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Abstract

By the early 1990s, employee stock ownership plans (ESOPs) had become as prevalent in unionized firms as in nonunionized firms. However, little research has been devoted to examining the implications of ESOPs for collective bargaining or, more generally, for cross ownership. In this paper, we extend the signaling model of Cramton and Tracy (1992) to allow partial ownership by the union. We demonstrate that ESOPs create incentives for unions to become weaker bargainers. As a result, the model predicts that ESOPs will lead to a reduction in strike incidence and in the fraction of labor disputes that involve a strike. We examine these predictions using U.S. bargaining data from 1970 to 1995. The data suggest that ESOPs do increase the efficiency of labor negotiations by shifting the composition of disputes away from costly strikes. Consistent with improved bargaining efficiency, we find that the announcement of a union ESOP leads to a 50 percent larger stock market reaction when compared with the announcement of a nonunion ESOP.

Key words: collective bargaining, ESOP, cross ownership, incomplete information, strikes, labor disputes

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The growth in Employee Stock Ownership Plans (ESOPs) in the 1980s fostered a considerable literature into the reasons for their adoption and their impacts on the adopting firm. ESOPs are “qualified pension” plans that were given explicit recognition and tax incentives by the Employee Retirement Incomes Security Act of 1974 (ERISA). In 1980, 4,925 ESOP plans existed covering approximately 5.3 million workers. By 1995, the number of plans had increased to 9,232 with coverage expanding to 7.2 million workers.¹ Beginning in 1988, it is possible to identify ESOPs that are established as a part of a collective bargaining agreement. As of 1991, union ESOPs covered 1.1 million workers, 6.6% of all private sector workers covered by collective bargaining agreements. In the same year, nonunion ESOPs covered 5.5 million workers, 6.4% of all private sector nonunion workers.² That is, by the early 1990s ESOPs had become as prevalent in unionized as in nonunionized firms.

Despite the relative prevalence of ESOPs in unionized firms, there has been very little research on the likely impact of ESOPs on collective bargaining. Ben-Ner and Jun (1996) develop a screening model of bargaining that allows the union to use an ESOP to buy a majority equity stake in the firm. In their model, during a contract negotiation the union’s initial offer to the firm consists of a wage demand and a buyout price. High valuation firms accept the wage demand with no labor dispute, low valuation firms accept the buyout price again with no labor dispute, and labor disputes screen the remaining intermediate firm types. The buyout option lowers the overall dispute rate and dispute duration by providing the union with an additional screening device.

While including ESOPs as a buyout option in a screening model is an interesting theoretical extension, this option is rarely exercised in practice. Figure 1 shows the distribution of ESOP ownership shares in our data of ESOPs at unionized firms. Less than three percent of these ESOPs involve a controlling interest in the firm.³ The ownership share for the typical union ESOP is substantially below 50%.

In this paper, we examine the impact of ESOPs on the collective bargaining process when the union has a noncontrolling ownership interest in the firm. This conforms to nearly all union

¹ See DOL (1999).

² We thank Doug Kruse for tabulating the number of participants in collectively bargained ESOPs from the IRS Form 5500 data.

ESOPs observed in the data. Rather than focusing on the adoption of an ESOP as a bargaining outcome, we focus instead on the effect that an existing ESOP has on current contract negotiations. We do this by extending the signaling model of Cramton and Tracy (1992) to allow the union members to hold an equity stake in the firm. The ESOP causes the union to internalize to a degree the costs to the firm associated with labor disputes. As the union's equity stake grows, we show that the union is less likely to select the strike threat and that the firm is more likely to accept the union's initial wage offer. ESOPs, then, are predicted to shift the composition of disputes from strikes towards holdouts.⁴

We test these predictions using a sample of U.S. contract negotiations. Unionized firms that adopt an ESOP do not appear to have any significantly different bargaining experience prior to the ESOP adoption than unionized firms that do not adopt an ESOP. The data indicate a decline in the incidence of strikes following the adoption of an ESOP. In addition, following the adoption of the ESOP these firms experience a reduction in the fraction of labor disputes that take the form of a strike. The data are consistent with ESOPs altering the relative attractiveness of the strike and the holdout threats.

The signaling model predicts that ESOPs should improve the efficiency of collective bargaining by reducing the incidence of costly strikes. This improved bargaining efficiency creates value for the firm's shareholders over and above any of the traditional arguments for why ESOPs should lead to higher profitability. This suggests that the announcement of a union ESOP should generate a larger stock market reaction than for the announcement of a non-union ESOP. We test this prediction by conducting an event study of ESOP adoptions. We find that the announcement of a union ESOP leads to a differentially larger stock market reaction as compared to the announcement of a non-union ESOP.

More generally, an ESOP can be thought of as an example of cross ownership. Cross ownership ties the success of each company to its partners. As a result, the companies have better incentives in negotiating and investing in long-term supply relationships. Bargaining costs are reduced and the companies enjoy a more productive collaboration. Our analysis is relevant to

³The best known example of unions using an ESOP to gain a controlling interest in a company was the union buyout of United Airlines in 1993. Cott and Stuart (1995) provide a useful summary of this buyout.

⁴Holdouts are labor disputes in which the union agrees to work under the terms of the expired labor agreement while negotiations continue. In a holdout, the union puts pressure on the firm using a variety of tactics such as "work-to-rule."

the study of cross ownership.

The paper is organized as follows. In the next section we describe important features of ESOP pension plans. In section 3, we show how ESOPs can be added to a signaling model of labor contract negotiations. We discuss the data and present our findings in section 4. We conduct in section 5 an event study of the announcement of a new ESOP to explore the implications of ESOPs for the firm's shareholders. The final section contains thoughts for future work.

2. A primer on ESOPs

ESOPs were formally sanctioned in 1974 as a type of retirement plan under *ERISA*. A firm that wants to set up an ESOP establishes a trust fund in which to make contributions. These contributions are allocated to individual worker accounts held by the trust. Allocation formulas vary in practice but are based on factors such as the worker's level of compensation and years of service. Vesting of assets allocated to worker accounts takes one of two forms: no vesting for the first five years, followed by 100% vesting; or 20% vesting after three years, and 20% per year for the next four years. The nondiscrimination requirement stipulates that "highly compensated" employees cannot account for more than 30% of participants in the ESOP.⁵

An important feature of ESOPs for understanding their incentive effects for collective bargaining is that at least fifty percent of the ESOP's assets must be invested in the employer's securities. While other deferred compensation plans may in fact hold significant amounts of employer securities, they are not compelled to do so. Workers with 10 years of plan participation can begin to diversify their ESOP account when they reach age 55.⁶ This diversification option continues until the worker reaches age 60, when he/she is given a one-time option to diversify up to 50% of his/her account.⁷ The employee receives the vested assets in his/her account at the end of the employment relationship with the firm.⁸

Shares in an ESOP are legally owned by the ESOP trust. The control rights to these

⁵ Qualified plans must meet nondiscrimination tests regarding (a) coverage and (b) nondiscrimination in plans features. Each of these tests can be met through a variety of tests. Plans covering collectively bargained employees are effectively exempted from these rules.

⁶ See Oringer (2001).

⁷ This requirement applies to ESOP shares allocated to worker accounts after December 31, 1986.

⁸ See <http://www.esopassociation.org/whatis/howdo.html>

shares reside in the trustee of the plan, who is typically appointed by management. The trustee of the ESOP votes all nonallocated shares. In public companies, the plan participants must be allowed to vote their shares on “voting issues.”⁹ Fiduciary decisions, for example the consideration of a tender offer, need not be passed through to the participants. However, the ESOP can be set up so that this authority is given to the plan participants for decisions on allocated shares. Most public companies do structure their ESOPs in this manner (Rosen, Snyder, and Young 1993).

Motives for adopting an ESOP have been explored in the literature. First, Delaware law makes ESOPs a potential takeover defense.¹⁰ A firm incorporated in Delaware must wait three years after it acquires 15% of the target firm’s equity before it can merge with the target, unless it can obtain a waiver by 85% of the shareholders. In 1989, Polaroid won a decision in Delaware Court that upheld the company decision to issue 14% of its stock to an ESOP prior to the initiation of a hostile tender offer by Shamrock Holdings. Management may feel that giving voting rights to the union through an ESOP is a way of placing the votes in “friendly” hands (e.g., Chang and Myers 1992 and Chaplinsky and Niehaus 1994). Second, ESOPs were given special tax incentives in order to encourage their adoption. The specifics of these tax benefits, though, are not directly relevant for our purpose. Interested readers can find a detailed discussion in Beatty (1995) and Scholes and Wolfson (1990). Finally, ESOPs may improve worker productivity by giving workers an equity stake in the firm. Considerable effort has been devoted to pinning down the productivity effects of profit-sharing in general, and ESOPs in particular (Kruse 1993, Bell and Kruse 1995, and Kruse and Blasi 1995).

The net impact of ESOPs on a firm's profitability can be assessed by conducting an event study of the announcement effect of a new ESOP. The announcement of a new ESOP on average is viewed in a positive light by investors. Studies have found that the average two day cumulative excess stock return on the day prior to and the day of an ESOP announcement ranges from one to three percent (Gordon and Pound 1990 and Beatty 1995).¹¹

⁹ I.R.C. § 4975(e)(7) (1989).

¹⁰ General Corporation Law SS 203, effective 2 February 1988.

¹¹ This announcement effect captures more than just the tax benefits of an ESOP since it has been documented that stock prices react positively to ESOP adoption even when there is no tax benefit (and adopting companies are takeover targets). See Sellers, Hagan, and Siegel (1994) for further discussion.

3. Incorporating ESOPs into a bargaining model

It is often argued that ESOPs serve to improve worker incentives by giving individual workers ownership in the firm. The difficulty with this argument is that any given worker's performance has only a negligible impact on the firm's profitability. A rational worker, outside of top management, should not alter his/her behavior as a result of an ESOP. However, the impact of even a small ESOP on collective bargaining can be dramatic. This is because collective bargaining avoids the dissipation of incentives that is seen at the individual worker level. As a result, the presence of an ESOP will affect the union's wage demand and its decision to strike.

To assess the impact of an ESOP on collective bargaining we extend the wage bargaining model of Cramton and Tracy (1992). The model assumes one-sided private information in which the union is uncertain about the firm's profitability. The firm credibly signals its profitability through its willingness to postpone agreement. The union decides how best to pressure the firm by selecting the threat, either strike or holdout. Under holdout, the union continues to work under the terms of the expired labor agreement, but at a reduced level of efficiency. In contrast, striking typically involves a substantial disruption of production. We will see that an ESOP impacts not only wages, dispute incidence, and dispute duration, but also the form the dispute takes.

Consider the following stylized labor contract negotiation problem. A union and a firm are bargaining over the wage to be paid during a contract of duration T . Let v be the firm's value of the current union labor force working under a contract of duration T . It is common knowledge that v is drawn from the distribution F with positive density f on an interval of support $[l, h]$. However, at the outset of the negotiations only the firm knows the realized value of v .

Negotiations begin with the union selecting a threat $\theta \in \{H, S\}$, where H indicates the holdout threat and S indicates the strike threat. The union's threat choice remains in effect until a settlement is reached. Absent an ESOP, in the threat θ , the payoff to the union is x_θ and the payoff to the firm is $a_\theta v - b_\theta$, where $a_\theta \in [0, 1)$ and $b_\theta \geq 0$. The term $1 - a_\theta$ captures the dispute cost in that threat. Define $c_\theta = (b_\theta - x_\theta) / (1 - a_\theta)$ to be the relative payment difference during the threat θ . Since the total payoff in agreement is v and the total payoff during the threat θ is $a_\theta v - b_\theta + x_\theta$, the "pie" that the union and firm are bargaining over (the difference between the agreement and the threat payoffs) is $(1 - a_\theta)v + b_\theta - x_\theta = (1 - a_\theta)(v + c_\theta)$. We assume that the

pie is positive for all $v \in [l, h]$, which implies that $c_\theta > -l$.

Let w^0 denote the wage under the expired labor agreement. Since the terms and conditions of the previous labor agreement remain in force during a holdout, the workers continue to be paid w^0 during the holdout, so $x_H = b_H = w^0$ and $c_H = 0$. We assume there is some inefficiency during a holdout, $a_H < 1$.

With an ESOP, the union gets a share α of the profits of the firm. This changes the payoff flows both during the threat and after settlement as shown in Figure 2. The outcome of this bargaining process between the union and the firm denoted by $\langle t, w, \theta \rangle$ consists of the time of the settlement t where $t \in [0, T]$, the wage settlement w and the threat selected by the union θ . The union and firm payoffs are calculated as the sum of the threat payoffs and the agreement payoffs, weighted by the fraction of time spent in each state.

Define

$$D(t) = \frac{1 - e^{-rt}}{1 - e^{-rT}}$$

to be the discounted fraction of time spent in dispute if an agreement occurs at time t . Then, given the bargaining outcome $\langle t, w, \theta \rangle$, the union's payoff is

$$U(t, w, \theta) = [x_\theta + \alpha(a_\theta v - b_\theta)]D(t) + [w + \alpha(v - w)][1 - D(t)]$$

and the firm's payoff is

$$V(t, w, \theta) = (1 - \alpha)(a_\theta v - b_\theta)D(t) + (1 - \alpha)(v - w)[1 - D(t)].$$

Notice that the ESOP does not change the firm's incentives. The firm still seeks to maximize its overall profits, despite the fact that a share α of these profits is going to the union. In contrast, the ESOP does fundamentally change the incentives of the union. With an ESOP, the union cares not only about its wage, but also about the firm's profitability, which falls with higher wages and longer and more costly labor disagreements. As a result, the ESOP makes the union a less demanding negotiator. As we will see, the ESOP gives the union an incentive to select a less destructive threat and to demand a lower initial wage demand.

The bargaining sequence is as follows. Following the union's threat choice the union and the firm alternate making wage offers, with the union assumed to make the initial offer. After a wage offer is made by one side, the other side has two options: (1) make a counteroffer, in which case the bargaining continues, or (2) accept the current offer, in which case the bargaining ends and labor is supplied at the offered wage for the remainder of the contract period. As in Admati and Perry (1987), a bargainer can delay responding to an offer. This assumption leads to the signaling equilibrium in which the firm signals its value through its willingness to delay the agreement. For simplicity, we assume that the minimum time between offers is arbitrarily small.

The equilibrium of this bargaining game takes a simple form. If the wage under the expired labor agreement, w^0 , is sufficiently low (that is, below some indifference level \tilde{w}) the union decides to select the strike threat; otherwise ($w^0 \geq \tilde{w}$) the union selects the holdout threat. The indifference level wage, \tilde{w} , depends on r, T, F , the strike and holdout threat payoffs and the ESOP size α . A second indifference level, $m \in (l, h)$, determines the firm's response to the union's initial wage offer. If the firm's valuation is higher than this indifference level, $v > m$, the firm accepts the union's initial wage offer and an immediate settlement takes place. Otherwise, the firm rejects the union's initial wage offer and a labor dispute begins. Whether the dispute is a strike or a holdout depends on the union's prior threat choice.

The signaling equilibrium is characterized by three propositions, which are proven in Appendix A.

Proposition 1. *Let θ be the threat chosen by the union. In the limit as the time between offers goes to zero, there is a perfect Bayesian equilibrium with the following form:*

- *The union makes an immediate offer of $w_\theta(m) = x_\theta + \frac{1-2\alpha}{2-2\alpha}(1-a_\theta)(m+c_\theta)$, where*

$m(c_\theta) \in (l, h)$ maximizes

$$(M) \quad (1-2\alpha)(m+c_\theta)(1-F(m)) + \int_l^m \left(\frac{(v+c_\theta)^{2-2\alpha}}{(m+c_\theta)^{1-2\alpha}} - 2\alpha(v+c_\theta) \right) dF(v).$$

- *The firm accepts the offer if $v \geq m$. Otherwise, if $v < m$ the firm waits until $\left(\frac{v+c_\theta}{m+c_\theta}\right)^{1-2\alpha}$ of*

the contract period remains before offering $w_\theta(v) = x_\theta + \frac{1-2\alpha}{2-2\alpha}(1-a_\theta)(v+c_\theta)$, which is

accepted by the union.

Several observations follow from Proposition 1. First, all wage offers are Rubinstein (1982) full information wage offers. The wage offer consists of the union's payoff in the threat θ , x_θ , plus the fraction $\frac{1-2\alpha}{2-2\alpha}$ of the bargaining rents (the avoided loss) based on the firm's profitability, v (or m in the case of the union's initial offer). For bargaining units without an ESOP ($\alpha = 0$), the rents are split equally between the union and the firm with the union receiving its share of the rents entirely through the settlement wage. At the other extreme, for bargaining units with a controlling interest in the firm ($\alpha = 1/2$), there is no longer any bargaining conflict between the firm and the union. The union receives a "competitive" wage equal to its threat payoff, x_θ . However, the union still collects half of the rents, $v - x_\theta$, though it now receives the payment entirely through its equity stake. For intermediate values of α , the union receives some of its rents through the wage and some through its equity stake. Second, during a labor dispute the union has every incentive to impose as much inefficiency on the firm as possible. The wage under both threats increases linearly with the degree of inefficiency, but the strength of this incentive diminishes with α .

For a given threat θ , we can determine how the dispute incidence and duration respond to changes in the distribution of v , changes in the threat payoffs, or to changes in the size of the ESOP. The following proposition says that dispute activity increases with uncertainty. In addition, dispute activity increases when the threat θ becomes more attractive to the union (i.e., c_θ falls). However, dispute activity decreases with larger ESOPs (as α rises).

Proposition 2. *Suppose that m uniquely maximizes (M) . Dispute incidence $F(m)$ and dispute duration $D(v) \equiv 1 - \left(\frac{v + c_\theta}{m + c_\theta}\right)^{1-2\alpha}$ increase with a linear, mean-preserving spread of the distribution of F . Moreover, dispute incidence and duration decrease as c_θ increases and as α increases.*

Dispute activity depends on the amount of uncertainty about the firm's private information. Dispute incidence always exceeds one-half, and converges to one-half in the limit

as uncertainty disappears.¹² Recall that c_θ measures what the firm pays less what the union receives in the threat θ scaled by the dispute cost. Proposition 2 yields several testable predictions. For example, if a local union receives strike benefits throughout a strike from its national union (and the costs of the benefits are spread across the national membership), then this lowers c_S which should increase strike incidence and lengthen strike durations. Similarly, if workers on strike qualify for general welfare payments, this also lowers c_S and should increase the incidence and duration of strikes.

The intuition for why ESOPs reduce dispute incidence and dispute duration stems from the fact that as α increases the union's preferences become more in line with the firm. A bargaining unit without an ESOP receives rents only through the negotiated wage. Labor disputes are a costly activity that allows the union to raise its wage. A bargaining unit with an ESOP no longer collects its rents entirely through the negotiated wage. Depending on the size of the ESOP, a portion of the union's rents is now collected through its ownership stake in the firm. As the ESOP share α increases, the union collects a higher share of its rents through its equity stake, which dampens the union's incentive to invest in costly labor disputes in order to raise its wage. At $\alpha = 1/2$, all of the union's rents are collected through its equity stake and there is nothing left to disagree about. Consequently, dispute incidence and duration vanishes to zero.

Our third proposition demonstrates that the union's threat decision depends critically on the current wage under the expired labor agreement, w^0 .

Proposition 3. *If $w^0 < \tilde{w}$, the union selects the strike threat; if $w^0 \geq \tilde{w}$ the union selects the holdout threat, where*

$$\begin{aligned} \tilde{w} = & x_S + (1 - a_S)(m_S + c_S)(1 - F(m_S)) - (1 - a_H)m_H(1 - F(m_H)) \\ & - \frac{\alpha}{1 - \alpha} (c_S(1 - a_S)F(m_S) + (1 - a_S) \int_l^{m_S} v dF(v) - (1 - a_H) \int_l^{m_H} v dF(v)) \end{aligned}$$

and $m_S = m(c_S)$ and $m_H = m(c_H)$ maximize **(M)**.

¹² By dispute incidence we mean the likelihood that either a strike or a holdout takes place. Dispute incidence less than one-half results when there is a fixed cost to initiating a dispute.

The intuition is that the union will select the strike threat if and only if the higher bargaining costs that are associated with a strike are more than made up for by a higher wage. If the current wage under the expired labor agreement is sufficiently high, this is not the case and the union prefers the holdout threat.

Proposition 3 provides a key insight into strike activity. The overall incidence of strikes depends not just on the overall incidence of disputes, but also on the fraction of disputes that involve a strike. As shown earlier, the level of dispute activity depends on the degree of uncertainty and the size of the ESOP. The composition of disputes between strikes and holdouts depends on w^0 , the size of the ESOP, the threat payoffs and the location of the distribution of v .

We would like to determine how the size of the ESOP impacts the composition of disputes. An examination of the Rubinstein wage provides some insight:

$$w_\theta(v) = x_\theta + \frac{1 - 2\alpha}{2 - 2\alpha}(1 - a_\theta)(v + c_\theta).$$

We see that as α increases, the wage under both threats falls. However, assuming that the strike threat is much more destructive than the holdout threat ($a_S \ll a_H$), then it is the case that as the ESOP share increases the wage under the strike threat is falling much faster than the wage under the holdout threat. A higher ESOP share reduces the relative wage gap between the strike and the holdout threats. Hence, we should expect that an ESOP should increase the relative attractiveness of the holdout threat. The incentive to strike is further reduced when the union factors in the dispute costs. The less destructive threat, holdout, results in lower dispute costs. Thus, our intuition is that we should expect ESOPs to shift the composition of disputes away from strikes.

This intuition is difficult to establish without making further assumptions on the threat payoffs. One useful simplification is

Assumption S. $b_S = x_S$.

This states that what the firm pays out during a strike is equal to what the union receives

implying that $c_S = 0$.¹³ In the case of holdout, recall that the firm pays the union the wage from the expired contract, which means $b_H = x_H = w^0$, and $c_H = 0$. Thus, with Assumption S, $c_H = c_S = 0$, which implies that the union selects the same cutoff level m under either threat ($m = m_S = m_H$). As a result, the incidence and duration of the dispute is the same under either threat. Since $a_S < a_H$, it immediately follows that the expected loss from a strike is higher than the expected loss from a holdout. In addition, we can show

Proposition 4. *Suppose Assumption S holds and m is the unique maximizer of (M) . Then as α increases from 0, \bar{w} falls and the union is more apt to choose the holdout threat. Moreover, if v is uniformly distributed, then for all α , the union's threat choice shifts toward holdout as the size of the ESOP grows.*

Propositions 1–4 yield a number of predictions about how collective bargaining changes with the introduction of an ESOP. As a union's equity position in the firm grows, we should expect fewer and shorter disputes. Moreover, the union should be less apt to select the more destructive strike threat, and thus strike incidence should be less. To get a sense of the magnitude of these effects, we set the model parameter values to the benchmark levels of Cramton and Tracy (1994). These parameter values were calibrated such that the equilibrium outcome with $\alpha = 0$ (no ESOP) fits the descriptive statistics of private-sector collective bargaining in large (more than 1,000 workers) private-sector bargaining units in the U.S. from 1970 to 1989.¹⁴

Figure 3 shows how dispute incidence changes in the benchmark model with the introduction of an ESOP. Overall dispute incidence declines slowly as the ESOP ownership share increases from 0 to 25 percent. However, there is a substantial change in the form that disputes take, resulting in a large decline in strike incidence. Strike incidence, initially at 11 percent with $\alpha = 0$ falls roughly linearly to 0 at $\alpha = 0.17$. This decline in strike incidence is the result of the union avoiding the more costly strike threat when the union has an equity interest in

¹³ Assumption S can hold in a variety of situations. If the firm closes down during a strike and the union workers do not find alternative employment, then the assumption holds. Similarly, if the firm hires replacements at a competitive wage and the striking workers find alternative employment at the competitive wage then the assumption also holds.

¹⁴ Specifically, we assume v is uniform on 1 ± 0.07 , w^0 is uniform on 0.48 ± 0.05 , $a_S = 0.75$, $a_H = 0.96$, $x_S = b_S = 0.35$, $r = 10\%$, and $T = 2.7$ years.

the firm.

Figure 4 shows how the expected loss from disputes declines as the union's ESOP ownership share increases. The expected loss conditional on the strike threat is cut in one-half as α increases from 0 to 0.25—this is the consequence of the mean strike duration dropping from 36 days at $\alpha = 0$ to 18 days at $\alpha = 0.25$. However, the expected loss from disputes drops by a factor of more than four as α increases from 0 to 0.25. The faster decline in the dispute loss is the result of two sources of reduction as the union's equity interest increases: 1) shorter disputes and 2) the shift away from the more costly strike threat.

The decline in dispute costs with the introduction of an ESOP raises the possibility that both the union and the firm may benefit from the ESOP, all else equal. In our benchmark model, this is not the case. With $\alpha = 0$, the union and firm split the pie roughly equally, but as the union's ownership share increases to 20 percent, the split shifts to 60/40 in favor of the union. This suggests that firms would offer ESOPs only in conjunction with some combination of tax breaks and concessions by the union.

To summarize, the benchmark model—calibrated to fit the main features of U.S. collective bargaining—suggests several hypotheses: 1) ESOPs should result in lower strike incidence, strike duration and fraction of disputes involving a strike, 2) ESOPs should result in lower expected dispute costs, and 3) ESOPs should be associated with union concessions. The size of the ESOP impact depends on the union's ownership share of the firm. According to the benchmark model, the average impact of ESOPs based on the observed distribution of ESOP shares (see Figure 1) is as follows: dispute incidence falls from 51.8 to 51.6 percent, strike incidence falls from 11.1 to 5.5 percent, and the union's selection of the strike threat falls from 21.4 to 10.7 percent.

4. ESOP data and empirical findings

Our primary data source for ESOP information was the *National Center for Employee Ownership* (NCEO). For each publicly held corporation, we used NCEO data to determine whether an ESOP exists, the date the ESOP was adopted, and the percent of total shares held by the ESOP. We sent surveys to 387 corporations where there was any indication of possible error in the NCEO data. A total of 268 companies responded to the survey, although about a third of responses were not informative since the plan administrators claimed that they did not have

information about the specific circumstances surrounding the adoption of their ESOPs. We made corrections to the data based on the usable survey responses. In addition, we checked the accuracy of our ESOP data against those reported in Chang and Mayers (1992), Gordon and Pound (1990), and Chaplinsky and Niehaus (1994). Finally, we cross-checked our data with the information provided to the Internal Revenue Service in the Form 5500.¹⁵ We were unable to check the accuracy of ESOPs that were put into place before 1988 due to the fact that many of these companies were subsequently delisted. Our final ESOP sample for which we have complete data consists of 142 firms.

Our collective bargaining data consists of all private sector major bargaining units followed by the Bureau of Labor Statistics (BLS) from 1970 to 1995.¹⁶ The BLS compiles settlement, effective, and expiration dates for each round of contract negotiations. Strike beginning and ending dates are from BLS and Bureau of National Affairs data, and consist of compilations from public sources. Each bargaining unit is assigned a unique identification number by the BLS. A total of 1,101 bargaining units and 6,585 negotiations are captured in the data. Since our ESOP data only covers public companies, we restrict our sample to this set of firms. CUSIP numbers were merged in using the firm name listed by the BLS and data sources on mergers and acquisitions during the sample period. Valid CUSIP numbers were available for 4,635 negotiations involving 715 bargaining units. A full set of control variables (described below) were available for 3,994 contract negotiations.

We merged the sample of ESOPs into our collective bargaining data using the firm's CUSIP number. This merging had to be done with care to take account of any mergers and acquisitions, as well as instances where firms sell-off or acquire divisions that are covered by collective bargaining.¹⁷ For example, a division of a company with its bargaining units covered

¹⁵ Every ESOP involving more than 100 participants must file a Form 5500 report with the Internal Revenue Service. Beginning in 1988, the Form 5500 data indicate if the ESOP is part of a collective bargaining unit.

¹⁶ Major bargaining units cover 1,000 or more workers. The BLS stopped collecting bargaining data on major bargaining units at the end of 1995.

¹⁷ If the firm is being acquired then the treatment of its ESOP is similar to a 401(k) plan -- the assets would be moved into a successor plan, usually a 401(k) in the acquirer. That plan might sell the shares if it is a large percentage of the acquirer's stock. Alternatively, the shares could be cashed out and employees could roll them into an IRA or pay taxes and keep the money, or the employees could simply be given the shares.

by an ESOP may be sold to another company with no ESOP (or, alternatively, the division may go through a management/leverage buy out).¹⁸ For our analysis, we tracked bargaining units and whether they are covered by the original ESOP plan. We used Standard & Poors Compustat and Center for Research in Securities Prices (CRSP) as primary source of data for tracking firms and divisions. For additional background detail, we used Securities Data Corporation data on asset sell-offs for restructuring in the 1990s, Moody's Manuals, 10-Ks filed with the SEC, and Directory of Corporate Affiliates. Finally, we also deleted all contract negotiations in the airline and railroad industries since their bargaining is covered by different statutory and case law.

The pattern of adoption of ESOPs over time in our data is presented in Table 1. Of the 142 total ESOP plans that we linked to our bargaining data, around 2% were put into place in the year following the passage of *ERISA*. In the early to mid-1980s some ESOPs were put into place as part of concession bargaining by the firm.¹⁹ Adoption rates significantly picked up in 1989, following the enhancement of some of the ESOP tax incentives and the Polaroid decision.

Overall, ESOPs were adopted by 22% of the bargaining units in our data. A total of 74% of contract negotiations involve firms that never adopt an ESOP. For the bargaining units involving firms that adopt an ESOP, the negotiations prior to the adoption date represent 16% of the total sample, while the negotiations following the adoption date represent 10% of the total sample. The fact that many ESOPs are adopted late in our sample period implies that we should interpret any estimated impact as a short-run effect.

Table 2 gives the distribution of ESOPs across broad industry classifications. The

¹⁸ A company that sells a division has a few options: (a) without affirmative employer action, the affected employees are treated as any terminated employees. The vested employees can then receive distributions pursuant to the plan's general provisions, and unvested employees forfeit their interest. (b) the company could choose to vest all employees, and otherwise treat the employees under (a) above. (c) the employer could retain the funds in the ESOP, and give continuing vesting service for employment with the buyer. Under any of these options, the employer might also facilitate rollovers to the buyer's plan (after liquidating the stock). Alternatively, the seller could implement a "trust-to-trust" transfer to the buyer's plan (again, with or without fully vesting--but usually after vesting). If a trust-to-trust transfer occurs, the buyer can either retain the stock fund (but freeze it) to enable the participants to retain favorable tax treatment (on net unrealized appreciation) upon distribution. However, most employers would prefer to liquidate the stock fund quickly. It should be noted that a partial termination requires full vesting. A partial termination occurs if a significant percentage of a plan's population is terminated as the result of employer action. Over 50% termination is always a partial termination, under 20% is never a partial termination and anything between 20% and 50% is subject to evaluation based on facts and circumstances.

¹⁹ See Flanagan (1984) for examples.

incidence of adoption among unionized firms is not uniform across industry classifications, and is relatively high in Petroleum & Coal and Transportation Equipment. By way of comparison, Bell and Kruse (1995) using Form 5500 data find that the overall incidence of ESOPs was 72.7% in Communications, 39.2% in Utilities, 11.3% in Manufacturing, and 11.7% in Finance, Insurance, and Real Estate. Bell and Kruse report that the incidence of ESOP adoption is three times higher in “high technology” sectors than for the private sector as a whole.

To investigate the impact of ESOPs on the collective bargaining process, we estimate strike incidence, dispute incidence and dispute composition specifications using probit models. These specifications allow us to control for firm-specific and cyclical effects on bargaining, changes in bargaining patterns over time, and factors specific to each industry and union that may impact bargaining outcomes.

We control for firm size and profitability. We use the log of the firm’s assets as our size measure, where information on firm assets is taken from the Standard & Poors Compustat database. We capture firm profitability using the firms reported net income for the year prior to the contract negotiation. Information on the firm’s net income is also taken from Compustat.²⁰

All of our probit specifications control for possible cyclical patterns in bargaining using aggregate, industry and local labor market controls. Aggregate cyclical conditions are captured by a set of year effects. These year effects will also control for changes in bargaining trends over time.²¹ Conditions in the industry and state labor markets are proxied by a set of employment trends and residuals. We fit regression models to the BLS quarterly industry and state-level employment series for the period 1970-2002. We allow for quadratic trends, quarterly seasonal effects, and autoregressive error terms.

$$\ln E_{it} = \beta_{i0} + \beta_{i1} t + \beta_{i2} t^2 + \sum_{j=1}^3 \delta_{ij} Q_j + U_{it}$$

$$U_{it} = \phi(L)U_{it-1} + \varepsilon_{it} ,$$

where $\ln E_{it}$ is log quarterly employment in industry/state i at time t ; Q_j is an indicator variable for

²⁰ The firm’s assets is taken from item # 6, while net income variable is item #172 in Compustat.

²¹ For example, strike incidence has declined by roughly 50% over this twenty-five year period.

the j^{th} quarter; $\phi(L)$ is an up to a second-order distributed lag polynomial; and ε_{it} is a white noise error term. We measure the tightness in the relevant labor market using the estimated quarterly employment residual, U_{it} . We also include the estimated current employment growth rate ($\beta_{11} + 2\beta_{12}t$) as a measure of longer-term performance in the industry or state.²²

For those bargaining units that adopt an ESOP, we include a pre- and post-adoption indicator in the specification. We measure the impact of ESOPs on bargaining outcomes by taking the difference between the pre- and post-adoption coefficient estimates. This approach does not constrain the bargaining units that adopt ESOPs to have had similar bargaining histories as the non-adopting bargaining units prior to putting the ESOP in place.

Before discussing the estimates of the impact of ESOPs on bargaining outcomes, we will briefly summarize the findings for the other control variables in Table 3. We find that the incidence of strikes as well as the fraction of labor disputes involving a strike decline with firm size. Controlling for the size of the firm, we find no effect of the size of the bargaining unit on any of the bargaining outcome measures. The likelihood of a strike increases with a firm's profitability as measured by the firm's net income. Controlling for the firm's profitability, strikes are more likely in industries and states that are experiencing increasing trend employment growth.

The overall impact of ESOPs on strikes is given in specification (1) of Table 3. The data indicate that bargaining units that are associated with firms that adopt ESOPs were no more likely to experience a strike in the pre-adoption period relative to bargaining units at firms that never adopt an ESOP. Following the adoption of an ESOP, the strike incidence for adopting bargaining units declines by 6.2 percentage points. Specification (2) suggests that ESOP bargaining units experienced on average a 2.8 percentage point lower dispute rate prior to the adoption of the ESOP. Following the establishment of the ESOP, these same bargaining units experienced only a slight decline in their dispute rate. Finally, as indicated in specification (3), prior to the adoption of an ESOP bargaining units that adopted an ESOP experienced a 1.6 percentage point higher fraction of disputes involving a strike as did bargaining units that never adopted an ESOP. Following the establishment of the ESOP, the fraction of disputes that

²² We also control for 2-digit industry effects as well as state effects. This implies that the industry and state trend employment effects are identified off of the time-varying component of the employment trends, β_{i2} .

involved a strike declined by 13.7 percentage points. This represents a 51 percent decline in the overall fraction of disputes taking the form of a strike.

Table 4 compares the average impact of ESOP adoption based on the theoretical benchmark model from section 3 with the empirical impact estimated from Table 3. The estimated impacts of ESOPs on strike and dispute incidence and dispute composition line up well with the calibration results based on the theoretical model.²³ The calibrated model indicates that the dispute rate should only slightly fall (0.2 percentage points) in the post-ESOP period, while the strike incidence should decline by nearly 50 percent. The estimates reported in Table 3 indicate no significant change in the dispute rate and a reduction in the strike incidence that virtually matches the calibrated estimate. Finally, the calibrated model indicated that the fraction of disputes that involve a strike should decline by nearly 11 percentage points. The empirical results find the fraction of disputes involving a strike following the adoption of an ESOP falling by slightly over 15 percentage points. Both the calibrated model and the empirical results indicate a large shift in the composition of labor disputes away from costly strikes following the adoption of an ESOP plan.

5. Shareholder and Labor Wealth Effects

In this section, we analyze the shareholder wealth associated with the announcement of an ESOP adoption. While the market reaction to an announcement of a new ESOP has been documented in the literature, we provide new evidence on the announcement gains/losses disaggregated by the collective bargaining status of the firm. If ESOPs improve the efficiency of contract negotiations and if these efficiency gains are shared between the union and the firm, then we would expect to see these gains to the shareholders capitalized into the announcement effect of a union ESOP. We measure these announcement effects using an event-time methodology as described in MacKinaly (1997). We calculate cumulative abnormal returns (CAR) over three intervals around the announcement date of ESOP. We also normalize the gain or loss by the number of employees to find out the average gain/loss to each worker.²⁴

²³ The estimated marginal effects of ESOPs on dispute incidence, strike incidence and dispute composition are all insignificantly different from the calibrated marginal effects.

²⁴ We take the number of employees for the year of ESOP adoption for each firm as reported by the Standard & Poor's Compustat database. It should be noted that the results reported here do not change if we choose the

Table 5 provides descriptive statistics on the firms in our overall (union and non-union) ESOP sample where we know the exact date of the ESOP adoption.²⁵ We report information on firm size (measured by the book value of assets and employment), growth opportunities (measured by market to book ratio), and the size of the ESOP as a percentage of shares outstanding. Our sample of ESOP firms on average has nearly \$5.0 billion in assets. Unionized firms, with an average size of \$10.6 billion are about 3.4 times larger than the non-unionized firms. An average firm in our ESOP sample has about 21,000 employees. The unionized firms have workforces that are double the size of the non-unionized firms. Firms that adopt an ESOP have a mean (median) market to book of 1.3 (1.2), indicating growth prospects. Unionized firms have a slightly higher market to book than non-unionized firms. ESOPs on average have 11.6% of the firm's shares outstanding, with a median equity stake of 8.0%. Appendix B provides information on the name of the company, the year of ESOP adoption and percentage shares outstanding in the plan for our sample of union ESOPs.

Table 6 reports the event study results. We report CARs for three event windows (-5,5), (-5,1), and (-2,1), where $t = -1$ is the ESOP announcement date, and $t = 0$ is the date the announcement is reported in the press. For two of the event windows, we include the five days prior to the press release to capture any leakage of the news to the markets, although little is reported in the literature as to when the firm, if at all, shares the information with its employees about the ESOP. CARs for the overall sample of firms are positive and statistically significant over each of the three intervals. The eleven-day CAR (-5, 5) and the seven-day CAR (-5,1) are 1.6% and 1.5% respectively, while the four-day CAR (-2,1) is 1.3%.

Since our sample is different than those in other studies, we compare the announcement returns with findings in three other papers. Our calculated four-day return of 1.3%, is a bit higher than that of Beatty (1995) and Chang and Mayers (1992), but is much lower than Chang (1990) as reported below. These studies differ because of the type of ESOPs included in the sample. Beatty points out that Chang's reported excess return of 3.7% would be reduced to 1.6% if the 35

number of employees in the year before the year of ESOP adoption. The daily returns used in our study are collected from the Center for Research in Security Prices.

²⁵ The ESOP sample declines from 602 to 147 when we restrict ourselves to ESOPs where we know the announcement date. This dating information is important for conducting an event study of the stock market reaction to the announcement of the ESOP.

leveraged buyout ESOPs were excluded from his sample. Thus, our announcement return is roughly comparable to other studies.

Study	Sample Size	Sample Period	CARs
Beatty (1995)	122	1976-1989	1.0%
Chang (1990)	165	1976-1987	3.7%
Chang and Mayers (1992)	276	1976-1989	0.7%

Table 6 also reports CARs disaggregated by the union status of the firm. For the 120 non-unionized firms, the CARs are slightly smaller for the overall sample of firms. The CARs for the 27 unionized firms are around fifty percent larger than for the nonunion sample. For the unionized firms, the CARs are 2.4% for the interval (-5,5), 2.3% for the interval (-5,1), and 1.7% for the interval (-2,1). Whatever the benefits are to firms in general from establishing an ESOP, the benefits are considerably larger for unionized firms. To our knowledge, this feature of the data has not been previously noted in the literature.

The calibration results displayed in Figure 4 offer some insights into this finding. The costs to current shareholders of the firm giving employees an equity stake are the same regardless of the union status of the firm. Union and nonunion firms likely benefit equally from the tax advantages afforded by establishing an ESOP. If there are important productivity effects associated with ESOPs, it is less clear that they would be equally shared by non-union and union firms. However, the calibration exercise clearly illustrates that the expected bargaining losses associated with labor disputes declines with the size of the union's equity stake. This creates a differential value of an ESOP to union firms which if understood by investors should be capitalized in the announcement effect.

6. Conclusion

Firms and unions that repeatedly negotiate labor contracts have an incentive to adopt forms of compensation that minimize the renegotiation costs. The adoption of multi-year contracts with prespecified deferred payments and a cost-of-living clause is one example. By extending the contract duration the costs of renegotiation can be amortized over a longer time period. Similarly, ESOPs may alter the incentives of the firm and union in ways that help to

minimize the frequency and costs of labor disputes. Given the growth of ESOPs for unionized firms, the impact of ESOPs on the collective bargaining process is an important area of research.

In this paper, we argue that ESOPs may lead to fewer strikes as a fraction of total disputes. The presence of an ESOP changes the incentives of the union since it no longer collects its rents exclusively through the negotiated wage. We examine the impact of ESOPs on collective bargaining outcomes by extending the signaling model of Cramton and Tracy (1992) to allow the union to hold an equity stake in the firm. The model predicts that increasing the size of the union's equity stake acts to more closely align the union's interests with the interests of the firm. A consequence is a reduction in labor disputes and a shift by the union away from the more costly strike threat and towards the holdout threat.

Using data on major collective bargaining negotiations from 1970-1995, we find evidence consistent with the prediction that ESOPs (at least in the short run) reduce the overall incidence of strikes and shift the composition of labor disputes towards holdouts. In subsequent negotiations their fraction of labor disputes that involve a strike falls below the average for non-adopting bargaining units. The estimated magnitudes of the decline in strike incidence and the decline in the fraction of labor disputes that involve a strike match up well to the calibrated estimates from the model.

The theory suggests that shareholders of unionized firms should experience a differential gain from the adoption of an ESOP. We verify this by conducting an event study of the stock market reaction to ESOP adoptions. We find that the stock market reaction to a unionized ESOP adoption is 50% larger than for a non-union ESOP adoption. These findings indicate that ESOPs may provide firms and unions with a tool to improve the efficiency with which they renegotiate labor agreements.

Our analysis applies more generally to settings of cross ownership. Like ESOPs, cross ownership should reduce bargaining costs and make collaborations more productive.

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Table 1: Adoption of ESOPs - by Year

Year	Number of Bargaining Units Adopting	Percent of Total
1975	3	2.1
1976	1	0.7
1977	0	0
1978	0	0
1979	1	0.7
1980	0	0
1981	0	0
1982	1	0.7
1983	0	0
1984	5	3.5
1985	4	2.8
1986	1	0.7
1987	2	1.4
1988	2	1.4
1989	58	40.8
1990	10	7.0
1991	54	38.0
1992	0	0
1993	0	0
1994	0	0
1995	0	0
	142	100

Table 2: Adoption of ESOPs - by Industry

Industry	Number of Bargaining Units Adopting	Percent of Total ESOPs	Percent of BU's in Industry
Food	9	6.3	7.3
Lumber	1	6.7	1.2
Paper	14	9.9	4.0
Printing	5	3.5	2.3
Chemicals	9	6.3	2.5
Petroleum & Coal	9	6.3	1.6
Rubber	2	1.4	1.6
Stone, Clay & Glass	1	0.7	2.1
Primary Metals	12	8.4	5.5
Fabricated Metals	6	4.2	2.6
Machinery, ex. Elec.	9	6.3	3.9
Electrical Eq.	16	11.3	5.1
Transportation Eq.	30	21.1	6.8
Instruments	2	1.4	0.9
Misc. Mfg.	2	1.4	0.7
Transportation	11	7.7	3.7
Communications	3	2.1	4.2
	142	100	

Table 3: Impact of ESOPs on Collective Bargaining

	Strike Incidence	Dispute Incidence ^a	Dispute Composition ^b
	(1)	(2)	(3)
Pre-ESOP	-0.003 (0.013)	-0.028 (0.025)	0.016 (0.030)
Post-ESOP	-0.062** (0.015)	-0.009 (0.088)	-0.137** (0.034)
Lag Log Firm Assets	-0.025** (0.006)	0.013 (0.012)	-0.065** (0.014)
Lag Firm Net Income	0.027** (0.007)	0.007 (0.008)	0.050** (0.015)
Industry Employment Residual	-0.006 (0.005)	-0.011 (0.010)	0.000 (0.011)
Industry Employment Trend	0.036** (0.015)	-0.120** (0.029)	0.094** (0.029)
State Employment Residual	0.008 (0.005)	0.025** (0.009)	-0.002 (0.012)
State Employment Trend	0.039** (0.015)	0.052* (0.032)	0.104** (0.034)
Bargaining Unit Size	0.003 (0.002)	0.007 (0.008)	-0.001 (0.004)
Sample Size	3,994	3,994	1,976
Mean of dependent variable	13.2	49.5	26.8
ESOP Impact ^c	-0.059	0.019	-0.153
χ^2 (ESOP Impact = 0) [Probability Value]	7.63 [0.01]	0.20 [0.65]	9.91 [0.00]

Notes: Probit marginal effects and standard errors. Marginal effects for continuous variables correspond to a one standard deviation change in the variable. Standard errors are calculated using clustering by negotiations for the same bargaining unit. Specifications control for year, 2-digit industry, state and union fixed effects.

^a Dispute incidence is the ratio of strikes and holdouts to contract negotiations.

^b Dispute composition is the ratio of strike to disputes.

^c ESOP impact = Post-ESOP – Pre-ESOP

** significant at the 5% level * significant at the 10% level

Table 4: Comparison of Theoretical and Empirical Impact of ESOPs on Collective Bargaining

	Dispute Incidence	Strike Incidence	Dispute Composition
Pre-ESOP (theory)	51.8	11.1	21.4
Post-ESOP (theory)	51.6	5.5	10.7
ESOP Impact (theory)	-0.2	-5.6	-10.7
ESOP Impact (estimated)	1.9	-5.9	-15.3

Notes: The theoretical impact of an ESOP is calculated from the benchmark model of section 3, using the empirical distribution of ESOP ownership shares. The estimated ESOP impact is from Table 4.

Table 5. Descriptive statistics of the sample characteristics

<i>Variable</i>	<i>Sample Size</i> ^a	<i>Mean</i>	<i>Median</i>	<i>Min</i>	<i>Max</i>
<i>Employment (thousands)</i>					
All	147	20.9	4.8	.1	520.0
Non-union	120	16.1	2.8	.1	520.0
Union	27	42.0	24.7	2.3	186.8
<i>Book Value of Assets (\$ millions)</i>					
All	83	4,974.7	799.0	7.8	61,768.8
Non-union	62	3,072.1	538.0	7.8	52,984.0
Union	21	10,592.0	4,274.9	330.2	61,768.8
<i>Market Value / Book Value</i> ^b					
All	141	1.3	1.2	0.8	2.9
Non-union	115	1.3	1.2	0.8	2.9
Union	26	1.3	1.2	0.8	2.1
<i>ESOP (%)</i>					
All	151	11.6	8.0	.1	75.5
Non-union	124	11.6	8.0	.1	75.5
Union	27	11.7	7.0	2.4	60.0

Notes:

^a Sample size indicates non-missing variables in COMPUSTAT.

^b Defined as price-close calendar year times shares outstanding plus total assets minus common equity all divided by book value of assets.

Table 6. Cumulative average abnormal returns (CAR)

<i>Window</i>	<i>Sample</i>	<i>(5,5)</i>	<i>(5,1)</i>	<i>(2,1)</i>
Overall	147	0.016 ^{**} (0.007)	0.015 ^{**} (0.006)	0.013 ^{**} (0.004)
<i>Nonunion</i>	120	0.015 [*] (0.008)	0.013 [*] (0.007)	0.012 ^{**} (0.005)
<i>Union</i>	27	0.024 [*] (0.012)	0.023 ^{**} (0.010)	0.017 ^{**} (0.007)

Notes: ESOP announcement day (t = -1). Numbers in parentheses are standard errors. CARs estimated using the market model discussed in MacKinlay (1997). Parameters of the model are calculated using returns over the period -260 to -61 and 61 to 260.

^{**} significant at the 5% level, ^{*} significant at the 10% level

Figure 1. ESOP Ownership Shares for Unionized Firms

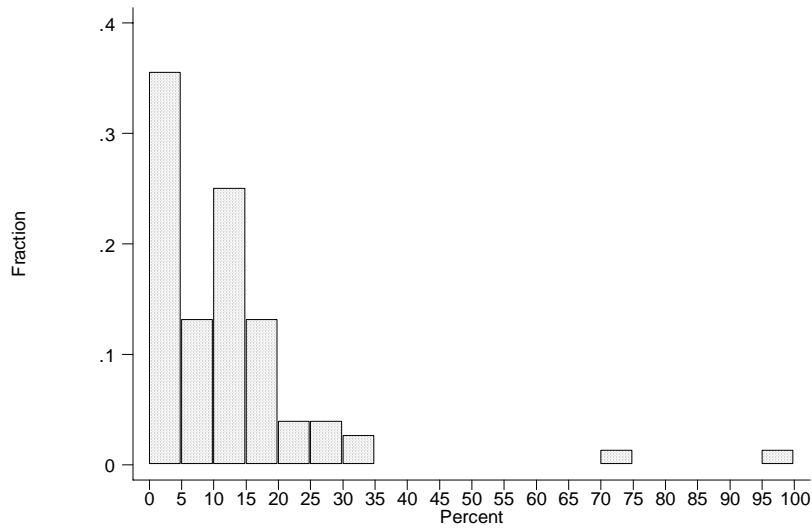


Figure 2. Payoffs from Bargaining Outcome $\langle t, w, \theta \rangle$ with an ESOP of size α

Payoffs During Threat θ		Payoffs After Settlement	
Loss: $(1 - a_\theta)(v + c_\theta)$		Firm: $(1 - \alpha)(v - w)$ Union: $w + \alpha(v - w)$	
Firm: $(1 - \alpha)(a_\theta v - b_\theta)$			
Union: $x_\theta + \alpha(a_\theta v - b_\theta)$			
0	t		T
Old Agreement Expiration	Time of Settlement		New Agreement Expiration

Figure 3. Dispute Incidence as a Function of ESOP Ownership Share

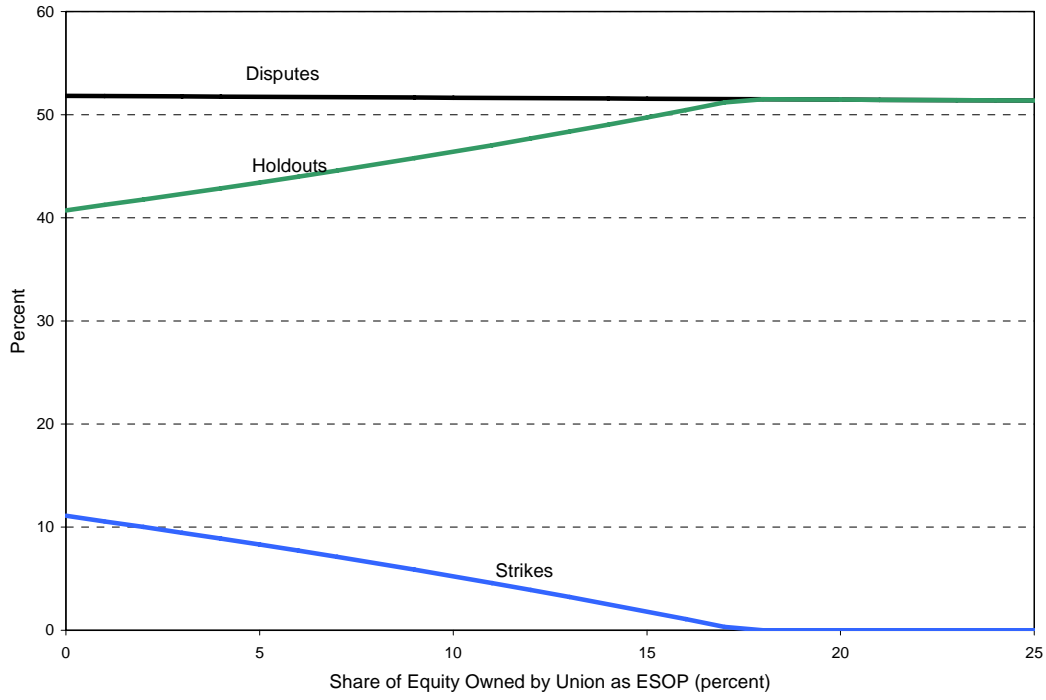
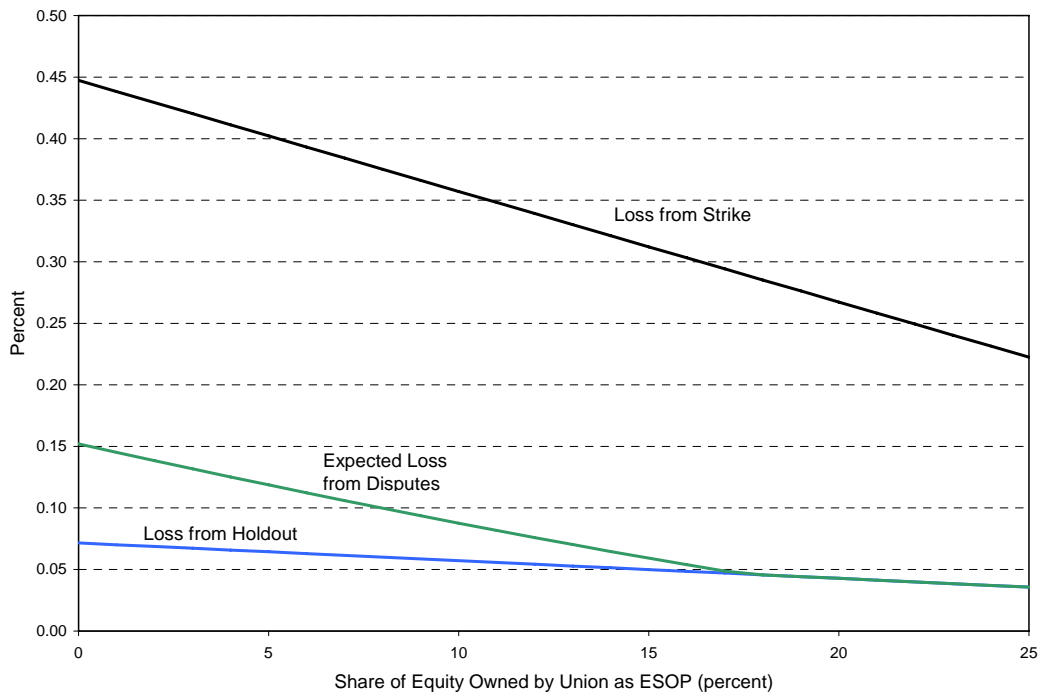


Figure 4. Expected Loss from Dispute as a Function of ESOP Ownership Share



Appendix A

The proofs of Propositions 1-3 are extensions of similar propositions in Cramton and Tracy (1992). As a result only a sketch of the proofs are given.

Proof of Proposition 1. We begin by establishing the Rubinstein wage when the union has an ESOP of size α . Then the payoffs during the threat θ and after settlement are as shown in Figure 1. The Rubinstein wage is determined from a pair of indifference relations, which require the firm offers a wage w_f and union offers wage w_u , such that each is indifferent between immediate acceptance of the other's offer or waiting and having the other accept their offer after a period of delay. Let δ be the discount factor between offers. Then the indifference relations for the union and firm are

$$\begin{aligned} w_f + \alpha(v - w_f) - x_\theta - \alpha(a_\theta v - b_\theta) &= \delta(w_u + \alpha(v - w_u) - x_\theta - \alpha(a_\theta v - b_\theta)) \\ (1 - \alpha)(v - w_u - a_\theta v + b_\theta) &= \delta(1 - \alpha)(v - w_f - a_\theta v + b_\theta). \end{aligned}$$

Solving for the wage offers yields

$$\begin{aligned} w_f &= \frac{\delta((1 - a_\theta)v + b_\theta) + x_\theta}{(1 + \delta)(1 - \alpha)} - \frac{\alpha}{1 - \alpha}((1 - a_\theta)v + b_\theta) \\ w_u &= \frac{(1 - a_\theta)v + b_\theta + \delta x_\theta}{(1 + \delta)(1 - \alpha)} - \frac{\alpha}{1 - \alpha}((1 - a_\theta)v + b_\theta) \end{aligned}$$

Finally, letting the time between offers go to zero ($\delta \rightarrow 1$), gives us the Rubinstein wage for the threat θ :

$$\begin{aligned} w_f = w_u &= \frac{1}{1 - \alpha} \left(\frac{x_\theta}{2} + \left(\frac{1}{2} - \alpha \right) ((1 - a_\theta)v + b_\theta) \right) \\ &= \frac{1}{1 - \alpha} \left(\frac{x_\theta}{2} + \left(\frac{1}{2} - \alpha \right) ((1 - a_\theta)v + (1 - a_\theta)c_\theta + x_\theta) \right) \\ &= \frac{1}{1 - \alpha} \left((1 - \alpha)x_\theta + \left(\frac{1}{2} - \alpha \right) (1 - a_\theta)(v + c_\theta) \right) \\ &= x_\theta + \frac{1 - 2\alpha}{2 - 2\alpha} (1 - a_\theta)(v + c_\theta). \end{aligned}$$

Next we need to determine the firm's optimal choice of delay, which credibly reveals its type. When the firm rejects the union's offer p , it makes the offer $w_\theta(v)$ after delaying for $D(t)$ of the contract period. The new contract expires at time T . Define

$$D(\Delta) \equiv \frac{1 - e^{-r\Delta}}{1 - e^{-rT}}.$$

The firm selects the delay Δ to maximize its profits:

$$\begin{aligned}
& \max_{\Delta} [D(\Delta)(1-\alpha)(a_{\theta}v - b_{\theta}) + (1-D(\Delta))(1-\alpha)(v - w_{\theta})] \\
& = \max_{\Delta} \frac{1-\alpha}{1-e^{-rT}} [(1-e^{-r\Delta})(a_{\theta}v - b_{\theta}) + (e^{-r\Delta} - e^{-rT})(v - x_{\theta} - \frac{1-2\alpha}{2-2\alpha}(1-a_{\theta})(v(\Delta) + c_{\theta}))] \\
& = \max_{\Delta} \frac{1-\alpha}{1-e^{-rT}} [(1-e^{-r\Delta})y_{\theta} + (e^{-r\Delta} - e^{-rT})(v - w_{\theta}[v(\Delta)])].
\end{aligned}$$

The first order condition is

$$\begin{aligned}
& e^{-r\Delta}(r(y_{\theta} - v + w_{\theta}[v(\Delta)]) - (1-e^{-r(T-\Delta)})w'_{\theta}[v(\Delta)]) = 0 \\
& \Rightarrow r(v - w_{\theta}[v(\Delta)] - y_{\theta}) + (1-e^{-r(T-\Delta)})w'_{\theta}[v(\Delta)] = 0,
\end{aligned}$$

where

$$\begin{aligned}
y_{\theta} & = a_{\theta}v - b_{\theta} \\
w_{\theta}(v) & = x_{\theta} + \frac{1-2\alpha}{2-2\alpha}(1-a_{\theta})(v + c_{\theta}) \\
v - w_{\theta}[v(\Delta)] - y_{\theta} & = \frac{1}{2-2\alpha}(1-a_{\theta})(v + c_{\theta}) \\
w'_{\theta}[v(\Delta)] & = \frac{1-2\alpha}{2-2\alpha}(1-a_{\theta})\frac{dv}{d\Delta}.
\end{aligned}$$

Hence,

$$\begin{aligned}
& r(v - w_{\theta}[v(\Delta)] - y_{\theta}) + (1-e^{-r(T-\Delta)})(1-2\alpha)(1-a_{\theta})\frac{dv}{d\Delta} = 0 \\
& \Rightarrow (1-D(t))^{\frac{1}{1-2\alpha}} = \frac{v + c_{\theta}}{m + c_{\theta}} \\
& \Rightarrow 1-D(t) = \left(\frac{v + c_{\theta}}{m + c_{\theta}}\right)^{1-2\alpha} \\
& \therefore D(v) = 1 - \left(\frac{v + c_{\theta}}{m + c_{\theta}}\right)^{1-2\alpha}.
\end{aligned}$$

The final step in the equilibrium construction is to determine the cutoff value m . When the union makes the initial offer $w_{\theta}(m) = x_{\theta} + \frac{1-2\alpha}{2-2\alpha}(1-a_{\theta})(m + c_{\theta})$, then the firm immediately accepts the union's offer if $v \geq m$. Otherwise, the firm with value v delays until $D(v)$ of the contract has passed. The union's utility if there is a dispute is

$$\begin{aligned}
&= (1 - D(v))(w_\theta(v) + \alpha(v - w_\theta(v))) + D(v)(x_\theta + \alpha(a_\theta v - b_\theta)) \\
&= (1 - D(v))((1 - \alpha)x_\theta + \alpha v + (\frac{1}{2} - \alpha)(1 - a_\theta)(v + c_\theta)) + D(v)((1 - \alpha)x_\theta + \alpha v - \alpha(1 - a_\theta)(v + c_\theta)) \\
&= (1 - \alpha)x_\theta + \alpha v - \alpha(1 - a_\theta)(v + c_\theta) + \frac{1}{2}(1 - a_\theta) \frac{(v + c_\theta)^{2-2\alpha}}{(m + c_\theta)^{1-2\alpha}}.
\end{aligned}$$

The union's utility if there is no dispute is

$$\begin{aligned}
&= w_\theta(m) + \alpha(v - w_\theta(m)) \\
&= (1 - \alpha)x_\theta + \alpha v + (\frac{1}{2} - \alpha)(1 - a_\theta)(m + c_\theta)
\end{aligned}$$

Thus, the union's expected utility is

$$\begin{aligned}
U(m) &= (1 - \alpha)x_\theta + \alpha E[v] + \frac{1}{2}(1 - a_\theta) \\
&\quad \times \left\{ (1 - 2\alpha)(m + c_\theta)[1 - F(m)] + \int_l^m \left[\frac{(v + c_\theta)^{2-2\alpha}}{(m + c_\theta)^{1-2\alpha}} - 2\alpha(v + c_\theta) \right] dF(v) \right\}
\end{aligned}$$

and the union chooses m to maximize

$$(1 - 2\alpha)(m + c_\theta)[1 - F(m)] + \int_l^m \left[\frac{(v + c_\theta)^{2-2\alpha}}{(m + c_\theta)^{1-2\alpha}} - 2\alpha(v + c_\theta) \right] dF(v)$$

The first order condition for maximizing m is

$$(1 - 2\alpha)(1 - F(m)) - (1 - 2\alpha)(m + c_\theta)f(m) + (1 - 2\alpha)(m + c_\theta)f(m) - (1 - 2\alpha) \int_l^m \left(\frac{v + c_\theta}{m + c_\theta} \right)^{2-2\alpha} dF(v) = 0$$

$$\therefore 1 - F(m) = \int_l^m \left(\frac{v + c_\theta}{m + c_\theta} \right)^{2-2\alpha} dF(v)$$

$$\Rightarrow 1 - F(m) = F(m) \left(\frac{m + c_\theta}{m + c_\theta} \right)^{2-2\alpha} - F(l) \left(\frac{l + c_\theta}{m + c_\theta} \right)^{2-2\alpha} - 2 \frac{1 - \alpha}{m + c_\theta} \int_l^m \left(\frac{v + c_\theta}{m + c_\theta} \right)^{1-2\alpha} F(v) dv$$

$$\Rightarrow 1 - F(m) = F(m) - 2 \frac{1 - \alpha}{m + c_\theta} \int_l^m \left(\frac{v + c_\theta}{m + c_\theta} \right)^{1-2\alpha} F(v) dv$$

$$\therefore F(m) \geq \frac{1}{2}$$

Now,

$$U'(\mu) = \frac{1}{2}(1 - a_\theta) \left[(1 - 2\alpha)(1 - F(\mu)) - \int_l^\mu \left(\frac{v + c_\theta}{\mu + c_\theta} \right)^{2-2\alpha} dF(v) \right]$$

$$a_\theta < 1 \ \& \ 0 \leq \alpha < \frac{1}{2} \Rightarrow U'(l) > 0 \ \& \ U'(h) < 0.$$

Since, $U'(\cdot)$ is a continuous function, the maximum occurs at an interior point m such that the first-order condition is satisfied. In addition, the second-order condition must also be satisfied, so

$$U''(m) < 0$$

$$\Rightarrow -f(m) - f(m) + (2 - 2\alpha) \int_l^m \frac{(v + c_\theta)^{2-2\alpha}}{(m + c_\theta)^{3-2\alpha}} dF(v) < 0$$

$$\therefore 1 - (1 - \alpha) \int_l^m \frac{(v + c_\theta)^{2-2\alpha}}{(m + c_\theta)^{3-2\alpha}} \frac{f(v)}{f(m)} dv > 0$$

$$\Rightarrow (m + c_\theta) f(m) - (1 - \alpha) \int_l^m \left(\frac{v + c_\theta}{m + c_\theta} \right)^{2-2\alpha} dF(v) > 0$$

$$\therefore (m + c_\theta) f(m) - (1 - \alpha)(1 - F(m)) > 0.$$

Proof of Proposition 2. First we show that dispute incidence falls with α . From the first-order condition:

$$1 - F(m(\alpha)) = \int_l^{m(\alpha)} \left(\frac{v + c_\theta}{m(\alpha) + c_\theta} \right)^{2-2\alpha} dF(v)$$

$$\Rightarrow -f(m) \frac{dm}{d\alpha} = f(m) \frac{dm}{d\alpha} - 2 \int_l^m \left(\frac{v + c_\theta}{m + c_\theta} \right)^{2-2\alpha} \left(\log \left(\frac{v + c_\theta}{m + c_\theta} \right) + \frac{1 - \alpha}{m + c_\theta} \frac{dm}{d\alpha} \right) f(v) dv$$

$$\Rightarrow (-2f(m) + 2 \int_l^m (1 - \alpha) \frac{(v + c_\theta)^{2-2\alpha}}{(m + c_\theta)^{3-2\alpha}} f(v) dv) \frac{dm}{d\alpha} = -2 \int_l^m \left(\frac{v + c_\theta}{m + c_\theta} \right)^{2-2\alpha} \log \left(\frac{v + c_\theta}{m + c_\theta} \right) f(v) dv$$

$$\therefore \frac{dm}{d\alpha} = \frac{\int_l^m \left(\frac{v + c_\theta}{m + c_\theta} \right)^{2-2\alpha} \log \left(\frac{v + c_\theta}{m + c_\theta} \right) \frac{f(v)}{f(m)} dv}{1 - \int_l^m (1 - \alpha) \frac{(v + c_\theta)^{2-2\alpha}}{(m + c_\theta)^{3-2\alpha}} \frac{f(v)}{f(m)} dv}$$

$$v \in [l, m] \Rightarrow \log \left(\frac{v + c_\theta}{m + c_\theta} \right) \leq 0$$

\therefore The numerator is negative and by the second order condition, the denominator is positive

$$\therefore \frac{dm}{d\alpha} < 0 \Rightarrow \frac{dF(m)}{d\alpha} < 0.$$

Therefore, dispute incidence falls as α increases.

Now consider how dispute duration depends on α :

$$D(\alpha) = 1 - \left(\frac{v + c_\theta}{m(\alpha) + c_\theta} \right)^{1-2\alpha}$$

$$\Rightarrow \frac{dD}{d\alpha} = - \left(\frac{v + c_\theta}{m + c_\theta} \right)^{1-2\alpha} \left(-2 \log \left(\frac{v + c_\theta}{m + c_\theta} \right) - \frac{1 - 2\alpha}{m + c_\theta} \frac{dm}{d\alpha} \right)$$

$$\Rightarrow \frac{dD}{d\alpha} = \left(\frac{v + c_\theta}{m + c_\theta} \right)^{1-2\alpha} \left(2 \log \left(\frac{v + c_\theta}{m + c_\theta} \right) + \frac{1 - 2\alpha}{m + c_\theta} \frac{dm}{d\alpha} \right)$$

$$\therefore \frac{dD}{d\alpha} < 0.$$

Therefore, dispute duration falls as α increases.

Now consider how dispute incidence depends on c_θ :

$$\begin{aligned}
1 - F(m(c_\theta)) &= \int_l^{m(c_\theta)} \left(\frac{v + c_\theta}{m(c_\theta) + c_\theta} \right)^{2-2\alpha} dF(v) \\
\Rightarrow -f(m) \frac{dm}{dc_\theta} &= f(m) \frac{dm}{dc_\theta} + 2(1-\alpha) \int_l^m \left(\frac{v + c_\theta}{m + c_\theta} \right)^{1-2\alpha} \frac{m + c_\theta - (v + c_\theta) \left(1 + \frac{dm}{dc_\theta}\right)}{(m + c_\theta)^2} f(v) dv \\
\Rightarrow (1 - (1-\alpha) \int_l^m \frac{(v + c_\theta)^{2-2\alpha}}{(m + c_\theta)^{3-2\alpha}} \frac{f(v)}{f(m)} dv) \frac{dm}{dc_\theta} &= (1-\alpha) \int_l^m \frac{(v + c_\theta)^{2-2\alpha} (v - m)}{(m + c_\theta)^{2-2\alpha}} \frac{f(v)}{f(m)} dv \\
\therefore \frac{dm}{dc_\theta} &< 0.
\end{aligned}$$

Therefore, dispute incidence falls as c_θ increases.

Similarly, consider how dispute duration depends on c_θ :

$$\begin{aligned}
D(c_\theta) &= 1 - \left(\frac{v + c_\theta}{m(c_\theta) + c_\theta} \right)^{1-2\alpha} \\
\Rightarrow \frac{dD}{dc_\theta} &= -(1-2\alpha) \left(\frac{m + c_\theta - (v + c_\theta) \left(1 + \frac{dm}{dc_\theta}\right)}{(m + c_\theta)^2} \right) \left(\frac{v + c_\theta}{m + c_\theta} \right)^{-2\alpha} \\
\Rightarrow \frac{dD}{dc_\theta} &= -(1-2\alpha) \left(\frac{m - v - (v + c_\theta) \frac{dm}{dc_\theta}}{(m + c_\theta)^2} \right) \left(\frac{v + c_\theta}{m + c_\theta} \right)^{-2\alpha} \\
v \in [l, m] &\Rightarrow (m - v) \geq 0 \\
\therefore \frac{dD}{dc_\theta} &< 0
\end{aligned}$$

Therefore, dispute duration falls as c_θ increases.

Finally, we wish to show that a linear mean-preserving spread of the distribution F increases both dispute incidence and dispute duration. This follows, because a linear mean-preserving spread of the distribution is equivalent to a rescaling of the original problem with a smaller c_θ . Hence, both dispute incidence and duration increase from the calculations above.

Proof of Proposition 3. The union will select the threat that maximizes its expected payoff. Using the first order condition, yields the following equation for its expected payoff:

$$\begin{aligned}
U(m) &= (1-\alpha)x_\theta + \alpha E[v] + \frac{1}{2}(1-a_\theta) \\
&\quad \times \{(1-2\alpha)(m+c_\theta)(1-F(m)) + (m+c_\theta)(1-F(m)) - 2\alpha \int_l^m v dF(v) - 2\alpha c_\theta F(m)\} \\
&= (1-\alpha)x_\theta + \alpha E[v] + (1-\alpha)(1-a_\theta)(m+c_\theta)(1-F(m)) - \alpha(1-a_\theta) \left(\int_l^m v dF(v) + c_\theta F(m) \right) \\
&= x_\theta + (1-a_\theta)(m+c_\theta)(1-F(m)) + \alpha(-x_\theta + E[v] + (1-a_\theta) \left(\int_l^m (m-v) dF(v) - m - c_\theta \right)) \\
&= x_\theta + (1-a_\theta)(m+c_\theta)(1-F(m)) + \alpha(a_\theta E[v] - x_\theta - (1-a_\theta)c_\theta + (1-a_\theta) \left(\int_l^h v dF(v) - m - \int_l^m (v-m) dF(v) \right)). \\
\therefore U_\theta &= x_\theta + (1-a_\theta)(m+c_\theta)(1-F(m)) + \alpha(a_\theta E[v] - b_\theta + (1-a_\theta) \int_m^h (v-m) dF(v))
\end{aligned}$$

The union will choose strike over holdout if and only if

$$U_H < U_S$$

$$\begin{aligned}
&\Rightarrow w^0 + (1-a_H)m_H(1-F(m_H)) + \alpha(a_H E[v] - w^0 + (1-a_H) \int_{m_H}^h (v-m_H) dF(v)) \\
&< x_S + (1-a_S)(m_S+c_S)(1-F(m_S)) + \alpha(a_S E[v] - x_S + (1-a_S) \left(\int_{m_S}^h (v-m_S) dF(v) - c_S \right)) \\
&\Rightarrow (1-\alpha)w^0 < (1-\alpha)x_S + (1-a_S)(1-\alpha)(m_S+c_S)(1-F(m_S)) - \alpha c_S(1-a_S)F(m_S) \\
&\quad + \alpha((a_S - a_H)E[v] + (1-a_S) \int_{m_S}^h v dF(v) - (1-a_H) \int_{m_H}^h v dF(v)) - (1-a_H)(1-\alpha)m_H(1-F(m_H)) \\
&\Rightarrow w^0 < x_S + (1-a_S)(m_S+c_S)(1-F(m_S)) - (1-a_H)m_H(1-F(m_H)) \\
&\quad - \frac{\alpha}{1-\alpha} (c_S(1-a_S)F(m_S) + (1-a_S) \int_l^{m_S} v dF(v) - (1-a_H) \int_l^{m_H} v dF(v)) \\
&\therefore \tilde{w} = x_S + (1-a_S)(m_S+c_S)(1-F(m_S)) - (1-a_H)m_H(1-F(m_H)) \\
&\quad - \frac{\alpha}{1-\alpha} (c_S(1-a_S)F(m_S) + (1-a_S) \int_l^{m_S} v dF(v) - (1-a_H) \int_l^{m_H} v dF(v)).
\end{aligned}$$

Proof of Proposition 4. Under Assumption S,

$$c_\theta = 0, \forall \theta \in \{S, H\}$$

$$\Rightarrow m_S = m_H = m(c = 0, \alpha)$$

$$\therefore D(v) = 1 - \left(\frac{v}{m}\right)^{1-2\alpha}$$

$$1 - F(m) = \int_l^m \left(\frac{v}{m}\right)^{2-2\alpha} dF(v)$$

Therefore, dispute incidence and dispute duration for a given v is the same for either threat choice.

$$\begin{aligned} \tilde{w} &= x_S + (a_H - a_S)(m(1 - F(m)) - \frac{\alpha}{1-\alpha} \int_l^m v dF(v)) \\ \Rightarrow \frac{d\tilde{w}}{d\alpha} &= \frac{a_H - a_S}{(1-\alpha)^2} \left(-\int_l^m v dF(v) - (\alpha(1-\alpha)mf(m) - (1-\alpha)^2(1 - F(m) - mf(m))) \frac{dm}{d\alpha} \right) \\ &= \frac{a_H - a_S}{(1-\alpha)^2} \left(-\int_l^m v dF(v) + (1-\alpha)(-mf(m) + (1-\alpha)(1 - F(m))) \frac{dm}{d\alpha} \right) \\ \frac{dm}{d\alpha} &= \frac{\int_l^m \left(\frac{v}{m}\right)^{2-2\alpha} \log\left(\frac{v}{m}\right) \frac{f(v)}{f(m)} dv}{1 - (1-\alpha) \int_l^m \frac{v^{2-2\alpha}}{m^{3-2\alpha}} \frac{f(v)}{f(m)} dv} \\ \Rightarrow (-mf(m) + (1-\alpha)(1 - F(m))) \frac{dm}{d\alpha} &= m \int_l^m \left(\frac{v}{m}\right)^{2-2\alpha} \log\left(\frac{m}{v}\right) dF(v) \\ \therefore \frac{d\tilde{w}}{d\alpha} &= \frac{a_H - a_S}{(1-\alpha)^2} \left(-\int_l^m v dF(v) + (1-\alpha)m \int_l^m \left(\frac{v}{m}\right)^{2-2\alpha} \log\left(\frac{m}{v}\right) dF(v) \right) \end{aligned}$$

$$\gamma \equiv -\int_l^m v dF(v) + (1-\alpha)m \int_l^m \left(\frac{v}{m}\right)^{2-2\alpha} \log\left(\frac{m}{v}\right) dF(v)$$

$$\therefore \gamma < -\int_l^m v dF(v) + (1-\alpha)m \int_l^m \left(\frac{v}{m}\right)^{1-2\alpha} dF(v)$$

$$v \in U[l, h] \Rightarrow$$

$$\gamma < \frac{1}{h-l} \left(-\int_l^m v dv + (1-\alpha)m^{2\alpha} \int_l^m v^{1-2\alpha} dv \right)$$

$$\Rightarrow \gamma < \frac{1}{h-l} \left(-\frac{1}{2}(m^2 - l^2) + \frac{1}{2}m^{2\alpha}(m^{2-2\alpha} - l^{2-2\alpha}) \right)$$

$$\Rightarrow \gamma < \frac{-l^2}{2(h-l)} \left(\left(\frac{m}{l}\right)^{2\alpha} - 1 \right)$$

$$\therefore \gamma < 0$$

When v is distributed uniformly then holdout is used more frequently as a threat choice as α increases.

$$\alpha = 0 \Rightarrow \gamma < -\int_l^m v dF(v) + m \int_l^m \frac{v}{m} dF(v)$$

$$\Rightarrow \gamma < 0$$

When the union is given a small positive share from zero share, then for any distribution of v , holdout is used more frequently as a threat choice as α increases.

Appendix B

Firms that are covered with Collective Bargaining Units and that adopted ESOPs.

1.1	Company Name	Adoption Date	% ESOP
	Anheuser-Busch Cos Inc	4/27/1989	5.5
	Boise Cascade Corp	5/3/1989	12.89
	Brunswick Corp	4/4/1989	5.97
	Colgate-Palmolive Co	6/20/1989	9.14
	Cummins Engine	7/12/1989	11.08
	Dennison Mfg Co	2/24/1976	5
	FMC Corp	4/14/1989	25.55
	GTE Corp	7/17/1989	3.68
	Lukens Inc	6/29/1989	12.8
	Maytag Corp	6/14/1989	3
	Mobil Corp	12/18/1989	2.44
	National Can Corp	2/20/1985	28.1
	National-Standard Co	12/22/1987	29.87
	Olin Corp	5/26/1989	6.31
	Phillips Petroleum Co	6/16/1988	6.12
	PPG Industries Inc	1/20/1989	14
	Quaker Oats Co	1/18/1989	2.52
	Rath Packing Co	9/24/1979	60
	Republic Airlines Inc	7/3/1984	18
	Sara Lee Corp	4/28/1989	6
	Stanley Works	6/7/1989	7.01
	Texaco Inc	12/12/1988	3.27
	Textron Inc	6/8/1989	4.17
	Tribune Co	4/5/1989	8.5
	United Technologies Corp	7/3/1989	8
	Us Airways Group Inc	8/14/1989	5
	Xerox Corp	7/11/1989	11.5