ will shift upwards, when the union faces the firm's answer, v^1. And the union will examine its new optimal increase of wages under the new relationship between q and w, determining its attitude according to **Rule 2**. In the present case of soft bargaining we exclude the possibility of strike. Therefore we can suppose that the union's second claim, w^2, satisfies inequality $v^1 \leqq w^2 \leqq w^1$. And if w^2 is equal to v^1, wage bargaining reaches an agreement. Accordingly let us suppose that w^2 is greater than v^1.

Step 4:

If the union's second claim, w^2, is equal to w^1, the firm's optimality is achieved again by v^1. Therefore the firm will persist in v^1. And the union's optimal w will be w^1 under v^1. Accordingly wage bargaining will come to a standstill. In this situation the union will strike work according to **Rule 4.** Thus soft bargaining will turn to hard bargaining. And we shall analyze it later. Therefore let us suppose that $v^1 < w^2 < w^1$.

When facing this claim w^2, the firm will change p as follows;

(39) $p(v) = 1$ for $v \geqq w^2$.

And we may suppose that the relationship between p and v shifts upwards. The firm will examine to accept w^2 or not according to **Rule 3.** When it accept w^2, bargaining will be closed. And if it persist in v^1, the union's optimal increase of wages under $q(v^1)$ does not change from w^2, so that soft bargaining will be turned to hard one according to **Rule 4.** Thus soft bargining will be continued if the firm shows its answer of v^2, which satisfies $\underset{v}{\text{Min}}\ V$ and is greater than v^1, to the union.

Therefore, in soft bargaining we obtain the following relationship;

(40) $v^1 < v^2 < v^3 < \cdots < w^3 < w^2 < w^1$,

and both the union and the firm will find an agreeable point in this processs.

6. Hard Bargaining

Let us turn to investigating the process of hard bargaining. Suppose that the labor union has struck for, say, a certain optimal period under w^1, according to **Rule 2** or **Rule 4.** Then it would be charged costs for the strike by $c(w^1)$. And at the same time the firm would also suffer costs due to the strike. Since firm's expected cost due to strike, $b[B\bar{S}]$, depends on its subjectively determined probabilities with respect to periods for strike, the firm's cost due to actual strike could be different from $b[B\bar{S}]$. For the sake of simplicity, however, let us assume that the actual cost was equal to the firm's expected one. Then the firm's V function after the strike, V_{S1}, will be

(41) $V_{S1} = pv + (1-p) \cdot b[B\bar{S}(v)] + b[B\bar{S}(w^1)]$.

Depending on this V function, we can show the firm's reaction under hard bargaining.

Step 1:

V_{S1} is same to V function before the strike except a constant term, $b[B\bar{S}(w^1)]$. Therefore, there are two possibilities. The first is such a case that v minimizing V_{S1} is identical to v^1. The second is a case where the global minimum of V_{S1} is reached at w^1 because of the upward shift of firm's expected cost curve caused by the fixed cost, $b[B\bar{S}(w^1)]$, even if v^1 is a local minimum point. Thus the firm will persist in v^1 even after the strike in the first case. But in the second case, it will accept w^1.

Step 2:

Suppose the firm persisted in v^1 again. Then, how will the union behave? The union has been charged $c(w^1)$ by its strike. Therefore its W function after the strike, W_{S1}, becomes

(42) $W_{S1} = [q + (1-q)r]w - (1-q) \cdot c(w) - c(w^1)$.

This W_{S1} shifts downwards from the original W function by a fixed term $c(w^1)$, so that the union will strike again to get w^1 except in such a case that the value of W_{S1} at w^1 becomes equal to or less than v^1. If W_{S1} (w^1) is equal to or less than v^1 it will accept v^1.

Step 3:

After the second strike, the firm's V function will be

$$(43) \quad V_{S2}=pv+(1-p)\cdot b[B\bar{S}(v)]+2b[B\bar{S}(w^1)].$$

That is, V_{S2} shifts upwards by $b[B\bar{S}(w^1)]$ compared with V_{S1}. Therefore the possibility that the firm accepts w^1 will become greater than before.

Step 4:

If the firm answered v^1 to the union again at **Step** 3, however, the union's W function will turn to

$$(44) \quad W_{S2}=[q+(1-q)r]w-(1-q)\cdot c(w)-2c(w^1).$$

This situation will intensify the tendency for the union to accept v^1.

Now it is obvious that such a situation should appear that either the union or the firm is obliged to accept the assertion of the other side after several strikes. For actual costs due to strikes are accumulatively increased in both sides. Thus hard bargaining will be fininished, and reach a solution.

7. Conclusion

In the above we are able to clarify that wage bargaining will have a solution either in the form of soft or in that of hard bargaining. This is because functions $q(w)$ and $p(v)$ shift in the process of bargaining, and because costs due to actually happened strikes in both sides of bargaining intensify a tendency for one of participants to accept the other's assertion, as the number of strikes is increased.

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