Wages, Benefits and Efficiency in Union-Firm Bargaining

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Abstract

This paper provides an efficient union-firm bargaining solution within the right to manage framework, by separating efficiency and distributional considerations through bargaining over wage and non-wage benefits. We show that without insurance considerations, efficiency is achieved by equating the wage and workers' opportunity cost and providing the union with a surplus share in accordance with its bargaining power. We also show that with insurance considerations, the optimal contract, again, equates the wage and workers' opportunity cost, but it also provides full insurance. There is empirical evidence that non-wage benefits are, indeed, common and play an important role in union contracts.

KEYWORDS: Union Contracts, Efficient Bargaining, Right to Manage
JEL Classification: J5; C78

1 Introduction

Two main alternative models have been the focus of the trade union bargaining literature: the 'efficient bargaining model' and the 'right to manage model'. In the right to manage model, the union and the firm bargain over the wage, but the firm alone chooses the level of employment (after the wage has been determined). Consequently, in this model, there are unexploited welfare gains. In the efficient bargaining model, on the other hand, since the union and the firm bargain over both the wage and level of employment, in general, the bargaining outcome in this model is efficient.[1] The problem is that empirical evidence suggests that it is rare for the union and firm to bargain over both wages and employment (see, for example Oswald (1982), Oswald (1993) and Oswald and Turnbull (1985)).[2] This raises a difficult question, namely: if there are additional gains from bargaining over both wages and employment why don't the bargaining parties understand this and capture these potential gains?

While there have been several studies that provide a framework for discriminating between the two alternative models empirically (see for example, MaCurdy and Pencavel (1986), Pencavel (1991), Nickell and Wadhwani (1991)), little work has been done to address the theoretical difficulty implied by the inefficiency of the right to manage model. One notable exception is Booth (1995b), where it is shown that when bargaining is over both the wage and severance pay, the right to manage model yields an efficient outcome. The efficiency result in Booth (1995b) is obtained since redundancy payments introduce, what is referred to as "an ex-post redistribution scheme". Essentially, these redundancy payments reduce the "effective" wage rate (by increasing the "marginal cost of not hiring an additional worker") and as a result, efficient employment levels are obtained.

The objective of this paper is to provide an alternative bargaining protocol that yields an efficient outcome within the right to manage framework. Unlike the Booth (1995b) model, however, efficiency here does not require "an ex-post redistribution scheme". Instead, efficiency is obtained by the adoption of a "two-part tariff" bargaining protocol, in which the union and the firm bargain over the wage and a

[1] It was also proposed in the literature that uncertainty (or, generally, various informational imperfections) may render even the efficient bargaining model as inefficient because the wage/employment contract may not be incentive compatible. See Bean (1984) and Booth (1995a).

[2] In fact, Bughin (1996) studies bargaining power over employment and finds that it depends on "product market structure and variables affecting union wages."

transfer payment. These transfer payments can be thought of, for example, as (lump sum) fringe benefits and severance pay. The two-part tariff bargaining protocol enables the parties to achieve efficiency by separating efficiency considerations (choice of the wage) from distribution considerations (division of the surplus). The correct choice of the wage makes sure that the "pie" reaches its optimal size. The choice of the transfer payments then simply divides this optimal size pie.

Since fringe benefits data is not readily available, these benefits have not always been taken into account in empirical studies that examined the union/non-union wage gap (see Booth (1995a)). Nevertheless, there is evidence to suggest that fringe benefits (for example, pension plans, life, accident and health insurance, vacation pay, etc.) may, indeed, be important in union contracts (see Freeman (1981), Freeman and Medoff (1984), Lewis (1986), Kornfeld (1993) and Akyeampong (2002), for estimates of the magnitude and importance of fringe benefits in the US, Australia and Canada).[3] Similarly, as pointed out in Booth (1995b), redundancy payments are also common in the labour market. For example, in the UK there are statutory redundancy payments, but extra-statutory payments are also observed (see Millward et al. (1992)).

First, we consider a model with risk neutral workers and no uncertainty. We show that efficiency is obtained by setting the wage to be equal to the opportunity cost wage: given this wage, total surplus is maximized. Furthermore, the union receives a transfer payment in the form of a share of the (optimal) surplus; a share that corresponds to its bargaining power. In the second model, we add insurance considerations by looking at risk averse workers and an uncertain environment. We show that the equilibrium contract provides full insurance and is efficient. Full insurance is obtained by providing the *same state independent* wage/benefits payment package to employed and unemployed workers (this result is, therefore, related to Agell and Lommrud (1992), where union egalitarianism is viewed as an insurance scheme). The benefits received by employed and unemployed workers can be thought of as fringe benefits and severance payments, respectively. Efficiency is achieved, again, by setting the *state independent* wage to be equal to the opportunity cost of workers. The use of non-wage benefits in the contract, therefore, means that, even

[3] For example, using Australian data, Kornfeld (1993) finds that "union members were about 15% more likely to have access to a pension plan than were nonunion workers". Similarly, using Canadian data, Akyeampong (2002) finds that coverage rates in insurance plans for unionized employees were approximately double those for non-unionized (about 80% versus 40%) and that the "union advantage in pension plan coverage was much larger (80% versus 27%)".

though the parties do not bargain over the level of employment, a two part tariff scheme can be used to achieve efficiency by separating efficiency from distributional considerations.

2 Risk Neutral Workers and No Uncertainty

As is well known, any agreement between a risk averse union and a risk neutral firm will involve insurance considerations. Since the purpose of this paper is to provide an alternative bargaining protocol that yields an efficient outcome within the right to manage framework, it is useful to begin with a simple model; one in which insurance considerations do not play a role. We do this by assuming, first, that there is no uncertainty and the union's utility function is linear in income. The case of a risk averse union and uncertainty will be discussed in the next section.

Consider the relationship between a firm and its workers. Workers are represented by a union whose objective is to maximize the (expected) utility of the membership. The workers' union consists of m members. An employed worker receives a wage rate of w, whereas an unemployed worker receives the opportunity cost wage, w^0. In addition, the union receives, from the firm, a total lump sum transfer of s that represents various fringe benefits and severance payments. We assume that the firm employs only union workers. Thus, if we denote the number of employed workers by n, then this is also the number of employed *union* members (this assumption can be easily relaxed to allow for both union and non-union workers; see for example Besancenot and Vranceanu (1999)).

The union's utility is, therefore, given by (for a discussion of union objectives and specific utility functions see, for example, Booth (1995a), Oswald (1982), Farber (1986) and Anderson and Devereux (1989)):

$$\widetilde{u}(w, s, n; m, w^0) = n\ w + [m - n]w^0 + s \tag{1}$$

Note that given risk neutrality, the distribution of the benefits among union members does not play a role. In other words, we can assume that the benefits are distributed among union members according to some (union) distribution rule (the firm, of course, only cares about the total transfer, not its distribution). For example, the fringe benefits may go only to employed workers, or they may go all members. The benefits may also go to unemployed workers as severance payments. In the next section, once we introduce uncertainty and risk aversion, we will allow for the distribution of the transfer payment to be determined optimally by the union. As will be shown, the distribution of benefits will then play an insurance role.

The firm uses labour and capital services, n and K, respectively, to produce its output, y, according to the production function $y = f(K, n)$, where f is increasing and concave in K, n. Since we are not interested in explaining K, we normalize it to 1 and write the production function as:

$$y = f(K, n) = F(n) \tag{2}$$

The game between the two parties has the following time line: (i) In stage one, the union and the firm engage in a Nash bargaining game, in which the wage and the transfer payment are determined, (ii) In stage two, given the outcome of the bargaining game, the firm chooses the level of employment.

2.1 The Solution of the Game

2.1.1 Stage Two: The Level of Employment

In stage two, the firm chooses the level of employment, given the previously determined wage and transfer payment. Assuming that the firm is risk neutral, and normalizing the price of output, p, to 1, its problem is given by:

$$\underset{n}{\text{Max}}\{F(n) - wn - s : n \leq m\} \equiv \pi(w) - s \tag{3}$$

where $\pi(w)$ is the *variable* profit function. As usual, the variable profit function is decreasing and convex in w.

In order to focus on the efficiency of the bargaining protocol, and following Booth (1995b), we restrict our attention to the case where the firm's employment choice, defined as $n^*(w)$, is such that it does not exceed the available supply of union workers, i.e., $n^*(w) \leq m$ (this will be the case if w and m are "sufficiently" high). From Hotelling's lemma the optimal level of employment, is, therefore, given by:[4]

$$n^* = -\frac{\partial \pi(w)}{\partial w} \equiv n^*(w) \tag{4}$$

[4] For example, with the production function $y = n^{1/2}$, the firm's variable profit and labour demand functions become simply: $\pi(w) = \frac{1}{4w}$, $n^*(w) = \frac{1}{4w^2}$, respectively. The condition $n^*(w) \leq m$ can, therefore, be written as: $-\frac{\partial \pi(w)}{\partial w} \leq m$, or $w \geq \frac{1}{2m^{1/2}}$. Note that since $\frac{1}{2m^{1/2}}$ is a small number for a union of a "meaningful" size, this is not an implausible condition. This condition will be discussed further, once we solve for the equilibrium wage.

so that, for any given wage, w, the union's utility is:

$$\widetilde{u}(w, s, n^*(w); m, w^0) \equiv u(w, s; m, w^0) = n^*(w)\ w + [m - n^*(w)]w^0 + s \tag{5}$$

2.1.2 Stage One: The Bargaining Game

Following the literature, we use the Generalized Nash Bargaining solution (see Osborne and Rubinstein (1990), Booth (1995a)), which can be obtained by solving the problem:

$$\begin{aligned} &\operatorname*{Max}_{w,s}\{(\pi(w) - s - \pi^0)^{(1-\beta)}(u - u^0)^{\beta}, \quad (6)\\ u - u^0 \quad &\geq \quad 0,\ \pi(w) - s - \pi^0 \geq 0\} \end{aligned}$$

where $\pi(w)$ and u are defined above (in equations (3) and (5)), the disagreement points are $u^0 = mw^0$ and $\pi^0 = 0$, and where the parameter $0 \leq \beta \leq 1$, captures the union's bargaining power. In the standard Nash bargaining solution, rivals have equal power so that $1 - \beta = \beta$.

Using equations (3) and (5), the bargaining problem can be written as:

$$\operatorname*{Max}_{w,s}\{[\pi(w) - s]^{(1-\beta)}[n^*(w)\ (w - w^0) + s]^{\beta} \tag{7}$$

Let the solution to the above bargaining problem be given by: $\{w^*(\beta;\theta), s^*(\beta;\theta)\}$, where θ represents all the other parameters of the problem.

It is, then, easy to verify that the equilibrium of the bargaining game is such that:

Proposition 1 $w^*(\beta;\theta) = w^0, \quad s^*(\beta;\theta) = \beta\pi(w^0)$.

Proof. Define: $\Pi \equiv \pi(w) - s$ and $V \equiv n^*(w)\ (w - w^0) + s$. Assuming an interior solution, the first order conditions with respect to s and w, can then be written as:

$$\begin{aligned} \frac{\beta}{V} - \frac{(1-\beta)}{\Pi} \quad &= \quad 0 \quad (8)\\ \frac{\beta}{V}\frac{\partial V}{\partial w} + \frac{(1-\beta)}{\Pi}\frac{\partial \Pi}{\partial w} \quad &= \quad 0 \quad (9) \end{aligned}$$

respectively. Using (8) in (9) we get:

$$\frac{(1-\beta)}{\Pi}[\frac{\partial V}{\partial w} + \frac{\partial \Pi}{\partial w}] = 0 \tag{10}$$

But, $\frac{\partial V}{\partial w} = \frac{\partial n^*(w^*)}{\partial w}(w^* - w^0) + n^*(w^*)$ and $\frac{\partial \Pi}{\partial w} = \frac{\partial \pi(w^*)}{\partial w} \equiv -n^*(w^*)$, so it follows from (10) that $w^* - w^0 = 0$.[5] Now, using $w^* = w^0$ in (8) we get: $\frac{\beta}{s^*} - \frac{(1-\beta)}{\pi(w^0)-s^*} = 0$, hence: $s^* = \beta\pi(w^0)$. ■

To demonstrate the efficiency properties of the bargaining solution, let us compare it to the benchmark "social welfare" maximization problem. To do this, consider the problem of a joint, or "integrated", unit that consists of a firm, whose production function is given by $F(n)$ and union with m workers whose opportunity cost wage is w^0. The total payoffs of such a joint unit are given by: $F(n) + (m-n)w^0$. Note that these total payoffs are also the sum of the payoffs of the non-integrated firm and union. In both cases, this sum is simply total "income", $F(n) + mw^0$, minus the "true cost" of labour: nw^0.

Solving the problem:

$$\max_n \ \{F(n) + (m-n)w^0\} \tag{11}$$

and assuming an interior solution, with an employment level not exceeding m, we obtain the first order condition:

$$\frac{\partial F(n)}{\partial n} = w^0 \tag{12}$$

namely, the marginal product of labour must be set to the opportunity cost of labour. But, from the discussion above we know that the bargaining solution yields $w^* = w^0$. Consequently, a non-integrated firm that faces a wage rate of w^0 will maximize its profits by setting $\frac{\partial F(n)}{\partial n} = w^0$, which implies that the "social welfare" maximization requirement will be satisfied. The bargaining solution, therefore, leads to an efficient level of employment even though the level of employment is not part of the bargaining process.

The efficiency of the bargaining equilibrium can also be obtained by considering an alternative social welfare problem. Specifically, suppose that a "social planner" chooses the wage rate that maximizes total payoffs, given that the firm will choose the level of employment in the following stage. This problem is given by:

$$\max_w \{\pi(w) + [n^*(w)\ (w - w^0) + mw^0]\} \tag{13}$$

It is easy to show that these total payoffs reach a maximum at $w^* = w^0$ [6], so that the corresponding level

[5] Thus, with the production function $y = n^{1/2}$ and given the equilibrium wage, the condition for $n^* \leq m$ is now: $w^0 \geq \frac{1}{2m^{1/2}}$.

[6] The first order condition is given by: $\partial\pi(w)/\partial w + \partial n(w)/\partial w[w^0 - w] + n(w) = -n(w) + \partial n(w)/\partial w[w^0 - w] + n(w) = \partial n(w)/\partial w[w^0 - w] = 0$. Hence, $w^* = w^0$. Moreover, at $w^* = w^0$, the second order condition is satisfied since: $\partial^2 n(w^*)/\partial w^2[w^0 - w^*] + \partial n(w^*)/\partial w = \partial n(w^*)/\partial w < 0$.

of employment is: $n^*(w^0) = -\frac{\partial \pi(w^0)}{\partial w}$. Hence, again, the bargaining solution above leads to the socially optimal wage and is, consequently, efficient.

The two-part tariff nature of the contract, therefore, enables the parties to separate between efficiency and distributional considerations. As a result, the socially optimal wage, $w^* = w^0$, can be set. This wage guarantees that the firm will choose the optimal level of employment and hence the size of the pie will be maximized. For this to be possible, however, a transfer payment that redistributes the surplus is required. The size of this compensation depends, among other things, on the relative power of the union.

Thus, whereas in Booth (1995b), efficiency is achieved by the redundancy payments which reduce the effective wage rate (by increasing the "marginal cost of not hiring an additional worker"), here it is achieved by directly setting the wage rate to the opportunity cost wage w^0. This is possible in this model because an additional instrument (transfers) can be used to redistribute the surplus.

The solution that is provided here is similar to what is found in the literature on second degree price discrimination, or externalities in vertical industry structures (see Tirole (1988), for examples). In all of these cases, efficiency is achieved by setting the "correct price", which is made possible by using a transfer for redistributional purposes.[7]

Finally, as was indicated earlier, the solution above determines the transfer payments to the union, but it does not explain how these payments are distributed among union members. To be able to explain such a distribution we need to introduce either additional features into the union's utility function, or introduce uncertainty and risk aversion (as will be done in the next section). Nevertheless, it is clear that one possible outcome is that the transfer payments are distributed equally to employed and unemployed workers (as fringe benefits and severance payments, respectively). In such a case, all workers end up with the same total receipts, as is the case in Booth (1995b).

[7] Appelbaum (2007) provides an alternating offers union-firm bargaining model, in which the order of play and the bargaining protocol are determined endogenously, and shows that it yields a unique subgame perfect equilibrium which is also efficient.

3 Risk Averse Workers, Uncertainty and the Distribution of Benefits

In this section we introduce uncertainty and risk averse workers. A simple way to introduce uncertainty is to assume that the price of output is random (alternatively, we can assume that there are productivity shocks; say, if the production function is given by $y = aF(n)$, where a is a random productivity shock, both specifications are equivalent). For example, assume that p is a discreet random variable that can get the values, $(p_1...p_h)$ with probabilities $(q_1...q_h)$, $0 < q_i < 1$, $i = 1...h$, $\sum_{i=1}^{h} q_i = 1$.

We assume that the bargaining process is a three-stage game with the following time line. In stage 1, before the state of the world is known, the union and the firm engage in a Nash bargaining game in which the wage rate and the transfer payments are determined. In stage 2, the state of the world is revealed and the firm then chooses the optimal level of employment, for any state of the world, $i = 1...h$. In stage 3, the union decides on the distribution of the transfer payments among its members.

3.1 The Solution of the Game

3.1.1 Stage 3: The Distribution of the Transfer Payments

Given the state of the world, the firm's choice of employment (in stage two) and the outcome of bargaining game (in stage 1), the union chooses the optimal distribution of the transfer payments among its members. Thus, unlike in Booth (1995b), where only unemployed workers receive redundancy payments, here both employed and unemployed workers may receive non-wage benefit payments: the union determines optimally who receives payments and how much they receive.

Let the receipts of employed and unemployed workers, given the state of world i, be denoted by x_i and y_i, $i = 1...h$, respectively. We can think of x_i and y_i as the fringe benefits and severance payment received by employed and unemployed workers in state i, respectively (although, unemployed workers are not necessarily excluded from also receiving fringe benefits). In addition, let the wage rate, transfer payment and level of employment in state $i = 1...h$, be given by w_i, s_i and n_i, respectively. The union's utility function in state i is, then, given by:

$$u_i = n_i \, u(w_i + x_i) + (m - n_i)u(w^0 + y_i) \tag{14}$$

where:

$$n_i \; x_i + (m - n_i) \; y_i = s_i \tag{15}$$

and where we assume that u is an increasing and strictly concave utility function.

The union chooses a distribution of the transfer payment (the total benefits) that maximized total union payoffs:

$$\max_{x_i, \; y_i} \{n_i \; u(w_i + x_i) + (m - n_i) u(w^0 + y_i) : n_i \; x_i + (m - n_i) \; y_i = s_i\} \tag{16}$$

Let the optimal solution be denoted as: $\{x_i^*(n_i, w_i, s_i; m, w^0), y_i^*(n_i, w_i, s_i; m, w^0)\}$. It is easy to show that the solution is such that:

Proposition 2 *The optimal distribution of total benefits provides full unemployment insurance:* $w_i + x_i^* = w^0 + y_i^*$.

Proof. Define the Lagrangean for problem (16) as: $L_i = n_i \; u(w_i + x_i) + (m - n_i) u(w^0 + y_i) + \lambda(s_i - n_i \; x_i + (m - n_i) \; y_i)$. From the first order conditions it then follows that: $\frac{\partial u_i(w_i + x_i)}{\partial x_i} = \frac{\partial u_i(w_0 + y_i)}{\partial x_i} = \lambda$, hence $w_i + x_i^* = w^0 + y_i^*$. In other words, the optimal distribution of the total benefits provides full unemployment insurance. ■

Using the constraint we can solve for x_i^* and y_i^* as:

$$x_i^* = \frac{s_i - (m - n_i)(w_i - w^0)}{m} \tag{17}$$

$$y_i^* = \frac{s_i + n_i(w_i - w^0)}{m} \tag{18}$$

Thus, unlike in the previous section, where the distribution of benefits was indeterminate, here it follows directly from that fact workers are risk averse.

3.1.2 Stage Two: The Level of Employment

In stage 2, the firm chooses the level of employment given the state of the world and the previously determined wage and benefits, $\{w_i, s_i\}$. Assuming that the firm is risk neutral, for any given state of the world, i, its problem is:

$$\operatorname*{Max}_n \{p_i F(n) - w_i n - s_i\} \equiv \pi(w_i; p_i) - s_i \tag{19}$$

where $\pi(w_i; p_i)$, the variable profit function in state i, is convex in (w_i, p_i), decreasing in w_i and increasing in p_i. Again, in order to focus on the efficiency of the bargaining protocol, and following Booth (1995b), we restrict our attention to the case where the optimal level of employment choice, n_i^*, is such that it does not exceed the available supply of union workers, i.e., $n_i^* \leq m$. From Hotelling's lemma, the optimal level of employment is given by:

$$n_i^* = -\frac{\partial \pi(w_i; p_i)}{\partial w_i} \equiv n^*(w_i; p_i) \tag{20}$$

For any given wage and benefits, w_i, s_i, the union's utility, u_i^*, is therefore given by:

$$\begin{aligned} u_i^* &= n_i^* \, u(w_i + x_i^*) + (m - n_i^*) u(w^0 + y_i^*) \equiv m \, u(R_i) && (21) \\ \text{where } R_i &= w_i + x_i^* = w^0 + y_i^* = w^0 + \frac{s_i + n_i(w_i - w^0)}{m} \equiv R(w_i, s_i) && (22) \end{aligned}$$

3.1.3 Stage One: The Bargaining Game

In stage 1, before the state of the world is known, the union and the firm negotiate a state contingent wage/benefits contract. That is, they choose a pair (w_i, s_i), for every state of the world, $i = 1...h$. Define the union's expected utility, v, and the firm's expected profits, J, as:

$$\begin{aligned} v &= m \sum_{i=1}^{h} q_i \, u(R_i) && (23) \\ J &= \sum_{i=1}^{h} q_i [\pi(w_i; p_i) - s_i] && (24) \end{aligned}$$

The solution to the bargaining problem is, therefore, given by:

$$\begin{aligned} &\underset{(w_i, s_i),\ i=1...h}{\text{Max}} \{(v - v^0)^{\beta} (J - J^0)^{(1-\beta)} && (25) \\ v - v^0 &\geq 0, \ J - J^0 \geq 0\} \end{aligned}$$

where the disagreement points are $v^0 = m \, u(w^0)$ and $J^0 = 0$. Using equations (22), (23) and (24), the bargaining problem can be written as:

$$\underset{(w_i, s_i),\ i=1...h}{\text{Max}} \{[\sum_{i=1}^{h} m q_i [u(w^0 + \frac{s_i + n_i(w_i - w^0)}{m}) - u(w^0)]]\}^{\beta} [\sum_{i=1}^{h} q_i [\pi(w_i; p_i) - s_i]]^{(1-\beta)} \tag{26}$$

Let the solution to the above problem be given by: $\{w_i^*(\gamma), s_i^*(\gamma)\}, \ i = 1...h$, where γ represents the parameters of the problem. This solution is characterized by the following:

Proposition 3 *The bargaining solution is: (i) state independent with* $w_i^* = w^0$, $s_i = s^*$, $x_i^* = y_i^* = s^*/m$, *for all* $i = 1...h$, *(ii) efficient.*

Proof. (i) Define $V \equiv v - v^0$. Assuming an interior solution, the first order conditions with respect to w_i and s_i can then be written as:

$$\frac{\beta}{V}\frac{\partial u(R_i)}{\partial R_i} - \frac{(1-\beta)}{J} = 0 \tag{27}$$

$$\frac{\beta}{V}\frac{\partial V}{\partial w_i} + \frac{(1-\beta)}{J}\frac{\partial J}{\partial w_i} = 0 \tag{28}$$

respectively. From (27) it follows that

$$\frac{\partial u(R_i)}{\partial R_i} = \frac{(1-\beta)}{\beta}\frac{V}{J} \text{ for all } i = 1...h \tag{29}$$

and, therefore, R_i must be state independent; that is, it must be fixed. Now, since $[\frac{(1-\beta)}{\beta}\frac{V}{J}] = \frac{\partial u(R_i)}{\partial R_i}$ (from (29)) and $\frac{\partial J}{\partial w_i} = q_i \frac{\partial \pi(w_i;p_i)}{\partial w_i} = -q_i n_i$, condition (28) can be written as:

$$\begin{aligned} 0 &= \frac{\partial V}{\partial w_i} + [\frac{(1-\beta)}{\beta}\frac{V}{J}]\frac{\partial J}{\partial w} = m q_i \frac{\partial u(R_i)}{\partial R_i}\frac{\partial R_i}{\partial w_i} - \frac{\partial u(R_i)}{\partial R_i} q_i n_i \\ &= q_i \frac{\partial u(R_i)}{\partial R_i}[m\frac{\partial R_i}{\partial w_i} - n_i] = q_i \frac{\partial u(R_i)}{\partial R_i}[m(\frac{(w_i - w^0)}{m}\frac{\partial n_i}{\partial w_i} + \frac{n_i}{m}) - n_i] = q_i \frac{\partial u(R_i)}{\partial R_i}(w_i - w^0)\frac{\partial n_i}{\partial w_i} \end{aligned}$$

But, since $\frac{\partial u(R_i)}{\partial R_i} > 0$, $q_i > 0$ and $\frac{\partial n_i}{\partial w_i} = -\frac{\partial^2 \pi(w_i;p_i)}{\partial w_i^2} < 0$ (from the convexity of $\pi(w_i;p_i)$), this implies that we must have:

$$w_i^* = w^* = w^0 \text{ for all } i = 1...h. \tag{30}$$

Now, plugging (30) into condition (29) we get:

$$\frac{\partial u(w^0 + \frac{s_i}{m})}{\partial R_i} = \frac{(1-\beta)}{\beta}\frac{V}{J} \text{ for all } i = 1...h$$

which implies that the optimal transfer must also be state independent. That is:

$$s_i = s^* \text{ for all } i = 1...h \tag{31}$$

This, course, implies that the equilibrium receipts are given by:

$$R_i^* = R_i(w_i^*, s_i^*) = R_i(w^0, s^*) = w^0 + \frac{s^*}{m} \tag{32}$$

Now, substituting $R_i^* = w^0 + \frac{s^*}{m}$ into condition (29), the solution for s^* (assuming an interior solution) is given implicitly by the condition:[8]

$$\frac{\partial u(w^0 + \frac{s^*}{m})}{\partial R_i} = \frac{(1-\beta)}{\beta} \frac{m[u(w^0 + \frac{s^*}{m}) - u(w^0)]}{\sum_{i=1}^{h} q_i \pi(w^0; p_i) - s^*} \tag{33}$$

(ii) Since $w_i^*(\gamma) = w^0$ for all states of the world, it follows that the solution is efficient. ■

Thus, the bargaining solution provides full insurance and yields an efficient outcome even though the parties do not bargain over the level of employment. In addition, in equilibrium, the (state independent) fringe benefits received by employed workers are the same as the (state independent) severance payments received by unemployed workers.[9]

Let us now consider whether the outcome in the above two part tariff contract is, in fact, better than the outcome in the standard right to manage contract (where the bargaining is over the wage only). It is easy to verify that at $s = 0$, we have $\frac{\partial u(\cdot)}{\partial R_i} - \frac{(1-\beta)V}{\beta J} > 0$ (i.e., at $s = 0$, the objective function in (26) is increasing in s). Hence, the solution must involve a strictly positive value of s. This, in turn, implies that $s = 0$ is not a Pareto optimal solution and consequently, the firm and the union would prefer a two part tariff with a positive transfer.[10]

Finally, it is interesting to compare the results in this section with those in Booth (1995b). First, since the contract is between a risk neutral firm and risk averse workers, it is not surprising that in both models the contracts provide workers with full insurance: state-independent wage and non-wage payments and invariance of workers' incomes with respect to employment status. The invariance with

[8] While the solution for s^* in equation (33) is a bit more complicated than in the case without uncertainty, it can be shown that s^* increases with the union's bargaining power.

[9] In this model all workers are the same. It may, however, be interesting to examine the equality-of pay (for all union members) result in situations where union members are heterogenous (e.g. taking into account differences in seniority, productivity, information, etc.). With asymmetric membership, other considerations, such as incentives, play a role, thus the equality-of-pay result may be affected (see, for example, Frank and Malcomson, (1994)). This question is left for further research.

[10] Another question is how our solution compares with the "standard" efficient bargain contract (without transfer payments). As was noted above, the use of lump sum transfer payments enables the parties to separate efficiency considerations (choice of the wage) from distributional considerations (division of the surplus). Our optimal contract ensures that the size of the pie is maximized by choosing $w_i^*(\theta) = w^0$. The transfer payments then divide this optimal size pie. For illustration and comparison purposes, consider a "first best" solution, as given by the case of an "integrated unit", for example, a union that "owns" the production process. It is easy to show that such a "union owner" that chooses the levels of employment and compensation to its employed and unemployed workers will also choose the level of employment that maximizes the "size of the pie". Namely, it will choose the employment level so that the value of the marginal product of labour is equal to the opportunity cost of labour, w^0, as was the case in our model (in addition, all workers will receive the same payments). Thus, it will perform better than in the case of the standard efficient contract, in which only employment and the wage are negotiated, but in which transfer payments are not used to separate efficiency and distributional considerations.

respect to work status means that in both models employed and unemployed workers receive the same total payment (in Booth (1995b), the state independent wage received by employed workers is equal to the sum of the state independent opportunity cost wage and redundancy pay received by unemployed workers). But, although the wage is state-independent in both models, here the wage is set to be equal to the opportunity cost of labour, whereas in Booth (1995b) it is higher than the opportunity cost of labour; it is equal to the opportunity cost of labour plus the redundancy payment.[11] Second, in Booth (1995b) it is *assumed* that only unemployed workers receive a non-wage benefit (redundancy payment). Here, on the other hand, whether a worker (employed, or unemployed) receives a non-wage payment (fringe benefits, or redundancy payment) and the amount received are both determined endogenously as part of the game. Indeed, in equilibrium, they both receive the same total (wage plus benefits) payments: $R_i^* = w^0 + \frac{s^*}{m}$, thus, fringe benefits are equal to redundancy payments.[12] Third, both models yield efficiency in the choice of employment. But, while in Booth (1995b) efficiency is achieved by the redundancy payments which reduce the effective wage rate, here it is achieved by directly setting the wage rate to the opportunity cost wage. This is possible here because the two-part tariff nature of this contract enables the parties to separate between efficiency and distributional considerations.

4 Conclusion

This paper provides a union-firm bargaining protocol that yields an efficient outcome even within the right to manage framework. Efficiency is obtained by a two-part tariff scheme, in which the union and the firm bargain over the wage and transfer payments; for example fringe benefits and redundancy payments. The use of a two-part tariff enables the parties to achieve efficiency by separating efficiency from distribution considerations. The correct choice of wage ensures that surplus is maximized, whereas the choice transfer divides the optimal surplus. To avoid insurance considerations, we first consider a model with risk neutral workers and no uncertainty. We show that efficiency is obtained by setting the wage to be equal to the opportunity cost wage. The transfer payment is in the form of a share of the surplus; where the union's share

[11] The "premium" received by employed workers in this model is, therefore, captured by the fringe benefits.

[12] The fact that the total package for employed and unemployed workers is the same, as well as the existence of a premium raises the question of possible "entry" into the union. This issue of endogenous union membership and its determinants is very interesting, but it is not within the scope of this paper.

corresponds to its bargaining power. In the second model, we have risk averse workers and uncertainty. We show that the optimal contract provides full insurance and is efficient. Full insurance is obtained by providing a state independent wage/benefits package and by providing employed and unemployed workers with the same total receipts. Efficiency is achieved, again, by setting the state independent wage to be equal to the opportunity cost of workers.

This type of wage/fixed benefits contract is quite common in union-firm bargaining and there is empirical evidence to suggest that fringe benefits and redundancy payments may, indeed, play an important role in union contracts.

5 References

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