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COLLECTIVE BARGAINING AND THE DIVISION OF THE VALUE OF THE ENTERPRISE

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ABSTRACT

The enterprise (firm) is modeled as a collection of formal and informal contracts providing various factors of production with claims on the income stream in consideration of assets or services supplied to the enterprise. The strongly efficient bargaining model implies that the division of the quasi-rents will result in dollar for dollar exchanges of wealth between the union members and the shareholders. The leading inefficient bargaining models do not imply such tradeoffs in general. The model is tested by considering contract settlements during the years 1976 to 1982 as recorded by the Bureau of National Affairs in **Collective Bargaining Negotiations and Contracts**. Security price data for the firms were merged with these bargaining unit level settlement data. The tests provide substantial confirmation of the dollar for dollar wealth tradeoff between union members and shareholders.

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COLLECTIVE BARGAINING AND THE DIVISION OF THE VALUE OF THE ENTERPRISE

In this paper I view the enterprise as a collection of formal and informal contracts that connects suppliers of labor services, equipment, materials, managerial services, and capital into an organization.[1] The organization produces and distributes a product in exchange for income. This income is then divided among the contracting parties. All of the contracting parties have some claim on the income of the enterprise. It is instructive to distinguish two basic forms of this claim: (a) the right to a specific sum based on the purchase by the enterprise of an asset of the party and (b) the right to claim the residual income.

In enterprises with unionized work forces both union members and shareholders may have specific purchase and residual claims on the income of the organization. The value of the enterprise is the amount that could be obtained from the current sale of a complete residual claim. The claim of the shareholders is measured directly by the current value of all securities issued by the enterprise. The claim of the union members is measured indirectly by the amount the union could obtain from selling the right to work in the enterprise.

Although there is no organized market for the union members' claim, its value represents the capitalized difference between what a worker earns in the enterprise and what he could earn in the next best alternative. Union wealth exists because the managers of a unionized firm

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[1]I have substituted "enterprise" for "firm" to avoid the close identification of the value of the firm with the value of the shareholders' equity. The collection of contracts view of the enterprise is used by Michael Jensen and William Meckling (1976, 1979) and by Eugene Fama and Jensen (1983a, 1983b) to distinguish factors of production by

cannot replace workers at will due to the protection of collective action by employees provided by the National Labor Relations Act.[2] Employees may contest dismissals related to union organizing activity. Union members may contest other dismissals by challenging the employer's "just cause". Union members may also enjoy the right to preferential treatment during recalls from layoff. Consequently, a bargaining unit cannot be replaced at zero incremental cost by nonunion workers whenever the union attempts to extract some of the value of the enterprise above the opportunity cost of the labor supplied by its members.

The protection of collective action extends only to employees of an ongoing establishment. Workers, in general, are not protected. Consequently, American labor law promotes a contest between the union members and shareholders in which the shareholders must commit investments before the union engages in organizing activity. Only successful establishments will ever be organized. The set of all organized establishments, therefore, is not representative of all investments undertaken by shareholders. Organized establishments will, in general,

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the service they sell to the enterprise. Ownership and control are two separate services and, therefore, need not reside in the same factor. In the present model union members supply some ownership by appropriation of quasi-rents produced by the enterprise. These rents are made appropriable through the protection of employee collective action under the National Labor Relations Act. See Benjamin Klein, et. al. (1979) for a discussion of rent appropriation. See Richard Posner (1984) for a detailed treatment of the relation between economics and labor law. I will assume the managers' agency problems are fully solved. Therefore the interests of the managers are perfectly aligned with the interests of the shareholders.

[2]See Bernard Meltzer (1977 pp. 195-229) for an overview of the legal framework surrounding this protection.

be more successful than the average establishment. This implies that the value of a complete residual claim in an organized establishment exceeds the value of a complete residual claim on average. The expected quasi-rents accruing to an enterprise, conditional on being organized, are positive and greater than the ex ante return on new investment opportunities available at the time the shareholders committed resources to the enterprise. However, the shareholders are aware that successful investments may become unionized with some probability. The shareholders will only undertake investments in which their ex ante expected return exceeds the opportunity cost of the funds being committed. As long as new investment opportunities differ in their ex ante probabilities of being organized, the structure of American labor law can be expected to distort all investment decisions, perhaps substantially.[3]

In an ongoing enterprise shareholders claim their part of the value by purchasing securities that may appreciate in value and pay dividends. Union members claim their share of the value through periodic negotiations leading to a new collective bargaining agreement. The terms of this agreement specify the determination of bargaining unit compensation and limitations on managers' ability to redirect work away

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[3]Sumner Slichter (1941) made this point when arguing that highly unionized industries will tend to shrink in size owing to the abandonment of the industry by investment. The modern form of the argument is Carliss Baldwin's (1983) argument that investors will choose different technologies in order to reduce the probability of ex post appropriation of the quasi-rents. The question of whether the best shareholder strategy is to use inefficient technology or direct payments to workers to discourage unionization is unsettled. Stephen Bronars and Donald Deere (1986), and Robert Connolly et. al. (1986) discuss the analysis of such models for investment policy.

from bargaining unit members. Although the union equity claim is not alienable, seniority rules serve to allocate this claim among members.[4]

Prior to the negotiation of a new collective bargain public information about the state of the bargaining pair, economy, industry, enterprise, and labor market may be used to form an expectation regarding the outcome of the negotiation. As information accumulates, suggesting that the value of the enterprise has changed or that the claim of the union members on this value has changed, the current value of shareholder claims will change. When a new collective bargaining agreement that deviates substantially from expectations is announced, an informational event occurs. There are two nonexclusive interpretations of this event. First, the parties to the negotiation may have some private information about the value of the enterprise; then, the new agreement partially reveals that information and the value of both the shareholders' and union members' claims may change in the same

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[4]All major collective bargaining agreements contain wage provisions. Ninety-four percent of all major contracts contain provisions for changing the wage scales over the life of the agreement. Ninety percent regulate the manner in which workers may be laid off (59% of major contracts designate seniority as the sole factor determining layoffs). Fifty-one percent of all major contracts have income maintenance provisions specifying work guarantees, severance pay, or supplemental unemployment benefits. Ninety percent of major agreements restrict management rights by limiting subcontracting (50%), restricting supervisors from performing bargaining unit work (54%), restricting the adoption of technology (21%), or restricting plant closing (18%) (Bureau of National Affairs 1983). Eighty-nine percent of major contracts regulate the manner in which workers acquire seniority, which is a factor in layoff rules (89%) promotions (72%) and transfers (50%). Eighty-two percent of major contracts provide for one of the major forms of union security and 89% require dues check-off (Bureau of National Affairs 1983).

direction.[5] Second, the parties to the negotiation may have changed the division of the value of the enterprise for some unexpected reason; then, the value of the shareholders' and union members' claims change in opposing directions.

The goals of this paper are (a) to model the process by which outsiders form an expectation of the bargaining outcome and (b) to quantify the extent to which collective bargaining agreements redistribute the value of the enterprise between union members and shareholders. The theoretical framework developed in Section 1 shows how new information about external factors affecting the bargaining outcome and internal factors affecting the bargaining game is transmitted through the settlement announcement into a transfer of wealth between the shareholders and the union members. Section 2 develops an empirical method for measuring the expected change in union members' wealth using information that is current as of three months prior to the settlement date. The method is applied to a sample of 7,700 collective bargains negotiated between January 1976 and December 1982. In Section 3 I estimate the effect of the unanticipated union wealth changes on the value of the shareholders' equity around the month of settlement. Finally, Section 4 shows that on average new settlements involve changes in the division of the value of the enterprise and not the release of substantial amounts of private information about the enterprise value. My conclusions follow.

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[5]This is the essential feature of asymmetric information strike models. See Drew Fudenberg et. al. (1983), Beth Hayes (1984), and Joseph Tracy (1984, 1986a, 1986b).

1. Models of the Division of the Value

In a collective bargaining relationship in which the parties have symmetric information, the strongly efficient outcome maximizes the value of the enterprise conditional on the common information.[6] To highlight the precommitment of the shareholders' investment, I consider models in which employment and wages are the primary objects of negotiation and the capital stock is fixed. To characterize the bargaining situation, the information environment and product market conditions must be specified. Given this specification, one can determine the maximal value of the enterprise. The division of this value between the union and shareholder claimants, then, is the result of the negotiating process.

The union members' wealth consists of the value of their labor services at the enterprise. Each member of the union has identical labor market opportunities outside the bargaining unit. The preferences of the union are modeled using the following definitions:

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[6]James Brown and Orley Ashenfelter (1986) use the term strongly efficient to refer to the rent maximization model of John Dunlop (1944). Other theoretical analyses based on strong efficiency include Sherwin Rosen (1969), Robert Hall and David Lilien (1979), and Edward Lazear (1983). Weak efficiency refers to the model in which the outcome lies on the contract curve but the union's objective may be any function of wages and employment. Analyses based on weak efficiency include George DeMenil (1971), Ian McDonald and Robert Solow (1981), Andrew Oswald (1984), David Card (1986a, b). Thomas MaCurdy and John Pencavel (1986), and Randall Eberts and Joe Stone (1986). In the models of Henry Farber (1978a), James Dertouzous and Pencavel (1981), Pencavel (1984) the union chooses the wage rate and the firm chooses employment. Finally, in the models of Farber (1978b) and Ashenfelter and George Johnson (1969) the firms acts optimally given arbitrary union behavior. See Farber (forthcoming) for a review.

$L \equiv$ employed union work force,

$w \equiv$ any negotiated wage rate,

$x \equiv$ alternative wage rate, and

$(w - x)L \equiv$ period return to the union members.

All variables are measured over an arbitrary time period (taken to be one month in the empirical analysis). Since the alternative wage rate depends on conditions in the economy as a whole, new information about this wage rate is produced continuously. For the moment, assume that information about the alternative wage rate is available to both union members and shareholders.

The shareholders' wealth consists of the difference between the revenues of the enterprise and the wealth of the union members. The enterprise faces product market conditions that are influenced by external economic factors. The preferences of the shareholders, then, can be modeled as:

$y \equiv$ factors affecting revenue,

$R(L,y) \equiv$ period revenue of the enterprise, and

$R(L,y) - wL \equiv$ period return to the shareholders.[7]

The factors affecting the enterprise's revenue change constantly as a result of changes in economic conditions. For the moment, assume that

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[7]In this formulation, I assume that non-union workers, materials, physical capital, and other inputs are obtained by means of specific purchase contracts only. For technical clarity only the union workers and the shareholders have residual claims. See Rosen (1969) for an early analysis of the equity claims that non-union workers may have in this scenario (threat effects). Lazear (1983) and William Dickens (1985) consider union membership and threat effects in an equilibrium context.

information about these factors is also common to both union members and shareholders.

The relevant present value of wealth functions may be defined as:

$V^E \equiv$ maximum value of the enterprise,

$V^U \equiv$ maximum union members' wealth, and

$V^S \equiv$ maximum shareholders' wealth.

As is well-known the efficient outcomes of bargaining over wages and employment maximize any convex combination of V^U and V^S. The optimal employment choice and the value of the enterprise may be determined without reference to the negotiated wage rate. This value is given by:

$$(1) \quad V^E(\Omega_t) \equiv \max_{\{L_j\}} E\left[\sum_{j=t}^{\infty} \beta^{j-t} R(L_j, y_j) - x_j L_j \mid \Omega_t\right]$$

where

$\Omega_t \equiv$ set of all information known at the beginning of period t,

$\beta \equiv$ nominal, risk adjusted discount factor, and

$E[a \mid b] \equiv$ conditional expectation of a given b.

For any strongly efficient outcome, then, the union and shareholder values are given by:

$$(2) \quad V^U(\Omega_t) = \sum_{j=t}^{\infty} \beta^{j-t} E[(w_j^o - x_j) L_j^o \mid \Omega_t]$$

and

$$(3) \quad V^S(\Omega_t) = V^E(\Omega_t) - V^U(\Omega_t)$$

where

w_j^o ≡ wage rate negotiated in an efficient bargain and

L_j^o ≡ employment in an efficient bargain.

An important implication of the strongly efficient bargain is that the optimum size of union employment depends on current external information and does not depend on the negotiated wage rate.[8]

In order to derive the expected consequences of changes in the bargaining information on outcomes of the negotiation, it is necessary to model the solution to the efficient bargain. The strongly efficient bargaining game with infinite horizon and common information satisfies the assumptions of Ariel Rubenstein's (1982) model. Each bargaining round the union and the shareholders know Ω_t ; therefore, the expected size of the "total pie" is common information. Assume that no production can occur unless there is an agreement on wage rates. Then, because of the absence of informational asymmetries, there will always be such an agreement.[9] The negotiated outcome w^o will split V^E between the union and the shareholders with shares determined by the bargaining protocol used by the pair.[10] Model the division of the value by:

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[8]Card (1986b) makes the important point that if the empirical specification of the information set is incomplete, employment may appear to depend upon the negotiated wage rate because that rate is a leading indicator of the missing external information.

[9]As specified, the theoretical model does not permit strikes because there are no informational asymmetries. Introduction of these asymmetries produces rational strikes. See John Kennan (forthcoming) for a review of the structure of these models.

[10]Melvin Reder and George Neumann (1980) use the term "bargaining protocol" to refer to the implicit negotiation rules the union and shareholders use. In the language of game theory the exact division is determined by the timing of offers and cost of delaying an offer during bargaining. See Sheena McConnell (1986) for a good exposition.

$$(4) \quad w^{o} = \tau\, w^{U} + (1 - \tau)\, w^{S}$$

where

τ ≡ the parameter controlling the division of the value of determined by bargaining,[11]

w^{U} ≡ wage of the efficient bargain with the same value to the union as the best inefficient bargain, and

w^{S} ≡ wage of the efficient bargain with the same value to the shareholders as the best inefficient bargain.

Before relaxing the assumptions of the strongly efficient model, consider its implications for the relation between negotiation activity and the value of common stock. In the strongly efficient model, we may hold information constant from any date t forward. In period t, the information set Ω_t is known by both the union and the shareholders. Therefore, the market value of the shareholders' wealth as of date t completely reflects current information about collective bargains that will occur at all future dates. Suppose a negotiation is concluded at date $t + s$ with the announcement of settlement w^{o}_{t+s}. This settlement will depart from the expectation at date t by the forecast error:

$$(5) \quad e_{t+s} = w^{o}_{t+s} - E[w^{o}_{t+s} \mid \Omega_t] .$$

Since the forecast error has mean zero as of date t, the announcement of a settlement at date $t + s$ has no informational content, on average. In labor negotiations the actual date of settlement is unknown prior to

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[11]This is the parameterization of the bargaining outcome used by Svejnar (1986) in his analysis of the relative bargaining power in U.S. wage settlements.

the conclusion of the negotiation. Since the information content of the settlement is contained in the sign and magnitude of the forecast error e_{t+s}, on average, market adjusted security returns for enterprises that announce a collective bargaining agreement on a particular date should not systematically differ from zero.[12] The sign and magnitude of the change in shareholders' value should depend on the change in union members' wealth. When the settlement forecast error e_{t+s} is realized, it conveys information about the realized value of τ and changes in the external information as revealed in Ω_{t+s}. Since V^E is not affected by the value of τ, we have the strong prediction:

$$(6) \quad \frac{\partial V^S}{\partial \tau} = - \frac{\partial V^U}{\partial \tau} .$$

To determine the effects of new information about product market conditions and the opportunity cost of labor, a model of the effect of these variables on the distribution parameter τ is required. In general, the effects of these variables on τ will be ambiguous. Therefore, the predictions of the strong efficiency model with respect to the arrival of new external information will be stated as functions of the effect of this information on the settlement.[13] The effects of

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[12]In the language of Eugene Fama et. al. (1969) the announcement of a collective bargaining agreement is not new information, therefore, there is no event to which the security price can react. Accountants will recognize this argument as essentially the same reasoning underlying the claim by Ray Ball and P. Brown (1968) that the release of a firm's annual earnings should not, by itself, produce any stock market reaction. Susan Liberty and Jerold Zimmerman (1986) elaborate on the relation between labor negotiations, accounting earnings and stock returns.

[13]The sign and magnitude of the effect of opportunity cost and revenue shifter information on actual settlements may be determined empirically. The present model will make no predictions about these relations.

a change in the revenue shifter y are:

$$\frac{\partial V^U}{\partial y} = \sum_{j=t+s}^{\infty} \beta^{j-t-s} E\left[\frac{\partial w_j^o}{\partial y} L_j^o + (w_j^o - x_j) \frac{\partial L_j^o}{\partial y} \mid \Omega_t\right]$$

$$\frac{\partial V^S}{\partial y} = \sum_{j=t+s}^{\infty} \beta^{j-t-s} E\left[\frac{\partial R_j}{\partial y} - \frac{\partial w_j^o}{\partial y} L_j^o - (w_j^o - x_j) \frac{\partial L^o}{\partial y} \mid \Omega_t\right] .$$

If the new information about revenues increases the negotiated settlement, the effect on union wealth is positive (provided the revenue shifter also increases L^o) and the effect on shareholder wealth is ambiguous. If the new revenue information decreases the settlement wage, the effect on union wealth is ambiguous and the effect on shareholder wealth depends on the direct effect of the revenue shifter on revenue.

The effects of a change in the opportunity cost of labor are:

$$\frac{\partial V^U}{\partial x} = \sum_{j=t+s}^{\infty} \beta^{j-t-s} E\left[\left(\frac{\partial w_j^o}{\partial x} - 1\right)L_j^o + (w_j^o - x_j) \frac{\partial L_j^o}{\partial x} \mid \Omega_t\right]$$

$$\frac{\partial V^S}{\partial x} = \sum_{j=t+s}^{\infty} \beta^{j-t-s} E\left[\frac{\partial w_j^o}{\partial x} L_j^o - (w_j^o - x_j) \frac{\partial L_j^o}{\partial x} \mid \Omega_t\right] .$$

If the new information about opportunity wages increases the wage settlement, the effect on union wealth is ambiguous. If the new information decreases the wage settlement, then the direction of the effect on union wealth depends on the direct effect of the opportunity cost on L^o (usually negative). If the new information decreases the settlement

wage and employment, then the effect on shareholder wealth is positive. Otherwise, the effect is ambiguous.

In order to compare the predictions of the strongly efficient bargaining model with those of alternative models, it is necessary to specify the value of shareholders' and union members' wealth under the alternative. The most commonly used alternative model for the outcome of collective bargains assumes that the contract negotiations determine the wage rate and that the managers determine the level of employment unilaterally.[14] I will refer to this particular form of inefficient outcome as "inefficient bargaining."

It is not in the shareholders' interest to permit management to bargain inefficiently. The value of the enterprise and the value of the shareholders' wealth are both lower under inefficient bargaining than under the strongly efficient solution. Nevertheless, it may not be possible to achieve the strongly efficient solution. Then, the loss in shareholders' wealth given inefficient bargaining may be capitalized once and for all when the bargaining unit is formed.[15] Anticipated changes in the negotiated wage rate under inefficient bargaining do not exchange wealth dollar for dollar between the union and the shareholders. This result is similar to the effect of changes in the infor-

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[14]This is the model called the labor demand curve model by Dertouzos and Pencavel (1981). It is most closely related to a model proposed by Dunlop (1944).

[15]This is the interpretation Richard Ruback and Martin Zimmerman (1984) give to their finding that the value of shareholders' wealth declines when a union is successful in forming a new bargaining unit.

mation set on the values under strong efficiency.

Unanticipated changes in the negotiated wage rate are more difficult to model with inefficient bargaining. To illustrate the comparison between the two types of bargaining consider a single period division of the enterprise wealth under strongly efficient and inefficient bargaining. A strongly efficient bargain maximizes the value of the enterprise and divides the quasi-rents among the union members and shareholders. An inefficient bargain allows the union members and shareholders to negotiate over wage rates but allows the shareholders unilaterally to determine employment.

Suppose the enterprise revenue function is:

$$(7) \quad R(L,y) = yL - \frac{\theta}{2}L^2 ,$$

where

L and y are defined above, and

$\theta \equiv$ nonrandom revenue parameter.

This revenue function implies that marginal revenue is linear in both y and L. Suppose that the union objective function is:

$$(8) \quad V^U = (w - x)L .$$

The shareholder objective function is then:

$$(9) \quad V^S = yL - \frac{\theta}{2}L^2 - wL .$$

A strongly efficient bargain solves:

$$(10) \quad V^E = \max_L \left(yL - \frac{\theta}{2}L^2 - xL\right) .$$

In the strongly efficient solution any wage rate that divides the quasi-rent among the union members and the shareholders is efficient. A solution to the bargaining problem has the form:

$$(11)\quad L^{o}(x,y) = \frac{y - x}{\theta} ,$$

$$(12)\quad w^{o}(x,y,\tau) = \tau(\tfrac{1}{4}y + \tfrac{3}{4}x) + (1 - \tau)(\tfrac{3}{8}y + \tfrac{5}{8}x) ,$$

$$(13)\quad w^{U} = \tfrac{1}{4}y + \tfrac{3}{4}x ,$$

and

$$(14)\quad w^{S} = \tfrac{3}{8}y + \tfrac{5}{8}x .$$

In this solution to the bargaining problem w^{o} is a τ weighted average of the union members' reservation wage w^{U} and the shareholders' reservation wage w^{S}. These reservation wages are determined by finding the division of the value of the enterprise that leaves the union members and shareholders, respectively, indifferent between the strongly efficient and inefficient bargains. The resulting values are:

$$(15)\quad V^{U} = \theta(\tfrac{3}{8} - \tfrac{\tau}{8})\ (\tfrac{y - x}{\theta})^{2} ,$$

$$(16)\quad V^{S} = \theta(\tfrac{1}{8} + \tfrac{\tau}{8})\ (\tfrac{y - x}{\theta})^{2}$$

and

$$(17)\quad V^{E} = \tfrac{\theta}{2}(\tfrac{y - x}{\theta})^{2} .$$

The fundamental proposition of equal tradeoffs between union and shareholder wealth can be simply stated in this model as:

$$(18)\quad \frac{\partial V^U}{\partial \tau} = -\frac{\theta}{8}\left(\frac{y - x}{\theta}\right)^2$$

and

$$(19)\quad \frac{\partial V^S}{\partial \tau} = +\frac{\theta}{8}\left(\frac{y - x}{\theta}\right)^2 .$$

Clearly the reactions are equal in magnitude and opposite in direction.

For the analysis of market valuations of shareholders' wealth we need to evaluate the conditional expectation of the union members' and shareholders' values, given x and y, and the conditional expectation of the shareholders' value, given the innovation in union wealth. These expected values are:

$$(20)\quad E[V^U \mid y, x] = (\bar{w}^\circ - x)L^\circ ,$$

$$(21)\quad V^U - E[V^U] = (w^\circ - \bar{w}^\circ)L^\circ ,$$

$$(22)\quad E[V^S \mid y, x] = \left(\frac{y + x}{2} - \bar{w}^\circ\right)L^\circ ,$$

$$(23)\quad V^S - E[V^S] = -(w^\circ - \bar{w}^\circ)L^\circ ,$$

$$(24)\quad E[V^S - E[V^S] \mid V^U - E[V^U]] = -(V^U - E[V^U]) ,$$

$$(25)\quad \bar{w}^\circ = \bar{\tau}\left(\frac{1}{4}y + \frac{3}{4}x\right) + (1 - \bar{\tau})\left(\frac{3}{8}y + \frac{5}{8}x\right) ,$$

and

$$(26)\quad \bar{\tau} = E[\tau \mid y, x] .$$

Equation (24) is the regression relation that connects unexpected changes in shareholder wealth to unexpected changes in union wealth.

According to this model the theoretical regression coefficient is -1. Because equations (21) and (23) are linear in the unexpected change in the negotiated wage rate, the regression equation in (24) has a theoretical coefficient of -1 regardless of the sign or magnitude of the unexpected change in union wealth. Specifically,

$$(27)\quad E[V^S - E[V^S] \mid V^U - E[V^U] \text{ and } w^\circ > \bar{w}^\circ] = -(V^U - E[V^U])$$

and

$$(28)\quad E[V^S - E[V^S] \mid V^U - E[V^U] \text{ and } w^\circ \leq \bar{w}^\circ] = -(V^U - E[V^U]) .$$

Now consider the inefficient bargain in which the negotiated wage outcome is denoted simply by w. After the negotiation the shareholders may optimize employment. The resulting shareholders' value is:

$$(29)\quad Z^S = \max_L (yL - \frac{\theta}{2}L^2 - wL) = \frac{\theta}{2}(\frac{y - w}{\theta})^2 .$$

The employment outcome is

$$(30)\quad L = (\frac{y - w}{\theta}) .$$

The unexpected change in the value of union wealth, evaluated at the expected level of employment, is:

$$(31)\quad Z^U - E[Z^U] = (w - \bar{w})\bar{L} ,$$

where

$$Z^U = (w - x)L .$$

Finally, the required expectations are:

$$(32)\quad E[Z^S \mid y, x] = \frac{\theta}{2}\bar{L}^2 + \frac{\theta}{2}\frac{\sigma^2}{\theta^2} ,$$

$$(33)\quad Z^S - E[Z^S] = \frac{\theta}{2}\left[\left(\frac{y - w}{\theta}\right)^2 - \bar{L}^2 - \frac{\sigma^2}{\theta^2}\right] ,$$

$$(34)\quad E[Z^S - E[Z^S] \mid Z^U - E[Z^U]] = \left(\frac{\alpha\mu}{2\bar{w}\sigma^2} - 1\right)(Z^U - E[Z^U]) ,$$

where

$\alpha \equiv \frac{\bar{w}}{\bar{L}\theta}$, minus the elasticity of average demand for labor;

$\bar{L} \equiv \left(\frac{y - w}{\theta}\right)$, average demand for labor;

$\bar{w} \equiv E[w \mid y, x]$, the expected settlement;

$\sigma^2 \equiv Var[w \mid y, x]$, the variance of the settlement;

and

$\mu \equiv Skew[w \mid y, x] \equiv E[(w - \bar{w})^3 \mid y, x]$, the skewness of the wage settlement.

Equation (34) is the inefficient bargaining analogue of equation (24). Although equation (31) seems to imply that the union ignores the possibility that the shareholders may change L after w is negotiated, the model does not assume that either the union or the shareholders ignore this possibility. The expression for Z^S correctly allows for ex post changes to L based on w. The quantity $Z^U - E[Z^U]$ is the empirical analogue of $V^U - E[V^U]$ from the efficient bargain; it is not the unexpected change in union wealth given inefficient bargaining. Holding employment at the pre-agreement level permits comparison of the theoretical regression coefficients in the two bargaining models. This comparison requires an expression for the

covariance between innovations in union wealth, holding employment constant, and innovations in shareholder wealth given the shareholders' reaction to the inefficient contract. That is, equation (34) measures the conditional expectation of unexpected shareholder wealth changes under inefficient bargaining given measured unexpected union wealth changes, under the assumption of no employment adjustment, in order to compare the expected coefficient in equation (34) with the one in equation (24).

Equation (34) shows that maintaining linear marginal revenue implies that either zero elasticity of demand ($\alpha = 0$) or symmetric wage expectation errors ($\mu = 0$) are sufficient to make the expected regression coefficient, assuming inefficient bargaining, -1 . However, because of the nonlinearity of equation (33), if one conditions on only positive or negative unexpected union wealth changes, substantially different regression coefficients result.

The expression for the covariance between $Z^S - E[Z^S]$ and $Z^U - E[Z^U]$, conditional on y and x , is:

$$(35)\quad \mathrm{Cov}[Z^S - E[Z^S] \,,\, Z^U - E[Z^U] \mid y, x] = \frac{\theta^2}{2} E\left[\left(\frac{y - \bar{w}}{\theta}\right)^3 \left(\frac{w - \bar{w}}{\theta}\right) - 2\left(\frac{y - \bar{w}}{\theta}\right)^2 \left(\frac{w - \bar{w}}{\theta}\right)^2 + \left(\frac{y - \bar{w}}{\theta}\right) \left(\frac{w - \bar{w}}{\theta}\right)^3\right]$$

Since the mean forecast error for the wage change is 0 , if we consider only positive union wealth changes then:

$$(36)\quad E\left[\left(\frac{y - \bar{w}}{\theta}\right)^3 \left(\frac{w - \bar{w}}{\theta}\right) \mid w > \bar{w}\right] > 0 \,,$$

$$(37)\quad E\left[\left(\frac{y - \bar{w}}{\theta}\right) \left(\frac{w - \bar{w}}{\theta}\right)^3 \mid w > \bar{w}\right] > 0 \,,$$

and

$$(38)\quad E\left[\left(\frac{y - \bar{w}}{\theta}\right)^2 \left(\frac{w - \bar{w}}{\theta}\right)^2 \mid w > \bar{w}\right] > \bar{L}^2 \sigma^2 .$$

The expression in equation (38) is also the conditional variance of $Z^U - E[Z^U]$, given that w is greater than its mean. Therefore, the conditional regression coefficient considering only positive unexpected changes in union wealth is:

$$(39)\quad E[Z^S - E[Z^S] \mid Z^U - E[Z^U] , w > \bar{w}] = (\phi - 1)(Z^U - E[Z^U]) ,$$

where $\phi > 0$ because of (36) and (37). When only positive unexpected changes are considered, the regression of the unexpected change in shareholder wealth on the unexpected change in union wealth should yield a coefficient larger than -1 (between -1 and ∞) under inefficient bargaining. If we consider only negative unexpected changes in union wealth, then the regression coefficient is:

$$(40)\quad E[z^S - E[Z^S] \mid Z^U - E[Z^U] , w < \bar{w}] = (\Gamma - 1)(Z^U - E[Z^U]) ,$$

where $\Gamma < 0$ due to the sign reversals in equations (36) and (37) when the conditioning is reversed. In this case, then, inefficient bargaining implies that the regression coefficient should be less than -1 (between $-\infty$ and -1).

Equations (24), (27) and (28) imply that the expected regression coefficient is always -1 in the efficient case even if we restrict our attention to positive or negative unexpected changes in union wealth. Unless the distribution of negotiated wages is degenerate ($\sigma^2 = 0$), it

is impossible for equations (34), (39), and (40) simultaneously to imply that the regression coefficient under study is -1 with inefficient bargaining. That is, μ, ϕ, and Γ cannot be zero simultaneously. In general, $\alpha \neq 0$ or $\mu \neq 0$, hence, decomposing the unexpected union wealth change $\hat{}$ into positive and negative outcomes produces a regression with equal expected coefficients on both positive and negative outcomes only under efficient bargaining. Under inefficient bargaining if the marginal revenue function is linear in employment, then, positive unanticipated changes in the negotiated wage rate decrease shareholder wealth by less than a dollar for every dollar increase in union wealth. Under the same conditions, negative unanticipated changes in the negotiated wage rate increase shareholder wealth by more than a dollar for every dollar decrease in union wealth. Linear marginal revenue and symmetric expectation errors imply that the average effect of unanticipated changes in union wealth on shareholder wealth is -1 regardless of bargaining regime. This is a very special result. Any curvature in the marginal revenue function or asymmetry in the forecast error distribution will eliminate the exact dollar for dollar tradeoff, on average, for unanticipated changes in shareholder wealth under inefficient bargaining.

A third interpretation of the wealth tradeoffs between union members and shareholders arises from considering a nonstochastic version of the one period inefficient bargaining model.[16] Let $\Phi \equiv (w - x)/x$,

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[16]I am grateful to George Johnson for pointing out this interpretation. See his 1986 paper for other elaborations of efficient and inefficient contracting models.

the union-nonunion wage differential. Then, using standard envelope theorem results:

$$(41) \quad \frac{\partial V^U}{\partial w} = L[1 - \Phi \alpha] ,$$

$$(42) \quad \frac{\partial V^S}{\partial w} = -L ,$$

and

$$(43) \quad \frac{\partial V^S}{\partial V^U} = - \frac{1 + \Phi}{1 + \Phi(1 - \alpha)} .$$

The expression in equation (43) approaches -1 as either the union-nonunion wage differential or the elasticity of labor demand approach zero. This interpretation presumes that most statistical variation in w, L, and V^S arises from factors that are fundamentally observable to the union members and shareholders but not observable to the statistical analyst. To the extent the observed variation in these quantities is the result of new information to the union members and shareholders, this nonstochastic model must be interpreted using the regression equations (24), and (34).

In summary, under efficient bargaining unanticipated changes in the settlement that do not involve changes in the external economic information used by the bargainers exchange wealth between the shareholders and union members dollar for dollar. This result holds for all forms of the revenue function and all solutions to the efficient bargain. The tradeoff is linear regardless of the sign, magnitude, or distribution of the unanticipated change in union members' wealth. Under inefficient bargaining, the average effect of unanticipated changes in union members' wealth on shareholders' wealth is negative.

However, the tradeoff is only dollar for dollar, on average, in the special case of linear marginal revenue and symmetric unanticipated wealth changes for the union. Otherwise, the average effect depends upon the curvature of the marginal revenue function. Under inefficient bargaining, the magnitude of the unanticipated wealth change for the shareholders depends upon both the sign and magnitude of the unanticipated change in union members' wealth.

The final specification question considered is the effect of various types of measurement errors on the regression equations (24), (27), (28) and (34), (39), (40). I consider two types of measurement error. The first type arises if the scale of $V^U - E[V^U]$ is incorrect; that is, if the present value of union members' wealth is systematically overstated or understated in percentage terms. In this case the regression coefficients in equations (24) and (34) will be biased: towards zero if $V^U - E[V^U]$ is overstated and toward infinity if $V^U - E[V^U]$ is understated. In either case, the regression coefficients in equations (27) and (28) will reproduce the bias and the regresion coefficients in equations (39) and (40) will bracket the biased coefficient (instead of bracketing -1 .) The implications of efficient and inefficient contracting are, therefore, exactly the same as in the unbiased case.

The second type of measurement error occurs if $V^U - E[V^U]$ must be decomposed into a true forecasting error an error arising from incomplete information in the forecasting equation. In these cases the regression coefficients in all equations are biased towards zero;

however, the implications of efficiency and inefficiency are preserved. The coefficients in equations (27) and (28) remain identical to the coefficient in (24) while the coefficients in equations (39) and (40) bracket the coefficient in equation (34).

2. Measuring the Expected Change in Union Members' Wealth

In this section I discuss the development of bargaining unit level data that measure the wage settlement, bargaining unit size, and value of the shareholders' claim. These data come from a variety of sources. Each source, and the computations performed on the data from that source, is documented in the Data Appendix that accompanies this paper. The data were merged using manual and computer assisted methods. The resulting merged file was checked against the original published sources for a sample of the bargaining pairs.

The basic data on the collective bargaining outcomes were derived from an archival copy of the information published in **Collective Bargaining Negotiations and Contracts** between January 1976 and June 1984. There are 10,771 negotiations reported for the seven year period from January 1976 to December 1982. For each contract the BNA reported the company name, company division, union, local, type of bargaining unit(s), number of employees covered, location of the bargaining unit(s), industry, settlement date, contract term, whether there was a strike before settlement, and a variety of measures of the negotiation outcome.[17] The union was identified by the standard BLS iden-

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[17]These data are more extensive than other bargaining unit level data. However, they cover a shorter time span. Harold Grubert (1968) and Daniel Hamermesh (1970) appear to have been the first to make extensive use of bargaining pair data. Farber (1978b) extended the bargaining pair data of Hamermesh. Wayne Vroman (1982, 1984, 1986) has

tification number. The industry was identified by the four digit Standard Industrial Classification. No standard identifier was provided for the firm.

I merged CUSIP identifiers for up to four different employer firms into every contract for which either the company or division name matched a name on the master CUSIP list maintained by the Center for Research on Security Prices at the University of Chicago. The master CUSIP list identifies any company that had a security traded on the New York Stock Exchange (NYSE) since 1925, traded on the American Stock Exchange (AMEX) since 1962, or had financial information listed in the Compustat data base since 1945. The CUSIP identifier provides the link to security and financial data. The matching process was partially automated so that a research assistant could try many different forms of the name before concluding that no match was possible.

There were 4,212 contracts that could be linked to either NYSE or AMEX security data. There were 3,833 contracts that could be linked to Compustat financial data. The major reason for failure to link was that the contract was negotiated by a multiple employer bargaining unit in

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developed bargaining pair data from the **Current Wage Developments**. These data were also used by Beverly Hirtle (1985, 1986), who merged security price data, to model strike activity. Tracy (1984, 1986a, 1986b) makes extensive use of bargaining pair data from the **Collective Bargaining Calendar** merged with financial data from CRSP to study asymmetric information strike models. Tracy does not have settlement information. Wallace Hendricks and Lawrence Kahn (1984, 1985) have settlement data for the bargaining pairs but do not have links to financial and security data. Cynthia Gramm (1983) has made use of the Hendricks and Kahn data to study the relation between wage settlements and strikes.

the construction industry. All construction industry contracts have been removed from the analysis discussed in this paper. The second major reason for failure to link was that the employer was not a publicly held corporation. The third major reason for failure to link a CUSIP identifier was that the company and/or division name could not be found on the master list. Such employers may have financial data but these data are not available at present.

Closely held firms do not release financial data. Public sector employers and not-for-profit organizations do not have financial data that can be meaningfully compared to the stock market valuation and annual reports of publicly held firms. However, there are many similarities in the collective bargaining agreements negotiated in all of these settings. All non-construction non-government contracts remain in the analyses discussed in this paper except when financial data for the firm are used.[18]

The information on the wage settlement was used to construct the expected hourly wage rate for a representative member of the bargaining unit during each month of the contract up to a maximum of 48 months, given information available as of the date of settlement. This sequence of expected contract wage rates included all scheduled deferred payments and an estimate of the amount due to contingent COLA payments. The estimated COLA amounts were based on the previous 12 month change in the Consumer Price Index for Wage and Salary Workers on the date of settle-

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[18]SIC's 10-14, 20-89 are all included. SIC's 15-17 (Construction) and 90-99 (Governmental Services) are excluded.

ment and the table of typical COLA formulas in Hendricks and Kahn (1985, p. 102). In constructing the expected COLA payment, I used the actual payment interval and first payment date in the data. The formulas in Hendricks and Kahn were then used to estimate the expected size of the payment. See the Data Appendix for details.

Approximately 40% of the contracts had missing information on the number of workers covered. These contracts appear to encompass primarily small bargaining units with less than 1,000 workers. I developed an imputation formula for the missing number of workers based on the conditional expected bargaining unit size given that the unit was less than 1,000 workers and given the industry of the employer. The results reported here make use of this imputation but do not adjust measures of precision to reflect imputation uncertainty.

Table 1 contains a summary of the number of workers covered in the BNA collective bargaining agreements by major industry group and year of settlement. Summary data are provided for manufacturing, non-manufacturing and all contracts. For comparison purposes I also report the number of workers covered by contracts that the BLS lists as expiring in the same year as the BNA settlements.[19] The number of workers covered by BNA settlements follows the general pattern of bargaining found in BLS statistics for large bargaining units. The only major discrepancy occurs in 1982, when settlement was delayed into 1983 for several significant manufacturing agreements that expired in 1982.

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[19]These data are derived from the BLS **Bargaining Calendar**, published annually from 1976 to 1982.

Table I

Number of Workers Covered by Settlements in the BNA's **Collective Bargaining Negotiations and Contracts** Compared to the Number of Workers Covered in the BLS's **Bargaining Calendar** by Major Industry Group by Year (in thousands)

Industry	1976	1977	1978	1979	1980	1981	1982	All
Manufacturing								
BNA	1,726	1,417	530	1,564	1,095	487	866	7,684
BLS	1,838	1,636	466	1,720	1,282	550	2,002	9,495
Nonmanufacturing								
BNA	959	1,225	1,572	941	1,356	1,100	1,012	8,165
BLS	1,673	2,352	900	1,578	1,559	1,365	1,163	10,589
All Industries								
BNA	2,684	2,641	2,101	2,505	2,451	1,587	1,878	15,849
BLS	3,510	3,988	1,366	3,298	2,842	1,915	3,165	20,084

Notes:

a. Nonmanufacturing and All Industries exclude construction and governmental services.

Sources:

1. BNA data from **Collective Bargaining Negotiations and Contracts**, 1976 to 1982.
2. BLS data from **Bargaining Calendar**, 1976 to 1982.

The BNA agreements cover between 1.5 million workers (1981) and 2.7 million workers (1976).

Table 2 shows that number of collective bargaining agreements by major industry group and year of settlement. The overall sample is approximately 60% manufacturing agreements and 40% nonmanufacturing agreements. The manufacturing agreements represent all sectors. The nonmanufacturing agreements are concentrated in the transport, communication, utility, grocery store, and certain service industries. Unions of municipal, state, and postal service employees are not included. The largest number of contracts settle in 1977, the smallest in 1979. Comparable numbers are also reported for the BLS **Bargaining Calendar**.

On the basis of the wage settlement data in the BNA agreements it is possible to calculate the compound annual growth of the wage rate (inclusive of expected COLA payments) over the life of the contract. The formula for this growth rate is given by

$$(44) \quad g_t = \left(\frac{w_{t+12c}}{w_{t-1}}\right)^{1/c} - 1$$

where g_t ≡ the compound annual growth of the wage rate over the life of the contract beginning in month t,

w_{t-1} ≡ the wage prevailing in month $t-1$,

c ≡ the number of years the contract runs.

Table 3 presents a summary of the compound annual growth rate of expected wages for manufacturing, nonmanufacturing and all industries. For comparison purposes the table also presents published BLS summaries

Table 2

Number of Collective Bargaining Agreements Reported in the BNA's **Collective Bargaining Negotiations and Contracts** Compared to the Number of Expirations Reported in the BLS's **Bargaining Calendar** by Major Industry Group by Year

Industry	1976	1977	1978	1979	1980	1981	1982	All
Manufacturing								
BNA	754	1,019	637	586	690	642	560	4,888
BLS	341	458	221	292	387	259	351	2,309
Nonmanufacturing								
BNA	429	502	365	312	444	363	380	2,795
BLS	372	401	236	318	320	266	261	2,174
All Industries								
BNA	1,183	1,521	1,002	898	1,134	1,005	940	7,683
BLS	713	859	457	610	707	525	612	4,483

Notes:

a. Nonmanufacturing and All Industries exclude construction and governmental services.

Sources:

1. BNA data from **Collective Bargaining Negotiations and Contracts**, 1976 to 1982.
2. BLS data from **Bargaining Calendar**, 1976 to 1982.

of the average annual growth rate of wages for contracts settled during the indicated year. The BLS numbers, which I cannot reproduce because the Bureau will not release the microdata for research purposes, are not strictly comparable. The BLS makes no estimate of expected COLA payments and computes a simple, not a compound, annual average growth rate. Table 3 shows that there are substantial differences in the wage adjustments calculated by my method as compared to the BLS method. In general, taking account of the expected COLA payments results in higher compound growth rates.[1] For manufacturing the annual growth rate of negotiated wage rates, using information available in the month of settlement is 3.4 percentage points higher than the BLS estimate over the 1976-1982 period. In nonmanufacturing the COLA adjusted estimate is 1.6 percentage points higher, on average.

3. Measuring the Relation Between Union and Shareholder Wealth

There are four steps in my analysis of the relation between union and shareholder wealth. First, I convert the information on wage rates, settlement date, unit size and industry from the collective bargaining agreement into an estimate of total labor cost. Second, I develop a forecasting model for the present value of labor cost that decomposes the cost of realized collective bargains into expected and unexpected components. Third, I develop an estimate of the unexpected change in

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[20]In 1981 my procedure results in a lower estimate for nonmanufacturing agreements than the BLS estimate. This appears to be due to differences in the coverage between **CBNC** and the **Current Wage Developments** sources.

Table 3

Expected Compound Annual Growth Rate Calculated for BNA Wage Settlements Compared with Simple Annual Rate of Adjustment over the Life of the Agreement As Reported by the BLS by Major Industry Group by Year (percentage per year)

Industry	1976	1977	1978	1979	1980	1981	1982	All
Manufacturing								
BNA	8.2	8.0	8.5	10.2	10.3	10.1	6.1	8.8
BLS	6.0	5.5	6.6	5.4	5.4	6.1	2.6	5.4
Nonmanufacturing								
BNA	8.4	7.7	8.6	10.2	11.4	6.9	5.2	8.4
BLS	6.8	6.0	6.4	6.8	8.3	8.8	4.7	6.8
All Industries								
BNA	8.4	7.7	8.6	10.2	10.9	7.9	5.6	8.6
BLS	6.4	5.7	6.5	6.1	6.7	7.5	3.5	6.1

Notes:

a. Nonmanufacturing and All Industries exclude construction and governmental services.

Sources:

1. BNA data are employment weighted average compound annual growth rates over the life of the new agreement, including expected COLA payments (**Collective Bargaining Negotiations and Contracts**, January 1976 to December 1982, archival data files).
2. BLS data are average percent adjustments in wages in major collective bargaining settlements over the life of the contract at an annual rate of change (**Current Wage Developments**, December 1983, page 36). BLS figures exclude expected COLA payments but are employment weighted.

shareholder wealth from security price movements around the time of settlement. Fourth, I relate the unexpected changes in shareholder wealth to the unexpected changes in union wealth using the regression equations developed in the first Section. This Section discusses each step in turn. The Data Appendix contains detailed examples of the calculations.

Table 4 illustrates the process of estimating the present value of labor cost based on the information in the collective bargain and ancillary information from public data sources. The Table shows the average values of the components of the present value of labor cost for all settlements in each year. The hourly wage rates are taken from my projection of the contract wage rates, including both scheduled deferred increases and expected COLA payments. Annual hours of work is 52.1424 times the BLS estimate of weekly hours and weekly overtime.[21] Annual wage cost per worker is the product of the first year contract wage rate and annual hours of work. Annual fringe benefit cost per worker is the percentage of gross pay represented by legally required payments, insurance, pensions and other items (excluding pay for time not worked and overtime) times annual wage cost per worker.[22] The first year cost per worker is the sum of annual wage cost per worker and annual fringe benefit cost per worker based on the first year wage rate. Second

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[21]**Employment and Earnings**, Table C-2, annual averages for the previous year by two-digit SIC industry groups, March, 1977-83.

[22]**Employee Benefits**, Table 6, annual averages for major industry groups (essentially two-digit SIC based), 1975, 1977-82.

Table 4

Components of the Present Value of Bargaining Unit Labor Costs as Estimated on the Date of Settlement and as Expected Three Months Prior to Settlement for All Industries by Year

Component of Present Value	1976	1977	1978	1979	1980	1981	1982	All
Old Hourly Wage Rate ($/hour)	5.85	6.47	6.41	7.66	8.12	8.50	9.56	7.37
New Hourly Wage Rate (month 12, $/hour)	6.41	7.07	6.99	8.58	8.98	9.20	10.02	8.04
Annual Hours per Worker (000)	2.25	2.21	2.06	2.25	2.12	1.95	2.06	2.15
Annual Wage Cost per Worker ($000)	14.48	15.80	14.60	19.52	19.27	17.88	20.78	17.34
Annual Fringe Cost per Worker ($000)	3.34	3.93	3.36	4.65	4.92	4.08	5.07	4.17
First Year Cost per Worker ($000)	17.83	19.74	17.96	24.18	24.19	21.96	25.85	21.52
Second Year Cost per Worker ($000)	19.21	21.19	19.65	26.71	27.06	23.98	27.40	23.45
Third Year Cost per Worker ($000)	20.46	22.40	21.09	28.94	29.58	25.02	28.47	25.02
Length of New Contract (years)	2.84	2.85	2.87	2.92	2.80	2.81	2.76	2.84
Annual Interest Rate (percent)	9.56	8.94	9.48	10.66	13.54	16.18	16.38	11.71
Present Value per Worker ($000)	48.40	53.91	51.94	67.84	66.92	54.20	64.13	58.17
Size of Bargaining Unit (000)	2.27	1.74	2.10	2.79	2.16	1.58	2.00	2.06
Old PV per Bargaining Unit ($000,000)	93.45	80.10	90.87	153.64	117.82	73.62	116.44	101.32
New PV per Bargaining Unit ($000,000)	109.84	93.62	108.93	189.27	144.65	85.59	128.12	120.00
Expected PV (Growth Method $000,000)	108.37	91.90	107.23	185.05	144.52	84.94	130.83	118.94
Unexpected PV (Growth Method $000,000)	0.53	0.67	0.48	1.74	-0.93	-0.50	-3.03	-0.10
(Standard Deviation)	(14.86)	(8.50)	(25.94)	(54.86)	(44.98)	(43.25)	(55.47)	(37.53)
Expected PV (Direct Method $000,000)	109.22	92.81	108.30	187.29	143.57	85.67	131.44	119.69
Unexpected PV (Direct Method $000,000)	0.61	0.81	0.63	1.98	1.08	-0.08	-3.32	0.31
(Standard Deviation)	(12.53)	(13.58)	(39.14)	(60.00)	(21.07)	(39.66)	(80.05)	(41.68)

Notes:

a. Excludes construction and governmental services (SIC's 15-17, 90-99).

b. Entries from "Old Hourly Wage Rate" to "Present Value per Worker" are weighted averages using the size of the bargaining unit as the weight. Entries from "Size of Bargaining Unit" to the end of the table are simple averages and standard deviations over all bargaining units. There are 7,683 bargaining units. See Tables 1 and 2 for the breakdown of workers and bargaining units by year.

Sources:

1. Hourly wage rates, contract length, unit size, settlement date, industry, COLA terms: Collective Bargaining Negotiations and Contracts, as recorded in archival data base 1976-82.
2. Annual hours: Employment and Earnings Table C-2, annual average weekly hours, 1976-82, 2-digit SIC level.
3. Annual fringe cost: Employee Benefits, Table 6, annual average rate 1975, 1977-82, 2-digit SIC level.
4. Annual interest rate: Moody's BAA rate from Data Resources, Inc. average of daily rates during the month.
5. All other lines: author's calculations.

and third year cost per worker are based on the second and third year wage rates, respectively. The first, second, and third year wage rates are the ones effective on the last month of the contract year.

I converted these annual labor cost estimates into present values. As the "Length of New Contract" row of Table 4 shows, most workers are covered by three year contracts; however, present values were calculated using the actual contract length and using fixed horizons of one, three, and nine years for all contracts. The projected annual labor costs were reduced to present value using the Moody's BAA rate that prevailed during the settlement month. The "Annual Interest Rate" row of the Table summarizes these rates. The "Present Value per Worker" row shows the present value of labor cost per worker over the life of the new contract. This is multiplied by the size of the bargaining unit to obtain an estimate of the present value of labor cost for the bargaining unit. The "Old PV per Bargaining Unit" row shows the present value of labor cost assuming that the wage rate on the last month of the old contract remains effective over the life of the new contract. The "New PV per Bargaining Unit" row shows the projected present value of labor cost associated with the new agreement.

Consider next the related problems of forecasting the present value of labor cost for the bargaining unit and measuring the unexpected change in labor cost that is realized when the settlement is announced. It is necessary to specify the horizon over which any unexpected change in labor cost is likely to persist and to estimate a forecasting equation for the relation between external information and the present

value of labor cost. Since the size of the unexpected change in union wealth depends substantially on both of these assumptions, I have systematically examined the effects of different present value horizons and different forecasting equations on the resulting measure of unexpected union wealth change.

The only useful forecasts of labor cost must be based on information that is available prior to the day the collective bargaining agreement is settled. I consider two types of legitimate forecasting information: indicators of the state of the economy three months before the date of settlement and indicators of the state of the bargaining unit near the end of the previous contract. I also consider two types of illegitimate forecasting information: estimates of the industry-specific and year-specific differences among agreements. The legitimate forecasting information can be known in advance of settlement. The illegitimate information can only be known ex post. Therefore, forecasts based on the industry and year effects are more accurate than any true ex ante forecast.

I forecast two different measures of the change in labor cost: the compound annual growth rate of the contract wage (g_t) and the percentage change in the present value of labor cost per worker between the old and new contract (f_t) .[23] Table 5 presents the summary sta-

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[23]In terms of the items summarized in Table 4 this variable is defined as 100 x ("New PV per Bargaining Unit"/"Old PV per Bargaining Unit" - 1). The size of the bargaining unit cancels from the numerator and denominator of the ratio since it was measured on the date of settlement of the new contract.

tistics and least squares regression results (weighted by the size of the bargaining unit) for equations using three different information sets and both measures of labor cost change.

Table 5, Columns A-D present the results for equations predicting the compound growth rate of wages. These results are most comparable to other studies of the determinants of negotiated wage changes that use bargaining unit level data.[24] Column A presents means and standard deviations for all of the major variables used in Columns B-D. Column B presents the estimated regression coefficients and standard errors from an equation that uses only major economy-wide predictors, all measured three months prior to settlement. Column C includes two bargaining unit-specific predictors, measured as of the end of the old contract. Column D includes two-digit SIC industry effects and year-effects. Columns B and C are very similar and quite consistent with other studies. In particular, the inflation elasticity of about one-half is consistent with other evidence. The unemployment elasticity of about -.6 is also consistent with other evidence.[25] As Column C shows, over this period high wage bargaining units received lower wage increases and larger units received higher increases. Column D shows that the inclusion of industry and year effects substantially improves the goodness-of-fit of

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[24]In particular see W. Craig Riddell (1979) and Louis Christofides et al. (1980) for Canada and Hamermesh (1970), Farber (1978b), Vroman (1982, 1984, 1986), Svenjar (1986) and Hirtle (1986) for the United States.

[25]These equations are often called "micro-Phillips curves." Hamermesh (1970), Riddell (1979), and Vroman (1982) interpret their results for similar equations in this manner.

Table 5

Estimates of the Effects of Economy-wide, Bargaining Unit-specific, and Industry-specific Information on Annual Expected Wage Growth and Present Value of Labor Cost Growth for Wage Settlements Negotiated between January 1976 and December 1982

Wage Settlement Measure:	Compound Annual Growth Rate				Percentage Change in Present Value			
Variable Name	(A) Mean (S.Dev.)	(B) Coeff. (S.Err.)	(C) Coeff. (S.Err.)	(D) Coeff. (S.Err.)	(E) Mean (S.Dev.)	(F) Coeff. (S.Err.)	(G) Coeff. (S.Err.)	(H) Coeff. (S.Err.)
Percent Change in Wage Settlement Measure	8.6 (3.2)	Dep.	Dep.	Dep.	18.2 (7.4)	Dep.	Dep.	Dep.
Annual Percent Change in Consumer Price Index for Wage & Salary Workers (lagged 3 months)	8.8 (3.0)	0.52 (0.02)	0.55 (0.02)	0.45 (0.04)	8.8 (3.0)	0.93 (0.05)	0.95 (0.05)	0.22 (0.10)
Annual Percent Change in Real Gross National Product (lagged 3 months)	3.0 (2.7)	0.22 (0.02)	0.13 (0.02)	-0.04 (0.03)	3.0 (2.7)	0.48 (0.06)	0.40 (0.06)	0.12 (0.08)
Annual Percent Change in Average Hourly Earnings of Nonagricultural Workers (lagged 3 months)	7.9 (0.8)	-0.81 (0.05)	-0.66 (0.05)	-0.47 (0.08)	7.9 (0.8)	-1.81 (0.12)	-1.79 (0.12)	-1.13 (0.18)
Civilian Unemployment Rate (lagged three months)	7.2 (1.0)	-0.64 (0.06)	-0.55 0.05	0.43 (0.12)	7.2 (1.0)	-2.08 (0.13)	-2.07 (0.13)	-0.03 (0.28)
Log of the final wage rate in the previous (expiring) contract	2.0 (0.3)		-2.62 (0.12)	-4.02 (0.17)				
Log of one year of labor cost under old contract					5.7 (2.3)		-1.86 (0.22)	Note a
Log of the size of the bargaining unit	2.8 (2.2)		0.05 (0.02)	0.07 (0.02)	2.8 (2.2)		2.03 (0.23)	0.05 (0.04)
Intercept		14.36 (0.74)	17.56 (0.73)	10.37 (1.38)		37.74 (1.72)	42.57 (1.82)	21.55 (3.22)
Industry Effects		No	No	Yes		No	No	Yes
Year Effects		No	No	Yes		No	No	Yes
Unweighted sample size	7,683				7,683			
Standard Error of Equation		2.87	2.78	2.50		6.69	6.66	5.94
Adjusted R-squared		0.20	0.25	0.39		0.19	0.20	0.36

Notes:

a. The equation is too collinear to include this variable.

Sources:

1. Wage Settlements from Collective Bargaining Negotiations and Contracts January 1976 to December 1982.
2. Consumer Price Index for Urban Wage & Salary Workers, not seasonally adjusted, Official BLS data.
3. Real Gross National Product, not seasonally adjusted, Official Department of Commerce data.
4. Average Hourly Earnings for Nonagricultural Production Workers, not seasonally adjusted, Official BLS data.
5. Civilian Unemployment Rate, not seasonally adjusted, Official BLS data.

the equation; however, the effects of the economy and bargaining unit information are substantially changed. The equation in Column D could not have been used by an informed observed to predict wage settlements.

Table 5, Columns E-H present the results for equations predicting the percentage change in the present value of labor cost. Column E presents summary statistics. Column F presents the regression coefficients and standard errors for an equation that uses only economy-wide information. Column G includes the bargaining unit-specific information. Column H includes the industry and year effects. All results for these equations are qualitatively similar to the results for the wage rate growth equations.

I used two methods for decomposing the present value of labor cost into expected and unexpected components. The first method is based on the wage rate growth forecast. Let $E[V_t^U]$ represent the expected present value of labor cost, C_t represent the annual labor cost based on the old hourly wage rate, $\hat{g}_t$ represent the predicted compound annual growth rate (from Table 5, Columns B-D) divided by 100, $\hat{u}_t$ represent the residual from the growth rate forecasting equation divided by 100, and β_t represent the annual discount factor. Then, the present value of expected labor cost over T years is

$$E[V_t^U] = \sum_{j=1}^{\infty} \beta_t^j (1 + \hat{g}_t)^j C_t .$$

The unexpected change in labor cost is (to a first order approximation):

$$V^U - E[V_t^U] = \sum_{j=1}^{\infty} \beta_t^j \, j \, \hat{u}_t (1 + \hat{g}_t)^j C_t .$$

The average values of expected union wealth and the unexpected change in

union wealth from these formulas are summarized in Table 4 in the Rows "Expected PV (Growth Method)" and "Unexpected PV (Growth Method)." The standard deviation of the unexpected change is summarized in the following row.[26]

The second method for decomposing the present value of labor cost into expected and unexpected components is based on the forecasting equation for the percentage in change in present value. Let V^U_{t-1} represent the present value over a horizon of T years of labor cost using the hourly wage rate at the end of the old contract, V^U_t represent the present value over a horizon T years of labor cost using the hourly wage rates in the new contract, $\hat{f}_t$ represent the predicted percentage change in the present value over a horizon of T years (from Table 5, Columns F-H) divided by 100, and $\hat{v}_t$ represent the residual from the percentage change in present value forecasting equation divided by 100. Then, the present value of expected labor cost over T years is

$$E[V^U_t] = (1 + \hat{f}_t)\, V^U_{t-1} .$$

The unexpected change in labor cost is:

$$V^U_t - E[V^U_t] = \hat{v}_t\, V^U_{t-1} .$$

The average values of expected union wealth and the unexpected change in union wealth from these formulas are summarized in Table 4 in the Rows "Expected PV (Direct Method)" and "Unexpected PV (Direct Method)." The

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[26]The growth method summary statistics in Table 4 use the equation in Table 5, Column C.

standard deviation is summarized in the following row.[27]

Consider next the calculation of the expected shareholder wealth and the unexpected change in shareholder wealth. The expected shareholder wealth is given by the value of common stock on the last day of the month three months prior to the settlement month. Call this $E[V_t^S]$. Let r_{t-2}, r_{t-1}, and r_t represent the difference between the dividend inclusive return on common stock in month t and the value weighted return on the New York Stock Exchange during the same month. Then the unexpected change in shareholder wealth is:

$$V_t^S - E[V_t^S] = ((1 + r_{t-2})\ (1 + r_{t-1})\ (1 + r_t) - 1)\ E[V_t^S]$$

See the Data Appendix for details of this calculation.

Consider, finally, the effect of the new collective bargaining agreement, and the resulting unexpected change in union wealth, on shareholder wealth. Because of the way in which the information sets were chosen, my measure of the unexpected change in union members' wealth captures the effects of changes in a three month period beginning two months prior to the settlement month and ending with the settlement month. My measure of the unexpected change in shareholders' wealth captures the effects of changes over the same period of months. Therefore, these two quantities correspond to the unexpected wealth changes whose regression relation is modeled, under strong efficiency assumptions, in equations (24), (27), and (28), and, under inefficiency

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[27]The direct method summary statistics in Table 4 use the equation in Table 5, Column G.

assumptions, in equations (34), (39), and (40). That is, they correspond to unexpected wealth changes that are realized over the same real time period.

During the negotiation of the new collective bargaining agreement, rational investors will adjust the value of shareholders' wealth to reflect all the information about future labor cost contained in the forecasting equations for union members' wealth. On the date of settlement, the stock market will react to the new information; however, the expected value of the new information is zero. Stock prices should not move systematically in either direction, on average. In a conventional security price event study, then, one would not expect any substantial excess return in the months surrounding the settlement of a new collective bargain.[28] Analysis of the excess returns for the employers involved in my collective bargains confirms this prediction. The average excess return in the month of settlemnt is 0.17% (with a standard error of 0.16). The cumulative excess return in the three month period beginning two months before settlement and ending on the settlement month is 0.83% (with a standard error of 0.27). Evidently, there is some favorable information in the fact of settlement alone; however, the magnitude is trivial.[29]

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[28]See Fama et al. (1969) for a description of the event study methodology, See Steven Brown and Jerold Warner (1980) and G. William Schwert (1981) for a summary of the statistical properties of these tests.

[29]This result should be compared to the -1.38% average excess return on the announcement of a certification drive and the -2.41% excess return if the union is successful in winning the subsequent election found by Richard Ruback and Martin Zimmerman (1984).

Regression analysis reveals substantial evidence that the sign and magnitude of the unexpected change in union wealth affect the change in shareholder wealth. Tables 6 and 7 summarize this evidence. Table 6 reports the summary statistics, regression coefficients, and standard errors for an analysis of the effect of unexpected union wealth changes on unexpected shareholder wealth changes when the union wealth change is measured using the wage rate growth method. Table 7 reports similar results when the unexpected union wealth change is measured using the direct present value method. The Panels, Rows and Columns of both Tables have identical interpretations. Panel A shows the results when the horizon used to calculate the present value of the unexpected change in union wealth is the length of the new contract. Panel B shows the results when the horizon used to calculate the present value of the unexpected change in union wealth is varied systematically from one year to nine years for all contracts. Columns A-D report results for unexpected changes based on economy-wide forecasting information only (from Table 5, Columns B and F). Columns E-H report results for unexpected changes in union wealth based on all information including industry and year effects (from Table 5, Columns D and H).

The estimated effects in Tables 6 and 7 are very consistent with the strong efficiency model. As Panel A of both tables shows, when the length of the new contract is used as the horizon for unexpected union wealth changes, the estimated effect of these changes on shareholder wealth varies between -0.64 and -0.93 (from the Row "Unexpected Change in Union Wealth over the life of the New Contract" and Columns B, F, and

Table 6

Estimates of the Effect of the Unexpected Change in Union Wealth on the Unexpected Change in Shareholder Wealth
Using the Wage Rate Growth Forecasting Equations with Alternative Types of Forecasting Information

Forecast Equation Type:	Excludes BU-specific Information				Includes BU-specific Information				Year and Industry Effects			
Variable Name	(A) Mean (S.Dev.)	(B) Coeff. (S.Err.)	(C) Coeff. (S.Err.)	(D) Coeff. (S.Err.)	(E) Mean (S.Dev.)	(F) Coeff. (S.Err.)	(G) Coeff. (S.Err.)	(H) Coeff. (S.Err.)	(I) Mean (S.Dev.)	(J) Coeff. (S.Err.)	(K) Coeff. (S.Err.)	(L) Coeff. (S.Err.)
A. Horizon Determined by the Length of the New Contract												
Unexpected Change in Shareholder Wealth within 3 Months of Settlement (millions of dollars)	-11.0 (340.3)	Dep.	Dep.	Dep.	-11.0 (340.3)	Dep.	Dep.	Dep.	-11.0 (340.3)	Dep.	Dep.	Dep.
Unexpected Change in Union Wealth over the Life of the New Contract (millions of dollars)	-0.2 (50.5)	-0.64 (0.18)	-0.65 (0.18)		0.9 (47.0)	-0.63 (0.19)	-0.67 (0.20)		0.1 (34.5)	-0.77 (0.36)	-0.77 (0.36)	
Expected Bargaining Unit Wealth over the Life of the New Contract (millions of dollars)	215.4 (1,405.7)		0.00 (0.01)		214.3 (1,400.0)		0.00 (0.01)		215.2 (1,411.4)		-0.00 (0.01)	
Unexpected Change in Union Wealth Positive over the Life of the New Contract (millions of dollars)	3.4 (30.4)			-1.29 (0.30)	3.9 (34.4)			-0.88 (0.26)	3.1 (24.0)			-0.50 (0.51)
Unexpected Change in Union Wealth Negative over the Life of the New Contract (millions of dollars)	-3.6 (40.0)			-0.26 (0.23)	-3.0 (31.6)			-0.33 (0.28)	-3.1 (24.3)			-1.03 (0.50)
Intercept		-17.36 (6.83)	-17.70 (6.88)	-15.39 (6.86)		-8.22 (6.60)	-8.81 (6.65)	-7.22 (6.64)		-5.46 (9.06)	-5.39 (9.13)	-6.34 (9.14)
B. Various Fixed Horizons for the Change in Union Wealth												
1 Year Horizon Unexpected Change in Union Wealth	0.1 (7.2)	-5.57 (1.28)			0.3 (7.2)	-4.77 (1.26)			0.1 (5.7)	-4.97 (2.14)		
Positive Unexpected Union Wealth Change	0.5 (5.2)			-7.49 (1.75)	0.6 (6.0)			-4.98 (1.50)	0.4 (4.3)			-2.56 (2.86)
Negative Unexpected Union Wealth Change	-0.4 (4.8)			-3.52 (1.92)	-0.4 (3.8)			-4.40 (2.35)	-0.4 (3.7)			-8.14 (3.32)
3 Year Horizon Unexpected Change in Union Wealth	0.5 (41.9)	-0.93 (0.22)			1.5 (41.9)	-0.80 (0.22)			0.5 (33.6)	-0.84 (0.37)		
Positive Unexpected Union Wealth Change	3.7 (31.0)			-1.23 (0.30)	4.2 (35.2)			-0.84 (0.25)	3.5 (25.2)			-0.47 (0.48)
Negative Unexpected Union Wealth Change	-3.2 (27.8)			-0.56 (0.33)	-2.7 (22.1)			-0.69 (0.41)	-2.9 (21.6)			-1.33 (0.57)
9 Year Horizon Unexpected Change in Union Wealth	3.0 (294.4)	-0.12 (0.03)			10.0 (294.3)	-0.11 (0.03)			2.9 237.6	-0.12 (0.05)		
Positive Unexpected Union Wealth Change	26.7 (221.8)			-0.16 (0.05)	29.9 (251.4)			-0.12 (0.04)	24.8 (180.4)			-0.07 (0.07)
Negative Unexpected Union Wealth Change	-23.7 (190.3)			-0.16 (0.04)	-19.9 (149.1)			-0.09 (0.06)	-21.9 (151.1)			-0.18 (0.08)

Notes:

a. Unweighted sample size is 2,228.
b. All standard errors are corrected for heteroscedasticity in the underlying wealth change regression.
c. Positive and negative unexpected union wealth changes exclude amounts less than $3 million in absolute value.

Sources:

1. Unexpected changes in union wealth are based on estimated wealth change equations in Table 5.
2. Wage settlement data from Collective Bargaining Negotiations and Contracts, January 1976 to December 1982.
3. Security price and return data from Center for Research in Security Prices, January 1975 to December 1983.

Table 7

Estimates of the Effect of the Unexpected Change in Union Wealth on the Unexpected Change in Shareholder Wealth
Using the Present Value Forecasting Equations with Alternative Types of Forecasting Information

Forecast Equation Type:	Excludes BU-specific Information				Includes BU-specific Information				Year and Industry Effects			
Variable Name	(A) Mean (S.Dev.)	(B) Coeff. (S.Err.)	(C) Coeff. (S.Err.)	(D) Coeff. (S.Err.)	(E) Mean (S.Dev.)	(F) Coeff. (S.Err.)	(G) Coeff. (S.Err.)	(H) Coeff. (S.Err.)	(I) Mean (S.Dev.)	(J) Coeff. (S.Err.)	(K) Coeff. (S.Err.)	(L) Coeff. (S.Err.)
A. Horizon Determined by the Length of the New Contract												
Unexpected Change in Shareholder Wealth within 3 Months of Settlement (millions of dollars)	-11.0 (340.3)	Dep.	Dep.	Dep.	-11.0 (340.3)	Dep.	Dep.	Dep.	-11.0 (340.3)	Dep.	Dep.	Dep.
Unexpected Change in Union Wealth over the Life of the New Contract (millions of dollars)	1.2 (39.8)	-0.83 (0.26)	-0.95 (0.28)		1.9 (39.5)	-0.79 (0.28)	-0.96 (0.32)		0.1 (33.0)	-0.93 (0.32)	-0.93 (0.32)	
Expected Bargaining Unit Wealth over the Life of the New Contract (millions of dollars)	216.3 (1,410.7)		0.01 (0.01)		215.7 (1,409.8)		0.01 (0.01)		217.5 (1,423.7)		-0.00 (0.01)	
Unexpected Change in Union Wealth Positive over the Life of the New Contract (millions of dollars)	4.2 (34.2)			-0.88 (0.30)	4.5 (34.9)			-0.74 (0.32)	3.2 (23.7)			-0.71 (0.44)
Unexpected Change in Union Wealth Negative over the Life of the New Contract (millions of dollars)	-2.8 (19.7)			-0.69 (0.51)	-2.5 (17.9)			-1.01 (0.62)	-3.1 (22.5)			-1.17 (0.46)
Intercept		3.78 (6.69)	3.01 (6.74)			-8.54 (7.15)	-9.47 (7.19)			1.47 (6.85)	1.47 (6.90)	0.91 (6.91)
B. Various Fixed Horizons for the Change in Union Wealth												
1 Year Horizon Unexpected Change in Union Wealth	0.5 (12.1)	-0.62 (0.85)			0.5 (13.8)	-0.32 (0.80)			0.0 (9.8)	-0.90 (1.08)		
Positive Unexpected Union Wealth Change	1.0 (11.0)			-0.36 (0.93)	1.1 (13.1)			0.01 (0.85)	0.8 (7.9)			-0.23 (1.32)
Negative Unexpected Union Wealth Change	-0.5 (4.9)			-2.05 (2.08)	-0.5 (4.3)			-3.33 (2.58)	-0.7 (5.5)			-2.07 (1.89)
3 Year Horizon Unexpected Change in Union Wealth	0.9 (42.7)	-0.71 (0.24)			1.7 (43.7)	-0.62 (0.25)			-0.2 (34.6)	-0.79 (0.30)		
Positive Unexpected Union Wealth Change	4.2 (36.4)			-0.78 (0.28)	4.6 (39.0)			-0.60 (0.28)	3.3 (25.3)			-0.56 (0.41)
Negative Unexpected Union Wealth Change	-3.2 (21.6)			-0.53 (0.47)	-2.9 (19.0)			-0.71 (0.58)	-3.4 (23.1)			-1.06 (0.45)
9 Year Horizon Unexpected Change in Union Wealth	3.3 (184.3)	-0.23 (0.06)			5.6 (172.1)	-0.26 (0.06)			-1.1 (132.5)	-0.35 (0.08)		
Positive Unexpected Union Wealth Change	15.0 (171.5)			-0.24 (0.06)	15.8 (159.6)			-0.27 (0.18)	11.3 (102.5)			-0.30 (0.10)
Negative Unexpected Union Wealth Change	-11.6 (64.9)			-0.15 (0.16)	-10.1 (61.8)			-0.26 (0.07)	-12.3 (82.3)			-0.44 (0.13)

Notes:

a. Unweighted sample size is 2,228.
b. All standard errors are corrected for heteroscedasticity in the underlying wealth change regression.
c. Positive and negative unexpected union wealth changes exclude amounts less than $3 million in absolute value.

Sources:

1. Unexpected changes in union wealth are based on estimated wealth change equations in Table 5.
2. Wage settlement data from Collective Bargaining Negotiations and Contracts, January 1976 to December 1982.
3. Security price and return data from Center for Research in Security Prices, January 1975 to December 1983.

J) and is never statistically different from -1. As the amount of measurement error in the forecast decreases (going from Column B to J) the estimates get closer to -1. There is no information in the expected present value of union wealth (Columns C, G, and K) that is not already reflected in the expected shareholders wealth measured at the beginning of the three month period. The effect of positive and negative unexpected changes is either statistically identical (Column J) or shows a somewhat larger absolute effect for positive changes than for negative changes (Columns D and H). These results are consistent with the efficient bargaining equations (27) and (28) and are inconsistent with the inefficient equations (39) and (40).

Because the size of the unexpected change in union wealth is very sensitive to the horizon over which the error is hypothesized to continue (see the standard deviations in Panel B. Columns A, E, and I for the row "Unexpected Change in Union Wealth"), I have repeated the regression analyses for fixed horizons of one, three, and nine years in Panel B of Tables 6 and 7. The results for the three year horizon are essentially identical to the results in Panel A for both types of forecasting methods. They are consistent with the efficient bargaining equations and inconsistent with the inefficient bargaining equations. The results for one year and nine year horizons are also consistent with the strong efficiency model. The magnitude of the estimated effect, especially for the one year horizon, is sensitive to the forecasting method used. The symmetric effect of positive and negative wealth changes, however, is evident for all horizons.

Although Tables 6 and 7 show statistical evidence that is consistent with the strong efficiency model, there is some evidence that unexpected union wealth increases result in larger shareholder wealth loses than unexpected union wealth decreases produce in shareholder gains. This would be inconsistent with both of the bargaining models discussed in Section 1. Table 8 shows the reason for this result. The Table lists the ten bargaining units associated with the largest unexpected union wealth increases and the ten units associated with the largest unexpected union wealth decreases. The units associated with the ten largest union wealth increases are very consistent with the strong efficiency model. On the other hand, six of the ten largest decreases in union wealth are associated with the May 1980 basic steel agreement. The shareholder wealth changes for this agreement are inconsistent with either bargaining model. However, this is the only major example of such inconsistency in these data. Although, these agreements are influential in the statistical analysis of the symmetry of shareholder wealth responses, the anomaly is not troublesome enough to justify excluding these settlements.

4. Interpretation and Conclusion

My analysis of the relation between union wealth changes and shareholder wealth changes provides empirical support for the use of strongly efficient bargaining models as a basis for analyzing collective bargaining agreements. The sample of agreements analyzed is broadly

Table 8

List of the 10 Largest Positive and Negative Unexpected Changes in Union Wealth and the Associated Unexpected Change in Shareholders' Wealth from Agreements Settled between January 1976 and December 1982

Company Name	Union Name(s)	Settlement Date	Unexpected Union Wealth Change ($ mil)	Expected Union Wealth ($ mil)	BU Size (thou)	Unexpected Share. Wealth Change ($ mil)	Expected Share-holder Wealth ($ mil)
Ten Largest Increases in Union Wealth							
General Motors	Auto Workers	October 79	1,320	41,131	490	-223	16,583
Ford Motor	Auto Workers	October 79	540	16,527	197	-379	4,417
American Telephone & Telegraph	Communication Workers	August 80	530	22,430	363	-3,672	37,930
Eastern Airlines	Airline Pilots	April 77	169	1,715	4	-23	164
United Airlines	Machinists	June 79	152	1,591	18	-71	781
Boeing	Machinists	October 80	147	3,376	41	-430	3,684
Cessna Aircraft	Machinists	September 81	145	736	10	-145	610
United Technologies	Machinists	December 80	144	1,047	22	254	2,181
U.S. Steel	Steelworkers	April 77	119	8,909	118	137	3,683
Trans World Airlines	Machinists	November 78	108	1,175	14	-83	424
Ten Largest Decreases in Union Wealth							
General Electric	IUE, UE(Ind)	July 79	-137	5,475	90	237	11,202
Wheeling Steel	Steelworkers	May 80	-148	1,771	13	3	77
Armco Steel	Steelworkers	May 80	-153	1,825	13	-117	1,353
National Steel	Steelworkers	May 80	-156	1,866	14	-43	554
Westinghouse	IBEW, Ind. Salaried	September 79	-171	2,342	44	-104	1,697
Inland Steel	Steelworkers	May 80	-236	2,807	21	-13	666
Chrysler	Auto Workers, Salaried	November 79	-330	10,283	124	-130	559
Ford Motor	Auto Workers	February 82	-358	9,788	105	607	1,798
Bethlehem Steel	Steelworkers	May 80	-599	7,025	52	-16	1,023
U.S. Steel	Steelworkers	May 80	-1,163	13,597	100	-1	1,659

Sources: 1. Wage settlements from the BNA's **Collective Bargaining Negotiations and Contracts** 1976-1982.
2. Security values from the University of Chicago Center for Research on Security Prices, monthly master file and monthly returns file, 1975 to 1983.

representative and not restricted to a single industry.[30] The empirical finding that shareholders' wealth moves in the opposite direction of union members' wealth is consistent with other studies of the relation between unions and profitability that are based on broadly representative samples.[31] This finding is also consistent with the emerging literature on unions as rent-seeking organizations.[32] However, the finding is inconsistent with any continuing productivity enhancing activity by the union. Shareholders do not expect to recoup additional union wage cost in the form of extra productivity since they expect to bear the full financial burden of any unexpected increases.[33] Finally, my finding that share prices move in response to significant labor cost changes expands the growing literature that directly measures the

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[30]The analysis of Dertouzous and Pencavel (1981), Dertouzous and Timothy Quinn (1985), Brown and Ashenfelter (1986), and MaCurdy and Pencavel (1986) all deal with the newspaper industry. Eberts and Stone (1986) consider public school teachers. Card (1986b) studies the airline industry. Carruth and Oswald (1984) work with the British coal mining industry. Nancy Rose (1985a, b, and c) considers the trucking industry.

[31]Kim Clark (1984), Ruback and Zimmerman (1984), Richard Freeman and James Medoff (1984, Chapter 12).

[32]See Barry T. Hirsch and John T. Addison (1986, Chapter 7), Michael Salinger (1984), Rose (1985a, b, and c), Bronars and Deere (1986), and Connolly et al. (1986).

[33]This is consistent with Clark's (1984) finding of negligible productivity effects in a sample of establishments similar to my sample. My results are inconsistent with the Charles Brown and Medoff (1978) finding of substantial productivity-enhancing union effects.

effects of industrial relations activity on shareholders wealth.[34]

My quantitative results suggest that information that is current as of two months prior to the conclusion of a new collective bargain may be used to calculate an unbiased prediction of the value of the enterprise and the expected value of the claims of union members and shareholders. The information that becomes available at the settlement date appears to relate primarily to the division of the total value between shareholders and union members and not to the size of the total value of the enterprise. Unexpected changes in union wealth are offset by opposite changes in shareholder wealth of the same magnitude, on average. This result holds, on average, for both positive and negative changes in union wealth, considered separately. Thus, the major prediction of the strong efficiency model is confirmed. Although the result of dollar for dollar tradeoffs in wealth, on average, is consistent with a special form of the labor demand inefficient bargaining model, the result that the effect is the same for positive and negative unexpected changes in union wealth is not consistent with this inefficient bargaining model. On the whole, the security market evidence appears more consistent with the strong efficiency hypothesis than is the evidence from any other collective bargaining model test that has been conducted to date.

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[34]Neumann (1980) finds no shareholder wealth effects from strikes. However, Brian Becker and Craig Olsen (1986) use methods similar to the one used here to find such effects. Susan Liberty and Jerold Zimmerman (1986) find no effect of impending renegotiation of collective bargains on shareholder wealth, which is consistent with my finding that it is the sign and magnitude of the unexpected change in union wealth that matters. Ruback and Zimmerman (1984) find moderate effects on shareholder wealth from the formation of bargaining units.

Long term bargaining relationships may be modeled as if the parties try jointly to maximize the value of the enterprise, once a bargaining unit has been formed. Divergence of interest between the shareholders and the union members, which is consistent with my empirical results, may result exclusively from bargaining over the division of this value. My result should not be interpreted to mean that there are no (potential) efficiency losses from unionization. The value being divided by the union members and the shareholders is an ex post quasi-rent. Ex ante investors seeking new projects must adjust the expected returns from potential projects to reflect the probability that some of the quasi-rents from successful outcomes will be appropriated by union organizing. Thus, investors may systematically choose projects that have lower probabilities of rent appropriation even though, in the absence of unions, those projects have lower net present values than some projects with high rent appropriation probabilities. Capital investment decisions, then, may be distorted by the possibility of rent appropriation by the union. Once an enterprise has been established and a bargaining unit formed, it benefits both the shareholders and the union members to reach strongly efficient bargains. The evidence presented in this paper supports the conclusion that such bargains may occur on average.

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Data Appendix

This appendix describes the data sources and methods used to measure the change in the present value of bargaining unit labor cost as estimated from the historical archive of the Bureau of National Affair's **Collective Bargaining Negotiations and Contracts** data file and the change in the present value of shareholders' wealth around the date of settlement as estimated from the Center for Research in Security Price's **Monthly Stock Returns** data file. To illustrate how the calculations were performed I have selected a listing from the published data (the General Electric settlement shown in Table 8 of the main text). The calculations for that listing are performed in detail. All calculations were performed in double precision in SPSS-X. Examples in this Appendix have been rounded.

The published listing for the July 1979 General Electric contract with the International Union of Electronic, Electrical, Technical, Salaried and Machine Workers (IUE) and the United Electrical, Radio and Machine Workers of America (UE-Ind) (reprinted from the **Daily Labor Report**, July 27, 1979, No. 146, page B-3) follows:

Multistate

General Electric Co - IUE; 3-yr contract (3)
--INCREASE: 12¢ per hr retro to 7-2-70, 17.5¢ 6-30-80, 15¢ 6-29-81; revised c-o-l clause provides 6 semiannual adjustments of 1¢ per hr each 0.2 percent increase in CPI with 1st adjustment of 38¢ retro to 7-2-79; covers approx 70000 employees
--OLD RATE: $6.74 per hour
--OTHER PROVISIONS: First dental plan, imporved ins coverage; $15 per mo (was $10) pens per yr of serv; 3 wks vac after 7 yrs.

General Electric Co - UE(Ind): 3-yr contract (3)
--INCREASE: Wages & fringes same as with IUE (see above); covers approx 17,000 employees

The following is the information about the General Electric and IUE contract (with my annotations in parentheses) that was recorded in the archival data file that summarizes the published listing:

Identification Record
Record ID: 7915037 (published in 1979, number 15, listing 037)
Record Date: 790726 (date settlement was recorded in data file)
Company Name: General Electric Co.
Union: 347 (BLS code for the IUE)
Employees Covered: 90000 (combines UE-Ind employees)
Industry: 3600 (Electrical equipment)
Beginning Date: 790702
Ending Date: 820701
Term of Contract: 36 (months)
Source: 3 (direct report)
Strike: N (no strike preceeded settlement)

Settlement Records
Settlement Date: missing
Wage Rate: 6.74
Source: 0 (old contract)
Effective Date: 790702 Increase: 0.120
Effective Date: 800630 Increase: 0.175
Effective Date: 810629 Increase: 0.150
COLA: Y (contract contains contingent COLA)
Payment Period: S (semiannual)
First Payment Date: 800102

The archival dates were used to determine the earliest date at which settlement information was available. I defined this date as the earliest of the settlement date (missing in this example), the record date (July 26, 1979) and the publication date (July 27, 1979). The settlement day is never used. The settlement month and year for the example are July 1979.

On the basis of the archival information, I assigned the COLA formula for manufacturing settlements in 1979 from Hendricks and Kahn (1985, page 102). Of all manufacturing collective bargains settled in 1979 that contained contingent COLA provisions, 42.8% used one of the three major formulas. Of those agreements, 51.9% used the 1¢ per .3 change in the CPI formula, 39.0% used the 1¢ per .4 change in the CPI formula, and 9.1% used the equal percentage formula. In July 1979, the most recent twelve month change in the CPI was 21.0 points (10.86%). In January 1980 the scheduled wage rate would be \$6.86 (= 6.74 + 0.12). The three COLA formulas imply changes of \$0.700, \$0.525, and \$0.745, respectively, in January 1980. The weighted average of these expected COLA payments is \$0.636 (using 0.519, 0.390, and 0.428 as weights). Converted to a semiannual basis, this implies an expected COLA payment of \$0.318 for each six month period. Although the correct COLA formula is reported in the published listing, it is not recorded in the archival data file. In addition, the \$0.38 COLA payment due on July 1, 1979 is not reflected in the archival listing.

Using all the archival data information, the sequence of wage rates, projected on the basis of information that was available on the date of settlement, is summarized in Table A1.

Table A1

Summary of Projected Wage Rates for the General Electric Agreement with the Electrical Workers Unions (IUE and UE-Ind) in July 1979

Year	Month: Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
79	6.86	6.86	6.86	6.86	6.86	6.86	7.18	7.18	7.18	7.18	7.18	7.18
80	7.67	7.67	7.67	7.67	7.67	7.67	7.99	7.99	7.99	7.99	7.99	7.99
81	8.46	8.46	8.46	8.46	8.46	8.46	8.78	8.78	8.78	8.78	8.78	8.78

These projected wage rates are used in the formulas in the text for computing summary measures of the wage settlement. The compound annual growth rate of the projected wage rate in this contract is $100 \times ((8.78/6.74)^{(1/3)} - 1) = 9.21\%$ per year. This is the dependent variable in the growth rate forecasting equations (Table 5, Columns A-D). To compute the present value of expected labor cost during the life of the contract the following ancillary information is required:

Average regular hours per week 1979, industry 36: 40.3 (**Employment and Earnings**, March 1980, Table C-2, page 95)
Average overtime hours per week 1979, industry 36: 2.7 (same as above)
Fringe benefit rate for legally required payments; pension, insurance and other agreed-upon payments (employer's share); and other items 1979, electrical equipment industry: 23.2% (**Employee Benefits 1979**, Table 6, page 11, sum of lines 1, 2 and 5.)
Yield on Moody's Baa rated corporate bonds, July 1979: 10.29% per annum (Data Resources, Inc., university data bank)
Weeks per year: 52.1424 (constant).

The estimated labor cost for the bargaining unit during the first year of the contract, based on the wage rate for June 1980, is $(40.3 + 1.5 \times 2.7) \times 7.18 \times 1.232 \times 52.1424 \times 90{,}000 = \$1{,}841$ million. If the old wage rate of \$6.74 is used in this formula, then the estimated labor cost for one year is \$1,728 million. The estimated present value

of labor cost for the first year of the contract is $1,841/(1.1029^{.5}) = \$1,753$ million. The estimated present value of labor cost over the life of the contract is $1,841/1.1029^{.5} + 2,048/1.1029^{1.5} + 3,251/1.1029^{2.5} = \$5,284$ million, where \$2,048 and \$3,251 are the estimated cost in the second and third years of the contract based on the June 1981 and June 1982 expected wage rates.

The expected and unexpected parts of the present value of the bargaining unit labor cost were calculated using the predicted values and residuals from the wage growth forecasting equations (Table 5, Columns A-D) and the present value forecasting equations (Table 5, Columns E-H). The ancillary information required to calculate these quantities consists of the regressors used in the forecasting equation. These values are listed below:

Percentage change in the CPI April 1978 to April 1979: 10.66% (Data Resources, Inc. university data base, not seasonally adjusted)
Percentage change in real GNP first quarter 1978 to first quarter 1979: 2.24% (same as above, not seasonally adjusted)
Civilian unemployment rate April 1979: 5.8% (**Employment and Earnings**, May 1979, not seasonally adjusted)
Percentage change in average hourly earnings for nonagricultural production worker April 1978 to April 1979: 7.67% (Data Resources, Inc., university data base, not seasonally adjusted)

Consider first the projected growth rate method for determining the expected present value of labor cost. The expected compound annual growth rate for the wage rate, based on the equation in Column C of Table 5, is 10.60% and the unexpected change in the compound annual growth rate revealed on the date of settlement is 9.21 - 10.60 = -1.39%. The present value of expected labor cost over

the three year contract is $1{,}728 \times (1.106/1.1029^{.5} + 1.106^2/1.1029^{1.5} + 1.106^3/1.1029^{2.5}) = \$5{,}475$ million. (This number appears in the "Expected Union Wealth" column of Table 8.) The present value of unexpected labor cost over the three year period is $1{,}728 \times -.0139 \times (1/1.1029^{.5} + 2 \times 1.106/1.1029^{1.5} + 3 \times 1.106^2/1.1029^{2.5}) = -\$137$ million. (This number appears in the "Unexpected Union Wealth Change" column of Table 8.) This unexpected change in union wealth is the independent variable in Table 6, Panel A. In Table 6, Panel B the present value of the unexpected union wealth change is calculated using one, three, and nine year horizons. The three year horizon calculation is identical to the one illustrated. The one year horizon uses only the first year projected growth. The nine year horizon uses six additional years of projected growth at 10.6% per year and discounts at 10.29% per year.

Consider next the direct method for forecasting the present value. On the basis of the final wage rate in the old contract, the present value of labor cost over the three years of the new contract is $\$1{,}728 \times (1/1.1029^{.5} + 1/1.1029^{1.5} + 1/1.1029^{2.5}) = \$4{,}491$ million. The percentage change in present value revealed on the date of settlement is $100 \times (5{,}284/4{,}491 - 1) = 17.67\%$. This is the dependent variable in the present value forecasting equations (Table 5, Columns E-H). The expected percentage change in present value based on Table 5, Column G is 22.98% and the unexpected percentage change in present value revealed on the date of settlement

is 17.67 - 22.98 = -5.31%. In dollars the expected present value is 1.2298 x 4,491 = $5,522 million and the unexpected change in present value is -.0531 x 4,491 = -$238 million. This unexpected change is used as the independent variable in Table 7, Panel A. The independent variable in Table 7, Panel B is based on unexpected percentage changes in present values over one, three, and nine year horizons. The one year horizon present value uses only first year information in the contract. The three year horizon is exactly as illustrated here. The nine year horizon uses information on deferred and COLA increases up to the end of the new contract. The projected wage rate on the last month ($8.41 in the GE example) is used for the remaining years. Separate forecasting equations were used for each horizon length.

To calculate data items based on the value of General Electric's common stock, the following items from the Center for Research on Security Price **Monthly Stock Returns File** are required:

General Electric Co. CUSIP: 36960410
Stock price April 30, 1979: $49.125
Number of outstanding shares on April 30, 1979: 228,036 (thousands)
Return, including dividends, during May, June, and July: 1.42%, 1.78%, 3.50%
Return on the (value weighted) NYSE during the same months: -1.49%, 4.48%, 1.52%
Adjusted GE return during May, June, and July: 2.91%, -2.70%, 1.98%

The adjusted return is defined as the difference between the dividend inclusive stock return and the return on the value weighted NYSE index. The expected shareholder wealth at the end of the month three months before the settlement

date is 49.125 x 228.036 = $11,202 million. (This number appears in Table 8 in the "Expected Shareholder Wealth" column.) The unexpected change in shareholder wealth, adjusted for market movements is 11,202 x ((1.0291 x .9730 x 1.0198) - 1) = $237 million. (This number appears in Table 8 in the "Unexpected Shareholder Wealth Change" column.) The unexpected change in shareholder wealth is the dependent variable in Tables 6 and 7.

The regression analysis in Table 5 is weighted using the size of the bargaining unit as the weight. Means, standard deviations, and regression statistics, therefore, represent the typical worker who belongs to a bargaining unit.

The regression analyses in Tables 6 and 7 are heteroscedasticity corrected estimates on a bargaining unit basis. The means, standard deviations and regression statistics represent a typical bargaining unit. The heteroscedasticity takes an unusual form in this regression--the residual variance of shareholder wealth is largest for small absolute values of the independent variable. The weight used to correct the heteroscedasticity is 1 + 8 exp(-|unexpected change in union wealth|). This weighting factor induces homoscedasticty on the residual variance but has an imperceptible effect on the regression coefficients.