The efficient (wage-employment) bargaining solution

The efficient bargaining solution removes the inefficiency of the wage bargaining solution by leading to efficiency with respect to employment.

Assume that the wage-employment bargaining solution is derived by the parties splitting the “net gain” from a bilateral bargain. We then have to define what we mean by the “net gain”. Consider then a case where the “starting point” for the firm is zero profits (the gain is then the realized profit level R) and the “starting point” for the union is where all workers receive the unemployment benefit b.

(One way to view this is that if there is no agreement in the bargain, there will be a work stoppage in which case the firm will earn zero profits, and all the workers will get the unemployment benefit b.)

Assume also that the relative bargaining power of the union is $\beta$, and that of the firm is $1-\beta$. The so-called Nash bargaining solution then implies that the following Nash product (NP) should be maximized with respect to w and L:

$$\max NP = U^\beta \Pi^{1-\beta} = [(u(w)-u(b))L]^\beta [pf(L)-(w-e)L]^{1-\beta}$$

with respect to L and w. This yields the following two-equation system:

$$\frac{\partial NP}{\partial w} = \beta U^{\beta-1} \Pi^{1-\beta} Lu'(w) - (1-\beta)U^\beta \Pi^{-\beta} L = 0$$

$$\frac{\partial NP}{\partial L} = \beta U^{\beta-1} \Pi^{1-\beta} (u(w) - u(b)) - (1-\beta)U^\beta \Pi^{-\beta} (w-e) = 0.$$
Note the difference between this problem and the wage bargaining ("righ-to-manage") problem, where we in addition had to impose a constraint that the firm is on its demand curve for labor. Here there is no such constraint, and we may optimize freely.

This leads to the following two conditions:

\[
\frac{U}{\Pi} = \frac{\beta}{1-\beta} u'(w)
\]

\[
\frac{u(w) - u(b)}{u'(w)} = -(pf'(L) - (w - e)).
\]

(14) expresses the split of the net gain between the two parties which should be according to relative bargaining powers of the two parties \((\beta/(1-\beta))\), and relative risk aversion \((u'(w) = 1\) and constant will here express risk neutrality, \(u'(w) < 1\) and falling in \(w\) expresses risk aversion for workers; firms are always assumed to be risk neutral).

(15) expresses the shape of the contract curve. We find that along the contract curve the following relationship holds (differentiating (15):

\[
\frac{dw}{dL} = \frac{(u'(w))^2 pf''(L)}{[u(w) - u(b)]u''(w)}.
\]
We may here consider two separate cases, namely a) workers are risk neutral \( u'(w) = 1 \) and \( u''(w) = 0 \) and workers are risk averse \( u''(w) < 0 \).

a) Worker risk neutrality. Then we always have \( dw/dL \) infinitely high: the contract curve is vertical. This implies a unique optimal solution for \( L \), given by \( pf'(L^{opt}) = b-e \) (from (15)).

b) Worker risk aversion. In this case the contract curve generally has positive slope, from (16), but “starts” (in the point \( b, L^{opt} \)) with an infinite slope, i.e. vertically. It then curves up to the right. This will be illustrated in class, in a figure.

Consider the risk neutrality case with \( e=0 \) (i.e. the firm pays no tax to the government if it lays off/fires workers; there is no “experience rating”). Then we know that \( L \) is a constant independent of the bargaining power of the parties, and given by \( L^{opt} \). From (14)-(15) \( w \) is now given by

\[
(17) \quad w = (1-\beta)b + \beta b \frac{f(L)}{L}.
\]

In this case the wage is a weighted sum of the worker opportunity cost \( b \), and the average product of labor, with weights equal to the relative bargaining powers for, respectively, the firm and the union.
Efficient bargaining as an equilibrium in a repeated game

The model above took as given that the parties have not incentives to deviate from an efficient bargaining solution, once it is reached. In practice it may however be the case that the firm may be in a position to actually affect employment ex post, after the wage has been set. In that case we have seen that the monopoly union solution, or the right-to-manage solution, must be invoked, in the absence of any cooperation between the two parties.

Another way to view this problem is however to think that the firm actually may set employment unilaterally in a given period, but that it may be constrained by long-run considerations. The main new point here is that the relationship between the union and the firm is likely to be ongoing over a large number of periods, not just the single period we have been discussing so far. We will show that this may make it rational for the firm to actually set the employment level equal to the bargained level, instead of setting employment at a point on the regular demand function.

We will study a simple model to make this point. Assume now that the relationship between the union and the firm goes on for a potential infinity of periods, and that the parties discount the future with a fixed discount factor $\delta < 1$ (corresponding to a positive interest rate $r$, by the relationship $\delta = 1/(1+r)$). Assume also that the union members are risk neutral, as in the last example above.

The two parties are now assumed to agree on an efficient bargaining solution, described by $f'(L_B) = b$, and $w = w_B$ given by (17). This defines a profit level $\Pi_B$ for the firm, and a utility level $U_B$ for the union.
We also assume that if there is no bargaining solution, the union is free to set the wage unilaterally, and the firm to set employment, i.e., we have the monopoly union solution. This defines a profit level $\Pi_M$ for the firm, and utility level $U_M$ for the union. The nature of the bargaining solution will be such that $\Pi_B > \Pi_M$, and $U_B > U_M$ (both parties gain by bargaining instead of unilateral action; this is illustrated in the figure which is distributed).

Note that we must have $w_B < w_M$. If not, the firm could not gain from the efficient bargaining solution (since the firm maximizes profit given $w_M$ in the monopoly union solution).

We also assume that in a given period, if the parties have agreed on an efficient bargaining solution, the wage is first set equal to $w_B$, and then the firm is free to set employment. The question is whether the firm may have incentives to still set employment equal to $L_B$.

Consider now a case where firm sets $L = L_D$, so as to maximize short-run profits in the first period, after the wage has been set at the efficient bargaining level $w_B$. $L_D$ will be set to maximize short-run profits of the firm given the efficient bargaining wage, i.e., such that $f'(L_D) = w_B$. This leads to a profit level for the firm equal to $\Pi_D > \Pi_B$ (since profits now are maximized given $w_B$, which they are not in the efficient bargaining solution). Note that we also have $\Pi_D > \Pi_M$ (since $w_B < w_M$).

Consider the following sequential game:

In the first period, the union sets $w = w_B$. If the firm then sets $L = L_B$, the union in the next period sets $w = w_B$, and so on.

If instead the firm in the first period instead deviates, and sets $L = L_D$, the union sets $w = w_M$ in all future periods from then on. (The firm will then in all future periods set $L = L_M$.)
The same sequence of events is assumed to take place after the firm, in any one given future period, has set \( L = L_D \).

The firm is thus “punished” for not keeping the agreement to hold employment at the level \( L = L_B \). It is a punishment since, in future periods, the firm will only obtain a profit of \( \Pi_M \), against a profit in all future periods of \( \Pi_B \) if the two stick to the bargaining solution. We want to study whether the firm after all wants to keep to the bargaining solution, instead of deviating.

The discounted future utility to the firm of maintaining the bargaining solution is given by

\[
V(B) = \Pi_B + \delta \Pi_B + \delta^2 \Pi_B + ... = \frac{1}{1 - \delta} \Pi_B.
\]

The discounted future utility to the firm of deviating in the first period, and obtaining the monopoly union solution in future periods, is

\[
V(D) = \Pi_D + \delta \Pi_M + \delta^2 \Pi_M + ... = \Pi_D + \frac{\delta}{1 - \delta} \Pi_M.
\]

We find that \( V(B) > V(D) \) given that

\[
\Pi_B > (1 - \delta) \Pi_D + \delta \Pi_M.
\]

Since \( \Pi_D > \Pi_B > \Pi_M \), we see that (20) is fulfilled whenever the discount factor \( \delta \) is sufficiently close to one. This implies that the firm is sufficiently patient to keep its part of the bargain (retain employment at the level \( L_B \), instead of deviating to the alternative level \( L_D \)).
Some other interesting cases to be studied (which are not detailed in the lectures)

The case of elastic product demand

Another alternative case is one where the demand for the product of the firm is elastic, such that when output is reduced, the product price goes up. It can be shown that this can be used strategically, by the union, to push up the wage by more than otherwise, since the firm is hurt less by such an increase.

This case will be studied in more detail in a later exercise.

The case of endogenous effort

In the model so far it has been taken as given how hard workers are to work, in terms of intensity and hours. These features may be part of the bargain. It will not be studied in detail here, but will become more prominent in the lectures on implicit contracts (over the next two weeks).

Overall macroeconomic effects of unions in economies where not the whole labor force is unionized

This is also a case that will not be considered in detail in the lectures. An example of this topic will be taken up in the seminar exercise for next week (part 2).

One main point here is that when one sector of the economy is unionized, and employment is reduced in that sector due to unions (e.g. under the monopoly union solution), wages may be depressed in the rest of the economy; there may form queues for membership in unions; and we may or may not have excessive unemployment of union members. This issue may in turn depend on the policy of unions to allow members in.