TRADE UNIONS, EMPLOYEE SHARE OWNERSHIP AND WAGE SETTING: A POLITICAL-ECONOMY APPROACH*

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Abstract

Employee share ownership is becoming increasingly important. This paper studies employee share ownership in an economy with decentralised monopoly-union wage setting. Union members differ in exogenous share endowments and choose wages under majority rule. A skewed distribution of shares turns out to lead to higher wages and lower employment. Switching to a more equal distribution can increase employment and production. An optimal portfolio rule suggests that macro-economic gains are to made from limiting the diversification of portfolios. We also show how the transfer of shares to employees can be made economically feasible and implementable.

Key words: Trade unions, employee share ownership, voting

JEL classification: D63, J51

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I. Introduction

Share ownership by employees has grown significantly since the end of the eighties. In 1983 an estimated 4,174 employee stock ownership plans (ESOPs) were active in the U.S.[1,2] By the end of 1987 their number had rapidly grown to 8,777, covering 7 million employees.[3] At the beginning of 1998 the number of ESOPs had reached 11,000 with 9 million employees.[4] The United States even provides tax reliefs and lending facilities for companies to finance the ESOPs.[5,6] As reported in Conte and Svejnar (1990) there is empirical evidence of a strong positive relationship between worker participation in ESOPs and non-managerial share-ownership (especially at low and moderate levels of ownership) on the one hand, and profitability and productivity on the other hand. In addition, sales and employment growth are usually higher after adoption of an ESOP program.

Theoretically, we can think of three channels through which employee-share ownership may work in favour of increased employment and profitability:

(i) esops may increase firms' incentives to hire "additional" labour, á la Weitzman (1983,

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[1] General Accounting Office (December 1986).

[2] Hereafter, we shall use "ESOP" to denote the employee share ownership program in the way it is recognized by US law, and "esop" if we mean the broader concept. The latter includes other share ownership programs that, for example, do not enjoy tax reliefs or lending facilities.

[3] National Center for Employee Ownership (1988).

[4] Rodrick (1998).

[5] The intended purpose of ESOP incentives was "to provide a realistic opportunity for more U.S. citizens to become owners of capital, and to provide an expanded source of equity financing for corporations". The trust executing the plan should invest at least 51 % of its means in the employer's stock. Employees receive stock rights in proportion to their income. Estimates of the average yearly contribution to ESOPs vary widely, from 0.5 to 10 percent of total wages and salaries. The median percentage of stock owned by ESOPs is estimated at 10 for 1986. See Conte and Svejnar (1990) pp.145-148 for statistical and juridical details of ESOPs.

[6] For fiscal reasons, ESOPs are very expensive as an instrument of corporate finance, and therefore unlikely to be used for this purpose. See Conte and Svejnar (idem).

1984, 1985).

(ii) esops may reduce moral hazard problems resulting from asymmetric information,

(*a*) when workers have more information, like in an efficiency wage model á la Shapiro and Stiglitz (1984).

(*b*) when firm owners have more information, á la Grossman and Hart (1981),

(iii) esops may change unions' behaviour through the collective decision making within the union (political economy).

Our contribution in this paper is to explore (iii). Before doing so we will explain the other channels.

The first channel was shown by Weitzman (1983, 1984, 1985). He proposed to split labour income into a lower base wage and a share of profit. Such a payment plan alters firms' incentives to hire labour by changing the base wage of employees. Splitting a fixed factor reward into a fixed and a variable outcome-dependent part lowers the firm's marginal cost of labour - without reducing total costs. Lower marginal costs lead to an increase in production and employment, but it does not create any incentive on the supply side of the labour market, and in that way ignores workers' incentives.

Workers' incentives are the main focus of part (*a*) of the second channel. Underemployment equilibria resulting from the asymmetry of information where workers have the possibility of shirking, may be improved upon if the workers receive a share in the profits of the firm, thereby creating a direct link between worker effort and reward.

Part (*b*) of the second channel relates to underemployment equilibria resulting from firm owners having superior information, like in Grossman and Hart (1981). They argue that if firms are risk averse and real shocks in the economy are not observable, contracts have to be made contingent on employment. Then wages cannot be lowered unless unemployment is

increased, since only unemployment signals lower productivity. In equilibrium, employment is lower than it would be in a spot market for labour. Here employee share ownership could remove the asymmetry in information (see Hart (1983)). Letting employees own shares will take away the asymmetry between workers and management because dividends will signal the state the economy is in.

We suggest a third channel (which is novel to the literature) through which esops may work: the collective decision making of unions. Thereby we look at workers' incentives, but through the political decision making of the union. When unions are wage setters (monopoly-union case) and union members vote on the wage, each union member trades off the benefit for being employed (the wage) and the risk of becoming unemployed. This trade-off changes if the union member owns shares of the firm's profits. But the union member's most preferred wage will depend on how much the member owns of the firm. Thus there is a conflict among members with different share ownership. We will show that the wage in politico-economic equilibrium will depend on the distribution of shares among the union members.

In our context employee share ownership may act as a counterstrategy against non-competitive wage setting. We may think of employer and employees being interdependent through an agency relationship, and share ownership is an effective tool to reduce agency costs. Share ownership creates an interest with union members in the firm's expected profit in a similar way as performance based payment does in the classical principal-agent setting. A standard argument would be that the possession of shares gives individuals incentives to work harder. Here instead, the *union* demands a lower wage as a result of a political decision-making process. Thus, each employee, the pivotal median included, will balance the marginal utility from extra wage income with the marginal utility from dividend income. Equilibrium specifies a monotone relation between the capital share of the median voter and employment.

This allows us to make some inferences about the relation between the distribution of firms' shares and the level of employment.

A related paper on voting within unions is Blair and Crawford (1984), in which the union members vote on the wage level under a majority rule, but they own no shares in the firm. Their findings are that heavier reliance on seniority rules tends to increase the wage level and decrease the probability of getting a job.

The theory of endogenous policy has clarified the role of the distribution for economic policy making. Persson and Tabellini (1992) describe the analytical framework common to this literature. Persson and Tabellini (1994) is closer to ours in its implications. They show that both an unequal distribution and low levels of capital can be harmful for growth. In our paper, the economy has a similar property: inequality in share holdings will turn out to be harmful for production and employment. Similar conclusions have been drawn by Roemer (1993) in a different setting. Roemer analyses an economy where individuals differ in share ownership of a firm. The firm, when producing, causes an externality. The individuals, depending on their share endowments, would prefer different levels of production (and thereby of the externality) by the firm. The firm's decision is taken through a majority vote. The conclusion is that the more unequal the distribution of shares is, the greater is the externality.

The organisation of the paper is as follows. In section II, we develop the general model. The following section derives the politico-economic equilibrium, and contains the main theorem of the paper. In section IV, we discuss the implications of our findings, in particular for optimal portfolio rules, and we also show how transfers of shares to employees can be made economically feasible. Finally, section V concludes.

II. The Economy

We assume each sector consists of one firm and one union and many agents. We can think of this as a pool of labour with branch specific knowledge. Labour is immobile between sectors and membership is fixed.[7] To focus the analysis on the effects of stock-ownership there is complete certainty about the state of the economy.[8] Uncertainty enters only at the level of the individual worker, who does not know ex ante whether he will be unemployed ex post the political process. He knows everyone else's preferences, the resulting wage rate and the resulting employment ex ante. Consequently, the individual is faced with only two possible states of nature: employment and unemployment. Their probabilities will be determined endogenously. All individuals face equal probabilities of being unemployed, i.e. there is no seniority in our treatment. We adopt the following assumptions:

A1. Firms

There are J price taking firms that hire only labour, which is indivisible. Associated with each firm is one union who imposes a wage rate, and the firm then chooses employment. The returns will be given by

$$\boldsymbol{R_j} \equiv \max_{l_j} F_j(l_j) - w_j l_j \ , \ \forall \boldsymbol{j}=1,\dots,\boldsymbol{J} \tag{1}$$

where $F_j(\cdot)$ is the production function of firm j and $F_j(\cdot)$ ε C^3, $F_j'(\cdot) > 0$, $F_j''(\cdot) < 0$, $F_j'''(\cdot) \geq 0$. To rule out certainty about employment we require $F_j'(m_j)<b$, where b is the reservation wage.

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[7] The assumption of one firm per industry could be replaced by introducing an aggregated value marginal product of labour function, as Grossman (1983) does. So a multi-firm industry could be represented by one representative firm employing the aggregate labour force. Since we need the profits to determine dividends, we prefer to use the firm's profit function instead.

[8] Allowing for uncertainty in this respect would mean no radical change of the results. Wages would be the same for all states, and employment would vary across states.

A2. Households

There is a total of I individuals in the economy. Each is a member of only one union, specific for only one firm (or sector). There are m_j members of the union connected to firm j, so that $\sum_{j=1}^{J} m_j = I$. Individuals differ only with respect to their initial endowments, the vector of share-holdings in J different firms. Each individual i is endowed with a vector of shares $\alpha^i=\{\alpha_1^i,\alpha_2^i,...,\alpha_J^i\}$, normalised such that $\sum_{i=1}^{I} \alpha_j^i = 1$, $\forall j=1,...,J$. If the individual is

working he receives w_k, if he is unemployed he receives b. One may think of b as being the reservation wage or the valuation of leisure.

The expected utility of individual i, member of union k, is:

$$U^i(w_k) = u(W^i)p_k + u(B^i)(1-p_k) \tag{2}$$

where $W^i \equiv w_k + \sum_{j=1}^{J} \alpha_j^i (F(l_j) - w_j l_j)$ and $B^i \equiv b + \sum_{j=1}^{J} \alpha_j^i (F(l_j) - w_j l_j)$.

The probability of becoming employed, p, is equal for all individuals, $U^i(\ )$ is assumed to be strictly concave in w_k for holdings $\alpha_k^i \in [0,1/m_k]$, and $u \in C^2$, $u' > 0$, $u'' < 0$.

A3. Unions

In each union the wage decision is taken through a majority vote. All members of the union are treated equally, i.e. they all have one vote and face the same probability of becoming employed. The union is assumed to behave as a monopolist on its labour market: it has all bargaining power and dictates the wage level to the firm by choosing a point on the labour demand function, letting the firm manage employment.[9]

[9] This is the so called *right-to-manage* assumption, see Layard, Nickell and Jackman (1991).

Notice that the assumption of union monopoly power is an abstraction without loss of generality.[10] By not modelling any bargaining process, we are able to concentrate our attention on stock-ownership. Alternative bargaining solutions can be imposed without changing the qualitative results.

III. The Politico-Economic Equilibrium

Throughout this paper we deal with democratic unions (one member - one vote) in which the members vote directly on a labour contract, i.e. the wage rate, (or indirectly on representatives) under majority rule. Consequently, the union maximises the expected utility of the median employee. We now turn to the characterisation of the union members' preferences over wages.

It will turn out that the wage preferred by a particular worker depends on his/her endowment of shares in relation the a mean, defined as the inverse of the number of union members. Therefore we define a hypothetical mean holder as follows:[11]

Definition *A mean holder in firm k has a share*

$$\alpha_k^m \equiv 1/m_k \tag{3}$$

Proposition 1 *Given* A1 *and* A2

a) the preferred wage rate for the mean holder equals b, and

[10] The monopoly solution is merely one specific point on the (negatively sloped) labour demand curve. The relationship between stock-holdings and employment would not be affected by choosing any other point on the labour demand curve.

[11] The mean holder is not necessarily identifiable for each firm. In practice it would be rather rare to observe an individual worker, at a firm with 1000 employees for example, who holds exactly 1/1000 of the total share capital. Therefore we should either think of the mean as hypothetical or assume stock-ownership by workers to follow a continuous distribution. It is worth noting that the mean holder is not generally the mean holder in the whole economy, but the mean holder among those that are employed within the firm.

b) for individuals with shares of firm k less than those of the mean holder, the preferred wage rate is strictly greater than b.

Proof. a) The individual i's indirect utility as a function of w_k is given by (2) where $p=l_k/m_k$, and l_k satisfies (1). The first order condition, $U^{i\prime}(w_k)=0$, can be written as

$$u'(W^i)(1-\alpha_k^i l_k)\frac{l_k}{m_k} - u'(B^i)\alpha_k^i l_k \frac{m_k - l_k}{m_k} = -\{u(W^i) - u(B^i)\}\frac{l_k'(w_k)}{m_k} \tag{4}$$

where the primes $'$ denote first derivatives with respect to the argument in question. Note that the first order condition for profit maximisation of firm k has been utilised in the derivation of (4). The coefficients of $u'(W^i)$ and $u'(B^i)$ show how the wage level affects marginal utility through wage income and dividends. From now on we drop the superscript i and subscript k because there is no ambiguity. Define each individual's endowments, α, in proportions of those of the mean holder, α^m, such that $\alpha \equiv \theta\alpha^m = \theta/m$. Substitution into (4) shows that the following must hold for each individual too:

$$u'(W)\left(1-\theta\frac{l}{m}\right) - u'(B)\left(\theta - \theta\frac{l}{m}\right) = -\frac{l'(w)}{l}\{u(W) - u(B)\}. \tag{5}$$

Only in the case of the mean holder, $\theta=1$, the coefficients of $u'(W)$ and $u'(B)$ are identical. Strict concavity of $u(\cdot)$ and (5) imply $W^m = B^m$, which implies that $w = b$.[12]

b) Assume that Proposition 1b does not hold so that $w = b$ and $\theta\neq1$, then equation (5) becomes

$$u'(W)(1-\theta) = 0. \tag{6}$$

But (6) can only hold for $\theta = 1$, which is a contradiction, since this individual coincides with the mean holder. For individuals with endowments less than the mean holder $\theta < 1$, the first

[12] The left-hand side of (5) is negative for $w\geq b$ and $l\leq m$ and zero for $w=b$ and/or $l=m$. The right-hand side is strictly positive for $w>b$ and zero for $w=b$. Consequently the LHS=RHS iff $w=b$.

order condition is strictly positive for $w=b$, so that the objective is increasing in w, implying that the optimum wage must be strictly greater than b. QED

Proposition 1 can be understood intuitively through nearer investigation of equation (4). The right-hand side is (minus) the net loss of utility from not being employed times the marginal decrease in the probability of employment, due to a small increase in the wage. The left-hand side term is the marginal increase in expected utility due to the same change in the wage rate. The RHS is always strictly positive for $w>b$, so for an interior optimum to exist the left hand side must be strictly positive too. For the mean holder, however, the expected marginal change in utility of a small increase of w above b, can never be positive. As mentioned above, the coefficients of $u'(W^i)$ and $u'(B^i)$ are identical for the mean holder, implying that for this special individual a marginal change in the wage rate has equal impact on the marginal utility in the state of unemployment and in the state of employment. Proposition 1 results from equating marginal utilities across states. The mean holder would be completely insured against the risk of unemployment at no cost - in terms of a higher wage foregone in the state when he would be employed - if the wage would be set at the rate preferred by him. His optimal choice is the wage where the marginal utilities are equal regardless of whether he is employed or not, that is to set $w=b$. The second part of the proposition says that there is something to gain by demanding higher wage rate for individuals with lesser holdings than the mean (not the median) stock-holding employee. Such individuals would prefer to set the wage at such a level that profits would be zero. But then he would face a large probability of being out of work, being unable to appropriate the large wage. He faces a trade-off between a high wage and a high probability of being unemployed.

Proposition 2 *Given A1, A2 and* $u'''(.) \leq 0$ *there exists a unique mapping from the*

endowment space onto the space of preferred wages. The preferred wage rate is strictly and continuously decreasing in the share of the firm on the interval $\alpha_j \in (0,1/m_j]$, $\forall j=1,\ldots,J$.

Proof. See the appendix.

Now, we are ready to deal with the characterisation of the resulting political equilibrium. Applying the Median Voter Theorem [Mueller (1989) p.65-66] to the vote on the wage level within the labour union, we obtain:

Theorem *Given A1, A2, A3 and* $u'''(.) \leq 0$, *the distribution of shares of firm k among individuals employed in firm k determines the wage rate and the resulting employment in a political equilibrium. The more unequal the distribution is, (in the sense of a smaller share for the median holder relative to the mean holder), the higher will be the wage rate in equilibrium and the higher will be the resulting unemployment.*

Proof. Given Proposition 2, individuals' preferences over wage rates will be single-peaked and one, and only one, preferred wage rate exists for each individual. We can rely on the median voter theorem to find that the median wage cannot loose under majority rule. Since the endowments of shares map into the set of preferred wages the median wage is that preferred by the median holder. If the distribution is skewed so that $\alpha_k^{\text{MEDIAN}} < \alpha_k^{\text{m}}$, then according to Proposition 2 the relation among preferred wages is $w_k^{\text{MEDIAN}} > w_k^{\text{m}}$. A "skewer" distribution $\alpha_k^{\text{median}} << \alpha_k^{\text{MEDIAN}}$ implies $w_k^{\text{median}} >> w_k^{\text{MEDIAN}}$. Finally higher wage implies lower employment since $l_k(w_k)=F_k'^{-1} \Rightarrow l_k''(w_k)=1/F_k''(l_k)<0$. QED

IV. Discussion

In this section we illustrate the obtained results with the help of two examples. By discussing

two extreme cases, that of a one-firm one-union economy and an N-firm N-unions economy respectively, we can pin-point different aspects of the above propositions. In IV.4 we discuss how an employee share ownership plan can be implemented.

IV.1 A one-firm one-union economy

The analysis suggests that an unequal distribution of a firm's share capital will lead to equilibrium production and employment being at levels lower than desirable. In fact, production and employment could be increased if share capital would be redistributed towards the median holder. Arguing from the point of view of a firm with a single owner, any part of his share-capital distributed equally among all employees will raise production and employment in the firm. This rule will hold until the "single" owner has given away $(1\text{-}1/m)^{th}$ part of all stock, with all workers now owning an equal share ($1/m$) of the firm. A more equal distribution of share-capital does not *generally* lead to an increase in employment and output, however.

It may happen that political fractions seek majorities by compromising. When a majority is formed by the middle 50 percent of the voters, the opinions of those at the extreme "left" or "right" do not matter.[13] In the same way, labour unions will probably not care about members with extreme wage demands (*share-holdings*) - both high (*small*) and low (*large*). Wage demands could be mitigated by supplying the *median voter* in a trade union with larger stock-holdings, independent of whether this happens at the cost of the upper two

[13] Intuitively, using the median voter theorem, majorities will always be formed by the 50% of the voters centred around the median. In reality we also observe (extreme left and extreme right) majorities built around the first and third quartile. In that case, with some minor alterations, our conclusions and the following discussion would continue to hold with the median replaced by the first and third quartile respectively.

quartiles (the rich) or the lower two quartiles (the poor).[14] We can find conditions under which redistribution of share capital away from the lower (poorer) two quartiles in favour of the (richer) median holder can increase the prospects of employment, at the cost of their capital holdings. Redistribution away from the upper (richer) two quartiles towards the median *can* but will not *necessarily* increase the poor's capital. Ceteris paribus it *will* increase peoples' chances of employment, although at a lower wage.

The welfare implications of the above measures are not clear-cut, since the sum of marginal utility gains from a redistribution depends on the distribution of capital. It is not so difficult to think of cases where marginal losses are small and gains are large - but we will not discuss this in further detail here. We can be sure, ceteris paribus, that if $w>b$ lowering the wage rate can improve welfare. If lump-sum transfers and taxes were possible, this increase could be redistributed so that a Pareto improvement were realised.

IV.2 An N-firms N-unions economy

Proposition 2 leads to a special and interesting result: efficiency in employment and production of all firms requires that workers concentrate their ownership of share-capital in the firm employing them. As long as the median holder does not yet own $(1/m)^{th}$ part of the firm's capital, employment and production can be increased by redistributing shares towards the median holder. Assuming for simplicity that the share holdings of the employee closest to the median are only infinitesimal larger or smaller than the median's, it will be impossible to change the wage level by letting only the median employee/shareholder increase his share-holdings. Assuming that the same holds for some other firm, employment and production in both firms would be increased if workers exchanged their holdings of the other firm's stock

[14] It may be more realistic to expect that it is the upper one and lower one quartile that are neglected.

for that of their "own" firm.

In our model, every "optimal" portfolio will tend to consist to a larger extent of shares of the firm at which the individual works, than in conventional portfolio theory. Thus, from a political-economy point of view, for their portfolios to be optimal individuals ought to limit diversification. Traditional portfolio theory, however, tells us that from an individual standpoint an optimal portfolio should be well-diversified.

The cause of the anti-diversification effect is, naturally, that the more stock a worker owns, the lower will be the wage he demands. As soon as "outsiders" (people not working at this firm) come to own some of the shares, the incentive to keep wages down becomes weaker than if those shares were owned by all workers in equal proportions. This makes α^{median} smaller, thereby increasing the wage rate and lowering employment.

In our model there is no uncertainty, and thus agents do not have to take any risk aspects into consideration in their decision making. Consequently, they have no need for - or return from - portfolio diversification, because firms' profits are known in advance. Here a portfolio plays only one role, namely that of creating an incentive to moderate wage demands. Then it is self-evident that it will be desirable from a political-economy perspective to make individuals restricting their portfolios to the shares of one firm. In a world with uncertainty, individuals will start diversifying their portfolios in order to reduce their risk exposure (typically by <u>not</u> holding shares in the firm where they work), so there will be a *trade-off* between the advantages and disadvantages of diversification without qualitatively affecting the results. Our results simply imply that the desirable degree of diversification, and consequently the market portfolio, will be modified as soon as political decisions are taken into account.

Our results would also have consequences in the context of earlier and related studies.

If seniority of the Grossman (1983) type had existed, its negative effects on employment could have been offset by a seniority based stock-sharing program. The higher wage demands resulting from seniority could be countered with a portfolio that grows with age.[15]

IV.3 Relation to Principal-Agent Theory

As we mentioned in the introduction, there is a tangency to the literature on agency costs and ownership structure. Here, an agency relationship exists between the firm and the workers, because their objectives do not coincide. Our model offers something similar to what Jensen and Meckling (1976) were seeking: "it explains how the conflicting objectives of the individual participants [in the firm] are brought into equilibrium". But unlike the balancing between the interests of debtors and other outsider share holders on the one hand and the interests of the manager-share holder on the other hand, we look at the equilibrium properties resulting from the interaction between two *insider* groups: the manager and his employees.

The question relevant to us is whether the first best, unconstrained Pareto optimum solution can be reached or not. Since all aggregate uncertainty is absent, and the agents (workers) provide their efforts (labour) inelastically, there is no moral-hazard problem. Instead a problem arises that resembles moral hazard in its consequences. Workers tend to demand wages that are higher than what the firm would pay in a competitive market, and higher than what is optimal from a macroeconomic (i.e. employment - and production) perspective. This happens because workers have full discretion over a decision variable that would be under control of the employer in the classical principal-agent setting. In place of the non-

[15] One good example of such a seniority-based share-ownership programme can be found in Sweden. There, the commercial bank Svenska Handelsbanken pays its employees performance related annual bonuses in shares. The shares are administrated by a trust, and can only be cashed in annual parts after retirement.

observability of the action variable a beyond-control assumption has been introduced on the wage rate.

In order to counter the undesirable behaviour of the agents, the principal can do something similar to changing a wage contract: he can transfer share capital to his workers. By rewarding them for behaving in a way the firm wants them to, with a share of profit and greater employment probabilities, he provides workers with the same kind of incentives as in the classical principal-agent relationship. Notice however that, other than in the classical principal-agent setting, it is not enough to create individual incentives. The latter have to be mapped into the strategy of the union to render any effect.

Total agency costs consist only of the residual loss:[16] the reduction in welfare experienced by the principal due to divergence between the agent's decisions and those that would maximise the principal's welfare. In section III, we showed this loss to be positively related to the difference between the mean and median employee share-holdings, which embodies the degree of inequality between employer and employees.

In section IV.4 we will see that a transfer of shares from the owner-manager to the employees can reduce total agency costs. Although a transfer introduces some bonding costs, these are outweighed by the reduction in residual loss. So another interpretation of our conclusions is that spreading stock-ownership among employees and anti-diversification are efficient means to minimise losses from agency costs.

IV.4 Implementation of employee share ownership plans

[16] In general, total agency costs is the sum of monitoring costs, bonding costs and a residual loss. Because workers supply labour inelastically monitoring will not serve any purpose, and the concomitant costs are absent. As long as employees do not trade shares actively, bonding costs, i.e. expenditures that the agent makes to steer his own behaviour into a direction that benefits both the principal and himself, are not incurred either. Consequently, if no attempt is made to change the status quo through the transfer of assets.

Here we ask ourselves if an employee stock ownership program can emerge endogenously when the wage rate in politico-economic equilibrium exceeds its optimal level. In other words: do the owners of a firm, given some exogenously specified distribution of the stock holdings, have an incentive to voluntarily transfer, sell or donate shares to union members in order to affect the collective decision of the union? It turns out that this may be the case.

Consider one firm consisting of Q shares, of which q are owned by the employees and Q-q are owned by a single entrepreneur. Define $\omega \equiv q/Q$, then the entrepreneur's profit, π, is $\pi = (1-\omega)R(w)$, where $R(w) \equiv \max_l F(l) - wl$, and w is the wage preferred by the median voter in the union. Assume that all employees own equal numbers of shares, i.e. q/l shares. Then any employee's share of the firms profit is ω/l. If we suppose that the number of employed, l, is greater than the number of unemployed, m-l, then the median is employed and owns ω/l. Thus $\alpha^{median} = \omega/l \equiv \alpha$. If the entrepreneur sells shares to the employees he receives P per share. The profit of the entrepreneur before selling shares is $\pi_0 = (1-\omega_0)R(w_0)$. After the sale his profit is $\pi_1 = (1-\omega_1)R(w_1) + P(q_1 - q_0) = (1-\omega_1)R(w_1) + PQ(\omega_1 - \omega_0)$. Subtracting gives us the change in the entrepreneur's profit:

$$\pi_1 - \pi_0 = (1-\omega_1)R(w_1) + PQ(\omega_1 - \omega_0) - (1-\omega_0)R(w_0) = (1-\omega_1)[R(w_1) - R(w_0)] + [PQ - R(w_0)](\omega_1 - \omega_0)$$

which for a small change reduces to $d\pi = (1-\omega)dR(w_1) + [PQ - R(w)]d\omega$. Then

$$\frac{d\pi}{d\omega} = (1-\omega)\frac{dR(w)}{d\omega} + PQ - R(w) = (1-\omega)R'(w)\frac{dw}{d\omega} + PQ - R(w).$$

By the Envelope Theorem we know that $R'(w) = -l$. Next if $\frac{dw}{d\omega} = \frac{dw}{d\alpha}\frac{1}{l}$ is substituted into the expression for $d\pi/d\omega$, we find that

$$d\pi/d\omega = -(1-\omega)dw/d\alpha + PQ - R(w). \tag{8}$$

Here $-(1-\omega)dw/d\alpha$ is the gain in profitability from a decrease in the politico-economic

equilibrium wage as a result of a change in the employees' share ownership. This effect is always positive. Employees would be prepared to buy shares only if the price P is such that $P \leq R(w)/Q$. Therefore $PQ - R(w)$ is non-positive. If $P = R(w)/Q$ the change in the entrepreneur's profit share is always positive, and he would be willing to sell shares until $\alpha = 1/m$. Thus if $P = R(w)/Q$ for any $w \in (b, w^*]$, where w^* is the wage preferred by an individual with $\alpha = 0$, then profit sharing would emerge endogenously.[17]

V. Summary and Conclusions

We have found a channel through which employee ownership may increase production and employment: through the collective decision of the union. A union member's trade-off between expected wage and unemployment risk depends on the number of shares (s)he owns of the firm. The union's decision (taken by majority rule) will therefore depend on the distribution of shares among the union members. As a special case we found that if the median voter in the union owns a share of the firm equal to the inverse of the number of union members, then the union decision is the competitive wage. If the median owns less, the union's wage demand is greater than the competitive wage.

Furthermore we showed how it was possible to transfer shares from the owner-manager to his employees. We founded that if the value of all stock is equal to total profits, then it will always be profitable for owner-managers to sell stock to their workers until each worker owns a share equal to one over the number of union members. Even selling *below* the market price will be beneficial over some range.

[17] There may be reasons why this would not occur. Credit may be rationed, or individuals might face borrowing constraints. Uncertainty may make workers less willing to hold a large proportion of their wealth in one asset, making the price at which they would want to buy the shares (for the purpose of holding them, and not reselling them) too low for (8) to be positive. They do not affect our main conclusion that implementation of employee share ownership can be welfare improving.

The importance of the above observations lies in the fact that even if the first best is not attainable - namely the removal of the monopoly position - the second best solution can be manipulated so as to approximate the first best very closely by introducing share-ownership programmes for employees. As a consequence, in economies with labour unions an increase in employment can be achieved not only by dismantling the unions, but also by engaging employees in the firms' objectives through stock-ownership[18].

A concurrent implication we discovered was the existence of possible macro-economic advantages from limiting the degree of diversification of individuals' portfolios, running counter to the traditional portfolio-theory result that a portfolio should be well-diversified.

Appendix

Proof of Proposition 2

The objective function (2) is assumed to be twice continuously differentiable everywhere and given Assumption 2 a unique maximum with respect to w_j exists $\forall \alpha_j \in [0,1/m_j]$, $\forall j=1,\ldots,J$. Henceforth we will denote (2) by Γ and suppress its arguments. Relying on the implicit function theorem, the first order condition defines an implicit function, $f_j:\alpha_j \rightarrow w_j$, and its derivative $w_j'(\alpha_j) = -\{\partial^2\Gamma/\partial w\partial\alpha\}/\{\partial^2\Gamma/\partial w^2\}$ exists and is continuous on $[0,1/m_j]$. Assumption 2 implies that the second derivative of the objective function with respect to w, $\partial^2\Gamma/\partial w^2$, is strictly negative on the interval. Then it is easily seen that the sign of the derivative $w_j'(\alpha_j)$ is given by the sign of the partial derivative of the first order condition (4) with respect to α_j, $\partial^2\Gamma/\partial w\partial\alpha$. The partial of (4) with respect to α is (ignoring subscript j)

[18] Possible objections, fed by the fear of firms becoming unmanageable through the broad dispersion of share ownership, could be met by introducing so called *administrative offices*, alike those in The Netherlands. These offices own the share capital of firms and issue share-certificates without voting rights, thereby stripping the shares from all but the financial rights.

$$u''(W)\{F(l) - wl\}(1-\alpha l)l \;-\; u'(W)l^2 \;-\; U''(\boldsymbol{B})\{F(l) - wl\}\alpha l(m-l)$$
$$-\; u'(\boldsymbol{B})l(m-l) \;+\; \left(u'(W)\{F(l) - wl\} \;-\; u'(\boldsymbol{B})\{F(l) - wl\}\right)l'(w) \tag{9}$$

where we were able to disregard all $w'(\alpha)$ terms by applying the envelope theorem. Because of limited liability (or by assuming decreasing returns in one factor), $F(l)$ is always greater than or equal to wl. Proposition 1 ensures that $w \geq b$, and thus W≥B. Furthermore, since we know that individuals with $\alpha_j > 1/m_j$ will choose $w = b$, we can exploit the fact that we are only interested in finding the sign of the above partial derivative for values of $\alpha \in [0,1/m]$. Concentrate on the first and third term of (9), i.e.

$$u''(W)\{F(l) - wl\}(1-\alpha l)l \;-\; U''(\boldsymbol{B})\{F(l) - wl\}\alpha l(m-l). \tag{10}$$

Equation (10) is non-positive for $\alpha \in [0,1/m]$ if $u'''(.) \leq 0$. The last step consists of showing that the remainder of (9), i.e.

$$-u'(W)l^2 \;-\; u'(\boldsymbol{B})l(m-l) \;+\; u'(W)\{F(l) - wl\}l'(w) \;-\; u'(\boldsymbol{B})\{F(l) - wl\}l'(w) \tag{11}$$

is strictly negative values for $\alpha \in [0,1/m]$. Obviously, when $\alpha = 1/m$, this holds. Then it suffices to show that (11) is monotonically strictly increasing in α for $\alpha \in (0,1/m]$.

Differentiating (11) with respect to α gives

$$-u''(W)\{F(l) - wl\}l^2 \;-\; u''(\boldsymbol{B})\{F(l) - wl\}l(m-l)$$
$$+u''(W)\{F(l) - wl\}^2 l'(w) \;-\; u''(\boldsymbol{B})\{F(l) - wl\}^2 l'(w).$$

Collecting terms and rewriting, we obtain

$$-\left[u''(W)l + u''(\boldsymbol{B})(m-l)\right]\{F(l) - wl\}\,l \;+\; \left[u''(W) - u''(\boldsymbol{B})\right]\{F(l) - wl\}^2\, l'(w). \tag{12}$$

For any concave u the first term of (12) is strictly positive. The second term is non-negative if $u'''(.) \leq 0$. Consequently, the whole expression is monotonically strictly increasing in α for

$\alpha \in [0,1/m]$, so (11) is strictly negative for $\forall\alpha \in [0,1/m]$. Thus $\partial w_j/\partial\alpha_j < 0$, $\forall\alpha_j \in [0,1/m_j]$. QED

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