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UNION-FIRM BARGAINING OVER LONG TERM BENEFITS

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Union-Firm Bargaining over Long Term Benefits[1*]

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ABSTRACT.

The paper studies bargaining over workers' benefits which are due some time in the future. A union bargains on behalf of a workforce which may be diverse in the sense that workers' probabilities of staying with the firm vary. Bargaining structure, rather than the bargaining power of the union, is found to be the driving force in the model for determining the level of benefits. A further key issue is that of whose preferences are represented in the union's objective function, and thereby in the bargaining process.

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Union-Firm Bargaining over Long Term Benefits

1. Introduction.

The relationship between a firm and its workers often involves more than just paying a wage for the delivery of a contracted effort. Some workers may stay with a firm for a long period, and during a long term relationship they will receive different benefits from the firm. The most commonly observed kinds of deferred payment are old age pensions and sickness insurance, and in some instances shares or stock options. Such arrangements can be agreed upon individually, or bargained collectively by a union and the firm. In Europe firm-related pension schemes are generally provided on top of social insurance arrangements, whereas in the USA such pensions and sickness insurance arrangements may be the only insurance held. The role of the firm in providing savings and as insurance vehicles for its workers' pension plans has many explanations. For example, the firm's workforce may constitute a pool where adverse selection issues are avoided. Also, the firm may be able to avoid many of the costs of operating personal pension schemes by avoiding commisions and spreading fixed transactions costs over all employees. This latter explanation will be sufficient for our purpose: lower costs make firm pension schemes a preferred savings mechanism. This paper seeks to examine the implications of the bargaining activity between firms and labour unions for such deferred benefits. Wage bargaining may be considered the prime role of unions, but how does bargaining relate to the efficient provision of deferred benefits and pensions?

The promise of a future payment always involves some risk for the recipient, see Budden (2000) for some case-specific examples, and Curme and Kahn (1990) and Orr (1998) for more general considerations of the risk involved. Will the firm ever be in a position to deliver the goods? Specifically, the firm may go bankrupt, or may close down part of its operation, leaving the individual employee with a substantially lower pension fund as well as no job. An obvious example

is the case of defined benefit pension schemes. Here, the employee is promised a pension linked to his/her final salary. If his/her job is removed in mid-career before retirement age then it is only the credit relating to mid-career salary which determines the contribution of this employment to pension: the enhancement, through income growth to retirement age, of early years of service is lost. Also, the pension may be switched into a defined contribution rather than defined benefit scheme, with essentially the same outcome. Orr (1996) discusses the impact of firms "downsizing" on the type of pension offered in the USA. Bloom and Freeman (1992) show that the reduction in pension coverage rates and the shift to defined contribution schemes are only partly explained by structural changes. Orr argues that the remaining factors are linked to downsizing and the desire to avoid the capital risk of the defined benefit schemes. This is particularly sensitive in situations where mortality rates are falling so that actuarial costings of pension benefits tend to be understated. Certainly considerable concern is currently being voiced in the UK at both the capital risk of defined benefit schemes and the opportunities for firms to terminate these schemes in favour of less costly defined contribution schemes. On the other hand, it is not certain whether future compensation will have to be made in full by the firm since some or indeed all workers may leave the firm voluntarily before the time of delivery arrives. The credibility of firm promises, the duration of worker-firm relationships and workers' seniority may be important characteristics of how to evaluate compensation by means of deferred payment.

An important distinction in bargaining theory is between the right-to-manage model, and the efficient bargaining model, see McDonald and Solow (1981) and the survey by Oswald (1985). In the former model only wages are bargained and the firm unilaterally determines employment on the labour demand curve. However, this contract is not efficient. Efficient bargaining involves bargaining over wages and employment simultaneously, yielding an efficient outcome on the union-firm contract curve. Manning (1987) shows that the crucial point is not whether bargaining takes place

simultaneously. What matters is that the bargaining power is the same on all variables of importance. If a variable influencing the union utility is not covered by bargaining, the union or the firm will anticipate a reaction from the other, and the outcome is off the contract curve. Thus, Grout (1984) and Hoel and Moene (1988) show that the absence of binding contracts between firm and union leads to inefficient levels of capital, and that the capital stock is influenced by the union bargaining power. A pure efficient bargaining model is represented by the labour-managed firm, see Ireland and Law (1982), and long term contracts are credible since the workers control all variables. Thus workers have themselves paid the cost, and have an incentive to stay with the firm until future benefits are paid (Askildsen and Ireland (1993)). It is clearly more difficult for a profit maximising firm to engage in long term relationships, since it may have an incentive to deviate and choose a myopic, short term optimal path. Promises, not supported by credible contracts that are verifiable in a court of law, may be dynamically inconsistent.[2]

Some practical consequences of risky firm behaviour relate to costly insurance schemes for pensions, see Targett and Beattie (2000). The key issue of this paper is the analysis of bargaining when the firm can take actions to make the delivery of deferred benefits more likely. Examples include i) undertaking less risky investments to avoid significant chance of bankruptcy, ii) rejection of offers of takeover and merger, iii) avoiding downsizing at too fast a rate, and iv) avoiding employment policies which penalise existing workers (for example hiring senior personnel from outside rather than internal promotion). Such management policy choices obviously come under the normal interpretation of right to manage, rather than a factor in the bargaining process. The extent of deferred benefits can be agreed but not the mechanism which ensures their delivery. The question is what then determines the level of deferred benefits. Is it the distribution of bargaining power or the

[2] In some instances non-verifiable variables can be implicitely bargained, see Malcomson and MacLeod (1993) and Malcomson (1997). However, it is also recognised that some hold-up problems cannot be easily overcome.

level of the firm's commitment to delivery? Within the limitations of our model we will argue that it is the latter. Thus the highest levels of deferred benefits will be observed in firms which have a high survival probability and a reputation for cradle-to-grave employment, and not necessarily in those firms where unions have high bargaining power[3]. An important assumption of our model is that individual workers have risk aversion increasing with age (see next section).

A further issue relates to internal conflicts within a union. It may be difficult to agree on a common goal of the union when workers are heterogeneous. In particular they will differ in terms of their interest in the expected return from future benefits like a pension plan. It is customary to settle such political economy problems applying a median voter approach. However, the power structure of unions is not always so simple. Senior workers may have more power that younger workers, or there may be an elected agenda setter, see Freeman (1985) and Flanagan (1993). Thus, the content of the contract, but not the optimality of the bargaining process as such, is likely to be affected by the internal power structure of the union. An accepted tradition of "last-in-first-out" (LIFO) is a clear example of an allocation of power which may affect both union behaviour and the results of bargaining. The question then arises as to the impact of this kind of priority on the bargaining outcome when bargaining includes deferred benefits.

Our approach will be to take a very simple stylised model, and this is explained in the next section. The benchmark Pareto optimal solution is presented in section 3, and equilibrium under different bargaining regimes are compared in section 4. Heterogeneity in the work force is introduced in section 5, and a reinterpretation and modification of the model is made in section 6 to permit the LIFO convention to be analysed. Section 7 makes some concluding remarks.

[3] This line of reasoning follows the convention of modelling bargaining outcomes as the solution to e.g. a Nash cooperative bargaining problem. However, equally important for bargaining outcomes may be what can be bargained, who sets the agenda of bargaining etc. Ours is an example that such other matters are important for the outcome. Note that the resultant wages will still reflect bargaining power in the traditional sense.

2. Model.

Our model will be based on the following assumptions and framework.

1. Individual workers live for two periods. In the first they receive wage income *w*; in the second they may receive a benefit *s* on top of a base level of benefit normalised to zero.
2. The benefit is paid to the workers only if they stay with the firm and the firm remains in business; thus, both parties must survive for the benefit to be realized. The survival probability of the firm is *p*. The probability *q* of a worker staying with the firm, given that the firm stays in business, represents the type of each worker. In this paper we treat q as exogenously fixed. In the early sections all workers have the same q; later this is generalised.
3. The worker's lifetime utility is the sum of two period utility functions. Appropriate discount factors are included in the second period utility, but are left implicit since they play no additional role in the analysis.
4. Workers are assumed to have increasing risk aversion in age. This has theoretical, empirical and practical support. The theory applies to the notion of the individual making lifestyle choices in period 1 (for example how hard to work given the wage rates, what consumer durable goods are chosen to buy) and then being left few degrees of freedom when old or ill. Thus, retirement plans are based on a given income, but shortfalls on the income have dire consequences just as overshoots on income have little benefit. For older men and women "the lure of substantial financial gains was not worth the possible loss of money-in-hand." (Botwinick (1978) 129-130). Essentially, the inability to make up lost income by working harder in conjunction with a more uncertain lifetime (relative to mean lifetime) makes older people more risk averse. The practical evidence that supports increasing risk aversion is the recommended investment strategies as age

changes: on retirement a non-risky portfolio is the standard recommendation. Empirical analysis, for example Bakshi and Chen (1994) relate the data on US savings to this "life-cycle risk aversion hypothesis", by looking at how aggregate behaviour changes with the age distribution. They stipulate a relative risk aversion coefficient as changing linearly with average age, and find a significant positive slope, particularly for post-war USA.

5. To make the model tractable the increasing risk aversion is assumed to take a very simple form. The benefit yields a second period utility $u(s)$ to each worker, where

   $u'(s) > 0$, $u''(s) < 0$, $u(0) = 0$, $u'(0) > 1$.

   First period utility is assumed linear in the wage w. Thus the worker changes from being risk neutral in terms of *current income* in period 1 to risk averse in income in period 2. The model may be interpreted as a two period model or as a model with consumption in two possible states (for example in sickness and in health). A worker of type q has (the same) reservation utility $\bar{U}$, and her expected utility is given by

   (1) $$U = w + p\, q\, u(s)$$

   since the utility from benefit is only obtained if the firm survives and the worker remains within the firm.

6. The firm's expected profit Π is given by

   (2) $$\Pi = p\,(R - q\, s)\, N - w\, N - v(p), \quad N \leq M$$

   where $v(p)$ represents the costs of lost expected profit opportunities incurred by the firm to increase the survival probability p. We assume that $v(0) = 0$, $v'(p) > 0$ and $v''(p) > 0$. In later analysis we will take $v''(p)$ as constant. The cost of ensuring survival may be the rejection of an investment project with a high risk of disaster but with high expected profits. Declining such projects decreases the firm's expected profit but increases its chance of survival. Thus, there is a cost involved in increasing the firm's survival probability.

7. N is employment to be determined by the firm, or bargained with the workers. M is the capacity of the firm with respect to the labour force. Further workers are assumed unproductive. Thus, there is a simple production function which yields revenue linear in employment, RN, for $N \leq M$. All workers are equally productive up to the given level of capacity.

8. The benefit s represents the market value of real resources which the firm would otherwise retain. Therefore the firm's net revenue is $(R - qs)N$ to be received with probability p.

9. A generalised Nash bargain is applied to choose values of all or some of N, p, s and w. The bargain takes place at the start of period 1. No renegotiation is possible. Any remaining variables not included in the bargaining process are determined by the firm alone. The key variable likely to be omitted from the bargaining process is p.

10. We first consider the case where workers are homogeneous. When homogeneous, all workers are of the same type q. Under heterogeneity, the workers are distributed according to the density function $f(q)$ of worker types, still with a given maximum work force M. A further heterogeneity of workers is introduced later by assuming that they differ in terms of their trade off between wages and future benefits. Lastly, we investigate possible effects of applying seniority preferences in firing decisions.

3. Benchmark: The Pareto optimal solution

The Pareto optimal solution maximises the total "pie". Bargaining yields a particular distribution of the pie, which is analysed in the next section. We first find Pareto optimal solutions in our model.

Consider the problem of maximising the social gain from the firm's activities, $W(p,s,N) = \_ + N(U-\square)$. The wage transfer drops out since we have assumed U is linear in w, and so the gain is given by

(3) $W(p,s,N) = [p(R - qs) - \square + pqu(s)]N - v(p)$.

Provided maximum profit is non-negative and $U \_ \square$ (for firm and worker to willingly participate in the activity), the Pareto optimum requires that $\{p, s, N\}$ satisfy the following first-order conditions:

(4N) $[p(R - qs) - \square + pqu(s)] \_ 0$ *and* $N=M$

(4p) $[(R - qs) + qu(s)]N - v'(p) = 0$

(4s) $pq(u'(s) - 1) = 0$

We describe the solution to these first order conditions as $N=M$, $s=s^*$ and $p= p^*$. (4N) ensures that the social gain is positive. The solution s^* is the benefit level which equates the marginal utility of income in periods 1 and 2. The intuition of (4s) is that the expected marginal social cost of an additional unit of benefit is pq and the expected marginal social benefit is $pq\,u'(s)$ since the cost and the benefit transfer are only made if the worker-firm relationship survives. From (4p) the optimal p^* has the property that the marginal cost of additional survival probability in terms of profits forgone ($v'(p)$) is equal to the expected social gain from firm survival. Having obtained the biggest total "pie", it is left to the wage w to allocate the pie between the workers and the firm.

4. Bargaining with homogeneous workers

We will investigate two different bargaining regimes, which will yield different outcomes. Efficient bargaining represents the optimal solution when all variables can be contracted. On the other hand, a right-to-manage solution is interpreted as a situation where the firm has the discretion to determine at least one variable after the others are settled. In particular for our analysis here, the firm *may reserve the right to make decisions on the level of investments in the survival probability*. Since these decisions are taken to maximise the firm's outcome, rather than the total pie, they will not usually lead to a Pareto optimal solution.

(b) Efficient Bargaining

All relevant variables and conditions of work are determined cooperatively through bargaining between the workers and the firm. Thus, the variables *N, w, s* and *p* are bargained simultaneously. The outcome can be represented as the solution to an asymmetric Nash cooperative bargaining programme, with β as the exogenously given bargaining power of the firm and $(1 - \beta)$ representing the union's bargaining power, given the alternative wage _ for all workers[4]:

$$(5) \qquad \Omega = \{[p(R - qs) - w]N - v(p)\}^{\beta} \{[w + pqu(s)]N + (M - N)\Box - M\Box\}^{1-\beta}, \quad N \leq M.$$

We take the logarithmic transform of (5):

$$(6) \qquad \ln \Omega = \beta \ln \{[p(R - q\,s) - w]N - v(p)\} + (1 - \beta) \ln \{[w + pqu(s) - \Box]N\} ,$$

4 Alternatively, a sequential bargaining model might be used, cf, Manning (1987). With the same bargaining power on all stages, the same efficient solution will emerge. The bargaining power of the workers, β, would in a sequential bargaining model be interpeted as representing their degree of impatience, or time preference.

and maximize ln Ω with respect to *N, w, s* and *p*. The first order condition with respect to *w* may be written as

1. _ ln Ω /_w = 0 _ -β [w + p q u(s) - Ω]N + (1 - β) [(p(R - q s) - w)N - v(p)] = 0,

or, solved for *w*, as

(8) *w = (1 - β) [p(R - q s) - v(p)/N] - β p q u(s) + β Ω*

or
[(p(R - q s) - w)N - v(p)] =β {[p(R - q s)N - v(p)] +(p q u(s) - Ω)Ω } = β W(p,s,N)
[w + p q u(s) - Ω]N = (1-β) {[p(R - q s)N - v(p)] +(p q u(s) - Ω)Ω } = (1-β) W(p,s,N)

so that β gives the proportionate allocation of the surplus to the firm. Substitution into (6) yields

(6') *ln Ω = β ln_ +(1 - β) ln (1 - β) + ln W(p,s,N).*

Thus it is simple to prove

Proposition 1:

In an efficient bargain, the solution for p,s,N is Pareto optimal for any distribution of bargaining power. Only the wage rate w reflects relative bargaining power.

Proof:

For any given w, (6') shows that the values of *p,s* and *N* are chosen to maximise *W(p,s,N)*, and these are the Pareto optimal values *p*,s** and *M* given by (4*p*), (4*s*) and (4*N*). The wage rate is given by:

(8') $w = (1 - \beta)\,[p^*(R - q\,s^*) - v(p^*)/M] - \beta\, p^*\, q\, u(s^*) + \beta\,\bar{u}$

This completes the proof of Proposition 1.■

Efficient bargaining yields a Pareto efficient choice of s^* and p^*, whatever the level of bargaining power. Having derived s^* and p^*, and $N = M$, the wage is the only element of the bargain that depends on β. Note that with a pure capitalist firm, defined by $\beta = 1$ to reflect the property that all bargaining power is held by the firm, the wage level is

(9) $w^* = \bar{u} - p^*\, q\, u(s^*).$

In this case, workers receive only their reservation utility $\bar{u}$. If workers have some bargaining power, $0 < \beta < 1$, they will be able to capture some rent, and this will not affect p^* and s^*, just w^*. The added utility is seen by substituting the expression for w^* into the utility function (1). By using the definition of profit, utility will be given by

(10) $U = (1-\beta)W/M + \bar{u}$

where the workers' per capita gain above their reservation utility depends on their bargaining power $1 - \beta$. At the extreme, a labour-managed firm would choose p, s and N to maximise a worker's utility when all surplus is divided equally among the workers. Then $U = W/M + \bar{u}$.

Returning to the first-order conditions (4p) and (4s), we may derive the effects of changes in the workers' probability of staying with the firm. We find that assumption (5) on the form of $u(s)$ gives us the result that

$$dp^*/dq > 0$$

while it is clear from (4*s*) and (4*N*) that

$$ds^*/dq = 0 \text{ and } dN^*/dq = 0.$$

Using these in the expression for the wage, (8), we find that

$$dw^*/dq < 0.$$

Thus, as the probability of the workers staying with the firm increases, the firm will increase effort to survive. The benefit level will not change but wages will be reduced. The reason is that lower turnover and less frequent changes of jobs (higher q) give more room for expected future job-related benefits to offset current wages. Job security will increase, and for a given bargaining power, which determines the workers' share of the pie, wages must then be reduced. Similarly, the wage level may increase when mobility increases, and traditional job-attached benefits will to a larger extent be provided individually. Note also that the result is independent of worker control. Under efficient bargaining the firm's supply of public goods (like pensions) to the workers, depends on the workers' preferences only. The profit maximizing firm and the labour managed firm behave identically.

b) Right-to-manage: The firm determines p unilaterally.

Above we have derived the efficient solution, where the union and the firm simultaneously set all variables to be determined. However, it is not clear how the firm and the union can contract on *p*, the survival probability of the firm. Therefore, assume that *p* cannot be verified, which means in

effect that the firm can determine p after the wage, benefit and employment levels are contracted. Alternatively, the firm cannot commit to a contracted value of p.[5] Thus, at the first stage we solve for w, s and N, and at the second stage the firm chooses p to maximize expected profit. Hence, (s, N) solves

(11) $v'() = N(R - q\,s)$

which is independent of w.

It is easily verified that we still have full capacity employment, $N = M$. Also w is chosen according to (9) above. The workers know that p is set independently of w at the next stage (see (11) above).

On the other hand, from (11) above, we see that the choice of s does affect the optimal p chosen by the firm. Hence, the bargaining involves maximising

(12) $W(^{p}(s),s,N,) = [(s)(R - qs) - \square + (s)qu(s)]N - v((s))$.

The first order condition for s is simplified by using (11) to be

(13) $u(s)\,d/ds = (1 - u'(s))$.

Differentiating (11) for $N = M$, we find that

5 For example, an assurance to the unions that their members should accept a low wage and a bright future (high p) may be time inconsistent. Once the low wage is secured, a high-risk strategy would be optimal for the firm.

$$d/ds = - q\,[M/v''(p)] < 0.$$

Since $d/ds < 0$ and $u(s) > 0$, we must have $u'(s) > 1$ from (13). Remember that the efficient solution (4s) gives $u'(s^*) = 1$. Therefore, due to the concavity of $u(s)$, $< s^*$.

The equilibrium values of the right to manage model are given by (11), (13), N = M, and

(14) $= (1 - \square)\ \_(R - q\ ) - v()/M] - \square\ (q\ u() - \square).$

We can compare (11) where s= and $N=M$ with (4p), where p^* solves $v'(p^*) = M(R - q\ s^* + qu(s^*))$. Assumption (5) ensures that the maximum value of $q(u(s) - s)$ is at s^* and is positive. Hence

(15) $v'(p^*) - v'() = Mq(u(s^*) - s^*) + Mq > 0$

<u>*Proposition 2:*</u>

If (, ,) is the solution in the right-to-manage case and (p^*, s^*, N^*) that in the efficient bargaining case, then = N^* = M, and (i) $< s^*$, and (ii) $< p^*$

<u>*Proof:*</u>

(i) follows from (13) and (4s). (ii) follows from (15) as well as the convexity of $v(p)$.■

There will be a compensating adjustment of wages. Comparing the expressions for and w^*, i.e. (8') with (14), we see that $> w^*$ because

$$q\,u() - \square < p^*\,q\,u(s^*) - \square$$

and

$$(R - q) - v()/M > p^*(R - q) - v(p^*)/M > p^*(R - qs^*) - v\,(p^*)/M.$$

The latter follows from, (i) $< s^*$, such that the middle term is greater than the right hand term, and (ii) given , then maximises $p(R - q) - v(p)/M$.

The right-to-manage solution implies both a smaller survival probability for the firm and a smaller investment in benefits. The firm will choose p to maximize its profit, not taking into account the effect p has on the workers' utilities via s. The workers will find it more profitable to be paid now rather than in the future, since the deferred payment is received with less certainty when the firm cannot commit to its future behaviour. Therefore the reduction in benefits will be substituted by an increased wage, given the distribution of bargaining power and thereby the rule for sharing the total pie to be constant.

The firm's incentives to commit to a particular future action will depend on what happens to its profits. If profit is higher under the efficient bargaining solution, and commitment is costless, the firm might look for mechanisms to truthfully commit to its choice of p. However, profit may increase or decrease when going from an efficient solution to a right-to-manage solution. Compare the expressions

$$= \square\,[(R - q)\,M - v() + Mq\,u() - M\,\square]$$

and

$$\Pi^* = \Pi\,[p^*(R - q\,s^*)\,M - v(p^*) + M\,p^*\,q\,u(s^*) - M\,\Pi]$$

where we have substituted in the expressions for wages and w^* respectively. The first two terms are higher in than in Π^*, whereas the penultimate terms are higher in Π^*. If $> \Pi^*$ the firm may not agree to contract over p, even when this is found to be possible.

The comparative statics of the right-to-manage case are addressed via (11) and (13). On the assumption that $v''(p)$ is constant, ds/dq is found to be negative. Thus, if q is very small, d/ds is very small (from (11) and $\_\ s^*$ (from (13)). As q increases, so declines as the firm finds it more expensive to promise future benefits. The direct effect on p from increased q (via (11)) is negative, but the indirect effect (via a smaller) is positive. Thus, the effect of more stability on the part of the workers is lower benefits and an ambiguous change in the firm's survival rate.

The key difference between the efficient bargaining case and the right-to-manage case is the fact that, while in the former the benefit level s is at the Pareto optimal level, a lower level of benefits is set if the firm cannot commit to a survival probability.

5. Heterogeneous workers.

The workers are characterized by their types q with a known density function $f(q)$ with mean q^a and median q^m. Workers of all types will receive the same wage w, and also the same benefit s. Now

the internal power structure of the union will matter. Assume that the median voter carries the balance of power so that her utility drives the union's bargaining. If *f(q)* is symmetric, the median voter will be the average worker, and the same results will be derived as in the previous section. Alternatively the distribution may be skewed. The mean, q^a, is the statistic that figures in the firm's expected profit function. Thus, the objective functions are slightly altered to become:

(16) $U^m = w + p\, q^m\, u(s)$

(17) $\Pi = p\,(R - q^a\, s)\, N - wN - v(p), \quad N \leq M$

(18) $\ln \Omega = \theta \ln\{[p\,(R - q^a\, s) - w]\, N - v(p)\} + (1-\theta) \ln[w + pq^m\, u(s) - \bar{u}] + (1-\theta) \ln N, \quad N \leq M$

Again

$\partial(\ln \Omega)/\partial N > 0$, which implies $N = M$.

and

$$\partial(\ln \Omega)/\partial w = -\theta M/\{[p(R - q^a\, s) - w]\, M - v(p)\} + (1 - \theta)/\{w + p\, q^m\, u(s) - \bar{u}\} = 0$$

so that the wage is given by

(19) $w = (1 - \theta)\,[\,p(R - q^a\, s) - v(p)/M] - \theta\,[\,p\, q^m\ u(s) - \bar{u}]$.

The social value added by the firm is only affected by the mean type not the median:

(20) $W(p,s,N,) = [p(R - q^a s) - \bar{u} + pq^a u(s)]N - v(p)$

so that substitution of (19) into (18) yields, using (20):

(21) $\ln \Omega = \beta \ln\_ + (1 - \beta) \ln (1 - \theta) + \ln[W(p,s,M) - Mu(s)p(q^a - q^m)]$

Maximising (21) is equivalent to maximimising the term in square brackets. Note that any difference between the union's representative preferences (here the median individual) and the mean worker type produces an imperfection in the way the bargaining outcome seeks the largest pie. If we have efficient bargaining so that p and s are both agreed within the bargaining process, then Pareto efficiency is still not attained because of the agency problem within the union. First-order conditions yield

(22s) $- q^a + q^m \; u'(s) = 0 \; \Leftrightarrow \; u'(s) = q^a / q^m$

and

$$R - q^a \; s - v'(p)/M + q^m \; u(s) = 0$$

or

(22p) $v'(p) = M [R + q^m \; (u(s) - s\, u'(s))]$.

Let $k = (q^a - q^m)/q^m$ be a measure of skewness. Then, letting $s^{*\prime}$, $p^{*\prime}$ denote the optimal values under heterogeneity, first note that $u'(s^{*\prime}) = u'(s^*)(1 + k)$. The effects of heterogeneous workers on $p^{*\prime}$ relate to the different s in the two cases. If $k \neq 0$, the survival probability will also differ. To investigate this further, hold q^m fixed and change k from 0. From (22s) and (22p) respectively:

$$ds^{*\prime}/dk < 0 \qquad dp^{*\prime}/dk < 0$$

Thus, $s^{*\prime}$ and $p^{*\prime}$ move together and opposite to the skewness measure, k. Hence

$$s^{*\prime} \; s^{*} \quad \text{and} \quad p^{*\prime} \; p^{*} \quad \text{as} \quad k \; 0.$$

Instead, hold k fixed and change q^m, which implies that q^a changes in the same proportion. We see from (22s) that $ds^{*\prime}/dq^m = 0$, while from (22p) $dp^{*\prime}/dq^m > 0$.

In the *right-to manage* model, from (17), (20) and (21), the firm's optimal choice of p (to maximise (17)) and the bargaining outcome for s (to maximise (21) given the subsequent choice of p), lead to revised first-order conditions (22s') and (22p'):

(22s') $\quad p[\, q^a / q^m - u'(s)] = u(s)\, d/ds$

(22p') $\quad v'() = N\,(R - q^a\, s)$

The strategic effect d/ds in (22s') is found by differentiating (22p') and is clearly negative as before. Substituting for $N = M$ in equilibrium, the solution is denoted ', '. Then we can prove:

<u>*Proposition 3:*</u>

In a right-to-manage model, the equilibrium has smaller s and p than in the efficient bargaining model, for any level of skewness in workers' survival probabilities.

Proof:

(i) $s' < s^{*'}$ holds by comparing (22s) and (22s'), and (ii) $p' < p^{*'}$ follows from subtracting $v'(p^{*'})$ in (22p) from $v'(')$ in (22p'), using the respective equilibrium values of p and s.■

This result is explained as before in terms of the bargaining structure. It is also interesting to consider the internal power structure within the union, and compare the outcome to first best. There are now two sources of inefficiences. Without credible firm commitment, the union will, as in the homogeneous workers case, unambiguously bargain smaller benefits than would be obtained if the firm could commit to a firm survival probability. The skewed power structure may make things worse or better. It will necessarily be the case that benefits are lower if power distribution is egalitarian. However, if the median worker, who carries the balance of power, has a higher survival probability within the firm than the average worker, the right-to-manage solution may be closer to first best than efficient bargaining. The reason is of course that this median worker has an incentive to vote for too high a level of benefits.

6. Discrimination by Last-In-First-Out

It is frequently asserted that LIFO (last-in-first-out) is a convention subscribed to by both firms and unions. We will show that a minor adjustment of our model transforms it into one where the number of employees kept on by the firm is random and where the probability of a worker's survival to take up long-term benefits depends on the order of her hiring. Thus suppose that the firm's profit is

(23) $\quad \_ = xN(R - qs) - wN - v(p)$

where x is a random variable reflecting demand and is revealed after workers have been hired and paid the wage w but before production is complete and the workers receive the benefits s. The firm employs N workers (in equilibrium this will be assumed equal to the capacity M) but retains only xN to complete production. The expected value of x is p so that the expected profit of the firm is as before.

We will take q as the same for all workers. A worker of index i is the worker who had a proportion i workers hired before him and $1-i$ after her. The expected utility of the i-indexed worker is given by

(24) $$U_i = w + qIu(s)$$

where I is the probability that $x > i$. If the union reflects the preferences of the median worker (i = 1/2), then let the probability that $x > 1/2$ be I^m, and note that this will in general depend on p (as well as on other parameters of the x-distribution, but these we will ignore for simplicity). Hence $I^m = I^m(p)$, and the *efficient solution* to the firm-union bargaining game is to choose w, p, and s to maximise

(25) $$\ln \_ = \_ \ln\{(p(R - qs) - w)N - v(p)\} + (1-\_) \ln\{w + q\, I^m(p)\, u(s) - \_\}.$$

First-order conditions can be simplified by using the capacity level of employment (N=M) and the optimality condition for w in those for p and s respectively to obtain

(26p) $(R - qs)\, M - v'(p) + q\, I^m{}'(p)\, u(s)M = 0$

and

(26s) $-pqM + Mq\, I^m(p)\, u'(s) = 0$

or

$u'(s) = p/\, I^m(p).$

In the *right-to-manage* model the bargaining is over s while the firm chooses p, given s, to maximise $(p(R - qs) - w)M - v(p)$. The decision over s thus affects the subsequent decision over p with the slope $dp/ds = -qM/v''(p)$. The first order condition for s is thus

(27s) $\_ \ln\_/\_s = -pqN + qNI^m(p)u'(s) + \{-qN/v''(p)\}\{(R-qs)\, N - v'(p) + qu(s)N\, I^m{}'(p)\} = 0.$

Now the choice of p requires

(27p) $(R - qs)\, N - v'(p) = 0$

and then (27s) can be solved for

(27s') $-p + I^m(p)\, u'(s) + \{-qN/v''(p)\}\, u(s)\, I^m{}'(p) = 0.$

To compare the equilibria in the two models implies comparing p* and s* which solve (26p) and (26s) with and which solve (27p) and (27s'). This comparison is not always unambiguous but a local result can be obtained for when $I^m'(p)$ is small. We can prove the following

Proposition 4:

Let $I^m(p) = C + zJ(p)$ with $z \geq 0$. The efficient bargaining solution (p^*, s^*, N^*) yields i) $s^* =$ and ii) $p^* >$ with (, ,) representing the right-to-manage solution.

Proof:

Comparative statics of the systems around $z = 0$ yield

(28p) $- qN\, ds^* - v''(p)\, dp^* = -qNJ'(p)u(s)\, dz$

(28s) $I^m(p)\, u''(s)\, ds^* - dp^* = -J(p)\, u'(s)\, dz$

from (26p) and (26s) for the efficient bargaining model, and

(29p) $- qN\, d - v''(p)\, d = 0$

(29s) $I^m(p)\, u''(s)\, d - d = [-J(p)\, u'(s) + \{qNJ'(p)u(s)/v''(p)\}]\, dz$

from (27p) and (27s') for the Right-to-Manage model. As the left-hand-sides of these systems are the same when $z=0$, we can subtract (29p,s) from (28p,s) and then use Cramer's rule to show

(i) $d(s^* -)/dz = 0$

(ii) $d(p^* -)/dz = qNJ'(p)u(s) > 0.$■

Thus if $dz > 0$ and $J'(p) > 0$ we expect the right-to-manage model to yield a smaller chance of firm survival, while the first-order effects on long-term benefits are negligible. It is harder to make more

general comparisons. The reason is the difficulty in assessing how the median worker forms her expectations about firm survival. The signs and magnitude of deviations between the two regimes will depend on how changes in p are perceived, technically represented by the differentials of the $I^m'(p)$-function. Also, the $I^m'(p)$-function may be evaluated differently in the two bargaining regimes. Lastly, the relationship between the random variable x representing demand conditions and the median worker's perception of uncertainty need not be monotonic.

The LIFO principle is important in demonstrating that it is the median worker's perception of uncertainty that matters. Thus, what actually matters is the probability of this worker losing her job, or rather the median worker's consequential utility loss. If the median worker is either very senior, or has good market prospects outside the firm, the worker is likely to be affected by changes in p only to a small degree, as illustrated above for $z = 0$. With the strategic variable p having no significance to the worker, it will not be possible for the firm to take advantage of its discretion even in the non-commitment case. The outcome is efficient. In contrast, as long as the median worker is concerned with the firm's redundancy decisions, inefficiency arises in the right-to-manage solution. The deviation from first best depends not on LIFO as such but on how the median worker is affected by the resulting employment uncertainty.

7. Conclusion

Although we have found that the firm's inability to commit to a strategy for firm survival leads to lower benefits and a lower survival probability (almost certainly), we have shown that the *(s, p)* equilibrium is in each case independent of the allocation of power in the bargaining process, β. We note that the parties' bargaining powers β and $(1-\beta)$ are commonly seen as functions of the parties'

relative impatience as measured by the rates for discounting future payoffs, see e.g. Moene, Wallerstein and Hoel (1993). The bargaining power of the union does, however, affect the wage outcome, since the wage transfers utility from firm to workers at once and with certainty. All bargaining power is reflected in what happens in the short term wage bargaining. The technical explanation for this pure result is the worker's assumed linearity of utility in first-period wage. Some flavour of the result would still hold provided the workers were more risk averse in period 2 than in period 1. Arguments for this assumption relate to a number of sources of evidence and have been considered in section 1.

The result calls into question a number of apparently reasonable hypotheses. Among these would be the argument that long-term benefits are better argued when the union is in a strong position. This is not the case: a weak union may agree the same level of future benefits as does a very powerful union. What matters for the level of future benefits is the credibility of firm commitment. Without the ability to contract on firm survival, the union's powers to bargain for future benefits are small. The firm controls the main variable of importance for such benefits to be delivered: the firm's probability of staying in business.

It would be reasonable to believe also that workers who are loyal in the sense that they are likely to stay with the firm, would be remunerated by higher benefits. This need not be the case either. With efficient bargaining the benefit level, s, is independent of this probability, q, and in the right-to-manage scenario benefits are decreasing in q. The firm will take advantage of the possibility that they do not need to pay the benefit. It is less costly to give promises of future benefits when workers are likely to leave the firm. For example, an option to buy shares in the firm some time in the future, provided workers stay with the firm, is less reluctantly given to a mobile workforce.

It is of course an assumption that the union ranks outcomes according to the median voter, while the firm uses the mean worker in determining the expected profit. If both union and firm decide on the same basis, then skewness, and worker heterogeneity in survival, has no effect on the analysis: we remain with the analysis of section 4. Alternatively, the union may give most weight, not to the median worker, but rather to the most relevant union member among the workforce. Two possibilities arise here: One is that it is the median union member who counts but this is not the median worker, see also Freeman (1985). This could arise if non-union workers had a different perspective. For example if these were "temporary" workers, in that their q-values were low, then $q^a < q^{m*}$, where q^{m*} is the union relevant statistic, and $k < 0$ due to the negative skewness. Then we know that the bargaining outcome will be for a higher benefit level and a higher firm survival probability whether the bargaining is efficient or right-to-manage. Essentially, the expected costs of providing benefits should the firm survive, has declined due to the likelihood of non-union workers being unable to collect on their benefit entitlement.

A second possibility is that the union does not decide its preferences by majority voting, but rather a representative is selected whose position may differ from the median worker's. For example, suppose a union hierarchy exists where the leadership takes the position that current wages are a measure of its "strength". This position is tantamount to q^{m*} being small. Then $k > 0$ since the distribution is effectively positively-skewed, and low p and s result. This second case emphasises the fact that although we have been discussing k as a measure of skewness, it is really a measure of the difference between the union's and the firm's attitude to the given worker heterogeneity. The union in the hands of an unrepresentative clique can act as if the distribution is skewed, even if it is not. In this vein, a number of scenarios can be investigated within the model. For example, suppose the clique was one with high q-values, investment in control of the union being more important to

those with greater likelihood of remaining with the firm. Then our model predicts higher s as benefits are more valued by the union bargainers, but also a lower probability of firm survival.

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