Employee stock ownership vs. profit sharing*

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Abstract

A popular argument in favor of profit sharing is that it increases employment, but the theoretical basis for the claim is controversial and the empirical results are ambiguous. This paper shows that employee stock ownership based on individually-held equity stakes avoids the theoretical problems of traditional, group-based profit sharing. Employee stock ownership shifts employment to the efficient level by either raising it from an initial state of underemployment or decreasing it from an initial state of overemployment. Since the effect on employment is not unidirectional, empirical tests need to differentiate between traditional profit sharing and employee stock ownership and to condition on the initial state of employment.

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1 Introduction

Among the many arguments for and against profit sharing, one of the most popular and controversial is Weitzman's (1984, 1987) conclusion that profit sharing increases employment. Weitzman used a union-firm bargaining model to show that giving workers a share of firm profits results in a lower wage which in turn increases the amount of labor demanded by the firm. However, the empirical evidence that profit sharing raises employment remains inconclusive.[1] And the theory depends on the assumption that workers bargain over just the wage rather than employment and the wage. Hiring more workers dilutes the fraction of the total profit share each worker receives, so current employees will oppose additional employment. Consequently, if bargaining over employment is allowed profit sharing has no impact on employment (Weitzman, 1987).

This paper shows that allowing employees to individually own equity stakes in their company, as occurs under standard forms of employee stock ownership that have become widespread in recent years, can implement Weitzman's ideas by avoiding this and other problems with traditional, group-based profit sharing. When workers own equity the wage rate falls because dividends and capital gains displace wage income, but current employees no longer have an incentive to oppose the hiring of more workers at the new wage. Since only workers who own stock receive a share of the profits, additional workers are tolerated as long as extra employment contributes to profits. As in a two-tier wage system, employment is more efficient because current and new workers receive different incomes. Unlike in such a system, the firm has no incentive to opportunistically replace current workers with new workers because they receive the same wage and because current workers have a claim to equity that is unaffected by termination.

While Weitzman concentrated on the problem of underemployment, unions are criticized

[1] In a survey of 11 studies Kruse (1998) finds that 6 have generally supportive results and 5 have mixed or unfavorable results.

not just for restricting employment opportunities by driving up wages but also for inflating labor demand by featherbedding. These conflicting perspectives can be reconciled by insider-outsider models which assume the union is concerned only with the utility of a limited number of insiders (Carruth and Oswald, 1987). When the number of insiders is small relative to demand, as may be true in a growing industry, underemployment results since insiders drive up the wage without concern for lost employment opportunities to outsiders (Oswald, 1985). When the number of insiders is large relative to demand, as may be true in a declining industry or in a state enterprise being restructured, overemployment results as the union acts to ensure jobs for insiders (McDonald and Solow, 1981).

In an insider-outsider model we find that employee stock ownership can eliminate not only underemployment but also overemployment, a problem that traditional profit sharing cannot solve. Offering equity to insiders is an effective way to "buy out" their opposition to downsizing. Under regular profit sharing workers forfeit their right to firm profits once they leave the firm, but equity-holding employees can retain their stake or can profit by selling it upon exit. Since stock ownership forces down the bargained wage rate and since exiting workers do not forfeit their share of firm profits, workers can be made indifferent between continued employment for the downsizing firm and the alternative of outside employment.

Regarding incentives to adopt employee stock ownership, Weitzman (1987) shows that because current workers are hurt by profit sharing the efficient profit share must be imposed by the government. Not only does this give the firm and workers an incentive to evade the profit sharing system, but the exact share that induces neither too little nor too much employment for a given firm is unlikely to be known by the government. These problems are avoided with employee stock ownership. Both the firm and workers benefit from the productivity gains of an efficient stake because workers can bargain to receive the equity at a discount. Moreover, there is no need to set a knife-edge optimal stake because there is a minimum stake that induces efficient employment and higher stakes continue to lead to the same efficient outcome.

In addition to the assumption of no bargaining over employment, the profit sharing results require other key restrictions on the bargaining game. If the profit share is open to bargaining along with the wage, the bargaining outcome reverts to the same inefficient solution as if there were no profit sharing (Anderson and Devereux, 1989). In contrast, bargaining over the equity stake leads to an efficient stake regardless of whether the stake is bargained over before wage and employment bargaining or concurrently. The profit sharing results also assume that both insiders and outsiders are paid a uniform wage rather than allowing insiders to bargain for a higher, separate wage. This assumption is not always defensible because insiders prefer a two-tier wage system to profit sharing and still prefer a two-tier system to uniform wages if profit sharing has been imposed. In the underemployment case employee stock ownership gives insiders the same total income as a two-tier system while avoiding the danger that the firm will opportunistically replace high-wage insiders with low-wage outsiders. In the overemployment case two-tier wages offer no benefits to insiders so employee stock ownership is strictly preferred.

Regarding empirical predictions, studies have not always distinguished between traditional group-based profit sharing and the increasingly standard system of employees individually owning equity stakes. This distinction is important not only because of the weak theoretical basis for regular profit sharing affecting employment, but because equity stakes are not predicted to have a unidirectional impact on employment. When the number of insiders is small and the initial employment level is inefficiently low, employee stock ownership is predicted to increase employment. But when the number of insiders is large and the initial employment level is inefficiently high, the opposite effect is predicted. A properly specified test of employee stock ownership must therefore condition on the initial state of underemployment or overemployment.

Distinguishing between traditional profit sharing and employee stock ownership is also necessary to understand the effect of profit sharing on employment variability. Based on the idea that profit sharing increases employment, it has been argued that firms with profit

sharing should have lower employment variability since they will reduce employment less when demand falls (Weitzman, 1984; Weitzman, 1985). Regardless of the merits of this argument for traditional profit sharing,[2] it does not follow in a model with stock ownership. As Carruth and Oswald (1987) show, employment rigidity with inefficiently high or low employment is a feature of collective bargaining. By giving workers an incentive to agree to the efficient employment level for different demand conditions, employee stock ownership solves this rigidity problem and therefore increases rather than decreases employment variability.

These results might offer some insight into the popularity of employee stock ownership despite the substantial costs to employees from inadequate diversification (Meulbroek, 2002). Employee stock ownership as analyzed in this paper covers several arrangements that are common in the United States. Employee Stock Ownership Plans (ESOPs) allow workers to accumulate equity which is held by a trustee until the worker retires or otherwise leaves the company. 401(k) plans allow firms to use company stock to match employee contributions to a trust which is available upon retirement or departure. Stock option plans allow employees to purchase stock at favorable prices in the future, thereby achieving the same linkage between firm performance and employee income as systems in which employees hold stock. And Employee Stock Purchase Plans (ESPPs) allow firms to use payroll deductions to finance employee acquisition of company stock at discounted rates. According to recent estimates of the extent of employee stock ownership in the United States, about 8.8 million employees participate in ESOPs, 8 to 10 million employees have stock options in their firms, about 11 million employees have 401(k) plans primarily invested in their own firm's stock, and about 15.7 million employees participate in ESPPs.[3]

[2]The theoretical argument also depends on the assumption that the firm unilaterally determines employment. In a survey of 11 studies (some of which also included tests of employment generation) Kruse (1998) finds that 5 support greater employment stability under profit sharing and 6 show either no support or support only in some samples. More recently Azfar and Danninger (2001) find a positive relation between stability and profit sharing that promotes long-term skill accumulation.

[3]These numbers are from an April 2002 update of "A Statistical Profile of Employee Ownership" compiled by the National Center for Employee Ownership and available at http://www.nceo.org/library/eo_stat.html. Note that employees may participate in more than one plan.

2 The Problems with Profit Sharing

This section reviews how either underemployment or overemployment can arise within an insider-outsider model and highlights the difficulties of using profit sharing as a solution to underemployment. The following section then shows how employee stock ownership can resolve both underemployment and overemployment.

Insider-outsider models assume a distinction between "insiders" who are represented in the union utility function and "outsiders" whose welfare is of no concern to the union.[4] In the following we adopt the basic utility function of Caruth and Oswald (1987).[5] Assuming there are a total of $\bar{L}_i$ inside workers with identical utility functions $u(\cdot)$, where $u' > 0$ and $u'' < 0$, and designating employment of inside workers by $L_i \in [0, \bar{L}_i]$ and outside workers by $L_o \geq 0$, the union utility function is defined as $U = u(y)L_i + u(\bar{w})(\bar{L}_i - L_i)$ where y is the income of inside workers when employed by the firm and $\bar{w}$ is the market wage available outside the firm. To represent profit sharing, let the income of employed insiders be $y = w + \frac{s}{L}\Pi$ where w is the bargained wage, s is the predetermined profit share, Π is firm profits, and $L = L_i + L_o$. Abstracting from other non-labor inputs, firm profits are $\Pi = R(L) - wL$ where firm revenue $R(L)$ satisfies $R_{LL} < 0$, $R_L(0) > \bar{w}$, $R(0) = 0$, and $R_L(L^*) = \bar{w}$ for some $L^* > 0$. We assume the firm is risk neutral and wishes to maximize profits net of the profit share.[6] In disagreement inside workers receive the market wage $\bar{w}$ and the firm receives zero profits.

Using the generalized Nash bargaining solution (Svejnar, 1986), union and firm bargaining powers are $\gamma \in (0, 1)$ and $1 - \gamma$ respectively while union and firm bargaining positions or

[4] Throughout the paper we will assume workers are represented by a union. Without a union informal bargaining may still arise or the firm may act proactively to keep wages and employment not too different from what a union could successfully bargain for. Hildreth and Oswald (1997) find that workers in profitable firms enjoy a wage premium whether or not they are unionized.

[5] In the Lindbeck and Snower (1983) version of the insider-outsider model, insiders harass or fail to cooperate with outsiders, lowering the productivity of outsiders and causing underemployment even without collective bargaining. This paper's results on underemployment also apply to the Lindbeck and Snower model, but not the results on overemployment since it is not an issue in their model.

[6] If the firm is interested in maximizing profits gross of the profit share the solution is unaffected.

disagreement payoffs are $u(\bar{w})\bar{L}_i$ and 0 respectively. The bargaining problem is then

$$\max_{w,L_i,L_o} \left(u(w+\frac{s}{L}\Pi)L_i + u(\bar{w})(\bar{L}_i - L_i) - u(\bar{w})\bar{L}_i\right)^{\gamma} ((1-s)\Pi)^{1-\gamma} \\ -\sigma L_i + \mu L_o \tag{1}$$

where σ and μ are the respective Kuhn-Tucker multipliers for constraints $L_i \leq \bar{L}_i$ and $L_o \geq 0$.[7] Maximizing with respect to the wage gives

$$w = \frac{R}{L} - \frac{1-\gamma}{\gamma}\frac{u(y)-u(\bar{w})}{(1-s)u'(y)} \tag{2}$$

which implies the income of employed workers in agreement, $y = w + \frac{s}{L}\Pi$, satisfies

$$y = \frac{R}{L} - \frac{1-\gamma}{\gamma}\frac{u(y)-u(\bar{w})}{u'(y)}. \tag{3}$$

Since $dw/ds < 0$ Weitzman concluded that if the firm could unilaterally choose the employment level, hiring labor up until $R_L = w$, profit sharing would increase employment. But Weitzman also noted that this result does not hold in the general case where employment levels are subject to bargaining. Allowing for such bargaining, the union will always want an insider to be hired first and the firm is indifferent, implying $L_o = 0$ if $L_i \leq \bar{L}_i$, so from the Kuhn-Tucker conditions for maximizing with respect to L_i and L_o we are left with three cases. Case I: All insiders are employed ($L_i = \bar{L}_i$) and some outsiders are employed ($L_o > 0$), implying $R_L = y$. Case II: All insiders are employed ($L_i = \bar{L}_i$) and no outsiders are employed ($L_o = 0$), implying $R_L < y$ and $R_L > \frac{y}{1-\gamma} - \frac{\gamma}{1-\gamma}R/L$. Case III: Some insiders are unemployed ($L_i < \bar{L}_i$) and no outsiders are employed ($L_o = 0$), implying $R_L = \frac{y}{1-\gamma} - \frac{\gamma}{1-\gamma}R/L$.[8] In all these cases the employment level depends on y not on w because union members are naturally concerned with their total income rather than just their wage income. Since y is unaffected by its distribution

[7] The conditions on R and u are insufficient to ensure the bargaining set is convex, but we will save discussion of this issue for the next section on employee stock ownership.

[8] If $\gamma = 1/2$ this reduces to the familar conclusion that along the contract curve the wage (or wage plus profit share in this case) is exactly between the marginal revenue and average revenue of labor, $y = \frac{1}{2}R_L + \frac{1}{2}R/L$.

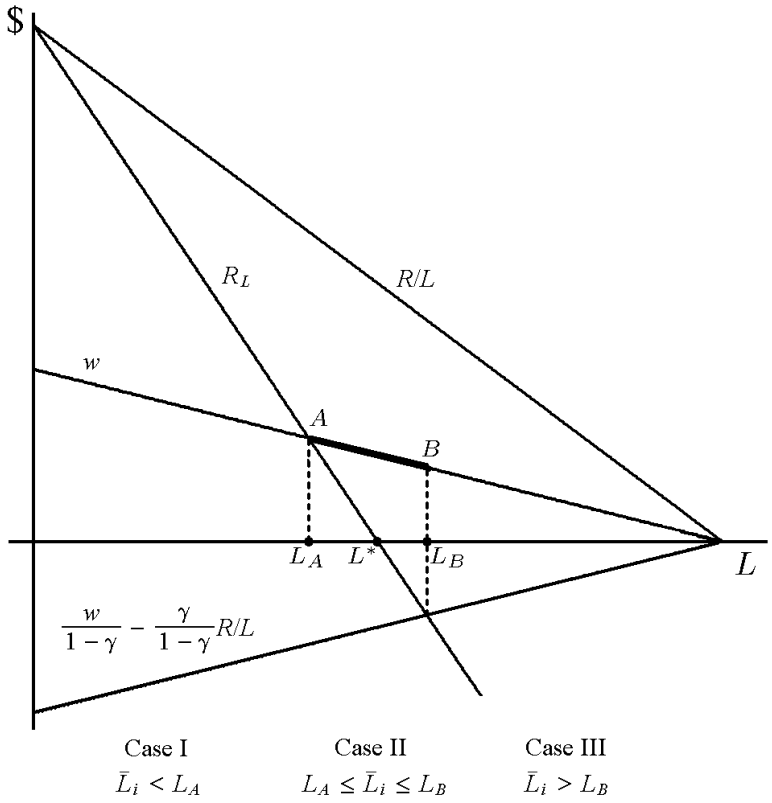

Figure 1: Underemployment and overemployment

between wage income and profit share income from equation (3) the profit share is completely irrelevant if employment is open to bargaining.[9,10]

Since the profit share has no effect, the standard analyses of union-firm bargaining without profit sharing still apply. In particular, Oswald (1985, 1993) considers Case I, Caruth and

[9]Anderson and Devereux (1989) extend Weitzman's irrelevance result for the underemployment case to the overemployment case. Note though that if profit sharing increases per worker productivity then higher productivity could indirectly induce higher employment (Wadhani and Wall, 1990; Kruse, 1992; Cahuc and Dormont, 1997).

[10]Weitzman justified the assumption of no employment bargaining on the basis of Oswald's (1985) argument that the union will cede the employment decision to the firm when the number of insiders is small as in Case I. If $s = 0$ then $R_L = w$ in this case, meaning that insiders do not need to bargain over employment since the outcome is the same employment level that the firm would choose unilaterally. But this argument does not extend to $s > 0$ since employment bargaining implies $R_L = w + \frac{s}{L}\Pi$, meaning a lower employment level than if the firm acted unilaterally.

Oswald (1987) consider all three cases with a focus on Case II, and McDonald and Solow (1981) analyze Case III. Figure 1 depicts employment and income levels in the three cases for equal bargaining power ($\gamma = 1/2$) when the revenue function is quadratic, $R = 100L - L^2$, the outside wage $\bar{w}$ is normalized to zero, $y = w$ because there is no profit sharing, and each insider has utility function $u(y) = y^{1/2}$. The line segment AB represents the possible set of bargaining outcomes with the exact outcome depending on the number of insiders. In Case I the number of insiders is less than L_A and insiders agree to the hiring of outsiders up until there are L_A total workers. Although the extra workers reduce average productivity and push worker income down, the revenue gains are so large that the firm can successfully bargain for the extra employment. Employment is still inefficiently low since the marginal revenue of labor exceeds the outside wage of 0 at employment level L_A. Case III represents the opposite situation in which the number of insiders is so large and the losses of excessive employment so high that the firm not only hires no outsiders but refuses to hire all insiders. For any number of insiders greater than L_B only L_B of them are hired, but more than would be efficient since the marginal revenue of labor is negative at L_B. Since risk averse workers are anxious to avoid unemployment the union can successfully bargain for some excess employment of insiders.[11] Case II represents the intermediate situation where the firm does not hire any outsiders but does hire all the insiders. The employment level is therefore fixed at $\bar{L}_i$, resulting in either underemployment or overemployment depending on the number of insiders. Since the wage is above the marginal product of labor, the firm would prefer to reduce employment but is unable to do so in negotiations.

The following section shows how employee stock ownership can resolve employment inefficiencies in each case by reducing the wage rate to the market wage even when the employment level is subject to bargaining.

[11] If worker utility functions are linear there are no gains to equalizing incomes across workers. In this case equation (3) reduces to $w = R/L - \frac{1-\gamma}{\gamma}(w - \bar{w})$, so $R_L = \frac{w}{1-\gamma} - \frac{\gamma}{1-\gamma}R/L$ reduces to $R_L = \bar{w}$, implying the efficient employment level.

3 Employee Stock Ownership

Employee stock ownership differs from traditional profit sharing in three essential ways. First, insiders individually own equity rather than all workers as a group claiming a profit share. Second, insiders can retain their equity stakes even if they leave the firm. Third, the adoption of employee stock ownership is decided internally by the firm and workers rather than imposed externally as is necessary under a profit sharing system. We will show that employee stock ownership can resolve underemployment because of the first difference and can resolve overemployment because of the second difference. Because of the third difference the efficient outcome can be reached in a way that benefits both sides.

We assume all insiders have identical equity stakes summing to a fraction e of outstanding equity. Since firm profits are zero in disagreement the disagreement point remains unchanged at $(u(\bar{w})\bar{L}_i, 0)$. Union utility in agreement is $U = u(w + (e/\bar{L}_i)\Pi)L_i + u(\bar{w} + (e/\bar{L}_i)\Pi)(\bar{L}_i - L_i)$. Note that the s/L term in the profit sharing model has been changed to $e/\bar{L}_i$ to incorporate the first difference between employee stock ownership and profit sharing. The second difference is reflected by unemployed insiders $\bar{L}_i - L_i$ also receiving an equity stake. The weighted Nash bargaining problem is now to maximize

$$\max_{w,L_i,L_o} \left(u(w + \frac{e}{\bar{L}_i}\Pi)L_i + u(\bar{w} + \frac{e}{\bar{L}_i}\Pi)(\bar{L}_i - L_i) - u(\bar{w})\bar{L}_i \right)^{\gamma} ((1-e)\Pi)^{1-\gamma} \\ -\sigma L_i + \mu L_o + \eta w \tag{4}$$

where σ, μ and η are the Kuhn-Tucker multipliers for constraints $L_i \leq \bar{L}_i$, $L_o \geq 0$, and $w \geq \bar{w}$ respectively. We add this last restriction because outsiders will never work for less than $\bar{w}$ and, without a profit share dependent on continued employment, neither will insiders.

When the equity stake e is zero there are again the three cases identified in the previous section. Underemployment occurs under Case I and also under Case II when $R_L(\bar{L}_i) > \bar{w}$. Overemployment occurs under Case III and also under Case II when $R_L(\bar{L}_i) < \bar{w}$. The following

proposition shows that a sufficiently large equity stake can solve both problems. To find this equity stake we do not rely on differentiation of (4) because the bargaining set need not be convex when the number of insiders is small as in Case I.[12] We avoid this problem in the proof of the following proposition by considering a convex superset of the bargaining set.

Proposition 1 *There exists* $e^* \in [0,1)$ *such that for all* $e \in [e^*,1)$ *the bargained employment level is efficient.*

Proof: The bargaining set for a given $e \in [0,1)$ is $S(e) = \{(u^u, u^f) \in R^2 | u^u = u(w + (e/\bar{L}_i)\Pi)L_i + u(\bar{w} + (e/\bar{L}_i)\Pi)(\bar{L}_i - L_i),\ u^f = (1-e)\Pi,$ for $0 \leq L_i \leq \bar{L}_i,\ L_o \geq 0,$ and $w \geq \bar{w}\}$ and the disagreement point is $d = (u(\bar{w})\bar{L}_i, 0)$. Even with free disposal in utility the bargaining set need not be convex,[13] so we (i) construct another set S' which is convex; (ii) show that $S(e) \subset S'$ for all $e \in [0,1)$; (iii) show that the solution to the game (S', d) involves efficient employment and is in $(S(e^*), d)$ for some $e^* \in [0,1)$, implying by Nash's axiom of the Independence of Irrelevant Alternatives that it is also the solution to the game $(S(e^*), d)$; and (iv) follow a similar sequence of steps to show that employment is still efficient for $e' \in [e^*, 1)$.

(i) Consider the set $S' = \{(u^u, u^f) \in R^2 | u^u \leq u(\bar{w} + (\beta/\bar{L}_i)\Pi^*)\bar{L}_i,\ u^f \leq (1-\beta)\Pi^*,$ for $0 \leq \beta \leq 1\}$ where L^* is the efficient employment level, $R^* = R(L^*)$, and $\Pi^* = R^* - \bar{w}L^*$. Since $u'' < 0$ this set is convex.

(ii) Suppose instead that $S(e)$ is not a subset of S', implying since there is free disposal in S' that there is some (x^u, x^f) in the efficient frontier of $S(e)$ and some $(x^{u'}, x^{f'})$ in the efficient frontier of S' such that (a) $x^u > x^{u'}$ and $x^f \geq x^{f'}$ or (b) $x^{u'} \geq x^{u'}$ and $x^{f'} > x^{f'}$. By the concavity of the utility function, $x^u > x^{u'}$ implies $(w + (e/\bar{L}_i)\Pi)L_i + (\bar{w} + (e/\bar{L}_i)\Pi)(\bar{L}_i - L_i) > (\bar{w} + (e/\bar{L}_i)\Pi^*)\bar{L}_i$ and the comparable relation holds for $x^u \geq x^{u'}$. Therefore both (a) and (b)

[12] Such a nonconvexity can be seen in Figure 2. The problem of nonconvexities was raised by Alexander and Ledermann (1996) who show the bargaining set may not be convex if the number of insiders is large as in McDonald and Solow (1981) but bargaining is over the wage alone.

[13] $S(e)$ is defined without free disposal to facilitate the graphical treatment in Figure 2.

each imply

$$\left(w+\frac{e}{\bar{L}_i}\Pi\right)L_i+\left(\bar{w}+\frac{e}{\bar{L}_i}\Pi\right)(\bar{L}_i-L_i)+x^f>\left(\bar{w}+\frac{\beta}{\bar{L}_i}\Pi^*\right)\bar{L}_i+x^{f'}, \tag{5}$$

or, simplifying, $R-\bar{w}L_i-wL_o>R^*-\bar{w}L^*$. Since $w\geq\bar{w}$ and $R^*-\bar{w}L^*$ maximizes profits for $w=\bar{w}$ this cannot hold.

(*iii*) The bargaining problem for the game (S',d) is

$$\max_{\beta}\left(u(\bar{w}+\frac{\beta}{\bar{L}_i}\Pi^*)\bar{L}_i-u(\bar{w})\bar{L}_i\right)^{\gamma}((1-\beta)\Pi^*)^{1-\gamma}. \tag{6}$$

The solution β^* is in $(0,1)$ because the disagreement point is within the interior of S' and $\beta\leq 0$ implies a union payoff no greater than its disagreement payoff and $\beta\geq 1$ implies a firm payoff no greater than its disagreement payoff. Now set $w=\bar{w}$ and let $L_i=\bar{L}_i$ and $L_o=L^*-\bar{L}_i$ if $\bar{L}_i\leq L^*$, and let $L_i=\bar{L}_i$ and $L_o=0$ if $\bar{L}_i\geq L^*$, giving the point in $S(e=\beta^*)$ of $\big(u(\bar{w}+(\beta^*/\bar{L}_i)\Pi^*)\bar{L}_i,\,(1-\beta^*)\Pi^*\big)$. This is the solution to the game (S',d).

(*iv*) Now consider bargaining games for $e'>e^*$. Define $S'(e')=\{(u^u,u^f)\in R^2|u^u\leq u(\bar{w}+(\beta/\bar{L}_i)\Pi^*)\bar{L}_i,\,u^f\leq(1-\beta)\Pi^*,\text{ for }e'\leq\beta\leq 1\}$. Note that $\big(u(\bar{w}+(e'/\bar{L}_i)\Pi^*)\bar{L}_i,\,(1-e')\Pi^*\big)$ Pareto dominates any point in $S'(e')$ with lower worker utility. Since $e'>e^*$ any point on the efficient frontier with higher worker utility involves a higher tradeoff with firm utility than occurs at $S'(e^*)$. And since the Nash product is homogenous of degree one, any point on a Nash level set with higher worker utility involves a lower tradeoff with firm utility than occurs at $S'(e^*)$. So the solution to $(S'(e'),d)$ for $e'\in[e^*,1)$ must be $\big(u(\bar{w}+(e'/\bar{L}_i)\Pi^*)\bar{L}_i,\,(1-e')\Pi^*\big)$. Following the same logic as before, now set $w=\bar{w}$ and let $L_i=\bar{L}_i$ and $L_o=L^*-\bar{L}_i$ if $\bar{L}_i\leq L^*$, and let $L_i=\bar{L}_i$ and $L_o=0$ if $\bar{L}_i\geq L^*$, giving the point in $S(e')$ of $\big(u(\bar{w}+(e'/\bar{L}_i)\Pi^*)\bar{L}_i,\,(1-e')\Pi^*\big)$, which is the solution to the game $(S'(e'),d)$. ■

It might seem that employees must be majority owners in the firm to agree to efficient employment levels.[14] But the firm already has some bargaining power so it is only necessary

[14]Of course, one solution is for insiders to buy all of the firm and either set wages at market levels or require

to strengthen the firm's position by giving workers some stake in a more efficient outcome. In fact, the equity stake necessary to gain sufficient concessions need not be very large. Solving for β^* from (6) and equating the equity stake to it,

$$e^* = 1 - \frac{1-\gamma}{\gamma}\frac{\bar{L}_i}{\Pi^*}\frac{u(y^*) - u(\bar{w})}{u'(y^*)}. \tag{7}$$

Continuing the example of Figure 1 in which the number of insiders is 25, the optimal employment level is 50, and $\gamma = 1/2$, efficient employment is guaranteed for $e^* = 1/3$. The bargaining sets $S(e^*)$ and S' and the Nash level set for the solution are shown for this example in Figure 2. Due to the equity stake, higher firm payoffs also lead to higher union payoffs. This alignment of interests is seen by the pointed shape of the bargaining set and particularly by the rising slope of the set on the frontier to the left of the peak. The nonconvexity on the efficient frontier to the right arises because even in this linear example the marginal impact on firm payoffs of higher worker payoffs is not monotonically increasing. The problem of potential multiple solutions due to this nonconvexity is avoided by choosing $e = e^*$ so that the solution to (S', d) is in $S(e^*)$.

While e^* guarantees efficiency, a smaller stake might be adequate to attain efficient employment when $\bar{L}_i < L^*$. Differentiating equation (4) with respect to w when $\bar{L}_i < L^*$ gives $w = \bar{w}$ when

$$e = \frac{\bar{L}_i}{L^*} - \frac{1-\gamma}{\gamma}\frac{\bar{L}_i}{\Pi^*}\frac{u(y^*) - u(\bar{w})}{u'(y^*)}, \tag{8}$$

or, in our example, $e = 1/6$. Due to the nonconvexity this equity stake may not be sufficient to maximize the Nash product, though in our example it is.[15] While equity stakes below e^* might attain sufficient employment, equity stakes above e^* always lead to efficient employment, an important issue since profit sharing above the optimum leads to excess employment. With

new workers to also buy stock in the firm.

[15] Using the same example but with worker bargaining power $\gamma = 7/8$, the equity stake $e^* = 7/9$ guarantees efficiency while the lower stake $e = 7/18$ would seem to from (8) but does not due to a nonconvexity.

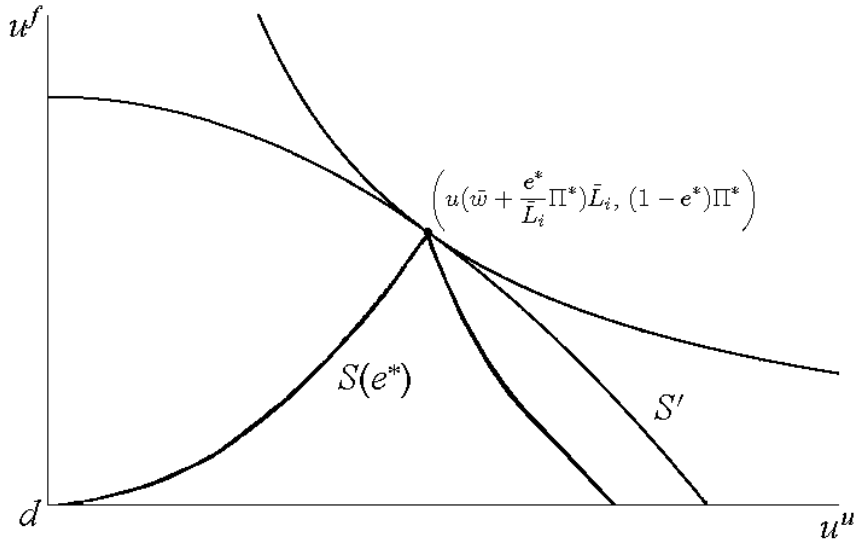

Figure 2: Bargaining with efficient stake $e^* = 1/3$.

higher equity stakes the peak of $S(e)$ shifts along to the right, staying on the frontier of S' where employment is efficient. The bargaining solution is at the efficient peak since any other point implies a lower Nash product.

With an efficient equity stake the bargained wage equals the market wage,[16] so insiders are indifferent to the employment level and the bargained outcome is the same employment choice the firm would make unilaterally. Allowing the firm to choose employment is particularly attractive because the optimal level is likely to change with demand conditions. As long as e^* is sufficiently high to ensure the wage remains at the market wage for possible labor demand curves, the firm will be able to rapidly adjust to changing demand. Rather than reducing employment variability, equity stakes allow the firm to efficiently adjust employment as conditions change.

An alternative to employee stock ownership which can also solve underemployment is a

[16]In an efficiency wage model this might not be a virtue since above-market wages increase productivity (Levine, 1989). Note that some of the productivity benefits of higher wages in an efficiency wage model might accrue instead from workers owning equity.

two-tier wage system in which outsiders are paid the market wage. Employee stock ownership mimics this system by giving insiders a higher income even as all workers receive the same wage. Since wages are equal, the employer does not have an incentive to opportunistically replace higher wage insiders with lower wage new workers, thereby avoiding a principle danger of two-tier wage structures. With an efficient equity stake if insiders decide to switch from bargaining over a uniform wage for all workers to bargaining over a higher wage for themselves alone they will still receive the market wage in the bargaining solution.[17] Unlike with profit sharing, the assumption of uniform wages is therefore not crucial to the results.

Regarding overemployment, one alternative is to equalize the incomes of employed and unemployed insiders through better unemployment insurance, but this involves adverse selection and moral hazard problems. Another option is to use cash payments to encourage workers to exit voluntarily, but workers will continue to press to enter the firm if the wage is above the market wage. Employee stock ownership works as an equivalent method that is self-enforcing. Since the wage rate is pushed down to the market wage, workers are willing to leave the firm voluntarily. Although profit sharing also pushes down the wage rate, workers will not leave because they forfeit their profit share upon exit.

A key issue is whether an efficient equity stake will be voluntarily agreed to by both sides. Even if the assumptions necessary to support profit sharing's positive effect on underemployment are correct, profit sharing must be imposed by the government since insiders will oppose it (Weitzman, 1987). In contrast, employee stock ownership allows insiders to benefit from the increased efficiency achieved by employing workers at the point where their marginal revenue product in the firm equals their opportunity cost of working for the firm.[18]

Proposition 2 *If insiders and the firm bargain over the equity stake with zero equity as the disagreement point* (i) *insiders acquire an efficient stake and* (ii) *the equity is traded at a*

[17] Allowing for such bargaining does not change the set S' so the bargaining outcome is unaffected for $e^* = \beta^*$.

[18] Ognedal (1992) finds both sides cannot benefit from equity stakes because the employment level is assumed to be fixed or to be set strategically by the firm at an overly high level, allowing for no efficiency gains to be shared.

discount.

Proof: (i) Let q be the price for $e = 1$, so that eq is the price for share e. Let $\widehat{e}$ be a stake that induces efficient employment. Consider any pair (e', q') where e' does not induce efficient employment. Let L_i', L_o', R', Π' and w' be the bargaining outcomes for $e = e'$. We are interested in an equity price $\widehat{q}$ such that $(\widehat{e}, \widehat{q})$ Pareto dominates (e', q'), implying that (e', q') cannot be the bargaining outcome. With $(\widehat{e}, \widehat{q})$ union utility is $u(\bar{w} + \frac{\widehat{e}}{\bar{L}_i}\Pi^* - \frac{\widehat{e}}{\bar{L}_i}\widehat{q})L_i^* + u(\bar{w} + \frac{\widehat{e}}{\bar{L}_i}\Pi^* - \frac{\widehat{e}}{\bar{L}_i}\widehat{q})(\bar{L}_i - L_i^*)$ or, simplifying, $u(\bar{w} + \frac{\widehat{e}}{\bar{L}_i}(\Pi^* - \widehat{q}))\bar{L}_i$. With (e', q') union utility is $u(w' + \frac{e'}{\bar{L}_i}\Pi' - \frac{e'}{\bar{L}_i}q')L_i' + u(\bar{w} + \frac{e'}{\bar{L}_i}\Pi' - \frac{e'}{\bar{L}_i}q')(\bar{L}_i - L_i')$. By the concavity of insiders' utility functions, the union is strictly better off with $(\widehat{e}, \widehat{q})$ when

$$\bar{w}\bar{L}_i + \widehat{e}(\Pi^* - \widehat{q}) = \left(w' + \frac{e'}{\bar{L}_i}(\Pi' - q')\right)L_i' + \left(\bar{w} + \frac{e'}{\bar{L}_i}(\Pi' - q')\right)(\bar{L}_i - L_i') \tag{9}$$

or, simplifying, $\widehat{q} = \Pi^* - ((w' - \bar{w})L_i' + e'(\Pi' - q'))/\widehat{e}$. Regarding the firm, its payoff is $(1 - \widehat{e})\Pi^* + \widehat{e}\widehat{q}$ with $(\widehat{e}, \widehat{q})$ and $(1-e')\Pi' + e'q'$ with (e', q'), so the firm is no worse off for $(1-\widehat{e})\Pi^* + \widehat{e}\widehat{q} \geq (1 - e')\Pi' + e'q'$. Substituting in $\widehat{q}$ and simplifying, the condition reduces to

$$R^* - \bar{w}L^* \geq R' - w'L_o' - \bar{w}L_i'. \tag{10}$$

which, since $w' \geq \bar{w}$, must hold by the definition of efficient employment. The union is strictly better off with $(\widehat{e}, \widehat{q})$ and the firm is no worse off, so $(\widehat{e}, \widehat{q})$ Pareto dominates (e', q').

(ii) The market will anticipate the sale of equity so the market price is the profit level with optimal employment, Π^*. Suppose that the bargained q is greater than or equal to Π^*. For the union to agree to this purchase its agreement payoff must exceed its disagreement payoff. Letting w^0 and L_i^0 represent the wage and insider employment when $e = 0$, the condition is

$$u(\bar{w} + \frac{\widehat{e}}{\bar{L}_i}\Pi^* - \frac{\widehat{e}}{\bar{L}_i}q)L_i^* + u(\bar{w} + \frac{\widehat{e}}{\bar{L}_i}\Pi^* - \frac{\widehat{e}}{\bar{L}_i}q)(\bar{L}_i - L_i^*) \geq u(w^0)L_i^0 + u(\bar{w})(\bar{L}_i - L_i^0). \tag{11}$$

Substituting and simplifying this is possible for $q \geq \Pi^*$ only if $u(\bar{w}) \geq u(w^0)$. But $w^0 > \bar{w}$ for $\gamma > 0$. ■

This model assumes that workers hold on to their equity stake but stock ownership reduces the bargained wage so workers have an incentive to resell their equity before bargaining over the wage (Grout, 1988). Such an incentive may explain why ESOPs and other employee stock ownership systems generally restrict the ability of employees to resell their equity. Note also that equity stakes are sometimes agreed to as part of a package with wage concessions (Kruse, 1996) so bargaining might be simultaneous rather than sequential.[19] If the equity stake, wage, and employment are all bargained over concurrently and the disagreement point is $(u(\bar{w})\bar{L}_i, 0)$, the solution to the game (S', d) in Proposition 1 is still feasible, implying an efficient outcome is still reached.

4 Conclusion

This paper shows that employee stock ownership can, in theory, solve the principal shortcomings of traditional profit sharing regarding inefficient employment levels. First, it can resolve both underemployment and overemployment. Second, there is a minimum equity stake that leads to employment efficiency rather than a single efficient stake for particular demand conditions. Third, the results do not depend on special restrictions on the bargaining game such as insiders and the firm not being able to bargain over employment levels, or insiders and outsiders having to be paid the same wage. Fourth, it does not require government intervention since both sides have an incentive to reach an agreement.

The success of employee stock ownership depends on one similarity with and three key differences from traditional profit sharing. The similarity is that in a bargaining model income from the equity stake pushes down the wage rate. The first difference is that each insider

[19] In Kovenock and Sparks (1992) concessions arise for a related but distinct reason. The willingness of the company to offer shares to workers is proof of the company's poor outlook, so workers agree to efficiency-enhancing wage concessions.

receives a portion of the firm's profits rather than workers as a whole receiving a share which is then divided. Insiders are therefore more willing to allow new workers to be hired when employment is inefficiently low. The second difference is that workers can retain a right to their equity stake even if they leave the company. This makes workers less opposed to exiting the firm when employment is inefficiently high. The third difference is the adoption of employee stock ownership is determined internally by the firm and workers rather than imposed externally as is necessary under a profit sharing system. The efficient outcome can therefore be reached in a way that benefits both sides.

Because of these difference, the two systems offer substantially different empirical predictions. Rather than unambiguously raising employment, employee stock ownership is expected to shift employment either up or down depending on the initial state of underemployment or overemployment. And rather than reducing employment variability, employee stock ownership should allow firms to change employment more rapidly in the face of changing demand conditions.

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