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PROFIT SHARING AND UNEMPLOYMENT: AN APPROACH WITH BARGAINING AND EFFICIENCY WAGE EFFECTS***

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ABSTRACT: We offer a unified framework to analyze the determination of employment, employee effort, wages and profit sharing when firms face stochastic revenue shocks. We apply a generalized Nash bargaining solution, which extends the wage bargaining literature by incorporating efficiency wage considerations, profit sharing and exogenous capital structure. The profit sharing instrument is demonstrated to have positive effort-enhancing and wage-moderating effects, which exactly offset the negative dilution effect in equilibrium. We show that introduction of profit sharing decreases equilibrium un-employment if the benefit replacement ratio is high enough, whereas the reverse holds if the benefit replacement ratio is below this threshold. (*JEL: J51, J41, G32*)

1 Introduction

In Europe the unemployment rate has shown a rising trend during the last twenty five years. This has raised the question of how to explain this development. Various versions of the union bargaining theory have been popular, because in most European countries over three quarters of the workforce have earned wages covered by collective bargaining. The 'right-to-manage' models (see e.g. LAYARD, NICKELL AND JACKMAN [1991]) provide the most popular approach among the union bargaining models. The main idea behind theories of efficiency wages is that the wage is not only a cost factor to the firm, but it also serves as an incentive device. Union bargaining and efficiency wage theories have typically represented separate approaches in the literature. However, the outcome generated through wage bargaining may be affected by effort provision by workers and vice versa. Some aspects of the interactions between wage bargaining and efficiency wage considerations are analyzed in LINDBECK AND SNOWER [1991], SANFEY [1993], BULKLEY AND MYLES [1996], ALTENBURG AND STRAUB [1999] and GARINO AND MARTIN [2000]. But these papers do not explore the implications of profit sharing for wage formation and equilibrium unemployment.

Profit sharing refers to remuneration mechanisms with a performance-related scheme consisting of a fixed base wage plus a share of profits or revenues of firms. Performance-related compensation is a common phenomenon in many modern economies. For example, in Finland The Confederation of Finnish Industry and Employers conducted a survey in 1999 and found that more than 50 per cent of all its member firms apply performance-related compensation schemes. For similar evidence regarding the frequency of profit sharing in, for example U.K. and France, we refer to WADHWANI AND WALL [1990] and CAHUC AND DORMONT [1997]. In fact profit sharing is an empirically important phenomenon in many OECD countries (see e.g. PENDLETON et. al (2001) and the DICE database collected by CESifo (to be found on http://www.CESifo.de). As profit sharing schemes are commonly used it is important to study their implications for wage formation, productivity and employment. WEITZMAN [1987] conjectured that profit sharing systems will reduce equilibrium unemployment. Some aspects of this intuition was formally developed by HOLMLUND [1991]. In a model with capital stock decisions JERGER AND MICHAELIS [1999] developed this approach further and showed how a switch from a fixed wage economy to a share economy results in lower aggregate unemployment. However, we would like to emphasize that these contributions focus on a world with no uncertainty where the profit sharing instrument is assumed to have no incentive effect on the effort decisions.

We conclude our literature review by observing that there is presently no unified framework to simultaneously deal with the determination of wages, employment, employee effort and profit sharing. In particular, the literature offers no evaluation of the equilibrium unemployment implications within a framework where the labour force has bargaining power and where performance-related wage contracts have incentive effects. The purpose of this paper is to carry out precisely such an analysis by starting from the notion that firms operate in an environment of uncertainty, and face bankruptcy risks. We also incorporate aspects of capital structure into the model, though as an exogenous feature. Prior to the stage of wage negotiations, and in anticipation of the outcome of this bargaining process, firms strategically commit themselves to profit sharing schemes and after the wage negotiations firms unilaterally make the employment decisions.

Our analysis shows that employment depends negatively on the effective labour cost, which consists not only of the wage rate, but also incorporates the interest rate and the firm's leverage rate. Further, the effort provision by employees is shown to depend positively not only on the usual efficiency wage considerations, but also on the effort-enhancing effects of profit sharing. In terms of wage determination we derive a generalized Nash bargaining solution, which both unifies and generalizes the wage bargaining literature by incorporating not only the efficiency wage considerations extended to capture uncertainty, but also profit sharing and exogenous capital structure. This generalized bargaining solution exhibits how performance-based evaluation in the form of profit sharing and debt-funding will have a strategic wage-moderating commitment value for a firm facing a union in wage negotiations. We also derive the optimal profit sharing system from the firm's point of view. The profit sharing instrument is demonstrated to have positive effort-augmenting and wage-moderating effects, which exactly offset the negative dilution effect at the optimal profit share in equilibrium. Finally, and importantly, we show that introducing profit sharing will reduce equilibrium unemployment in the presence of labour market policies with sufficiently high benefit replacement ratios, whereas the reverse holds if the benefit replacement ratio is low enough. This is because under the high (low) benefit replacement ratio the wage moderation effect of profit sharing dominates (is dominated) by its direct effect on employment. The critical threshold value of the benefit replacement ratio depends negatively on the labour market imperfections whereas positively on the disutility of effort.

There is currently a fair amount of empirical evidence from several countries suggesting that the real interest rate and the firm's leverage (or share of debt financing) will have a negative effect on employment (see e.g. SHARPE [1994], HANKA [1999], NICKELL AND NICOLITSAS [1999] and FUNKE, MAURER AND STRULIK [1999]). The potential role of financial factors in employment determination raises questions regarding the employment implications of financial factors more generally. An emerging literature has focused on the interaction between corporate finance, wage and employment policies.[1] We add to this literature by exploring the implications of exogenous leverage rates on wage formation and equilibrium unemployment.

We proceed as follows. Section 2 presents the basic structure of the model as well as the time sequence of decisions under circumstances where a firm operates in an environment characterized by uncertainty and thereby risk of bankruptcy. The determination of effort by employees and the employment decisions by firms are studied in section 3. In section 4 we investigate the wage determination in the presence of efficiency wage considerations and under the assumption firms commit themselves to a profit sharing system. In section 5 we characterize the optimal profit sharing scheme. Section 6 outlines the implications for equilibrium unemployment of profit sharing, union bargaining power, leverage and the benefit replacement ratios. Finally, we present concluding comments in section 7.

[1] BRONARS AND DEERE [1991] as well as PEROTTI AND SPIER [1993] demonstrate how firms can use debt as a strategic instrument to reduce the costs that unionized workers can impose on shareholders through their collective bargaining power. GARVEY AND GASTON [1998] introduce a strategic role of debt into a simple version of an efficiency wage model. DASGUPTA AND SENGUPTA [1993] investigate the role of capital structure as a strategic instrument designed to affect the outcome of bilateral bargaining with workers or other input suppliers. SARIG [1998] studies the effect of leverage on shareholder-union bargaining and shows that leverage may affect shareholders' bargaining position vis-à-vis their employees by affecting the shareholders' threat point.

2 The Basic Structure of the Model

We consider a firm operating in an environment characterized by uncertainty. In conformity with the efficiency wage hypothesis we assume that the output of the firm depends not only on the number of workers employed, but also on the effort supplied by each worker. By employing L units of labour, each providing effort denoted by a, the stochastic revenues accruing to the firm are given by

(1) $$\theta\, R(a,L) \quad ,$$

where θ denotes a random revenue shock with a cumulative distribution function $F(\theta)$, and an associated density function $f(\theta)$ with $\theta \in \left[0, \bar{\theta}\right]$, $\bar{\theta} \leq \infty$. We assume that the production function $R(a,L)$ satisfies the following conventional properties: $R_a > 0, R_{aa} < 0, R_L > 0, R_{LL} < 0$ and $R_{aL} > 0$.

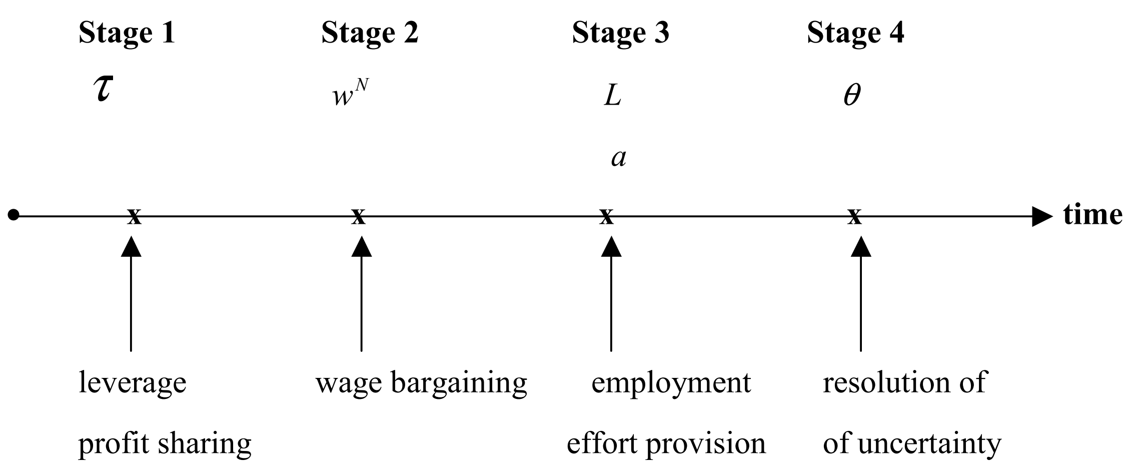
In the long run, the firm is assumed to commit itself to the form of the wage contract determining to what extent profit sharing will be utilized. The profit share, τ, determines what fraction of the firm's profits is transferred to employed workers as part of the contract. Conditional on the capital structure as well as the structure of compensation to organized labour, the firm and the trade union engage in wage bargaining regarding the base wage, w, to be paid to all the workers employed by the firm. We pay particular attention to characterizations of how the firm's leverage and profit sharing will impact on the negotiated wage.

Conditional on the negotiated wage contract the firm and the union members make their decisions. The firm unilaterally determines the employment level once the conditions of the wage negotiations have been settled. In line with the tradition of efficiency-wage models, we assume that the representative union member decides on effort so as to maximize his objective function, which takes into account that effort provision causes disutility. As the trade union is formed by homogenous agents and as intra-organizational agency issues within the union are outside the scope of our analysis, the union is assumed to be able to enforce the effort provision by the representative union member so as to eliminate the potential free rider problems.[2] At the stage of the wage negotiations the employer holds rational expectations regarding how the outcome of the bargaining will impact on the effort incentives of the individual union member. These incentives depend on the base wage as well as on the profit share.

We summarize the timing of the decisions made by the firm, the union and the representative union member in Figure 1. In the subsequent sections we turn to a more

Figure 1

Time sequence of decisions



detailed analysis of the decisions taking place at the different stages of the firm-union interaction by using backward induction and solving the game in reverse order.

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[2] If we were to apply an alternative formulation where individual efforts were not directly observable and workers were heterogenous, group punishment or reward schemes would have to be used for enforcement (see e.g. HOLMSTRÖM [1982]).

3 Determination of Employment and Effort

At this stage we assume that the firm has committed itself to a capital structure, which we assume to be exogenous in what follows. The fraction $\delta\,(0 \le \delta \le 1)$ of the firm's production expenses is covered by a standard debt contract exhibiting limited liability and characterized by an interest rate, r. This implies that the effective labour cost can be expressed by $(1-\delta)wL + \delta wL(1+r) = w(1+\delta r)L$, thereby exhibiting its dependence also on capital structure**.** Further, we assume that the wage negotiations have generated a wage contract with a wage w and that the firm has decided to apply the profit share τ.

Under these circumstances the firm decides on employment L so as to maximize the expected profits

$$(2) \qquad E\pi(a,L) = \int_{\hat{\theta}}^{\bar{\theta}} \big(\theta\, R(a,L) - w(1+r\delta)L\big)\, f(\theta)\, d\theta \quad ,$$

where

$$(3) \qquad \hat{\theta} = \frac{w(1+r\delta)\,L}{R(a,L)}$$

denotes the "break-even" state of nature such that the firm remains solvent for $\theta \ge \hat{\theta}$, and faces bankruptcy for $\theta < \hat{\theta}$. Hence the firm's employment decision as well as the employee's effort provision will impact on $\hat{\theta}$, and thereby on the probability of bankruptcy, F($\hat{\theta}$). Differentiating (3) with respect to a and L, respectively, we get

$$(3A) \qquad \hat{\theta}_a = -\frac{R_a(a,L)\,\hat{\theta}}{R(a,L)} < 0$$

and

$$(3L) \qquad \hat{\theta}_L = \frac{\hat{\theta}}{R(a,L)}\left[\frac{R(a,L)}{L} - R_L(a,L)\right] > 0\,.$$

Hence, an increase in effort (employment) will shift the break-even state of nature downwards (upwards) meaning that increased effort (employment) will decrease (increase) the probability of bankruptcy.

Conditional on the negotiated wage contract the representative employed union member makes the effort decision in order to maximize the expected utility

$$(4) \quad Eu(a) = w + \left[1 - F(\hat{\theta})\right]\left[\frac{\tau}{L}\int_{\hat{\theta}}^{\bar{\theta}}\left(\theta R(a,L) - w(1+r\delta)L\right) f(\theta)\, d\theta\right] - g(a),$$

where the increasing and convex function $g(a)\,(g'(a), g''(a) > 0)$ g(a) is a monetary representation of the disutility of effort. It is assumed that the negotiated base wage, w, is paid to employed workers prior to finalisation of the production. With probability 1-F($\hat{\theta}$) the firm remains solvent and the employed union member is remunerated with a profit share, τ/L determined by the employer, on top of the base wage.

The formulations (3) and (4) incorporate an important qualitative, and empirically relevant, difference between the base wage w and the performance-based profit share τ. The fact that w is part of the definition of $\hat{\theta}$ captures the commonly observed feature that wages represent senior claims relative to those of debtholders, while the performance-related profit share represents a contractual claim, which is junior relative to that of debtholders.

The optimal combination of employment and effort provision is determined by the system of first-order conditions

$$(5) \qquad \int_{\hat{\theta}}^{\bar{\theta}} (\theta R_L(a,L) - w(1+r\delta))\; f(\theta)\, d\theta = 0$$

and

$$(6) \qquad -\frac{f(\hat{\theta})}{1-F(\hat{\theta})}\,\hat{\theta}_a \left[\frac{\tau}{L}\int_{\hat{\theta}}^{\bar{\theta}}(\theta R(a,L) - w(1+r\delta)L)\; f(\theta)\, d\theta\right] + \frac{\tau}{L}R_a(a,L)\int_{\hat{\theta}}^{\bar{\theta}}\theta\, f(\theta)\, d\theta = \frac{g'(a)}{1-F(\hat{\theta})}.$$

According to equation (5) the firm chooses the employment level so as to equalize the expected marginal return from labour (the term $\theta R_L(a,L)$) to the effective wage cost (the term $w(1+r\delta)$) under limited liability whereby the firm will bear the production costs only in solvent states of nature.

Equation (6) characterizes the determination of effort by a representative employee so as to equalize the marginal benefit (the LHS terms) to the marginal disutility of effort (the RHS term). The first term on the LHS describes the effect of effort on the break-even state of nature, above which the firm remains solvent. Since higher effort decreases $\hat{\theta}$ and thereby decreases the probability that the firm faces bankruptcy, it will represent a positive marginal benefit by increasing the probability that an employee gets the share, τ/L, of the profit realization. The second term on the LHS in (6) captures the higher marginal product of increased effort provision in solvent states of nature.

In order to make it possible to highlight the economic mechanisms involved as transparently as possible we make the following three assumptions regarding the functional forms of the production technology, the probability distribution of the random revenue shock and the disutility of employee effort.

For the production technology we make

Assumption R: *The technology is assumed to satisfy*

$$R(a,L) = \frac{(a\,L)^{\alpha}}{\alpha} \quad .$$

The parameter α is restricted to satisfy $0<\alpha<1$ so that specification (R) can be thought of as a well-defined concave production function exhibiting decreasing returns to scale with effort and employment separated as complementary production factors.

For the distribution function of the random revenue shocks we make

Assumption F: *The random shock* θ, $\theta \geq 0$, *follows an exponential distribution with the density function given by* $f(\theta)=\lambda e^{-\lambda\theta}$ *with* $\lambda>0$.

This assumption is particularly appealing, because it implies a constant hazard ratio defined by $\lambda = f(\hat{\theta})/(1-F(\hat{\theta}))$.

For the disutility of employee effort we make

Assumption G: *The disutility of effort belongs to the class of iso-elastic functions* $g(a)=\gamma a^{1/\gamma}$ *with* $0<\gamma<1$.

Thus we consider a class of functions with the property that the disutility of effort can be captured through an increasing and convex relationship.

Under assumptions R, F and G the equilibrium condition (5) with respect to the employment decision can be simplified to yield

$$(7) \qquad \hat{\theta} \quad = \quad \frac{\alpha}{(1-\alpha)\,\lambda} \quad = \quad \frac{\eta-1}{\lambda} \quad ,$$

where $\eta = (1-\alpha)^{-1} > 1$ is the constant elasticity of labour demand with respect to the effective labour cost $\tilde{w} = w(1+r\delta)$. According to (7) the optimal employment decision will imply a constant probability of bankruptcy $F(\hat{\theta}) = 1 - e^{-\lambda\hat{\theta}} = 1 - e^{-(\eta-1)}$, which depends positively on the elasticity of labour demand. By combination of (R), (3) and (7) we end up with the optimal employment

$$(8) \qquad L^{*} \quad = \quad [w(1+r\delta)]^{-\eta}\ \lambda^{-\eta}\ a^{\eta-1} \left(\frac{1}{\eta}\right)^{-\eta} \quad .$$

According to (8) labour demand depends negatively on the effective labour cost and positively on the effort of employees.

Substituting the production function (R) as well as Assumptions F and G into (6) we obtain

$$\tau\, a^{\alpha}\, L^{\alpha-1}\, k\, \frac{2\eta-1}{\lambda} \quad = \quad \frac{a^{1/\gamma}}{k} \quad ,$$

where the probability of solvency $k = 1 - F(\hat{\theta}) = e^{-\lambda\hat{\theta}}$ is constant by (7). Substituting the RHS of (8) for L into this equation shows that the optimal effort provision can be explicitly expressed as

$$(9) \qquad a^{*} \quad = \quad \left[B\ \tau\ w\ (1+r\delta)\, k^{2}\right]^{\gamma} \quad ,$$

where $B \quad = \quad (2\eta-1)\,\eta^{-1} > 0.$

We can now summarize our characterization of the optimal combination of employment and effort provision in

Proposition 1 *Labour demand depends negatively on the effective labour cost as well as on the hazard rate capturing the uncertainty associated with the continuation of the firm's production, while positively on the effort by employees. Effort by employees depends* *positively on the profit share and the base wage as well as on the interest rate and the leverage rate.*

The labour demand (8) suggests that the higher is the firm's leverage rate, δ, the lower is employment, ceteris paribus. This lies in conformity with empirical evidence (see e.g. SHARPE [1994] and HANKA [1998], NICKELL AND WADHWANI [1991], NICKELL AND NICOLITSAS [1999] and FUNKE, MAURER AND STRULIK [1999]). According to (8) labour demand does not directly depend on profit sharing, which also lies in conformity with empirical evidence (see e.g. WADHWANI AND WALL [1990]) and CAHUC AND DORMONT [1997]). Instead by stimulating effort provision profit sharing enhances productivity and through that mechanism employment. Expression (9) emphasizes the dependence of optimal effort on profit sharing and capital structure in a way, which reminds of the principal-agent literature. These aspects have not previously been analyzed in the literature concerning union-firm wage bargaining[3].

Finally, for a given combination of the base wage and the profit share an increase in the firm's survival probability enhances effort provision $(a_k^* > 0)$. In principle, an increase in the bankruptcy probability can be thought to have two effects affecting effort provision in opposite directions (see e.g. SCHMIDT [1997]). An increase in the bankruptcy probability induces a threat-of-liquidation effect, which enhances effort. On the other hand, it reduces the firm's profits, which makes it less attractive to supply effort in the presence of profit sharing. In our model the latter effect dominates**.**

[3] This literature (see POHJOLA [1987], ANDERSON AND DEVEREUX [1989], HOLMLUND [1990], and JERGER AND MICHAELIS [1999]) has been restricted to deterministic models where profit shares are determined as a result of bargaining simultaneously with the base wage. Moreover, this literature has not considered the natural case where effort by an employee may be affected by a commitment to profit sharing.

4 Wage Negotiation

We now turn to analyze the wage negotiation between a union and a firm. We apply the Nash bargaining solution under the 'right-to-manage' approach according to which employment is unilaterally determined by the firm. Effort provision takes place at the discretion of the employees. Finally, and importantly, the wage negotiations are assumed to take place conditional on the system of profit sharing and the firm's exogenous leverage rate.

We denote the relative bargaining power of the union by β, and that of the firm by $(1-\beta)$. In line with (4) the objective function of the trade union can be written as

$$E\hat{U} = L\left[w + (1-F(\hat{\theta}))\frac{\tau}{L}E\pi\right] + (N-L)b - L\,g(a),$$

where the first term captures the benefits from employment to employed workers and the second term the unemployment benefits for unemployed union members. The last term denotes the disutility of effort for employed union members. We assume that the threat points of the union and the firm are $EU^o = Nb$ and $E\pi^o = 0$, respectively. Applying the traditional Nash bargaining solution the negotiating parties decide on w in order to maximize

$$\text{(10)} \qquad \Omega = [EU]^{\beta}\,[(1-\tau)\,E\pi]^{1-\beta}$$

with $EU = E\hat{U} - EU^o$ and subject to the labour demand (8) and the effort determination (9). In the Nash maximand (10) $E\pi = E\pi(a^*, L^*)$ denotes the expected profit of the firm adjusted with the factor $(1-\tau)$ in order to take the impact of profit sharing into account. The factor $EU = EU(a^*, L^*)$ denotes the expected rent of the union relative to the threat point. The expected profits and the expected rent of the union are evaluated at the equilibrium combination of effort and employment.

In anticipation of the equilibrium with respect to effort provision and employment the expected profit of the firm is given by

$$(11) \qquad E\pi = E\pi(a^*, L^*) \;=\; \int_{\hat{\theta}}^{\infty} [\theta \frac{\eta}{\eta - 1} (a^* L^*)^{\frac{\eta-1}{\eta}} - w(1 + r\delta) L^*]\, \lambda e^{-\lambda\theta}\, d\theta$$

or, alternatively, by[4]

$$(11') \qquad E\pi \;=\; \frac{k}{\eta - 1}\, w\, (1 + r\delta) L^* \quad ,$$

where $k = 1 - F(\hat{\theta}) = e^{-(\eta - 1)}$ denotes the probability of solvency.

The calculation of the union's expected rent captures the idea that all the N workers have incentives to seek employment. Those union members who are left unemployed due to the magnitude of the firm's production enjoy the outside option b. Those union members who enter the pool of unemployed people due to bankruptcy of the firm receive their base wage, which was assumed to be paid prior to the finalisation of the production, but they acquire no profit share. Thus the expected rent of the union, EU, is calculated to be

$$(12) \qquad EU \;=\; EU(a^*, L^*) \;=\; L^* \left[\; w - b + \frac{\tau}{L} E\pi(a^*, L^*) - \; g(a^*) \;\right] \quad .$$

The Nash bargaining solution has to satisfy the first-order condition

$$(13) \qquad \beta \frac{EU_w}{EU} \quad + \quad (1 - \beta) \frac{E\pi_w}{E\pi} \quad = \quad 0 \quad ,$$

where the subscript w denotes differentiation with respect to the wage rate w.[5] According to equation (13) the Nash bargaining wage rate is affected by the relative bargaining powers as well as by the relative effect of the wage rate on the objective functions of the negotiating agents. The marginal change in the expected profits of the firm from increasing the wage rate is negative, while the corresponding marginal change in the expected rent of the union is positive. The Nash bargaining solution has the intuitively appealing feature that the negotiated wage rate is an increasing function of the union's bargaining power, β (see

[4] This can be obtained by substituting the optimal employment and effort decisions into the expected profit function (11).

[5] We assume that the sufficient second-order condition for the Nash bargaining solution $\Omega_{ww} = \frac{\beta}{EU^2}\left[EU\, EU_{ww} - (EU_w)^2\right] \; + \; \frac{1-\beta}{E\pi^2}\left[E\pi\, E\pi_{ww} - (E\pi_w)^2\right] \; < \; 0$ holds.

Appendix A for details). By substituting the ratios (A1) and (A3), derived in Appendix A, into (13) we find that the Nash bargaining solution, w^N, can be expressed through the implicit representation

$$(14) \qquad w^N = \frac{1 + \dfrac{\beta}{\eta^* - 1}}{1 + \left[\dfrac{\tau\, k\,(1+r\delta)}{\eta - 1}\right]}\, b + \frac{1}{1 + \left[\dfrac{\tau\, k\,(1+r\delta)}{\eta - 1}\right]}\, g(a^*) ,$$

where $-\eta^* = \dfrac{wL_w^*}{L^*} = -\eta + (\eta - 1)\gamma$ denotes the total wage elasticity of labour demand, which incorporates both the direct negative effect of the wage rate and the indirect positive effect via effort provision.

In general, and unlike the earlier literature, (14) captures the new idea that profit sharing has two opposing effects. It tends to induce wage moderation (with respect to the base wage) as a part of the compensation is shifted to the performance-related profit share. But, the effort-enhancing effects of profit sharing will also increase the costs of effort provision (the term $g(a^*)$) and thereby increase the "individual rationality" constraint for each union member, which will have a positive effect on the wage rate. By substituting (9) into (14) the Nash bargaining solution can be expressed in explicit form according to

$$(15) \qquad w^N = \frac{1 + \dfrac{\beta}{\eta^* - 1}}{1 + \tau\, k\,(1+r\delta)\, h(\gamma,\eta)}\, b \quad ,$$

where $h(\gamma,\eta) \equiv \dfrac{1}{\eta - 1} - \gamma B k$. We can observe from (15) that the negotiated wage rate is proportional to the outside option b, increasing in the bargaining power of the union, and decreasing as a function of the total wage elasticity of wage demand. These effects coincide with those of conventional wage bargaining models except for the generalization that the total elasticity of labour demand incorporates the efficiency wage aspect.

The profit share affects the negotiated wage rate in an essential way. It has a wage-moderating effect ($\dfrac{\partial w^N(r,\tau,\delta,b)}{\partial \tau} < 0$) as soon as $\gamma < \hat{\gamma} = \dfrac{1}{(\eta - 1)B k}$. However, applying standard calculus it can be proven that $\hat{\gamma}$ is always strictly larger than one.[6] For that reason we can conclude that profit sharing always moderates the negotiated base wage. Similarly we can conclude that the leverage rate and the interest rate have wage-moderating effects in the presence of profit sharing ($\frac{\partial w^N(r,\tau,\delta,b)}{\partial \delta} < 0$, $\frac{\partial w^N(r,\tau,\delta,b)}{\partial r} < 0$).

We can now summarize our analysis in

Proposition 2: *The Nash bargaining solution for the negotiated wage is proportional to the outside option available to the union, increasing in the bargaining power of the union, and decreasing in the total wage elasticity of wage demand. In the presence of profit sharing the negotiated wage depends also on the compensation and capital structure. More specifically, the profit share, the interest rate as well as the leverage rate all have wage-moderating effects.*

The negotiated Nash wage (15) represents a generalization along several dimensions relative to the traditional Nash bargaining solution. Our analysis with the Nash bargaining solution (15) simultaneously includes efficiency wage considerations like in ALTENBURG AND STRAUB [1999], BULKLEY AND MYLES [1996], LINDBECK AND SNOWER [1991] and SANFEY [1993], the price of capital like in KOSKELA, SCHÖB AND SINN [1998], the effect of profit sharing on the wage rate like in HOLMLUND [1991] and the effect of the firm's leverage like in BRONARS AND DEERE [1991], GARVEY AND GASTON [1998], PEROTTI AND SPIER [1993] and DASGUPTA AND SENGUPTA [1993]. But these models do not incorporate the important effort-enhancing aspect of profit sharing.

The generalized Nash bargaining solution (15) implies several interesting special cases against which it can be compared relative to existing knowledge from the literature. We now turn to consider these special cases.

Firstly, in the absence of efficiency wage considerations with $h(0,\eta) = 1/(\eta - 1)$ we can reformulate (15) according to

6 In fact, a detailed analysis reveals that $\hat{\gamma}$ attains it minimal value approximately 1,79 at $\eta \approx 2{,}16$.

$$(16) \qquad w^N = \frac{1 + \dfrac{\beta}{\eta - 1}}{1 + \left[\dfrac{\tau\, k\, (1+r\delta)}{\eta - 1}\right]}\, b\,.$$

Thus, in the absence of efficiency wage considerations the wage-moderating effects of profit sharing (and leverage) are stronger as these are not reduced through increased costs of effort provision. Further, in this case the total wage elasticity of labour demand is reduced to the conventional elasticity.

Secondly, if all the bargaining power lies with the union ($\beta = 1$), the Nash bargaining solution is simplified to the monopoly union solution

$$(17) \qquad w^M = \frac{\dfrac{\eta^*}{\eta^* - 1}}{1 + \tau\, k\, (1+r\delta)\, h(\gamma,\eta)}\, b \quad .$$

In particular, (17) demonstrates explicitly how efficiency wage considerations and profit sharing impact on the optimal wage setting of a monopoly union. Profit sharing will reduce the optimal wage rate of a monopoly union, while efficiency wage considerations will raise it. In the absence of efficiency wage considerations and profit sharing, (17) implies the well-known monopoly wage

$$w^M\Big|_{\gamma=0,\,\tau=0} = \frac{\eta}{\eta - 1}\, b \quad .$$

Thirdly, if all the bargaining power lies with the firm ($\beta = 0$), the wage would be determined so as to maximize the expected profits. From (15) this case yields

$$(18) \qquad w^C = \frac{1}{1 + \tau\, k\, (1+r\delta) h(\gamma,\eta)}\, b \quad .$$

According to (18) introduction of profit sharing makes it possible to reduce the base wage of the workers even below the outside option. Consequently, profit sharing will have base wage effects operating in an opposite direction relative to the conventional efficiency wage considerations.

5 Profit Sharing

In the long run the firm determines the nature of the incentive scheme, in particular the profit share, offered to the organized workers. This decision serves as a strategic commitment relative to the subsequent stage of wage negotiations with the union. In what follows we consider the firm's optimal determination of a profit sharing system conditional on the subsequent equilibrium with respect to the employment and effort decisions and conditional on the Nash wage bargaining.

At this stage the firm decides on the profit share, τ, in order to solve

$$(19) \qquad \max_{\tau} \quad (1-\tau)\, E\pi \;=\; (1-\tau)\, k \left[\frac{\eta}{\eta-1} \left(a^* L^*\right)^{\frac{\eta-1}{\eta}} \;-\; w^N (1+r\delta) L^* \right] ,$$

subject to the bargaining outcome, $w^N(\tau)$, effort decision , a^*, and labour demand, L^*. The optimal profit share, τ^*, has to satisfy the first-order condition[7]

$$(20) \qquad -\,\tau^* \;+\; \left(1-\tau^*\right) \left[(\eta-1) \; \left(\frac{\tau^* a_\tau^*}{a^*} \;-\; \frac{\tau^* w_\tau^N}{w^N} \right) \right] \;=\; 0 \quad ,$$

where $a_\tau^* > 0$ and $w_\tau^N < 0$. According to (20) the optimal profit share is implicitly determined so that the negative dilution effect is exactly counterbalanced by the positive effort-enhancing and wage-moderating effects.

As is shown in detail in Appendix B the optimality condition (20) leads to a quadratic equation, which can, in principle, be solved, but its explicit solution is not very instructive. However, by taking into account that $\gamma = \dfrac{\tau^* a_\tau^*}{a^*}$ the solution to equation (20) can be implicitly determined by

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7 For the details of how to derive the first-order condition (20) we refer to Appendix B.

$$(21) \qquad \tau^* = \frac{(\eta-1)\left[\gamma - \dfrac{\tau^* w_\tau^N}{w^N}\right]}{1 + (\eta-1)\left[\gamma - \dfrac{\tau^* w_\tau^N}{w^N}\right]} .$$

From equation (21) we can directly infer that the optimal profit share satisfies that $0 < \tau^* < 1$ and that it is larger the more substantial is the wage-moderation effect. In fact, the profit share in the absence of a wage-moderating effect,

$$\tau^0 = \frac{(\eta-1)\gamma}{1 + (\eta-1)\gamma} ,$$

represents a lower bound for the optimal profit share, i.e. $\tau^* > \tau^0$.

We summarize the firm's optimal choice of profit share in

Proposition 3: *The profit sharing instrument has positive effort-augmenting and wage-moderating effects, which exactly offset the negative dilution effect in equilibrium. The optimal profit share is increasing as a function of the wage-moderating effect as well as of the wage elasticity of effort.*

In light of equation (21) we can also make an interesting characterization of the relationship between the optimal profit share and the firm's capital structure. Because the wage-moderating effect is an increasing function of the firm's leverage rate, an increased leverage rate will induce the firm to increase the profit share offered to the workers. Profit sharing stimulates effort provision and thereby it enhances productivity. As empirically documented by, for example, WADHWANI AND WALL [1990] and CAHUC AND DORMONT [1997] profit sharing will promote employment through this mechanism. But our analysis has characterized that the wage-moderating effect of profit sharing is an alternative and complementary mechanism reinforcing the positive employment effects.

A few contributions to the literature on wage bargaining, for example JERGER AND MICHAELIS [1999], HOLMLUND [1991], POHJOLA [1987] and ANDERSON AND DEVEREUX [1989], have analyzed profit sharing within a framework where the union-firm negotiations include profit shares in addition to base wages. In this literature the profit shares are determined at the stage of bargaining simultaneously with the base wages.

6 Aggregate Wage Setting and Equilibrium Unemployment

After having solved the sequence of decisions from a partial equilibrium perspective we now move on to explore the implications of profit sharing, union bargaining power, leverage and benefit replacement ratios on equilibrium unemployment in a general equilibrium framework.

Until now our wage bargaining analysis has referred to a representative industry, say i. By (15), for each representative industry the generalized Nash bargaining solution has the form

$$(22) \qquad w_i^N = A_i \, b \quad ,$$

where

$$A_i = \frac{1 + \dfrac{\beta}{\eta^* - 1}}{1 + \tau\, k\, (1 + r\delta)\, h(\gamma, \eta)} = \frac{Y}{1 + \tau\, k\, (1 + r\delta)\, h(\gamma, \eta)}$$

where the factors, A_i, are, in principle, industry-specific, but we have assumed that $A_i = A$, i.e. that all the industries are identical. Further, we have introduced the notation whereby $Y = 1 + \beta/(\eta^* - 1)$ denotes a wage mark-up determined by the union's bargaining power and the total wage elasticity of labour demand.

In a general equilibrium context the term b should be re-interpreted to be the relevant outside option. We specify the outside option as

$$(23) \qquad b = (1-u)\left(w^N + \frac{\tau}{L} E\pi\right) + u\,B \quad ,$$

where u denotes the unemployment rate, B the unemployment benefit and w^N is the negotiated wage rate in all the identical industries (for a standard justification we refer to, for example, LAYARD, NICKELL AND JACKMAN [1991, p. 100-101]). The formulation (23) captures the idea that all the identical industries adopt profit sharing so that an unemployed worker faces the probability *(1-u)* of being employed in another industry, which makes use of a similar compensation scheme.[8] We further restrict ourselves to the case of a constant replacement ratio $q \equiv B/w^N$.

Intuitively, we can form the following conjecture for the employment effects of profit sharing in a general equilibrium context. In light of the Nash bargaining solution (15) profit sharing will have a wage-moderating effect, thereby contributing to a reduction in the outside option (23), thus stimulating employment. On the other hand, increased profit sharing will add a direct positive effect to the relevant outside option, which will run counter to the wage-moderating effect. Finally, the unemployment compensation will add to the relevant outside option, and the size of the benefit replacement ratio determines to what extent profit sharing moderates this effect through wage reductions. If the benefit replacement ratio is sufficiently high, the wage moderating effect of profit sharing makes it more likely that the overall effect of profit sharing is employment-enhancing. Thus, from the form of the relevant outside option in the general equilibrium context, we have reasons to conjecture that profit sharing could stimulate employment as long as the benefit replacement ratio is sufficiently high so as to make the wage-moderating effect of profit sharing dominate relative to the direct effect. Our formal analysis will, in fact, confirm this intuition.

Combining (22), (23) and the assumption of a constant replacement ratio we find that the aggregate unemployment rate can be expressed according to

$$(24) \qquad u^N = \frac{1 - \frac{1}{Y}\left(1 + \tau\, k(1 + r\delta)\right)h(\gamma, \eta) + \frac{\tau\, k(1 + r\delta)}{\eta - 1}}{1 - q + \frac{\tau\, k(1 + r\delta)}{\eta - 1}},$$

where $Y = 1 + \frac{\beta}{\eta^* - 1}$ denotes the mark-up induced by the labour market imperfections.

From (24) we can see that $\frac{\partial u^N}{\partial Y} > 0$ and $\frac{\partial u^N}{\partial q} > 0$. Hence a higher benefit-replacement ratio or a higher mark-up – which is a positive function of trade union's bargaining power and a negative function of the total wage elasticity of labour demand - will increase equilibrium unemployment.

8 In this general equilibrium context we assume perfect labour mobility across industries.

We next introduce the notation $X = \tau k(1+r\delta)$. Differentiating (24) with respect to X we find that (see Appendix C)

$$(25) \qquad q \begin{Bmatrix} > \\ < \end{Bmatrix} q^* \quad \textit{if and only if} \quad \frac{\partial u^N}{\partial X} \begin{Bmatrix} < \\ > \end{Bmatrix} 0 \ ,$$

where

$$(26) \qquad q^* = \frac{\frac{1}{Y} - (\eta - 1)h(\gamma,\eta)}{1-(\eta-1)h(\gamma,\eta)} \ .$$

Consequently, according to (25) q^* defines a critical value of the benefit replacement ratio above which an increase in $X = \tau\, k(1+r\delta)$ will induce a reduction in the equilibrium unemployment (and vice versa if q is below this critical value). From (26) it can easily be seen that the critical value q^* depends negatively on the mark-up factor Y and positively on the probability of solvency k as well as the disutility of effort γ, (i.e. the wage elasticity of effort). Now we can summarize our conclusions in

Proposition 4: *Profit sharing - as well as the leverage rate and the interest rate - will reduce equilibrium unemployment in the presence of labour market policies with the benefit replacement ratio exceeding the critical value defined by (26). This threshold depends negatively on the labour market imperfections and positively on the wage elasticity of effort. The reverse happens if the benefit replacement ratio is smaller than this critical value.*

Consequently, profit sharing is an employment-enhancing instrument in environments with sufficiently generous labour market policies in the sense of sufficiently high benefit replacement ratios. Under these circumstances the employment-enhancing effect of profit sharing can be seen as a consequence of its wage-moderating effect. With more substantial labour market imperfections in the sense of higher wage mark-ups profit sharing is more likely to stimulate employment, because more substantial labour market imperfections will reduce the threshold with respect to the benefit replacement ratios. Conversely, more severe agency problems associated with higher disutility of effort γ -

meaning higher wage elasticity of effort - tends to reduce the wage-moderating effect of profit sharing, and consequently, the benefit replacement ratio threshold for the employment-enhancing effects of profit sharing.

Our results, characterized in proposition 4, add new dimensions to the literature (compare with, for example, HOLMLUND [1991] and JERGER AND MICHAELIS [1999]) in several respects. Firstly, we have shown that the impact of profit sharing on equilibrium unemployment depends on the relationship between the benefit replacement ratio and its critical value, which is turns depends on the mark-up induced by the labour market imperfections, the probability of solvency and the wage elasticity of effort. Secondly, we have incorporated efficiency wage considerations into the model and analysed profit sharing as a strategic wage-reducing commitment device, not subject to bargaining with the trade union. Thirdly, and finally, we have also characterized the relationship between (exogenous) leverage or interest rates and equilibrium unemployment.

From (24) we can also infer that the equilibrium unemployment exhibits a fairly complicated dependence on the probability of bankruptcy. The probability of solvency can directly be seen to increase the critical benefit replacement ratio above which profit sharing stimulates employment. When placing into perspective the predictions from our model of how the leverage rate or the probability of bankruptcy affect the unemployment rate, it should be remembered that our model incorporates neither imperfections in the product market nor optimizing behaviour by the institutions operating in the credit market. [9] In these respects the present model is not in all respects very well designed for an analysis of the relationship between capital structure and equilibrium unemployment. If the product market is imperfectly competitive, the firm's leverage can be expected to affect the mark-ups positively and thereby to increase equilibrium unemployment.

[9] We have excluded effects whereby an increased leverage rate would generate higher interest rates, which can be expected both to reduce investment and to increase mark-ups. In a model endogenizing the lending rate formation KOSKELA AND STENBACKA [2003] have explored the interaction between labour and credit market imperfections for the determination of equilibrium unemployment.

7 Concluding Comments

This study has offered a unified framework for simultaneously analyzing the determination of employment, effort provided by employed union members, wages, and profit sharing under uncertainty generated by a stochastic revenue shock. We initially showed that employment depends negatively on the effective labour cost as well as on the hazard rate capturing the uncertainty associated with the firm's production. The effective labour cost consists not only of the wage rate, but also the interest rate and the firm's rate of leverage. Further, the effort provision by union members was shown to depend positively not only on the usual efficiency wage considerations, but we also characterized the effort-enhancing effects of profit sharing.

Wage determination was analyzed by applying a generalized Nash bargaining solution, which extended the wage bargaining literature by incorporating not only efficiency wage considerations in the presence of uncertainty, but also profit sharing and capital structure. From the generalized bargaining solution we were able to conclude how capital structure and profit sharing will have a strategic wage-moderating commitment value for a firm facing a union in wage negotiations. We also derived the optimal profit sharing system from the firm's point of view. The profit-sharing instrument was demonstrated to have positive effort-augmenting and wage-moderating effects, which exactly offset the negative dilution effect in equilibrium.

Our analysis culminated in a characterization of the implications of profit sharing, bargaining power, benefit replacement ratios and leverage on equilibrium unemployment from a general equilibrium perspective. We proved that profit sharing will reduce equilibrium unemployment in the presence of labour market policies with sufficiently high benefit replacement ratios. This critical benefit replacement ratio threshold was shown to depend negatively on the institutional labour market imperfections, for example the bargaining power of unions, whereas positively on the wage elasticity of effort.

Though there is empirical evidence on the determinants of employment and wages, which lies in conformity with our findings, it still remains an important task for future research to evaluate the interactions between wages, employment and financial factors much more systematically than what has been done thus far. In terms of equilibrium unemployment consequences from profit sharing our analysis has highlighted the significance of labour market policies in the form of the benefit replacement ratio. Under circumstances with sufficiently generous labour market policies profit sharing was shown to stimulate employment. Furthermore, this was shown to be more likely the more significant are the institutional imperfections in the labour market. This is because under the high (low) benefit replacement ratio the wage moderation effect of profit sharing dominates (is dominated) by its direct effect on employment. It is an interesting and unexplored area for future research to empirically test these predictions.

Throughout the analysis we have assumed that firms make use of profit sharing as a commitment device. Of course, it might also be the case that firms decide on profit sharing after knowing the result of the wage negotiation. It is easy to convince oneself that our main results survive such an alteration with respect to the timing of decisions. In our analysis the union was assumed to be able to enforce the effort provision by the representative union member, which was justified through our focus on homogenous labour force so that agency issues within unions do not arise. It is beyond the scope of our paper to relax this assumption and incorporate the additional aspect arising from potential free rider effects among the organized employees.

Appendix A Derivation of the Nash bargaining wage rate

This appendix develops the expressions for the terms $\frac{E\pi_w}{E\pi}$ and $\frac{EU_w}{EU}$ in the first-order condition (13) of the Nash bargaining. We start by looking at the profit response by the firm to a change in the wage rate. The optimal employment decision of the firm has to satisfy the first-order condition $E\pi_L = 0$, which is equivalent to the condition $(aL)^{\alpha-1} = \frac{w(1+r\delta)\lambda}{a\,\eta}$. By taking account of this condition we find that $E\pi_w = \; k\,(1+r\delta)\frac{L}{w}\left[\frac{w\lambda}{\eta}\;\frac{wa_w}{a} - w\right] \; = \; k\,(1+r\delta)L\,[\gamma-1] < 0$, where the elasticity of effort with respect to wage is constant by (9). Hence, in light of equation (11') we can conclude that

(A1) $$\frac{E\pi_w}{E\pi} \;=\; \frac{1}{w}[\gamma-1][\eta-1] \;<\; 0\,.$$

As for the trade union side we find by combination of (12) and (A1) that the ratio $\frac{EU_w}{EU}$ can be expressed according to

(A2) $$\frac{EU_w}{EU} = \frac{1}{w}\left[-\eta^* \;+\; \frac{w+\frac{\tau}{L}E\pi\,((\gamma-1)(\eta-1)+\eta^*)-g(a^*)}{w-b+\frac{\tau}{L}E\pi-g(a^*)}\right],$$

where we have taken into account that effort provision exhibits constant wage elasticity according to $\frac{wa_w^*}{a^*} = \gamma$ and where $-\eta^* = \frac{wL_w^*}{L^*} \;=\; -\eta+(\eta-1)\gamma$ denotes the total wage elasticity of wage demand. Making use of the total wage elasticity of wage demand we can rewrite (A2) according to

(A3) $$\frac{EU_w}{EU} = \frac{1}{w}\left[\frac{(\eta^*-1)\left[g(a^*)-w-\frac{\tau}{L}E\pi\right] \;+\; \eta^*\,b}{w-b+\frac{\tau}{L}E\pi\;-g(a^*)}\right].$$

Appendix B Determination of the optimal profit share

By differentiation of the expected profit function (20) with respect to τ we find the necessary first-order condition to be given by

$$\text{(B1)} \quad E\pi_\tau = \lambda^{-\eta} (\frac{1}{\eta})^{-\eta} w^{1-\eta} a^{\eta-1} (-1 + (1-\tau)(\eta-1)(\frac{a_\tau}{a} - \frac{w_\tau}{w})) = 0 ,$$

where in this appendix we use the short notations $w = w^N(\tau)$, $a = a^*(\tau)$ and $L = L^*(\tau)$. Equation (B1) can easily be shown to be equivalent to

$$\text{(B2)} \qquad - \tau + (1-\tau)\left[(\eta-1) \left(\frac{\tau a_\tau}{a} - \frac{\tau w_\tau^N}{w^N} \right) \right] = 0 .$$

From (9) and (15) we can conclude that

$$\frac{\tau a_\tau}{a} = \gamma \quad \text{and} \quad \frac{\tau w_\tau}{w} = - \frac{\tau k (1+r\delta) h(\gamma,\eta)}{1 + \tau k (1+r\delta) h(\gamma,\eta)} ,$$

respectively, where $h(\gamma,\eta) \equiv \frac{1}{\eta-1} - \gamma B K$. Substituting these expressions into (B2) we get the equation

$$\text{(B3)} \qquad (1-\tau)(\eta-1)\left[\gamma + \frac{\tau k (1+r\delta) h(\gamma,\eta)}{1 + \tau k (1+r\delta) h(\gamma,\eta)} \right] = \tau .$$

(B3) defines a quadratic function with respect to τ and it can therefore, in principle, be solved explicitly.

Appendix C Equilibrium unemployment and profit sharing

The equilibrium unemployment equation (24) can be rewritten as

(C1) $$u^N = \frac{1 - \frac{1}{Y} + X\left[\frac{1}{\eta - 1} - \frac{h(\gamma,\eta)}{Y}\right]}{1 - q + X\frac{1}{\eta - 1}} \quad ,$$

where $X = \tau k(1 + r\delta)$. Differentiating (C1) with respect to X gives

(C2) $$\frac{\partial u^N}{\partial X} = \frac{1}{\left[1 - q + \frac{X}{\eta - 1}\right]^2}\left[g(1-q) - \frac{1}{\iota - 1}(1 - \frac{1}{Y})\right] ,$$

where $g = \frac{1}{\eta - 1} - \frac{h(\gamma,\eta)}{Y}$. From (C2) we can now conclude that $\frac{\partial u^N}{\partial X} < 0$ if and only if $q > \frac{m}{Y}$ with $m = 1 - (1-q)(\eta - 1)h(\gamma,\eta)$. This condition can be re-expressed as

(C3) $$q \begin{Bmatrix} > \\ < \end{Bmatrix} q^* \quad \Leftrightarrow \quad \frac{\partial u^N}{\partial X} \begin{Bmatrix} < \\ > \end{Bmatrix} 0$$

where

(C4) $$q^* = \frac{\frac{1}{Y} - (\eta - 1)h(\gamma,\eta)}{1 - (\eta - 1)h(\gamma,\eta)} \quad .$$

It can easily be verified that the critical value q^* depends negatively on the mark-up factor Y and positively both on the probability of solvency k and the disutility of effort γ. Hence the profit share, the leverage rate and the interest rate will have negative effects on equilibrium unemployment if the benefit replacement ratio exceeds the critical value q^*. The reverse relationship prevails if the benefit replacement ratio is below q^*.

References

ALTENBURG, L., AND M. STRAUB [1998], "Efficiency Wages, Trade Unions, and Employment," *Oxford Economic Papers*, 50, 726-746.

ANDERSON, S., AND M. DEVEREUX [1989], "Profit-sharing and Optimal Labour Contracts," *Canadian Journal of Economics*, 89, 425-433.

BRONARS, S.G., AND D.R. DEERE [1991], "The Threat of Unionization, the Use of Debt, and the Preservation of Shareholder Wealth," *Quarterly Journal of Economics*, 56, 231-234.

BULKLEY, G., AND G.D. MYLES [1996], "Trade Unions, Efficiency Wages and Shirking," *Oxford Economic Papers*, 48, 75-88.

CAHUC, P., AND B. DORMONT [1997], "Profit Sharing: Does It Increase Productivity and Employment? A Theoretical Model and Empirical Evidence on French Micro Data," *Labour Economics,* 4, 293-319.

DASGUPTA, S., AND K. SENGUPTA [1993], "Sunk Investment, Bargaining, and Choice of Capital Structure," *International Economic Review*, 34, 203-220.

FUNKE, M., W. MAURER, AND H. STRULIK [1999], "Capital Structure and Labour Demand: Investigations Using German Micro Data," *Oxford Bulletin of Economics and Statistics*, 61, 199-215.

GARINO, G., AND C. MARTIN [2000], "Efficiency Wages and Union-Firm Bargaining," *Economics Letters,* 69, 181-185.

GARVEY, G.T., AND N. GASTON [1998], "Getting Tough with Workers? More on the Strategic Role of Debt," mimeo.

HANKA, G. [1998], "Debt and the Terms of Employment," *Journal of Financial Economics,* 48, 245-282.

HOLMLUND, B. [1990], "Profit Sharing, Wage Bargaining, and Unemployment," *Economic Inquiry,* 28, 257-268.

HOLMSTRÖM, B. [1982], "Moral Hazard in Teams," *Bell Journal of Economics*, 13, 324-340.

JERGER, J., AND J. MICHAELIS [1999], "Profit Sharing, Capital Formation and the NAIRU," *Scandinavian Journal of Economics*, 101, 257-275.

KOSKELA, E., R. SCHÖB, AND H.-W. SINN [1998], "Pollution, Factor Taxation and Unemployment," *International Tax and Public Finance,* 5, 379-393.

KOSKELA, E., AND R. STENBACKA [2003], "Profit Sharing, Credit Market Imperfections and Equilibrium Unemployment," working paper, University of Helsinki.

LAYARD, R., S. NICKELL, AND R. JACKMAN [1991], *Unemployment: Macroeconomic Performance and the Labour Market*, Oxford University Press.

LINDBECK, A., AND D.J. SNOWER [1991], "Interactions between the Efficiency Wage and Insider-Outsider Theories," *Economics Letters,* 37, 193-196.

NICKELL, S., AND D. NICOLITSAS [1999], "How Does Financial Pressure Affect Firms? *European Economic Review*, 43, 1435-1456.

NICKELL, S., AND S. WADHWANI [1991], "Employment Determination in British Industry: Investigations Using Micro-Data," *Review of Economic Studies*, 58, 955-969.

PENDLETON, A., POUTSMA, E., van OMMEREN, J. AND C. BREWSTER [2001], *Employee Share Ownership, and Profit Sharing in the European Union*, Office for Official Publications of the European Commission, Luxembourg.

PEROTTI, E.C., AND K.E. SPIER [1993], "Capital Structure as a Bargaining Tool: The Role of Leverage in Contract Negotiation," *American Economic Review*, 83, 1131-1141.

POHJOLA, M. [1987], "Profit-Sharing, Collective Bargaining and Employment," *Journal of Institutional and Theoretical Economics,* 143, 334-342.

SANFEY, P.J. [1993], "On the Interaction between Efficiency Wages and Union-Firm Bargaining Models," *Economics Letters,* 41, 319-324.

SARIG, O.D. [1998], "The Effect of Leverage on Bargaining with a Corporation," *The Financial Review*, 33, 1-16.

SCHMIDT, K. [1997], "Market Incentives and Product Market Competition," *Review of Economic Studies,* 64, 191-213.

SHARPE, S.A. [1994], "Financial Market Imperfections, Firm Leverage, and the Cyclicality of Employment," *American Economic Review*, 84, 1060-1074.

WADHWANI, S., AND M. WALL [1990], "The Effects of Profit Sharing on Employment, Wages, Stock Returns and Productivity: Evidence from U.K. Micro Data," *Economic Journal,* 100, 1-17.

WEITZMAN, M. [1987], "Steady State Unemployment under Profit Sharing," *Economic Journal*, 97, 86-105.

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