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The effect of employee stock ownership on wage and employment bargaining

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When workers can bargain over wages and employment, standard insider–outsider models predict underemployment if the number of insiders is small and overemployment if the number of insiders is large. For instance, a union will restrict employment growth in an expanding firm and oppose layoffs in a contracting firm. This paper shows that employee stock ownership can solve both problems and that the necessary ownership share is often relatively small. The results are compared with related results in the literatures on profit-sharing and labor-managed firms. *Journal of Comparative Economics* **33** (3) (2005) 565–583. Business Economics and Public Policy, Kelley School of Business, Indiana University, 1309 East Tenth Street, Room 451, Bloomington, IN 47405, USA.

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1. Introduction

Unions have long been criticized for having seemingly contradictory effects on employment. On the one hand, they are accused of restricting employment in order to maintain high wages. On the other hand, they are criticized for featherbedding and other measures

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to maintain artificially high employment. These conflicting perspectives can be reconciled by insider–outsider models that assume the union to be concerned only with the utility of a limited number of insiders (Carruth and Oswald, 1987). When the number of insiders is small relative to the demand for labor, e.g., in a growing industry, underemployment results because 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, e.g., in a declining industry or in a restructuring state-owned enterprise, overemployment results as the union acts to ensure jobs for insiders (McDonald and Solow, 1981).

This paper shows that allowing employees to own equity stakes individually in their company, as occurs under standard forms of employee stock ownership, can solve both the underemployment and the overemployment problems. When insiders own equity, the bargained wage falls because dividends and capital gains displace wage income. When the number of insiders is small and underemployment is a problem, the lower wage makes the firm want to hire more workers. Since insiders also benefit from extra employment that contributes to profits, both sides favor expanding employment. In contrast, when the number of insiders is large and overemployment is a problem, the lower wage makes workers less reluctant to exit the firm. Since exiting workers do not forfeit their equity stakes, workers can benefit from increased efficiency due to downsizing.

Employee stock ownership is a particular form of profit sharing. Hence, these results are related closely to the influential argument by Weitzman (1984, 1985, 1987) that profit sharing can increase employment by lowering the bargained wage. Considering a model in which workers as a group receive a fixed profit share to be divided among them, Weitzman (1987) shows that profit sharing pushes down the wage in union–firm bargaining, with the implication that firms will hire more workers. Despite the appeal of this argument,[1] the empirical evidence remains inconclusive[2] and the theory depends on the assumption that workers bargain over only the wage. Since hiring more workers dilutes the fraction of each worker's profit share, current employees are hurt by additional employment. Consequently, if bargaining over both employment and the wage is allowed, profit sharing has no impact on employment (Weitzman, 1987).

Employee stock ownership differs from Weitzman's model of profit sharing in two essential ways. First, insiders own equity individually rather than workers as a group having claim to a profit share that they divide among themselves. Because additional workers do not dilute each insider's share of profits, insiders are more willing to allow new workers to be hired when employment is inefficiently low. Second, 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. Because of these differences, employee stock ownership allows insiders to receive rents from their position that they need not share with new workers or forfeit if they leave the firm. As a result, insiders will agree to changes in employment that increase efficiency and profits.

[1] Weitzman (1984), which emphasizes macroeconomic implications, was translated into seven languages, praised in a *New York Times* lead editorial entitled "Best Idea Since Keynes," and featured in academic conferences and symposia (Nordhaus, 1986).

[2] In a survey of eleven studies, Kruse (1998) finds that six have generally supportive results and five have mixed or unfavorable results.

Weitzman (1987) shows that the efficient profit share under group-based profit sharing must be imposed by the government because current workers are hurt by profit sharing. 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. Both problems are avoided with employee stock ownership. The firm and the workers benefit from the productivity gains of an efficient stake because workers can bargain to obtain the equity at a discount. Therefore, the efficient outcome can be achieved in a mutually beneficial way. Moreover, a knife-edge optimal stake is not necessary because a minimum stake that induces efficient employment exists and higher stakes lead to the same efficient outcome.

These results on union–firm bargaining have close parallels in the literature on labor-managed firms and cooperatives. Regarding underemployment, the reluctance of unionized workers to share their rents with new members corresponds to the classic theory that workers in labor-managed firms do not want to share their profits with additional employees (Ward, 1958). Regarding overemployment, the idea that unions will sometimes featherbed to protect employment corresponds to the problem that worker-managers may be reluctant to fire redundant members of the cooperative unless they are allowed to retain rights to their profit share (Bonin, 1984). As employee stock ownership can solve inefficient employment choices by unions, markets for membership rights would solve these problems for labor-managed firms, as Meade (1972) and Dow (1986, 1996) demonstrate. If workers are required to buy a stake in the labor-managed firm to get a job, existing members would not be averse to expanding employment. If workers can sell their stake, they would be willing to leave if the demand for labor decreased permanently.

Law (1977) and Spinnewyn and Svejnar (1990) demonstrate the close connection between the two systems; a labor-managed firm corresponds to the limiting case of union–firm bargaining in which the union has all the bargaining power and can force any combination of wages and employment on the firm. We find that the equity stake needed to ensure an efficient outcome is increasing in the union's bargaining power and that employees need to own the entire firm in order to attain efficient employment in the limiting case where the union has all the bargaining power. This result is consistent with markets for membership rights promoting efficient employment in labor-managed firms. The fact that only a partial ownership share is typically sufficient in union–firm bargaining rather than full ownership as in a labor-managed firm has several important implications. First, the capital risk to workers is reduced. Second, the workers can own normal equity in the firm, which is often tradeable on equity markets, rather than hold special membership rights, the markets for which are likely to be quite thin. Third, because workers do not own the entire firm, control of the firm is not vested in the workforce. While this situation eliminates any potential gain from worker democracy, it also limits the costs of worker control.

A key issue in the theory of labor-managed firms is whether the firm will gradually convert to a traditional, capitalist firm as more and more wage workers are hired and the number of worker-owners declines, as Ben-Ner (1984) develops. To investigate the related question for employee stock ownership, we consider a two-period model in which the firm and the insiders in the first period jointly decide whether to sell equity to new insiders in the second period. We find that existing insiders and the firm always benefit from ensuring that new insiders acquire equity so that the system is stable. However, new insiders receive

equity at a price that is just sufficient to induce them to buy the stock. Hence, all the profits from any efficiency gain due to employee stock ownership are realized by the firm and the existing insiders.

Regarding empirical predictions, studies of profit sharing have not always distinguished between traditional group-based profit sharing and the increasingly standard system of employees owning equity stakes individually. This distinction is important not only because of the weak theoretical basis for group-based 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 initial employment is inefficiently low, employee stock ownership is predicted to increase employment. However, when the number of insiders is large and initial employment is inefficiently high, the opposite effect is predicted. Therefore, a properly specified test of employee stock ownership must be conditioned on the initial state of underemployment or overemployment.

Distinguishing between group-based profit sharing and employee stock ownership is necessary to understand the effect of profit sharing on employment variability. Based on the idea that profit sharing increases employment, Weitzman (1984, 1985) argues that firms with profit sharing should have lower employment variability because they will reduce employment less when demand falls. Regardless of its merits for traditional profit sharing,[3] the argument 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 so that it increases rather than decreases employment variability.

These results offer some insight into the popularity of several common forms of employee stock ownership in the United States. Employee Stock Ownership Plans (ESOPs) allow workers to accumulate equity that is held by a trustee until the worker retires or otherwise leaves the company. In addition, 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. Finally, 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 US, about 8.8 million employees participate in ESOPs, about 10 million employees have stock options in their firms, about 11 million employees have 401(k) plans invested primarily in their own firm's stock, and about 15.7 million employees participate in ESPPs.[4]

[3] The theoretical argument also depends on the assumption that the firm determines employment unilaterally. In a survey of eleven studies, some of which also included tests of employment generation, Kruse (1998) finds that five support greater employment stability under profit sharing and six 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.

[4] These numbers are from a July 2004 update of "A Statistical Profile of Employee Ownership" compiled by the National Center for Employee Ownership. Note that employees may participate in more than one plan.

The negative impact of employee stock ownership on the bargained wage has several implications for these plans. First, workers have a strong incentive to sell their stock so as to raise the bargained wage. This incentive, in addition to the incentive to diversify (Meulbroek, 2002), may explain why ESOPs and others plans typically limit the ability of workers to sell their stock, often until retirement. Second, the diversification problem is not as strong as it might appear. As long as workers earn rents in the form of above-market wages, their future incomes are tied closely to the performance of the firm. By pushing down wages to the market level and shifting the rents into the returns to equity, employee stock ownership reduces this income risk and transfers it into asset risk. Hence, any increase in total risk is less than is usually assumed. Third, recent debates on how financial statements should account for transfers of stocks and stock options to employees typically assume that existing shareholders are hurt by the transfers. However, even without any efficiency gain, this negative effect may not occur if wages fall as a result.

The organization of the paper is as follows. In Section 2, we investigate underemployment and overemployment in an insider–outsider model and highlight the difficulties of using group-based profit sharing as a solution to underemployment. Section 3 then demonstrates that employee stock ownership can resolve both underemployment and overemployment. The final section concludes with implications for empirical work.

2. Underemployment and overemployment

Insider–outsider models distinguish between workers who are represented in the union utility, i.e., the insiders, and people whose welfare is of no concern to the union, i.e., the outsiders.[5] Following Carruth and Oswald (1987),[6] we assume there are a total of $\bar{L}_i$ inside workers having identical utility functions $u(\cdot)$, where $u' > 0$ and $u'' < 0$. We designate employment of inside workers by $L_i \in [0, \bar{L}_i]$ and that of outside workers by $L_o \geqslant 0$. The union utility function is defined as $U = u(w)L_i + u(\overline{w})(\bar{L}_i - L_i)$, where w is the bargained wage and $\overline{w}$ is the market wage. Firm profits are $\Pi = R(L) - wL$, where $L = L_i + L_o$ and firm revenue $R(L)$ satisfies $R_{LL} < 0$, $R_L(0) > \overline{w}$, $R(0) = 0$, and $R_L(L^*) = \overline{w}$ for some unique $L^* > 0$. We assume that the firm is risk neutral and aims to maximize profits. If bargaining ends in disagreement, all workers receive the market wage $\overline{w}$ and, for simplicity, the firm receives zero profits.

To model bargaining between the firm and union, we follow the literature in using the generalized Nash bargaining solution in which union and firm bargaining powers may vary. We let $\gamma \in (0, 1)$ represent union bargaining power and $(1 - \gamma)$ represent firm bargaining

[5] Throughout the paper, we assume that 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 similar to those resulting from union bargaining. Hildreth and Oswald (1997) find that workers in profitable firms enjoy a wage premium whether or not they are unionized.

[6] In Lindbeck and Snower (1988), insiders harass or fail to cooperate with outsiders, which lowers the productivity of outsiders and causes underemployment even without collective bargaining. Our results on underemployment apply also to the Lindbeck and Snower model, but our results on overemployment do not because this outcome is not relevant to their model.

power to capture the full range of possibilities, including one in which either the firm or union is strong enough to effectively set wages and employment unilaterally.[7] The generalized Nash bargaining solution can be justified axiomatically as a way of capturing different bargaining skills, or factors such as union solidarity, if Nash's symmetry assumption is dropped (Svejnar, 1986), or as the equilibrium outcome of an alternating offers game, as Binmore et al. (1986) demonstrate. In the latter case, bargaining powers capture asymmetries in the players' discount rates or in the intervals between offers.

In this model without employee stock ownership, the bargaining solution is given by:

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

subject to $L_i \leqslant \bar{L}_i$ and $L_o \geqslant 0$.[8] Maximizing (1) with respect to the wage gives:

$$w = \frac{R}{L} - \frac{1-\gamma}{\gamma}\frac{u(w) - u(\overline{w})}{u'(w)}. \tag{2}$$

The wage received by workers is higher as γ increases and, in the limit, workers divide up firm revenue, $w = R/L$, i.e., the firm is a labor-managed firm. Regarding employment, the union always wants an insider to be hired first while the firm is indifferent to employing an insider or an outsider. Hence, $L_o = 0$ if $L_i \leqslant \bar{L}_i$. From the Kuhn–Tucker conditions for maximizing with respect to L_i and L_o, we have three cases. In the first case, all insiders are employed, i.e, $L_i = \bar{L}_i$, and some outsiders are employed, i.e., $L_o > 0$, implying that $R_L = w$. In the second case, all insiders are employed and no outsiders are employed, i.e., $L_o = 0$, implying $R_L < w$ and $R_L > w/(1-\gamma) - \gamma/(1-\gamma)R/L$. In the third case, some insiders are unemployed, i.e., $L_i < \bar{L}_i$, and no outsiders are employed, implying $R_L = w/(1-\gamma) - \gamma/(1-\gamma)R/L$.[9] Only for the knife-edge case in which $\bar{L}_i = L^*$ is the outcome efficient.[10]

Oswald (1985, 1993) considers the first case, Carruth and Oswald (1987) consider all three cases with a focus on the second, Spinnewyn and Svejnar (1990) consider all three cases, and McDonald and Solow (1981) consider the third case. Figure 1 depicts employment and income levels in the three cases for equal bargaining power, i.e., $\gamma = 1/2$, the quadratic revenue function $R = 100L - L^2$, an outside wage $\overline{w}$ normalized to zero, and a utility function given by $u(w) = w^{1/2}$ for each insider. The line segment AB represents the possible set of bargaining outcomes with the exact outcome depending on the number of insiders. In the first case, the number of insiders is less than L_A so that insiders agree to

[7] The firm and union are not bargaining directly over a lump sum of money but rather over both wages and employment. Therefore, this bargaining problem is not equivalent to a simple division of rents between the firm and union.

[8] The conditions on R and u are insufficient to ensure that the feasible set is convex. Following Nash (1950), the set can be convexified through randomization.

[9] If $\gamma = 1/2$, this case reduces to the familiar result in McDonald and Solow (1981) that, along the contract curve, the wage or the wage plus the profit share falls exactly in between the marginal revenue and average revenue of labor, i.e., $y = \frac{1}{2}R_L + \frac{1}{2}R/L$.

[10] However, the tradition in the literature is to refer to any Nash bargaining solution as an efficient bargain since this outcome is on the Pareto-efficient contract curve using a union utility function that implicitly assumes the absence of side payments or other mechanisms to reallocate payoffs, such as equity stakes.

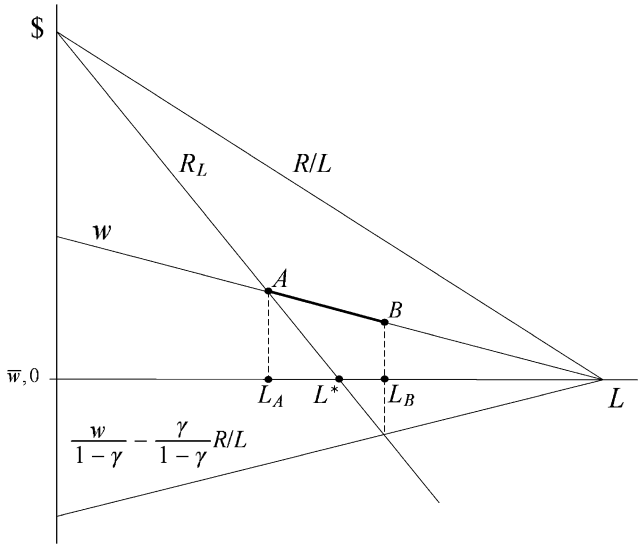

Fig. 1. Underemployment and overemployment.

hire outsiders up to a total of L_A workers. Although the extra workers reduce average productivity and push worker income down, the revenue gains are large enough that the firm can bargain successfully for the extra employment. Employment is still inefficiently low because the marginal revenue of labor exceeds the outside wage equal to zero at employment level L_A. The third case characterizes 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. However, even this level of employment is inefficient because the marginal revenue of labor is negative at L_B. Since risk-averse workers wish to avoid unemployment, the union can bargain successfully for some excess employment of insiders.[11] The second case is an intermediate situation in which the firm does not hire any outsider but does hire all of the insiders. Therefore, the employment level is 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 profit-maximizing firm would prefer to reduce employment but is unable to because of the union.

Before analyzing the impact of employee stock ownership, we consider first a bargaining game in which workers receive a share, denoted s, of firm profits to divide among themselves. Each worker receives a payoff of $y = w + (s/L)\Pi$ and the firm receives $(1-s)\Pi$. The bargaining solution is given by[12]:

$$\arg \max_{w, L_i, L_o} \left(u\left(w + \frac{s}{L}\Pi\right)L_i + u(\overline{w})\left(\bar{L}_i - L_i\right) - u(\overline{w})\bar{L}_i\right)^{\gamma} \left((1-s)\Pi\right)^{1-\gamma}, \qquad (3)$$

[11] If workers are risk neutral, no gains accrue to equalizing incomes across workers so overemployment is not a problem.

[12] For a given profit share, the bargaining problem is unaffected by whether the firm maximizes Π or $(1-s)\Pi$.

subject to $L_i \leqslant \bar{L}_i$ and $L_o \geqslant 0$. Maximizing with respect to w determines the bargained wage as:

$$w = \frac{R}{L} - \frac{1-\gamma}{\gamma}\frac{u(y)-u(\overline{w})}{(1-s)u'(y)}, \tag{4}$$

which implies that the income of employed workers, $y = w + (s/L)\Pi$, satisfies:

$$y = \frac{R}{L} - \frac{1-\gamma}{\gamma}\frac{u(y)-u(\overline{w})}{u'(y)}. \tag{5}$$

Since $\mathrm{d}w/\mathrm{d}s < 0$ from Eq. (4), Weitzman concludes that profit sharing would increase employment if the firm could choose the employment level unilaterally and hire labor up to the point at which $R_L = w$. However, Weitzman finds that this result is not robust to allowing workers to bargain over employment. Although higher employment can increase efficiency and profits, current workers must share the profits with more workers. Weitzman finds that the net effect is negative and concludes that workers would oppose any extra hiring. In fact, when bargaining over the employment level is allowed, profit sharing has no effect. Comparing Eqs. (5) and (2), which have the same form, each worker's income with profit sharing is the same as the wage without profit sharing for any given employment level. Similarly, derivation of the Kuhn–Tucker conditions for maximizing the Nash product with respect to employment indicates that the conditions depend on y in the same way as the conditions derived without profit sharing depended on w. Therefore, the same bargaining solution having the same employment level and the same income levels for workers, is reached with or without profit sharing.[13,14]

In addition to the assumption of no bargaining over employment, the profit-sharing results also require other restrictions on the bargaining game that might not always be appropriate. For example, if the parties can bargain over both the profit share and the wage, the bargaining outcome reverts to the same inefficient solution that arises in the case of no profit sharing, as Anderson and Devereux (1989) show. In addition, the model requires that both insiders and outsiders are paid a uniform wage so that insiders cannot bargain for a higher, separate wage. However, this assumption is not always defensible. As long as insiders do not put their jobs at too much risk from the higher wage, insiders prefer a two-tier wage system to profit sharing and prefer a two-tier wage system to uniform wages even if profit sharing has been imposed.

[13] Anderson and Devereux (1989) extend Weitzman's irrelevance result for the underemployment case to the overemployment case. However, if profit sharing increases per worker productivity, higher productivity could induce higher employment indirectly, as Wadhwani and Wall (1990), Kruse (1992), and Cahuc and Dormont (1997) demonstrate.

[14] Weitzman justifies the assumption of no employment bargaining based on the argument by Oswald (1985) that the union will cede the employment decision to the firm when the number of insiders is small as in the first case. If $s = 0$, $R_L = w$ in this case. Hence, insiders do not need to bargain over employment since the same employment level is chosen by the firm unilaterally. However, this argument does not extend to the case in which $s > 0$ because employment bargaining implies $R_L = w + (s/L)\Pi$, which results in a lower employment level than if the firm were to act unilaterally.

3. Employee stock ownership

Employee stock ownership differs from traditional profit sharing in two essential ways. First, insiders own equity individually rather than having claim to a profit share as a group. Second, insiders can retain their equity stakes even if they leave the firm. We will show that employee stock ownership can resolve the underemployment problem due to the first difference and the overemployment problem because of the second difference. Moreover, we find that the efficient outcome can be reached in a mutually beneficial way.

We consider a two-stage game in which the firm and the union bargain first over the price and quantity of the equity given to insiders, and then over the wage and employment. We solve this game backwards by first considering the wage and employment bargaining problem for any given amount of equity held by insiders. However, even if all of the parameters are bargained over simultaneously, i.e. the union and firm bargain over a package that includes employee stock ownership, wage cuts, and employment adjustments, the same efficient solution is achieved.

Starting with the wage and employment bargaining problem, we assume that all insiders have identical equity stakes summing to a fraction e of outstanding equity. The union's utility in the agreement outcome is given by $U = u(w + (e/\bar{L}_i)\Pi)L_i + u(\overline{w} + (e/\bar{L}_i)\Pi)(\bar{L}_i - L_i)$. The term denoted s/L in the profit sharing model has been changed to $e/\bar{L}_i$ in this specification to incorporate the first difference between employee stock ownership and profit sharing. The second difference is reflected by unemployed insiders, i.e., $\bar{L}_i - L_i$, also receiving an equity stake. Continuing the assumption that firm profits are zero in disagreement, the bargaining solution is given by[15]:

$$\arg \max_{w,L_i,L_o} \left(u\left(w + \frac{e}{\bar{L}_i}\Pi\right)L_i + u\left(\overline{w} + \frac{e}{\bar{L}_i}\Pi\right)\left(\bar{L}_i - L_i\right) - u(\overline{w})\bar{L}_i\right)^{\gamma} \times \left((1-e)\Pi\right)^{1-\gamma}, \tag{6}$$

subject to $L_i \leqslant \bar{L}_i$, $L_o \geqslant 0$ and $w \geqslant \overline{w}$, respectively. We add the last restriction because outsiders will never work for less than $\overline{w}$ and, if the profit share does not depend on continued employment, neither will insiders.

When the equity stake is zero, the three cases identified in the previous section apply. Underemployment occurs in the first case and also in the second case if $R_L(\bar{L}_i) > \overline{w}$. Overemployment occurs in the third case and also in the second case if $R_L(\bar{L}_i) < \overline{w}$. The following proposition indicates that a sufficiently large equity stake solves both inefficiencies. Deriving the efficient stake is problematic because the feasible set of payoffs need not be convex when the number of insiders is small as in the first case.[16] As Nash (1950) shows, randomization convexifies the feasible set of payoffs in an expected utility framework. However, differentiating (6) will not necessarily lead to the correct solution. The

[15] As in the profit sharing case, the following formulation assumes that the firm is interested only in maximizing the profits of non-worker owners, i.e, $(1-e)\Pi$. However, the bargaining solution is the same even if the firm maximizes Π.

[16] The problem of nonconvexities is raised by Alexander and Ledermann (1996) who show the feasible 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.

following proof shows that the non-convexity issue, with the resulting need to randomize over outcomes, can be avoided by considering the solution to a convex superset of the feasible set $S(e)$. First, we create an efficient convex superset S' that is independent of e and corresponds to the situation in which employment is fixed at $R_L(L) = \overline{w}$ and the resulting surplus is divided between the union and firm in any manner. Then, we show the existence of an e^* such that the solution to the bargaining game with S' is in $S(e^*)$, which implies that it is also the solution to the game with $S(e^*)$. Finally, we show that the solution is efficient for any higher e.

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

Proof. In Appendix A.

One might think that employees must own the firm completely or at least be majority owners to agree to efficient employment levels. However, the firm already has some bargaining power so it is only necessary to strengthen the firm's position by giving workers a stake in a more efficient outcome. Solving for e^* following the method outlined in the proof, we derive:

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

where $\Pi^* = R(L^*) - \overline{w}L^*$ and $y^* = \overline{w} + e^*\Pi^*$. Totally differentiating (7), we obtain $\mathrm{d}e^*/\mathrm{d}\gamma > 0$ so that the equity stake ensuring efficiency is increasing in union bargaining power and decreasing in firm bargaining power. In the limit, as γ approaches one and the union has complete bargaining power, e^* also approaches one. This is consistent with the result that a labor-managed firm with tradeable stock held entirely by the insiders can achieve efficient employment levels, as Meade (1972), Dow (1986, 1996) assert.

Depending on the union's bargaining power, the equity stake necessary to gain sufficient concessions need not be very large. Continuing the example depicted in Fig. 1 in which $\gamma = 1/2$ and the optimal employment level is 50, let the number of insiders be 25. Then, Eq. (7) implies that efficient employment is guaranteed for $e^* = 1/3$. The feasible sets $S(e^*)$ and S' and the Nash level set for the solution in this example are those drawn in Fig. 2. Due to the equity stake, higher firm payoffs also lead to higher union payoffs. This alignment of interests is characterized by the pointed shape of the feasible 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 of higher union payoffs on firm payoffs is not monotonically decreasing. The problem of potential multiple solutions due to this nonconvexity is avoided by using the convex superset S'.

While e^* guarantees efficiency, a smaller stake might be adequate to attain efficient employment when $\bar{L}_i < L^*$. Differentiating Eq. (6) with respect to w when $\bar{L}_i < L^*$ yields $w = \overline{w}$ if

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

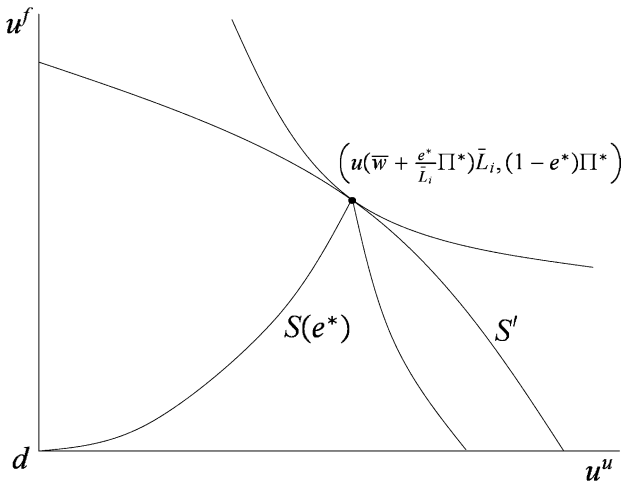

Fig. 2. Bargaining with efficient equity stake given by $e^* = 1/3$.

or, in our example, if $e = 1/6$. Due to the nonconvexity this equity stake may not be sufficient to maximize the Nash product, though in our example it is.[17] Although equity stakes below e^* might promote sufficient employment, equity stakes above e^* always lead to efficient employment, which is an important result because profit shares above the optimum lead to excess employment. With higher equity stakes, the peak of $S(e)$ shifts along to the right, but remains along the frontier of S' so that employment is efficient. The bargaining solution is at the efficient peak because any other point implies a lower Nash product.

With an efficient equity stake, the bargained wage equals the market wage,[18] so that insiders are indifferent to the employment level and the bargained outcome is the same employment choice that 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 all possible labor demand curves, the firm will be able to adjust rapidly to changing demand. Rather than reducing employment variability, equity stakes allow the firm to adjust employment efficiently to changing conditions.

An alternative to employee stock ownership that can also solve the underemployment problem is a two-tier wage system in which outsiders are paid the market wage. Employee stock ownership resembles this system because insiders receive a higher income even though all workers are paid the same wage. Since wages are equal, the employer has no incentive to behave opportunistically and replace higher-wage insiders with lower-wage

[17] Using the same example but setting worker bargaining power at $\gamma = 7/8$, the equity stake that guarantees efficiency is $e^* = 7/9$ even though a lower stake of $e = 7/18$ would appear to yield an efficient outcome from (8). This is not the case due to a nonconvexity.

[18] In an efficiency-wage model, above-market wages increase productivity as Levine (1989) demonstrates. However, some of the productivity benefits from higher wages in an efficiency-wage model may accrue from workers owning equity in our model.

new workers, which is a shortcoming of two-tier wage structures. If insiders own an efficient equity stake and decide to switch from bargaining over a uniform wage for all workers to bargaining over a higher wage for themselves only, insiders will continue to receive the market wage as the efficient bargaining outcome.[19] Contrary to group-based profit sharing, the assumption of uniform wages is not crucial to our results.

Regarding overemployment, one alternative solution is to equalize the incomes of employed and unemployed insiders through unemployment insurance with its accompanying adverse selection and moral hazard problems. Another option is to use cash payments to encourage workers to exit voluntarily, but workers will continue to try to enter the firm if the wage is maintained above the market alternative. Employee stock ownership works is a self-enforcing solution. Since the bargained wage is pushed down to the market wage, workers are willing to leave the firm voluntarily. Although profit sharing also pushes down the bargained wage, workers do not leave the firm because they forfeit their profit share upon exit.

A key to the implementation of an efficient equity stake is voluntary agreement by both sides. Even if the assumptions necessary to support the positive effect on underemployment from profit sharing are correct, this solution must be imposed by the government because of insiders' opposition, as Weitzman (1987) demonstrates. In contrast, employee stock ownership allows insiders to benefit from the increased efficiency achieved by employing workers to the point at which their marginal revenue product in the firm equals their opportunity cost of working for the firm.[20]

To see this, we now consider the first stage of the game in which the firm and the union bargain over the equity stake and the equity price. Let q be the price if e is normalized to one, so that eq is the amount paid for share e. We assume that the insiders receive zero equity in a disagreement situation and that the game then proceeds to the second stage. Since the equity price can act as a side payment in this game, the two parties should be able to reach an efficient agreement that is mutually beneficial. This intuition is confirmed by the following proposition. Since the wage is decreasing in e, insiders must be compensated for lower wages if they are to agree to hold equity. Therefore, the bargained equity price must be below the market price.[21]

Proposition 2. *If insiders and the firm bargain over the equity stake and zero equity is the disagreement point, insiders acquire an efficient equity stake, i.e.,* $e \geqslant e^*$*, and equity is traded at a discount, i.e.,* $q < \Pi^*$.

Proof. In Appendix A.

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

[20] Ognedal (1992) finds that 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, thereby precluding the existence of any efficiency gain to be shared.

[21] The bargained equity price is lower than the market equity price of $q = \Pi^*$ if the firm's value is based on its new more efficient employment level. Hence, insiders receive a claim on firm profits for less than the value of the actual profits. However, the bargained equity price may not be lower than the market equity price if the firm's value is based on the original inefficient employment level.

This two-stage game assumes that workers hold their equity stake after acquiring it. However, workers have an incentive to diversify their assets so they should prefer to sell this equity. Moreover, since stock ownership reduces the bargained wage, workers have an additional incentive to sell their equity before the wage bargaining stage, as Grout (1988) and Harbaugh (2001) demonstrate.[22] These incentives may explain why ESOPs and other employee stock ownership systems restrict the ability of employees to sell their equity stakes for long periods, often until retirement. The two-stage structure implies that wage and employment bargaining happen after the equity stake is determined. In practice, equity stakes are sometimes agreed to as part of a package of wage concessions, as Kruse (1996) discusses.[23] To allow for this possibility, let the equity stake, wage, and employment be bargained over concurrently and let the disagreement point of $(u(\overline{w})\bar{L}_i, 0)$ be as before. Since the solution to the game (S', d) in Proposition 1 is still feasible, an efficient outcome is achieved.

To this point, we have examined a static model in which the number of insiders is fixed. A key consideration in modeling union behavior is the way in which the number of insiders changes over time. The standard assumption in the literature is that union control is determined by seniority so that new workers become insiders after a long enough period of membership. From our perspective, the relevant issue is whether new insiders also acquire equity so that the employee stock ownership system is maintained. To investigate this point, we examine a simple two-period extension of our previous model. In the first period, the existing $\bar{L}_{i_1}$ insiders retire at the end of the period and bequeath their positions to a given number of outsiders.[24] In the second period, the new $\bar{L}_{i_2}$ insiders then bargain over wages and employment with the firm. Second-period bargaining is identical to that analyzed in Proposition 1. The remaining issue is whether the second-period insiders acquire sufficient equity, denoted e_2, to ensure efficient employment and at what price, denoted q_2, they purchase this equity.

We assume that the first-period insiders and the firm determine e_2 and q_2. The firm favors offering second-period insiders an efficient share to induce profit-maximization by reducing the wage and ensuring efficient employment. In the second period, first-period insiders no longer receive a wage so their interests are aligned fully with those of the firm. Therefore, we expect the firm and the first-period insiders to agree on an arrangement by which new workers must acquire an efficient equity stake to become employees. Since new employees face a competitive job market, their power is limited. As long as the equity price makes them no worse off than they would be with a market wage but no equity stake, such a proposal is acceptable to them. The proof of the following proposition confirms this

[22] Even if wage and equity stake bargaining occur simultaneously, additional rounds of wage bargaining will take place once the contract expires, so workers still can benefit from selling their equity.

[23] In Kovenock and Sparks (1990), concessions arise for a different reason. The willingness of the company to offer shares to workers establishes the company's poor prospects, inducing workers to agree to efficiency-enhancing wage concessions.

[24] We do not model formally the transition from outsider to insider. In the simplest case, $\bar{L}_{i_2}$ would represent the number of outside workers who are employed in the first period, but in practice the process could be more complicated. Since we find that the new second-period insiders always purchase the efficient equity stake at the market price, their exact number is unimportant.

intuition. Existing shareholders, including first-period insiders, are assumed to sell equity in proportion to their existing equity. If shareholders were to compete on price in selling their equity or if the firm were to issue new equity, the proof would be slightly different but the main result would still hold. The proof demonstrates that the interests of the two sides are aligned fully and that the best feasible outcome for each side is to have the second-period insiders acquire the efficient stake at no price discount.[25]

Proposition 3. *If first-period insiders and the firm determine the equity stake and the purchase price for second-period insiders, the equity stake acquired by second-period insiders is efficient, i.e.,* $e_2 \geqslant e^*$*, and equity is traded at the market rate, i.e.,* $q_2 = \Pi^*$.

Proof. In Appendix A.

This result indicates that employee stock ownership can be a stable system even though the efficiency gains are captured entirely by the first generation of insiders and the firm.[26] This result is similar to the situation in which tradeable ownership rights make labor-managed firms stable even though the financial gains are concentrated on the initial membership, as Meade (1972) discusses. In theory, new insiders do not receive discounted shares but, in practice, they are likely to receive preferential treatment. If profits are uncertain, risk-averse workers will require a discount to make them willing to accept stock ownership. Furthermore, workers are likely to gain influence within the union and to acquire equity gradually rather than immediately. Therefore, new insiders may have some bargaining power with which to obtain equity at a discount.

4. Conclusion

This paper demonstrates that employee stock ownership can, in theory, induce efficient employment outcomes from union–firm bargaining. First, employee stock ownership can resolve both underemployment and overemployment inefficiencies. Second, a minimum equity stake ensures employment efficiency for all demand conditions rather than requiring a different profit share for different demand conditions. Third, the results do not depend on special restrictions on the bargaining game, e.g. restricting insiders and the firm from bargaining over employment levels or requiring that insiders and outsiders be paid the same wage. Fourth, implementing an employee stock ownership plan does not require government intervention because both sides have an incentive to reach a mutually beneficial agreement.

[25] To extend the model to more periods is straightforward. With three periods, second-period insiders have an incentive to ensure that third-period insiders have equity so that the value of their own equity will not fall below their purchase price.

[26] The proposition takes equity in the first period as given. Bargaining over the equity in the first period follows the procedure discussed in Proposition 2 except that the value of the stock reflects profits in both periods. Since first-period insiders do not suffer from lower wages in the second period but do gain from higher profits, their incentive to accept employee stock ownership is strengthened.

Empirical studies attempting to determine whether group-based profit sharing raises employment and reduces employment variability are not conclusive. Because of the differences between group-based profit sharing and employee stock ownership, this paper shows that the two plans offer substantially different empirical predictions. First, 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. Second, rather than reducing employment variability, employee stock ownership allows firms to change employment more rapidly in the face of changing demand conditions. Hence, empirical work evaluating the impact of employee stock ownership requires properly specified tests that can capture these different theoretical predictions.

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Appendix A

Proof of Proposition 1. The feasible set for a given $e \in [0,1)$ is $S(e) = \{(u^u, u^f) \in R^2 \mid u^u = u(w + (e/\bar{L}_i)\Pi)L_i + u(\overline{w} + (e/\bar{L}_i)\Pi)(\bar{L}_i - L_i),\ u^f = (1-e)\Pi,$ for $0 \leqslant L_i \leqslant \bar{L}_i,\ L_o \geqslant 0$, and $w \geqslant \overline{w}\}$ and the disagreement point is $d = (u(\overline{w})\bar{L}_i, 0)$. Even with free disposal in utility the feasible set need not be convex.[27] Hence, we construct another set S' which is convex and show that $S(e) \subset S'$ for all $e \in [0,1)$. Then we show that the solution to the game (S', d) involves efficient employment and is in $S(e^*)$ for some $e^* \in [0,1)$, implying that it is also the solution to the game $(S(e^*), d)$ due to Nash's axiom of the Independence of Irrelevant Alternatives. Following a similar sequence of steps, we show that employment is still efficient for $e' \in [e^*, 1)$.

First, consider the set $S' = \{(u^u, u^f) \in R^2 \mid u^u \leqslant u(\overline{w} + (\beta/\bar{L}_i)\Pi^*)\bar{L}_i,\ u^f \leqslant (1-\beta)\Pi^*,$ for $0 \leqslant \beta \leqslant 1\}$ where $\Pi^* = R(L^*) - \overline{w}L^*$. Since $u'' < 0$, this set is convex.

Now, suppose instead that $S(e)$is not a subset of S'. Free disposal in S' ensures the existence of 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 $x^f \geqslant x^{f'}$ or (b) $x^{u'} \geqslant x^{u'}$ and $x^{f'} > x^{f'}$. By the concavity of the utility function, $x^u > x^{u'}$ implies $(w + (e/\bar{L}_i)\Pi)L_i + (\overline{w} + (e/\bar{L}_i)\Pi)(\bar{L}_i - L_i) > (\overline{w} + (e/\bar{L}_i)\Pi^*)\bar{L}_i$ and the comparable relation holds for $x^u \geqslant x^{u'}$. Therefore, both (a) and (b) imply that:

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

[27] $S(e)$ is defined without free disposal to facilitate the graphical representation in Fig. 2.

or, after simplifying, $R - \overline{w}L_i - wL_o > R(L^*) - \overline{w}L^*$. Since $w \geqslant \overline{w}$ and $R(L^*) - \overline{w}L^*$ maximizes profits for $w = \overline{w}$, this inequality cannot hold.

The bargaining problem for the game (S', d) is given by:

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

The maximizing value of β, denoted β^*, is in $(0, 1)$ because the disagreement point is within the interior of S' and $\beta \leqslant 0$ implies a union payoff no greater than its disagreement payoff while $\beta \geqslant 1$ implies a firm payoff no greater than its disagreement payoff. To confirm that the solution $(u(\overline{w} + (\beta^*/\bar{L}_i)\Pi^*)\bar{L}_i, (1-\beta^*)\Pi^*)$ to the game (S', d) is in $S(e^*)$ for $e^* = \beta^*$, set $w = \overline{w}$ and $L_i + L_o = L^*$.

Now consider bargaining games for $e' > e^*$. Define $S'(e') = \{(u^u, u^f) \in R^2 \mid u^u \leqslant u(\overline{w} + (\beta/\bar{L}_i)\Pi^*)\bar{L}_i,\ u^f \leqslant (1-\beta)\Pi^*, \text{ for } e' \leqslant \beta \leqslant 1\}$. Note that $S'(e')$ is convex and $S(e') \subset S'(e')$. Also note that $(u(\overline{w} + (e'/\bar{L}_i)\Pi^*)\bar{L}_i, (1-e')\Pi^*)$ Pareto-dominates any point in $S'(e')$ having lower worker utility. Since $e' > e^*$, any point on the efficient frontier yielding higher worker utility involves a higher tradeoff with firm utility than occurs at $S'(e^*)$. Moreover, since the Nash product is homogeneous of degree one, any point on a Nash level set with higher worker utility involves a lower tradeoff with firm utility than occurs at $S'(e^*)$. Hence, the solution to the game $(S'(e'), d)$ for $e' \in [e^*, 1)$ must be $(u(\overline{w} + (e'/\bar{L}_i)\Pi^*)\bar{L}_i, (1-e')\Pi^*)$. To confirm that this solution is in $S(e')$, set $w = \overline{w}$ and $L_i + L_o = L^*$. □

Proof of Proposition 2. Let $\hat{e}$ be a stake that induces efficient employment, the existence of which is ensured by Proposition 1. Consider any pair (e', q') for which 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 $\hat{q}$ such that $(\hat{e}, \hat{q})$ Pareto-dominates (e', q'), implying that (e', q') cannot be the bargaining outcome. With $(\hat{e}, \hat{q})$, union utility is given by $u(\overline{w} + \frac{\hat{e}}{\bar{L}_i}\Pi^* - \frac{\hat{e}}{\bar{L}_i}\hat{q})L_i^* + u(\overline{w} + \frac{\hat{e}}{\bar{L}_i}\Pi^* - \frac{\hat{e}}{\bar{L}_i}\hat{q})(\bar{L}_i - L_i^*)$ or, after simplifying, by $u(\overline{w} + \frac{\hat{e}}{\bar{L}_i}(\Pi^* - \hat{q}))\bar{L}_i$. With (e', q'), union utility is given by $u(w' + \frac{e'}{\bar{L}_i}\Pi' - \frac{e'}{\bar{L}_i}q')L_i' + u(\overline{w} + \frac{e'}{\bar{L}_i}\Pi' - \frac{e'}{\bar{L}_i}q')(\bar{L}_i - L_i')$. For any (e', q'), consider the $(\hat{e}, \hat{q})$ such that:

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

or, after simplifying, $\hat{q} = \Pi^* - ((w' - \overline{w})L_i' + e'(\Pi' - q'))/\hat{e}$. By the concavity of insiders' utility functions, the union is strictly better off with $(\hat{e}, \hat{q})$ than with (e', q'). Regarding the firm, its payoff is $(1-\hat{e})\Pi^* + \hat{e}\hat{q}$ with $(\hat{e}, \hat{q})$, and $(1-e')\Pi' + e'q'$ with (e', q'), so the firm is no worse off with $(\hat{e}, \hat{q})$ if $(1-\hat{e})\Pi^* + \hat{e}\hat{q} \geqslant (1-e')\Pi' + e'q'$. Substituting for $\hat{q}$ and simplifying, the condition reduces to:

$$R^* - \overline{w}L^* \geqslant R' - w'L_o' - \overline{w}L_i'.$$

Since $w' \geqslant \overline{w}$ and $R(L^*) - \overline{w}L^*$ maximizes profits for $w = \overline{w}$, this condition must hold. The union is strictly better off with $(\hat{e}, \hat{q})$ and the firm is no worse off so $(\hat{e}, \hat{q})$ Pareto dominates (e', q').

The market will anticipate the sale of equity so the market price is the profit level characterized by optimal employment and the market wage, denoted by 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 if $e = 0$, the condition is:

$$u\left(\overline{w} + \frac{\hat{e}}{\bar{L}_i}\Pi^* - \frac{\hat{e}}{\bar{L}_i}q\right)L_i^* + u\left(\overline{w} + \frac{\hat{e}}{\bar{L}_i}\Pi^* - \frac{\hat{e}}{\bar{L}_i}q\right)\left(\bar{L}_i - L_i^*\right) \geqslant u\left(w^0\right)L_i^0 + u(\overline{w})\left(\bar{L}_i - L_i^0\right).$$

Substituting and simplifying, this inequality is feasible for $q \geqslant \Pi^*$only if $u(\overline{w}) \geqslant u(w^0)$. However $w^0 > \overline{w}$ for all $\gamma > 0$. □

Proof of Proposition 3. For simplicity, we assume that the revenue function R and the market wage $\overline{w}$ are the same in each period so that e^*, L^*, and Π^* for period 2 are the same as defined previously. We show the proof for the case in which $\bar{L}_{i_2} \leqslant L^*$. The case in which $\bar{L}_{i_2} > L^*$ follows similarly. Let $e_1 > 0$ be the total stake of first-period insiders in the first period. For any given equity stake and price (e_2, q_2), the second-period payoff to a first-period insider is $u(\frac{e_1}{\bar{L}_{i_1}}(1-e_2)\Pi_2 + \frac{e_1}{\bar{L}_{i_1}}e_2q_2)$ and the second-period payoff to the firm is $(1-e_1)(1-e_2)\Pi_2 + (1-e_1)e_2q_2$. Letting $A = (1-e_2)\Pi_2 + e_2q_2$, both payoffs are increasing monotonically in A. Hence, we seek to maximize A subject to the participation constraint for a second-period insider, i.e., $w_2 + \frac{e_2}{\bar{L}_{i_2}}\Pi_2 - \frac{e_2}{\bar{L}_{i_2}}q_2 \geqslant \overline{w}_2$. Rearranging this constraint, we have:

$$q_2 - \Pi_2 \leqslant \frac{\bar{L}_{i_2}}{e_2}(w_2 - \overline{w}). \tag{A.1}$$

We investigate the existence of some (e_2', q_2') satisfying (A.1) that yields a higher A than $(\hat{e}_2, \Pi^*)$ for which e_2' does not induce efficient employment but $\hat{e}_2 \geqslant e^*$ does. Suppose that bargaining between the second-period insiders and the firm generates such an outcome. Adapting previous notation for the bargaining outcomes, we have:

$$\left(1 - e_2'\right)\Pi_2' + e_2'q_2' \geqslant (1 - \hat{e}_2)\Pi^* + \hat{e}_2\Pi^*$$

or $\Pi_2' + e_2'(q_2' - \Pi_2') \geqslant \Pi^*$. Substituting in (A.1), a necessary condition for the existence of (e_2', q_2') is $\Pi_2' + \bar{L}_{i_2}(w_2' - \overline{w}) \geqslant \Pi^*$. Rewriting and simplifying, this condition is equivalent to $R_2' - w_2'L_{o_2}' - \overline{w}\bar{L}_{i_2} \geqslant R(L^*) - \overline{w}L^*$. Since $w_2' \geqslant \overline{w}$, $R(L^*) - \overline{w}L^*$ maximizes profits for wage $\overline{w}$ and $\bar{L}_{i_2} + L_{o_2}' \neq L^*$ by supposition, we arrive at a contradiction. Therefore, an efficient $\hat{e}_2$ must be chosen, implying that $w_2 = \overline{w}$ and $\Pi_2 = \Pi^*$. From (A.1), $q_2 \leqslant \Pi^*$ then follows. Since A is increasing in q_2, the first-period insiders and the firm will set the maximum $q_2 = \Pi^*$. □

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