

## STEADY STATE UNEMPLOYMENT UNDER PROFIT SHARING\*

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This paper has several aims. First of all, it seeks to tell a reasonable story about how asymmetric treatment of high-seniority ‘insider’ workers and non-tenured ‘outsiders’ can give rise to bad macroeconomic steady states in a wage economy. The ultimate source of the unemployment–inflation dilemma in this story is the idea that low-seniority outsider workers end up unemployed because they have too little voice in negotiations over wages. The paper then considers profit sharing as a possible alternative payment mechanism having the automatically corrective incentive property that employers always want to hire more outsiders. Given the assumptions of the model, it is shown that widespread profit sharing will result in lower unemployment and more output even though it is individually rational for insiders always to prefer wages over profit shares. Put more fancifully, a wage system has a negative macroeconomic externality, while a profit-sharing system has favourable externality effects on employment and, indirectly, on price stability. If the logic of the externality argument is accepted, the path is open for government policy to encourage widespread profit sharing as an instrument for lowering the NAIRU.

### I. THE CAST OF CHARACTERS

There are four key players in the model: insider workers, outsider workers, firms, and the government.

In making much hinge on the distinction between insider workers and outsider workers, I am following the pioneering work of Lindbeck and Snower.<sup>1</sup> They identify insiders as those who already have a job and outsiders as those who are unemployed or laid off. A theory or paradigm is then developed, based largely on the asymmetric cost of replacing insiders by outsiders, which provides a microeconomic explanation for the prevalence of involuntary unemployment. The theory clarifies why outsiders do not underbid insiders, posits a major role for unions, and suggests novel policy measures to lower unemployment by reducing the market power of insiders *vis-à-vis* outsiders. Overall, I believe the insider–outsider paradigm has a strong resonance of plausibility and provides the most reasonable microeconomic framework yet put forth for thinking about unemployment-related issues.

Actually, I would perhaps go even further than Lindbeck and Snower in

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<sup>1</sup> See Lindbeck and Snower (1984). See also the supportive empirical paper by Gregory (1985).

stressing the deep-seated nature of the insider–outsider paradigm, which in my opinion transcends mere job markets and labour unions. In every sphere of social relations there tends to be a fundamental distinction between the relatively sympathetic treatment of those insider members of the family, community, or nation with whom we identify, and more of a hands-off attitude toward those nameless, faceless outsiders with whom we do not identify. Indeed, much political and social conflict is, in essence, about where to draw this line, or at least where to shade a grey area. The economic theorist's highly abstract possibility of 'side payments' between employed and unemployed workers is only one of many factors in labour relations. If insiders are treated so differently from outsiders in the world at large, and so much hinges on the distinction, why should the workplace be entirely exempt from such influences?

In any event, I will here define insiders as workers having high seniority and outsiders as those having low seniority. A key assumption is that pay bargains are negotiated between insider workers and firms, with outsiders having very little say. This might be envisioned as the ultimate outcome of a bargaining process between management and a majority-rule labour union where layoffs are by seniority – in which case the union's preferences are those of the steady-state median voter. Or, it might come about more generally for the kinds of reasons previously alluded to. In either case it will be convenient to maintain the fiction that long-run equilibrium bargaining takes place between a firm that is essentially interested in profits and a representative tenured worker essentially interested in pay.

There is a second basic assumption that may also be viewed as controversial. I will assume that, at least in the long run, the firm is on its demand for labour schedule.<sup>1</sup> Once a pay contract has been signed, the union cannot restrict the company from eventually hiring as many workers as it wants on the given contract. Labour–management negotiations are essentially limited to bargaining over pay parameters, while hiring of new workers is, in labour-relations parlance, 'not a mandatory subject to bargaining'. Granted that this will sometimes result in ex-post inefficient pay-employment combinations,<sup>2</sup> and whether or not it can ultimately be 'explained' in terms of transactions costs, enforcement technologies, informational asymmetries, or other buzzwords of contemporary economic theory, the idea that the hiring decision is essentially a management prerogative seems so deep-seated a feature of capitalism that I believe it may fairly be accepted as a useful point of departure for the purpose of this paper.

<sup>1</sup> Aside from a great deal of casual empiricism, there is also some formal evidence for this proposition in a wage economy. See Nickell and Andrews (1983) and Oswald (1984). In a wage firm where senior workers are essentially indifferent to unemployment, the contract curve coincides with the labour demand curve, so that it is efficient for insider workers and management to limit themselves to bargaining about the wage, letting management decide the employment level. It must be admitted that a distressingly large number of alternative hypotheses are also available, with some formal evidence for them too. See Farber (1984) for a survey. I am therefore forced in this paper to rely on what I personally believe to be the best description of the hiring decision, yet without being able to claim overwhelming theoretical or empirical evidence for it.

<sup>2</sup> This point was first noted by Leontief (1946). See also McDonald and Solow (1981).

## II. THE BASIC IDEA

The principle on which this paper rests is quite simple. Suppose the firm controls the employment decision. Then, other things being equal, under a profit-sharing system the firm is more inclined to expand employment and output than under the corresponding wage system.

The following example illustrates the basic point. Suppose the typical firm can produce output  $Y$  out of labour  $L$  by the production function  $F(L)$ . Let the firm's revenue function be  $R(Y)$ . If the firm pays a fixed wage  $w$  it will hire labour and produce output at the level where profits  $R[F(L)] - wL$  are being maximised, or where the marginal revenue product of labour  $R'F'$  equals the wage  $w$ .

Now imagine, as a kind of thought experiment, that a profit-sharing system is put in place promising to pay each worker a base wage  $\omega$  and a share  $\lambda$  of gross profits per capita. Each worker is now paid  $W = \omega + \lambda\{R[F(L)] - \omega L\}/L$ . The firm's net profits are now  $(1 - \lambda)\{R[F(L)] - \omega L\}$ , and the net marginal value of an extra worker is  $(1 - \lambda)(R'F' - \omega)$ . Provided only that  $\omega < w$ , the firm will wish to expand output and employment from its previous position. No matter how one interprets the 'other things being equal', a profit-sharing system is more expansionary than a wage system. If pay parameters are set so that workers are initially paid the same amount immediately after conversion from a wage into a profit-sharing system, the firm will wish to expand employment and output, thereby contracting its price (and pay). If pay parameters are set so that, after the firm's reaction to the introduction of a profit-sharing contract, each worker ends up being paid the same as under the previous wage contract, then output and employment must be higher, with prices lower. The expansionary effects are stronger the smaller is the base wage  $\omega$ , irrespective of the profit-sharing coefficient  $\lambda$ .

There is a simple explanation of all this. When factor costs are lowered, a profit-maximising monopolist will want to hire more input, produce more output, and charge a lower price. When faced with a pure profits tax, on the other hand, the monopolist will choose to hire the same amount of input, produce the same output, and charge the same price. So far as the monopolist is concerned, conversion from a wage system to a profit-sharing system (with a smaller base wage) is equivalent to lower factor costs coupled with a pure profits tax. Hence the expansionary bias of a profit-sharing system over a wage system.

This suggests that near-universal profit sharing might create full employment, or something close to it, with corresponding strong implications for macro-economic theory and policy. These themes have been explored in models where the labour market is essentially competitive – although sluggish, so that pay parameters are the slowest adjusting variables in the system.<sup>1</sup> The standard result is that in long-run equilibrium, wage and profit-sharing systems are isomorphic. But a profit-sharing system displays 'excess demand for labour' in the sense that firms would like to hire more labour than they are actually able

<sup>1</sup> See, for example, Weitzman (1983, 1985).

to hire on the equilibrium profit-sharing contract parameters they themselves have chosen. With sticky pay parameters, this means that a profit-sharing system tends to preserve full employment even out of equilibrium, whereas a contractionary shock to a wage system is more likely to cause unemployment. It was argued heuristically that this basic contrast between wage and profit-sharing systems should carry over to situations where labour has more than atomistic market power – where, for example, pay parameters have been pushed up by some fraction of their competitive equilibrium values (say the same fractional increase for both systems). In such situations, it was claimed, realpolitik wage economies are more likely to end up in regimes with greater unemployment than their realpolitik profit-sharing analogues.<sup>1</sup> The present paper attempts to tackle more formally the problem of specifying a long-run resting point (around which the short-run fluctuations occur) when insider labour has non-negligible market power.

### III. THE MODEL

Consider an economy consisting of a large fixed number<sup>2</sup> of symmetric monopolistically competitive firms. Each firm produces output from labour according to the production function

$$Y = F(L). \quad (1)$$

The firms are identical except that each is the sole producer of a slightly, but symmetrically, differentiated product. If one firm is charging a price  $P$  while all the other firms are charging a price  $\bar{P}$ , demand for the one firm's product will be

$$Y = D(P/\bar{P}; M/\bar{P}). \quad (2)$$

In the above demand function,  $M$  is a quasi-fixed shift variable standing for various aggregate demand factors. Throughout the paper  $M$  will be treated as an exogenously given macroeconomic parameter, indirectly dependent on various policy variables like government spending, the money supply, taxes, and so forth, whose exact specification is not essential to the argument. More specifically, and without additional loss of generality, let  $M$  simply represent, in reduced form, total economy-wide money expenditures divided by the number of firms. Demand for one firm's product can be written in the particular form (2) without any loss of generality because of the requirement that the firm's demand function should be homogeneous of degree zero in  $P$ ,  $\bar{P}$ , and  $M$ . To make sense in a symmetric situation, the demand function (2) should have the property

$$M/\bar{P} = D(1; M/\bar{P}). \quad (3)$$

From (2), the firm's revenue function is

$$R(Y; M, \bar{P}) = Y\bar{P}D^{-1}(Y; M/\bar{P}). \quad (4)$$

<sup>1</sup> See Weitzman (1985).

<sup>2</sup> The basic points I am trying to make would only be strengthened if the number of monopolistically competitive, increasing returns to scale firms were variable, with new firms entering or old firms exiting in response to perceived profit or loss opportunities. The same comment applies also to capital intensity. Both wage and profit-sharing systems will, in equilibrium, hire capital to the point where the marginal revenue product of capital equals the interest rate. This can readily be proved in the current set up.

(This paper follows the notational convention that the independent variable to the left of the semi-colon symbol ‘;’ represents the primary functional relationship. Variables to the right of the semi-colon are to be viewed more like subscripted quasi-fixed parameters. Inverses and derivatives, when not otherwise specified, are taken with respect to the primary independent variable. Sometimes variables to the right of the semi-colon will be suppressed for notational convenience in an unambiguous context.)

Suppose that a firm pays its workers by the profit sharing formula

$$W(\omega, \lambda, L, M, \bar{P}) = \omega + \lambda \frac{R[F(L); M, \bar{P}] - \omega L}{L} = \omega(1 - \lambda) + \lambda \frac{R[F(L)]}{L}. \quad (5)$$

In the above formula  $\omega$  represents the base wage, while  $\lambda$  stands for the share of gross profits per capita paid out to each worker. Both  $\omega$  and  $\lambda$  are treated as quasi-fixed contractual parameters in the short run, while the firm is relatively free to adjust  $L$ . A wage system is the special case  $\lambda = 0$ . (Throughout this paper  $W$  and the term ‘pay’ refer to total per-employee compensation of base wages plus profit shares.)

The firm’s profits are then

$$\Pi(\omega, \lambda, L, M, \bar{P}) = R[F(L); M, \bar{P}] - W(\omega, \lambda, L, M, \bar{P}) \cdot L. \quad (6)$$

Using (5), equation (6) can be rewritten as

$$\Pi(\omega, \lambda, L, M, \bar{P}) = (1 - \lambda) \{R[F(L); M, \bar{P}] - \omega L\}. \quad (7)$$

#### IV. LONG-RUN EQUILIBRIUM

Suppose that the insider workers permanently attached to each firm are organised into a union having some bargaining power. Layoffs are strictly by seniority, and the union members vote on any compensation package using the principle of majority rule. Then, in any long-run steady state equilibrium, the union’s preferences are those of the median-tenure voter who, on the margin, will always favour a pay raise over increased employment (so long as it does not threaten his job, e.g. by forcing mass layoffs via large-scale plant closings). The counter force to ever-higher pay demands from the side of the union is greater resistance from the side of a management increasingly undesirous of granting them. The basic qualitative results of the present paper would also hold when the union puts some weight on employment, so long as it is small relative to the weight put on pay. Even if it were not a fair empirical generalisation, the idea that the union cares a lot more about insider pay than about outsider jobs might still be viewed as a theoretically interesting polar assumption because without it the model is incapable of generating steady state unemployment.

The union wants high pay  $W$ , while management wants high profits  $\Pi$ . These objectives are in conflict. The resolution is taken to be a weighted Nash bargaining solution which maximises, for each firm, the function

$$W^b \Pi^{1-b}, \quad (8)$$

where  $b$  is a parameter representing the relative bargaining strength of the union compared to the firm. Note that it would make no difference for the Nash bargaining solution if, instead of being expressed in nominal pay and profits, the formula (8) were expressed in terms of real pay  $W/\bar{P}$ , or relative pay  $W/\bar{W}$ , or real profits  $\Pi/\bar{P}$ , since one firm and its union have no control over the price level or pay elsewhere.

In effect, the outcome of the bargaining process can be described as a two-stage decision making process. In the second stage, given any base wage and profit-sharing coefficient, the firm sets the employment level to maximise profits, which also determines (in a profit-sharing system) the level of pay. In the first stage the 'Nashian arbitrator' sets any free pay parameters at precommitted levels which maximise (8) for each firm, taking account of the second stage Stackelberg-like profit-maximising response of the firm.

Some justification for maximising a function of the form (8) can be found in recent work on the theory of repeated games. The threat point in the repeated game here is the strike or lockout, which by hypothesis yields  $W = 0$ ,  $\Pi = 0$ , while  $b$  in this context stands for possible asymmetries in the bargaining procedure, in the elasticity of marginal utility, and in the parties' beliefs.<sup>1</sup> The essential logic of the paper is unaltered when there are different threat point values, although the algebra is made considerably more complicated.

The question of why, if there is involuntary unemployment, the firm does not negotiate with outsider workers, who are willing to do the insiders' work for lower pay, is not directly addressed here. Some answers in terms of hiring-firing costs, co-operation harassment activities, disruptive behaviour, and the like are given in Lindbeck and Snower (1984). Answers in terms of the opportunity cost of time spent in bargaining are given in Shaked and Sutton (1985). There may even be 'sociological' reasons, previously alluded to. In this paper I merely assume as a polar case that it simply is not feasible for the firm to replace tenured insider workers by non-tenured outsiders, and hence, to a first approximation, relative bargaining strengths are independent of the outsiders.

It is slightly more convenient to work with a logarithmic version of (8) – the function

$$V = b \log(W) + (1 - b) \log(\Pi). \quad (9)$$

Suppose, as a kind of thought experiment, that the profit-sharing coefficient  $\lambda$  is statutorily fixed by the government at some predetermined value. (It is not clear how this should be done in practice – perhaps by tax incentives on profit-sharing income.) The base wage will then be negotiated to maximise (9), allowing for the firm's profit-maximising employment reaction.

Without loss of generality, let labour units be normalised so that the economy-wide full employment level divided by the number of firms is one. Then the unemployment rate  $u$  is related to the average employment level per firm  $L$  by the simple formula

$$u = 1 - L. \quad (10)$$

<sup>1</sup> See Binmore *et al.* (1985).

Suppose that all firms except one have negotiated a base wage  $\bar{\omega}$ , and then selected an employment level  $\bar{L} (\leq 1)$  and price  $\bar{P}$ . Let the one firm's profit-maximising amount of labour to hire as a function of the relevant variables be formally denoted

$$L(\omega; \bar{\omega}, \bar{L}, \lambda, M, \bar{P}). \quad (11)$$

The above employment function, sometimes denoted  $L(\omega)$  for brevity, must satisfy the following conditions:

*Case I (labour is demand constrained):* If  $\bar{L} < 1$ ,  $L(\omega)$  from (11) solves

$$\Pi[\omega, \lambda, L(\omega), M, \bar{P}] = \max_{L \geq 0} \Pi(\omega, \lambda, L, M, \bar{P}). \quad (12)$$

(With unemployed labour available, the profit-maximising firm will hire workers to the point where the marginal revenue product of one more equals the base wage.)

*Case II (labour is supply constrained):* If  $\bar{L} = 1$ ,  $L(\omega)$  from (11) solves

$$\Pi[\omega, \lambda, L(\omega), M, \bar{P}] = \max_L \Pi(\omega, \lambda, L, M, \bar{P}) \quad (13)$$

subject to:  $\omega + \lambda \{R[F(L)] - \omega L\} / L \geq \bar{\omega} + \lambda [\bar{P}F(1) - \bar{\omega}]$ .

(When the labour force is fully employed, the firm is constrained to pay at least the going rate.)

Substituting  $L(\omega)$  from (11) into (9), the logarithm of the weighted Nash bargaining function with built-in employment reaction becomes

$$V(\omega; \bar{\omega}, \bar{L}, \lambda, M, \bar{P}) = b \log W[\omega, \lambda, L(\omega), M, \bar{P}] + (1-b) \log \Pi[\omega, \lambda, L(\omega), M, \bar{P}]. \quad (14)$$

The following concept of a long run equilibrium will be used.

**Definition:** A symmetric Nash equilibrium is a triple  $[\omega^*, L^* (\leq 1), P^*]$  simultaneously satisfying:

$$(i) \quad V(\omega^*; \omega^*, L^*, \lambda, M, P^*) = \max_{\omega} V(\omega; \omega^*, L^*, \lambda, M, P^*) \quad (15)$$

( $\omega^*$  maximises the weighted Nash product of pay and profits.)

$$(ii) \quad L(\omega^*; \omega^*, L^*, \lambda, M, P^*) = L^* \quad (16)$$

( $L^*$  is the profit-maximising value of  $L$ .)

$$(iii) \quad P^* = R[F(L^*); M, P^*] / F(L^*) \quad (17)$$

( $P^*$  is the profit-maximising value of  $P$ .)

(Note that the macroeconomic equilibrium condition

$$P^* \cdot F(L^*) = M \quad (18)$$

is then automatically guaranteed by (3).)

## V. THE PURE WAGE SYSTEM

At this point it is useful to treat specially the case  $\lambda = 0$ , both to gain an intuitive feel for the long-run equilibrium concept (15) – (17) in a familiar setting, and

also to motivate an additional condition that must be imposed on the model economy for solutions to make sense. Much of the reasoning for the simpler case  $\lambda = 0$  can be carried over to the case  $\lambda > 0$ .

Suppose, then, that the government has statutorily fixed  $\lambda$  at zero. Profit sharing is thereby forbidden, and the economy is left with a pure wage system. To emphasise the point, let the wage here be denoted  $w$  (instead of  $\omega$ ).

The long-run equilibrium (15)–(17) can be solved as follows. Suppose first the wage economy is in a regime with positive unemployment:

$$u = 1 - L^* > 0. \quad (19)$$

Then, suppressing extra variables where the meaning is otherwise clear, each firm's profit function is

$$\Pi(w) = R\{F[L(w)]\} - wL(w), \quad (20)$$

where

$$R\{F[L(w)]\} \cdot F'[L(w)] = w. \quad (21)$$

With unemployed labour available to be hired (condition (19)), the Nashian arbitrator's maximand

$$V(w) = b \log(w) + (1 - b) \log[\Pi(w)] \quad (22)$$

will have an interior solution satisfying

$$V'(w) = 0, \quad (23)$$

$$\text{or} \quad \frac{b}{w} + (1 - b) \frac{\Pi'(w)}{\Pi(w)} = 0. \quad (24)$$

Since from duality theory

$$\Pi'(w) = -L, \quad (25)$$

condition (24) can be rewritten as

$$1 = \frac{\Pi(w)}{wL(w)} \left( \frac{b}{1 - b} \right). \quad (26)$$

In any symmetric equilibrium situation where every firm is hiring the same amount of labour  $L$  and charging the same price  $P$ , the price elasticity of demand faced by the firm is, from (3),

$$e(L) = \frac{D'[1; F(L)]}{F(L)} \quad (27)$$

The monopoly 'markup coefficient' of price over marginal cost is then

$$\mu(L) \equiv \frac{e(L)}{e(L) - 1} \quad (28)$$

so that the profit maximising price is

$$P = w\mu(L)/F'(L). \quad (29)$$

Profits are then

$$\Pi = PF(L) - wL = w \cdot [\mu(L) F(L)/F'(L) - L]. \quad (30)$$



Substituting (30) into (26) yields the basic condition

$$1 = S(L^*) \frac{b}{1-b} \quad (31)$$

for the optimal solution  $L^*(b)$ , where

$$S(L^*) \equiv \frac{\mu(L^*) F(L^*)}{L^* F'(L^*)} - 1.$$

Equation (31), representing a long-run equilibrium condition, is, of course, expressed in purely 'real' terms. Nominal variables are tacked on to the long-run equilibrium condition (31) by equations (18) and (29). Thus, in the long run,  $P$  and  $w$  are proportional to  $M$ .

Note that any attempt to use macroeconomic policy to stimulate the economy toward a higher level of employment than  $L^*$  by, in effect, increasing  $M$ , might temporarily succeed in a short run when wages are quasi-fixed. But employment would decline back to  $L^*$  in the longer run when wages are renegotiated up, and that would be passed on into a correspondingly higher price level. In this sense

$$u(b) = 1 - L^*(b) \quad (32)$$

represents a NAIRU-like 'natural-rate' unemployment level in the present model.

The expression

$$S(L) \equiv \frac{\mu(L) F(L)}{L F'(L)} - 1 \quad (33)$$

that appears in (31) is the ratio of profits to the wage bill, or 'capital's share' divided by 'labour's share', expressed as a function of the employment level  $L = 1 - u$ . The following condition must hold for the model to make sense.

*Assumption: the ratio of profits to the wage bill  $S(L)$  is pro-cyclical, or*

$$S'(L) > 0. \quad (34)$$

As well as being a good stylised macroeconomic fact in its own right, condition (34) is needed to make  $L^*(b)$  in equation (31) behave sensibly if, as seems plausible for a wage economy, higher  $b$  should cause lower  $L$ .<sup>1</sup>

Using definition (33), let  $b(0)$  be defined as the full employment cutoff value of  $b$  that satisfies (31) for  $L^* = 1$ :

$$1 = S(1) \frac{b(0)}{1-b(0)}. \quad (35)$$

The variable  $b(0)$  in the above equation can be explicitly solved out to yield

$$b(0) = \frac{1}{1 + S(1)}. \quad (36)$$

<sup>1</sup> A rough heuristic story about why some implicit condition on tastes and technology like (34) is needed to make  $L^*(b)$  behave sensibly in a wage economy can be told along the following lines. When insider bargaining strength  $b$  is increased, a greater weight is placed on  $w$  relative to  $\Pi$  in the Nashian arbitrator's  $V$ -function. If condition (34) does *not* hold, it means that the ratio of wages to profits (per worker) is pro-cyclical. But then, it turns out, the only way wages can be raised relative to profits is by increasing employment. Thus, an increase in  $b$  results in greater employment. This does not seem to me to be a sensible description of a wage economy.

The economic content of conditions (31)–(36) may conveniently be summarised by the following implications. There exists a ‘cutoff value’  $b(o)$  of  $b$ ,  $0 < b(o) < 1$ , such that  $b \leq b(o)$  implies full employment, while  $b > b(o)$  means  $u$  (the unemployment rate) is positive. Furthermore, in the range  $b \geq b(o)$ ,

$$u'(b) > 0. \quad (37)$$

Using definition (33) to rewrite  $V'$  as

$$V'(w) = \frac{1}{w} \left\{ b - \frac{1-b}{S[L(w)]} \right\} \quad (38)$$

it is routine to establish, using (34), that  $V(w)$  is a single-peaked function.

Note that, under widespread unionisation, insider workers may not actually benefit much from an economy-wide increased value of  $b$ , if they do at all. As an empirical fact, the real wage  $w/P = F'(L)/\mu(L)$  (from (29)) is probably not strongly related to employment levels  $L$ . Then the economy-wide effect of universally increased insider bargaining power is primarily to cause greater unemployment among outsiders, from (37), not to increase the real wages of the insiders. Combining (18), (29), (34), (37), it is tedious but routine to derive

$$w'(b) > 0 \quad (39)$$

for  $b \geq b(o)$ . But when every company's money wages go up, because of bigger  $b$ , so do the prices of goods the workers buy, and, as an empirical fact, probably in about the same proportion.

So far the situation has been fully analysed in the unemployment region  $b > b(o)$ . What happens, though, in the full-employment region  $b \leq b(o)$ ? The methodology used to derive condition (23) is invalid under full employment and some sort of a corner solution of  $V$  is implied, so that a different approach is required.

Suppose, as will presently be confirmed, that when  $b \leq b(o)$  each firm pays a competitive (full employment) wage  $W^*$  and charges a correspondingly marked-up price  $P^*$  where

$$W^* = \frac{MF'(1)}{F(1)\mu(1)}, \quad (40)$$

$$P^* = \frac{\mu(1)W^*}{F'(1)}. \quad (41)$$

When  $L^* = 1$  for each firm, condition (13) for  $\lambda \rightarrow 0$  means that if any firm pays a lower wage  $w < W^*$ , it implies  $L = 0$  for that firm, whereas  $w \geq W^*$  implies  $L = L(w)$  satisfying (20), (21).<sup>1</sup> Now, should  $w$  be lowered in any firm to below the competitive value  $W^*$ , that would clearly decrease the firm's  $V$ -function, since both pay and profits should then decline. What about raising  $w$  above  $W^*$ , which would help the firm's insider workers' pay but hurt its profits?

<sup>1</sup> Note that, strictly speaking, condition (13) is for a profit-sharing economy. A wage economy could either be treated as the limit of a profit-sharing economy as the profit-sharing coefficient goes to zero, or, equivalently, (13) could be modified in the obvious way to treat directly the infinitely elastic supply of labour available to a firm in a full-employment wage economy.

From (22),

$$V'(W^*) = \frac{b}{W^*} + \frac{(1-b)\Pi'(W^*)}{\Pi(W^*)}. \quad (42)$$

Using definition (35), it is tedious but routine to verify that expression (42) is negative whenever  $b < b(0)$ , so that the single-peaked function  $V(w)$  defined on  $w \geq W^*$  has a corner solution at  $w = W^*$ .

Thus, a complete characterisation of the equilibrium solution has been derived for a wage economy. Its main properties can be summarised as follows.

Under the assumptions of the model, there exists a cutoff value  $b(0)$  for the wage economy such that  $b \leq b(0)$  implies a competitive labour market solution with  $u(b) = 0$ ,  $w(b) = W^*$ , whereas  $b > b(0)$  implies a non-competitive labour market solution with  $u(b) > 0$ ,  $w(b) > W^*$ , and  $u'(b) > 0$ ,  $w'(b) > 0$ .

#### VI. THE PROFIT SHARING ECONOMY

Imagine now that the government has statutorily fixed  $\lambda$  at some positive value. The long-run equilibrium (15)–(17) can be solved as follows.

First suppose that  $\omega$  has been negotiated at a sufficiently high value that the profit-sharing economy is in a regime with positive unemployment. (It follows from the same logic as was developed in the pure wage case that, independent of  $\lambda$ , which just determines a multiplicative constant for the profit function, there will be unemployment if and only if

$$\omega > W^*, \quad (43)$$

where the competitive wage  $W^*$  is defined by (40).) In such a situation, each firm is free to hire as much labour as it wants.

Then, suppressing extra independent variables where the meaning is otherwise clear, each firm's profit function is

$$\Pi(\omega; \lambda) = (1 - \lambda) (R\{F[L(\omega)]\} - \omega L(\omega)), \quad (44)$$

$$\text{where} \quad R'\{F[L(\omega)]\} \cdot F'[L(\omega)] = \omega. \quad (45)$$

Each employed worker is then paid

$$W(\omega; \lambda) = \omega + \lambda \frac{R\{F[L(\omega)]\} - \omega L(\omega)}{L(\omega)} = (1 - \lambda)\omega + \lambda \frac{R\{F[L(\omega)]\}}{L(\omega)} \quad (46)$$

and the Nashian arbitrator's maximand

$$V(\omega; \lambda) = b \log W(\omega; \lambda) + (1 - b) \log \Pi(\omega; \lambda) \quad (47)$$

will have the interior solution

$$V' = \frac{bW'}{W} + (1 - b) \frac{\Pi'}{\Pi} = 0. \quad (48)$$

Since from duality theory

$$\Pi'(\omega; \lambda) = -(1 - \lambda) L(\omega), \quad (49)$$

the first-order condition (48) can be rewritten as

$$1 = S(L^*) \frac{b}{1-b} E, \quad (50)$$

where  $S(L)$  is defined by (33), and

$$E \equiv \frac{dW}{d\omega} \frac{\omega}{W} \quad (51)$$

is the elasticity of pay with respect to the base wage.

In order to evaluate  $E$ , rewrite  $W$ , using (33), as

$$W(\omega; \lambda) = (1 - \lambda)\omega + \lambda\omega \{S[L(\omega)] + 1\} \quad (52)$$

and differentiate (52) with respect to  $\omega$ , yielding

$$W' = W/\omega + \lambda\omega S'(L) L'(\omega). \quad (53)$$

Substituting from (53) into (51) yields

$$E = 1 + \frac{\lambda\omega^2 S'(L) L'(\omega)}{W}. \quad (54)$$

Since the second term in (54) is negative, because  $S' > 0$  and  $L' < 0$ , it can be deduced that

$$E < 1, \quad (55)$$

whenever  $\lambda > 0$ . (Result (55), which is hardly surprising, merely states that under profit sharing a 1% increase in base wages translate into a less than 1% increase in pay because of the adverse effects on gross profits.)

Equation (50) represents the equilibrium condition for a profit-sharing economy when  $E < 1$ , and for a wage economy when  $E = 1$  (from (31)). Using (34) to compare  $L^*$  when  $E < 1$  and when  $E = 1$ , the following simple qualitative comparison is immediate:

*A profit-sharing economy has lower steady state unemployment than the corresponding wage economy.*

It is possible to make stronger quantitative statements if additional structure is put on the problem. Suppose, as seems reasonable, there exists a cutoff function  $b(\lambda)$  such that

$$b > b(\lambda) \Rightarrow u > 0 \quad (\text{or, equivalently, } \omega > W^*)$$

$$b \leq b(\lambda) \Rightarrow u = 0 \quad (\text{or, equivalently, } \omega \leq W^*)$$

Then it can be shown that

$$b'(\lambda) > 0. \quad (56)$$

The proof is as follows. When  $b = b(\lambda)$ , the equilibrium condition (50), which is just holding on the borderline, becomes

$$1 = S(1) \frac{b(\lambda)}{1-b(\lambda)} E(\lambda) \quad (57)$$

where  $E(\lambda)$  is the value of (54) for  $L = 1$ ,  $\omega = W^*$ , i.e.

$$E(\lambda) = 1 + \frac{\lambda}{W} (W^*)^2 S'(1) L'(W^*). \quad (58)$$

With (18) also holding in equilibrium, (46) becomes

$$W = W^* + \lambda(M - W^*) \quad (59)$$

or 
$$\frac{W}{\lambda} = \frac{W^*}{\lambda} + M - W^*. \quad (60)$$

From (60) it follows that  $\lambda/W$  is a monotonically increasing function of  $\lambda$ .  $E(\lambda)$  in (58) is therefore declining in  $\lambda$ , or

$$E'(\lambda) < 0. \quad (61)$$

Combining (61) with (57) yields (56), the proposition to be proved. When  $b > b(\lambda)$ , so that  $u > 0$  and  $\omega > W^*$ , it can easily be shown that the equilibrium price level is  $P = \omega\mu/F' = M/F$ .

Thus far equilibrium has been analysed for  $b > b(\lambda)$ , a situation of positive unemployment. The rest of this section is devoted to characterising an equilibrium in the full employment case  $b \leq b(\lambda)$ ,  $u = 0$ ,  $\omega \leq W^*$ .

In the full employment case the equilibrium solution is

$$L^* = 1, \quad (62)$$

$$W^* = \omega^* + \lambda[P^*F(1) - \omega^*], \quad (63)$$

$$P^* = \frac{\mu(1) W^*}{F'(1)} = \frac{M}{F(1)}, \quad (64)$$

where  $W^*$  is the competitive wage defined by (40).

Condition (63), which can be rewritten

$$\omega^*(\lambda) = \frac{1}{1-\lambda} [W^* - \lambda P^*F(1)], \quad (65)$$

is a basic theoretical result. In any full employment equilibrium each worker is paid exactly the competitive wage  $W^*$ . When  $\lambda$  is exogenously increased in a full employment equilibrium, the renegotiated base wage endogenously declines according to formula (65) by just enough to maintain a perfectly competitive pay level.

In a situation where

$$\omega^* < W^* \quad (66)$$

there are important implications for the disequilibrium behaviour of the system. When (66) holds, a profit-sharing economy with sticky pay parameters  $(\omega^*, \lambda)$  remains at full employment even if  $M$  changes unexpectedly to any new value in the range

$$M \geq \frac{\mu(1) \omega^* F(1)}{F'(1)}. \quad (67)$$

When pay parameters are temporarily stuck (with quasi-fixed base wages satisfying (66)) but all other variables are free to adjust, the short-run equilibrium price will accommodate according to the formula

$$P = \frac{M}{F(1)} \quad (68)$$

while hired labour and output remain at full employment levels. By contrast, in a wage economy, unexpectedly lower  $M$  in the presence of sticky wages causes unemployment to go up. The reason for these results is that each firm in the long-run equilibrium state of a profit-sharing economy, when (66) holds, wishes to hire more labour on its existing contract but cannot find any unemployed workers desiring to come on board. This 'excess demand for labour' remains even after (small) changes in aggregate demand (coupled with sticky pay parameters in the short run) temporarily force the system out of steady state equilibrium, before pay parameters have had time to catch up.<sup>1</sup>

The proof that (62)–(64) constitutes a long-run equilibrium when  $b \leq b(\lambda)$  is as follows.

Let the economy be at full employment equilibrium  $\bar{L} = 1$ ,  $\bar{\omega} \leq W^*$ ,  $\bar{P} = M/F(1)$ , where the prevailing level of pay is

$$\bar{W} = \bar{\omega} + \lambda [\bar{P}F(1) - \bar{\omega}]. \quad (69)$$

Given any parametrically fixed base wage  $\omega$  satisfying

$$\omega \leq W^* \quad (70)$$

let  $L(\omega)$  from (11), (13) be the supply constrained solution of

$$\text{Max}_L R[F(L)] - \left( \omega + \lambda \left\{ \frac{R[F(L)] - \omega L}{L} \right\} \right) L \quad (71)$$

subject to:

$$\omega + \lambda \left\{ \frac{R[F(L)] - \omega L}{L} \right\} \geq \bar{W}. \quad (72)$$

If (70) is in effect, the solution of (71), (72) must cause the constraint (72) to hold with full equality. The reason is that if (72) has a zero shadow price, then (71), (72) is equivalent to the problem

$$\text{Max}_L (1 - \lambda) \{R[F(L)] - \omega L\} \quad (73)$$

which has the solution

$$R'[F(L)]F'(L) = \omega, \quad (74)$$

implying

$$L > 1, \quad (75)$$

whenever  $\omega < W^*$ . But (75) is a contradiction with the equilibrium condition  $L \leq 1$ . Hence, (70) implies that (72) must hold with full equality, or

$$\omega + \lambda \left\{ \frac{R[F(L)] - \omega L}{L} \right\} = \bar{W}. \quad (76)$$

<sup>1</sup> These themes are developed much more fully in Weitzman (1985; 1984; 1983), q.v. In particular, it is explained how excess demand for labour can coincide with absence of inflationary pressure to push up pay parameters.

Now when (76) holds, the supply constrained firm's pay is independent of  $\omega$ , since  $L(\omega)$  automatically adjusts, by long term attrition and new hiring, to keep worker pay at  $\bar{W}$ . In this case  $W = \bar{W}$  independent of  $\omega$ , and the Nashian arbitrator's problem is reduced to maximising the firm's profits

$$\text{Max}_{\omega \leq W^*} R\{F[L(\omega)]\} - \left( \omega + \lambda \frac{R\{F[L(\omega)]\} - \omega L(\omega)}{L(\omega)} \right) L(\omega). \quad (77)$$

With  $L(\omega)$  defined as the solution to (71) under the constraint (76), the optimisation problem (77) can be rewritten simply as

$$\text{Max}_L (1 - \lambda) \{R[F(L)] - \bar{W}L\}, \quad (78)$$

where the dummy variable  $\omega$  has been dropped because it is superfluous.

The solution of (78) is  $R'[F(L^*)] \cdot F'(L^*) = \bar{W}$ . (79)

From (79), then, there is full employment,

$$L^* = 1, \quad (80)$$

if and only if

$$\bar{W} = W^*. \quad (81)$$

Condition (63) is implied by (80), (81), and (76). Condition (64) is immediate. This concludes the proof that (62)–(64) constitutes an equilibrium solution in the full employment case.

Thus we have the following important observation.

*Provided  $\lambda$  is high enough so that*

$$b(0) < b < b(\lambda), \quad (82)$$

*insider bargaining power that creates long-run 'natural' unemployment in a wage economy will not cause unemployment in a profit-sharing economy.*

A wage system ends up in the excess supply of labour non-competitive wage region, while a profit-sharing system will be in the competitive-pay excess demand for labour region with correspondingly different consequences for macroeconomic policy. This result should be carefully understood. It is contingent upon a number of assumptions, the most important of which were outlined in the beginning of the paper. These assumptions seem quite reasonable to me as a generalised description of the world in which we live, but they obviously can be challenged.

Suppose that in addition to (82) it is assumed that the markup of prices over wages in a wage system is approximately independent of the employment level, or

$$\mu(L)/F'(L) \sim \text{constant}. \quad (83)$$

Then the somewhat striking conclusion of this paper is that if workers were forced to receive some part of their pay as a share of per-capita profits and restricted to bargaining about base wages (or the opposite arrangement – fixed base wages and bargaining only about profit shares), everyone would be better off. Under the assumptions being made, real pay of the employed would be (approximately) the same in both systems. But with profit sharing, every worker

has a job, there is more output, real profits are higher, and prices are lower for any given level of aggregate demand.

It is important to understand where these results are coming from. So long as the firm determines employment to maximise profits given the pay parameters, it will offset wage pushiness in a profit-sharing context by hiring more outsider workers. Since the insider workers cannot actually obtain the higher pay they seek, and the only ultimate result of their wage pushiness is to damage their firm's profitability, the weighted Nash bargaining solution becomes the competitive equilibrium. The Nash arbitrator comes down, so to speak, on the side of the employer (and, without explicitly considering their needs, the outsider workers) because the employer has to give up such a large amount of profit in order to improve the pay of the insider workers even a slight amount.

Of course a collusive deal between firms and insiders to restrict new hiring of outsiders could theoretically be made, and it might be somewhat more likely under profit sharing. If collusion were taken to an extreme, the worst-case scenario would yield wage and profit-sharing economies at the same long-run equilibrium. That is being ruled out by the hypothesis that under capitalism the employer basically determines the employment level. Incomplete collusion to restrict new hires would yield 'in between' results that would soften, but not eliminate, the basic differences between wage and profit-sharing systems being stressed in this paper.

The situation is very different in a wage economy. There the insider workers can directly negotiate the money wage they actually end up receiving even after the employer makes the necessary adjustments at the expense of the unemployed outsiders. Note that the insiders of a wage economy may not actually end up better off when they all are playing the game of 'push'. When all insider workers are pushing up money wages, under (83) that just causes prices to rise and the 'natural rate' to go up without actually altering real wages.

Although profit sharing may result in a Pareto superior configuration, it is not stable under free choice of payment mechanisms. If both  $\omega$  and  $\lambda$  are objects of negotiation, the economy will end up with a wage system and its associated steady state unemployment. To see this clearly, imagine a profit-sharing system, with  $\lambda$  fixed so that  $b(\lambda) > b$ , in its full-employment competitive-pay equilibrium. If one firm converted to a wage system paying a competitive wage, the situation would be essentially identical for the firm and its median worker who would both be equally well off. With  $b$  large enough to satisfy  $b > b(o)$ , however, a competitive wage is not an equilibrium in the class of all wages, as was previously shown. The Nashian arbitrator could obtain a higher value of the  $V$ -function by raising the firm's wage above the competitive level. Thus, a higher than competitive wage is preferred over competitive profit sharing by the firm's Nashian arbitrator.

To tell the story more colourfully, the median worker would vote for conversion from competitive profit sharing to an all-wage system at a somewhat higher than competitive wage level. The firm would not like the idea, and would react by laying off some workers, but with  $b$  large enough to satisfy (82) the



Nashian arbitrator would rule in favour of the insider workers. When all firms and insider workers act this way, the profit-sharing system unravels. The insider workers do not actually gain anything from mass conversion to a wage economy, because prices also go up, but self-interest compels them to push in this direction. And from a wage economy they have no desire to move toward profit sharing. A motion to introduce profit sharing into a wage firm would be defeated by majority vote of the insiders, since it would result in the firm hiring outsider workers and lowering the pay of insiders. Of course if every firm converted to profit sharing there would be no outsider unemployed workers to hire and the insiders would be no worse off. But in all instances the insiders will vote for pure wages over profit shares to maintain their illusory prisoner's dilemma advantage.

#### VII. EXTENSIONS AND CONCLUSIONS

The main conclusion is fairly obvious. Widespread profit sharing can be a powerful aid to inflation-free full employment because it gives firms an incentive to turn outsider unemployed workers into insiders. But, if this model rings true, it is unlikely to evolve by itself because of a strong public good or prisoner's dilemma aspect. If society wants the beneficial side effects of profit sharing, the government must play an actively supportive role. This role could take many forms. Perhaps the most useful form of support would be a substantial tax break for profit-sharing income – 'a working person's capital gains tax' – to encourage firms and insider workers to adopt high- $\lambda$  behaviour that is publicly rational but privately irrational. (Any preferential tax treatment of share income in specific instances should be made conditional upon the firm and union explicitly agreeing that the firm is able to hire as many outsider workers as it wants.)

It was noted that wage and profit-sharing systems yield about the same real pay to each employed worker provided (83) holds. This is dependent upon the coefficient of insider bargaining power  $b$  being the same for each firm. Suppose, though, that the coefficient of bargaining power for the insider workers of firm  $i$  is  $b_i$ , which differs from firm to firm while always satisfying

$$b(0) < b_i < b(\lambda). \quad (84)$$

Then the story will be very similar in the aggregate to the case  $b_i = b$ . Average real pay will be the same under wage and profit-sharing systems. But the insider worker from a high- $b_i$  firm will be better off under a wage system, whereas the low- $b_i$  insider worker will fare better under economy-wide profit sharing. This does not at all mean that the low- $b_i$  insider will vote for profit sharing. For reasons similar to those already explained in the previous section, the low- $b_i$  insider will vote against profit sharing for his own firm even though he would personally get higher real pay if the entire economy were converted to a profit-sharing system. Furthermore, even if profit sharing were universal, the

low- $b_i$  insider worker would vote to convert to a wage although, when all insiders unravel the profit-sharing system by so voting, the low- $b_i$  insider will be worse off.

Profit sharing can be a great equaliser of workers' income. Even with differing coefficients of bargaining strength  $b_i$ , a free-access profit-sharing system will result in equal pay for equal work for all workers in all firms, and no unemployment. But a wage system will result in higher pay for the insiders of a high- $b_i$  firm than for the insiders of a low- $b_i$  firm, as well as some overall unemployment. In a wage economy the Nashian arbitrator will award wages (and, indirectly, employment) to a firm on the basis of whether its insider workers enjoy greater or lesser bargaining strength. But that same Nashian arbitrator in the same situation will make equal pay parameter awards to all workers in a profit-sharing economy. This is one reason why the greatest resistance to profit sharing is likely to come from those sectors or firms where powerful unions are able to extort above-competitive wages. The insiders in such situations will actually find their pay lowered (relative to others) from conversion to profit sharing unless a government tax benefit or subsidy offsets the loss of their monopoly premium.

Of course all of the previous analysis ignores uncertainty. Some economists would argue that a profit-sharing system is inferior to a wage system because it forces workers to bear some risk. But such arguments typically embody a basic fallacy of composition that is related to confusion about the insider-outsider distinction. For insiders a profit-sharing system is more risky. But a wage system is more risky for outsiders. Actually, when a complete analysis is performed which considers the situation not as seen by an insider worker but by a neutral observer with a reasonably specified social welfare function defined over the entire population of insiders and outsiders, it becomes abundantly clear that the welfare advantages of a profit-sharing system are likely to be enormously greater than a wage system. The basic reason is not difficult to grasp. A wage system allows huge first-order Okun-gap losses of output and welfare to open up when a significant slice of the national income pie evaporates with unemployment. A profit-sharing system stabilises aggregate output at the full employment level, creating the biggest possible national income pie, while permitting only small second-order Harberger-triangle distortion losses to arise because some crumbs have been randomly redistributed from one firm's workers to another's in what is essentially a zero-sum game.<sup>1</sup>

This paper has woven the insider-outsider paradigm into a theory of wage-push inflation at any unemployment level below the 'natural rate'. How good is this story as an explanation of a positive NAIRU? I think the answer depends, as it should, on particular circumstances of time and place. For most European economies today, I believe the model of this paper is a quite good description of the essential problem. For the United States, I am less confident

<sup>1</sup> The size of these firm specific redistribution losses is bound to be further limited when it is considered that output and employment in the profit-sharing macroeconomy as a whole is stabilised and private insurance of profit shares could be used to make such losses even smaller.

about this model capturing the predominant factor behind a positive NAIRU, although I think it is correctly identifying an important element. However, without going into all the details I would like to stress here that widespread profit sharing could be a powerful tool for lowering the NAIRU even under alternative scenarios.

One leading alternative (but related) theory contends that long term unemployment is largely inertial or hysteresis-like.<sup>1</sup> Whatever initial displacement caused the increased unemployment in the first place, once unemployment continues long enough it almost gets built into the system – perhaps because the long-term unemployed outsiders cannot or do not act effectively as a disciplining force in wage setting, perhaps because working skills atrophy without work, perhaps because the plight of the long-term unemployed gets forgotten by the electorate, perhaps for other reasons. In this view the rate of change of unemployment typically has a more powerful effect on wage settlements than the absolute level of unemployment.

If this kind of inertial effect lies behind the too-high NAIRU, then presumably widespread profit sharing would help to lower it. The long-term unemployment would have difficulty developing in the first place out of an initial contractionary shock because profit-sharing firms are reluctant to let go of workers. Taking as given this kind of inertial NAIRU, leaving aside how it got started in the past, the natural expansionary bias of a profit-sharing system (under which an employer has greater propensity on the margin to hire and less propensity to fire) should act over time as a built-in counterforce to help ‘gobble up’ the unemployed.

Another popular interpretation of the ‘natural rate’ of unemployment is that it represents semi-permanent frictional unemployment, due to microeconomic structural changes, which cannot be reduced by pure macroeconomic policies except temporarily and at the cost of increasing inflation.<sup>2</sup> But the wage system is heavily implicated in this concept of the NAIRU too. After all, both wage and profit-sharing systems respond to shifts in relative demands by sending a signal that eventually transfers workers out of a losing firm or sector and over to a winner. Under a wage system the signal to a worker that his firm is a loser in the game of capitalist roulette, and it is time to look for a new job with a winning firm, is that the worker is laid off and must suffer through an unemployment spell of some duration while searching for the new job. Under a profit-sharing system, no firm voluntarily lets go of a worker because of weak demand. It is the worker who chooses to leave because pay is too low relative to what is available elsewhere at successful firms eager to include new workers into their current profit-sharing payment plans.

There are yet other, more exotic explanations of the ‘natural rate’, such as misperception theories, asymmetric information theories, fairness theories, efficiency wage hypotheses, and so forth.<sup>3</sup> But in every case that I have

<sup>1</sup> See Gregory (1985) for the seminal article. See also Blanchard and Summers (1986).

<sup>2</sup> See Tobin (1972), for example.

<sup>3</sup> See Stiglitz (1984), and the references contained therein, for a survey of some unemployment theories.

examined, a profit-sharing system would lower (or at least not raise) the steady state unemployment rate relative to a wage economy.<sup>1</sup>

Finally, I would like to relate the conclusions of this paper to the predominant disequilibrium view of macroeconomics. The mainstream explanation of short-run unemployment is that it is caused by insufficient aggregate demand (relative to sticky pay parameters). But here again the unemployment is inextricably tied up with a wage system. When a sticky wage economy resting at its (positive) natural rate is shocked by lower aggregate demand, that causes additional unemployment. But when a sticky profit-sharing economy resting at its (near-zero) natural rate is subjected to an aggregate demand shock it remains at full employment.

From all of these theoretical exercises considered together it seems difficult not to draw the conclusion that a profit-sharing economy is more likely to have lower unemployment than a wage economy.

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<sup>1</sup> One possible exception to lower equilibrium unemployment under profit sharing is the efficiency wage class of theories. (See Katz (1986) for a survey.) In that framework wage and profit-sharing systems could, depending on the specification, end up at the same equilibrium, with profit sharing losing its 'excess demand for labour' property. But even in the efficiency wage context, the out-of-equilibrium behaviour of a profit-sharing system, when pay parameters are sticky, yields less unemployment than a wage system.