The Effect of Wage Bargains on the Stock Market Value of the Firm

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I estimate the change in the value of common stock resulting from an unexpected change in collectively bargained labor costs. Using bargaining unit wage data and NYSE stock returns, I find a dollar-for-dollar tradeoff between these variables. This result is consistent with stock valuations based on present value maximizing managerial decisions (Hotelling's lemma). I also find support for the hypothesis that collective bargains maximize the sum of shareholders' and union members' wealth.

This paper considers three simple and direct questions. First, are unexpected changes in union labor costs related to unexpected changes in the market value of the common stock of the employer firm? Second, can one conclude anything about the efficiency of resource allocation decisions in unionized firms from the estimated relation between unexpected changes in union labor costs and unexpected changes in common stock values? Third, can one conclude anything about the efficiency of the contracting environment between the union and the firm from the estimated relation between labor costs and common stock values?

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To answer the first question, I develop a model for estimating the expected change in union labor costs around the time of a wage contract renegotiation, conditional on information available to both the union and the employer three months prior to the eventual settlement. The unexpected change in union labor costs is the difference between the present value of the labor costs implied by the actual settlement, given information available on the day of settlement, and the predicted present value, given my estimated model. I also measure the change in the market value of common stock over the same time period, conditional on movements in the entire stock market. A regression model shows that common stock value moves in the opposite direction of union labor costs.

The empirical relation between the unexpected change in union labor costs and the unexpected change in the value of common stock is consistent with profit-maximizing managerial decisions if the stock market reaction can be predicted using Harold Hotelling's (1932) lemma for the firm's profit function. Hotelling's lemma implies that the effect of a change in the present value of labor costs should be a change in the present value of profits of equal magnitude and opposite direction. Under the assumption that unexpected changes in labor costs last for the length of the new contract (or approximately three years), the estimated empirical relation is consistent with Hotelling's lemma. The stock market reaction to new collective

bargaining agreements, then, is broadly consistent with investor beliefs that management is profit maximizing.

The efficiency of the contracting environment between the union and the firm is determined by the extent to which resource allocation decisions maximize the sum of union members' and shareholders' wealth.[1] A strongly efficient contracting environment (in the sense of James N. Brown and Orley Ashenfelter, 1986) exists if management makes employment decisions *within the existing bargaining unit* using an external wage rate, and not the contract wage rate, as the opportunity cost of labor. The empirical relation between the unexpected change in labor costs and the unexpected change in common stock values is consistent with a strongly efficient contracting environment if the shareholders' wealth change is equal and opposite to the union members' wealth change for all levels of the unexpected change in labor costs; that is, if the estimated relation is linear. The empirical relation is inconsistent with strong efficiency if the shareholders' wealth declines by less than the amount of an unexpected increase in union members' wealth or increases by more than the amount of a decrease in union members' wealth; that is, if the relation between unexpected changes in common stock values and unexpected changes in labor costs is convex. The estimated empirical relations are not statistically different from linear. Therefore, the stock market reaction to new collective bargains is, on the average, consistent with the prediction of strong efficiency in the contracting environment.

Section I of this paper defines union members' and shareholders' wealth and surveys the context of the study. Section II contains the formal derivation of the implications of profit-maximizing and efficient contracting for the relation between shareholders' and union members' wealth. Section III explains the data sources and methods used for measuring union members' wealth. Section IV carries out the measurement of the unexpected change in labor costs, determines its statistical relation to the unexpected change in the value of common stock, and tests the formal hypotheses of Hotelling's lemma and strong efficiency. Section V compares the results to other studies of union effects on profits and concludes. The Appendix provides a detailed description of data sources and calculations.

I. The Definition of Union Members' and Shareholders' Wealth

A modern corporation is a collection of formal and informal contracts that connects suppliers of labor services, equipment, materials, managerial services, and risk-bearing into an organization that produces and distributes a product or service in order to generate sales revenue.[2] The revenue produced by the activity of the corporation is divided among the contracting parties. All contracting parties have some claim on this revenue—either in the form of a contractual sum based on the purchase or rental by the corporation of an asset owned by the party or in the form of a residual claim. In corporations with unionized workers the shareholders have the residual claim on the income of the organization but the workers enjoy some property rights over their jobs.[3] The value of the shareholders' residual claim is the current value of common stock issued by the enterprise. The value of the union members' job right is the amount that could be obtained by selling the right to work in the enterprise. Union members' job rights are valuable because union organizing may increase the costs of replacing the union

[1] Union members' wealth is the present value of the excess of union labor costs over labor costs using a nonunion work force. Shareholders' wealth is the market value of outstanding common stock.

[2] The collection of contracts view of the firm is used by Michael Jensen and William Meckling (1976) and Eugene Fama and Jensen (1983a,b) to study problems in corporate control.

[3] See Bernard Meltzer (1977, pp. 195–229) for an overview of the legal protection surrounding union organizing activity and employment in the United States.

workers with lower paid nonunion workers.[4] The union members' job rights are not alienable and, therefore, no organized market may form in which these claims are traded. The value of the union members' wealth is approximated by the capitalized difference between what the workers earn in the corporation and what they could earn in their next best alternative employment.

The questions I examine in this paper use the fact that the firm is unionized in two distinct ways. First, the public nature of the contracts between union workers and firms facilitates direct measurement of important labor cost variables such as the hourly wage rate and union employment within the firm. Combining this information with public information on the value of the firm's common stock permits me to construct a direct test of the hypothesis that managers maximize profits. Such a direct test of the profit dual relation has not been performed using this combination of market measures.

My second use of the fact that the sample firms are unionized is to consider whether observed changes in the contracts involving union labor provide evidence about the efficiency of the contracting environment. Specifically, I consider whether the resource allocation decisions surrounding collective bargaining agreements maximize the total value of the enterprise—the sum of shareholders' and union members' wealth. The maximum total value of the enterprise is the present value of total quasi-rents—the present value of revenues minus labor costs valued at the opportunity cost of a nonunion worker's time. This test of the efficiency of the contracting environment is in the spirit of recent theoretical and empirical work on union contracting regimes.[5]

[4] In the law and economics literature the union members are said to appropriate quasi-rents from the shareholders. I am abstracting from other types of appropriable quasi-rents. See Benjamin Klein et al. (1979) for a discussion of these contracting problems.

[5] Brown and Ashenfelter (1986) use the term "strong efficiency" to refer to the total quasi-rent maximization model of union wage determination put forth by John Dunlop (1944). Other analyses based upon strong efficiency include Sherwin Rosen (1969), Robert Hall and David Lilien (1979), and Edward Lazear (1983). The "inefficient" model has also been called the "labor demand curve model" by James Dertouzos and John Pencavel (1981), referring to Dunlop's model in which the union maximizes its share of the rents accepting the tradeoff between wages and employment summarized by the firm's labor demand curve. The analyses of Henry Farber (1978a), Dertouzos and Pencavel (1981), and Pencavel (1984) are all based on the inefficient model. Brown and Ashenfelter (1986) and Thomas MaCurdy and Pencavel (1986) discuss some of the implications of the inefficient model for employment outcomes. An intermediate variation is called "weak efficiency." In weakly efficient models the shareholders and union members need not use wealth maximization as their objective, but all outcomes do lie on a contract curve. Analyses based on weak efficiency include Wassily Leontif (1946), George deMenil (1971), Ian McDonald and Robert Solow (1981), David Card (1986a,b), MaCurdy, and Pencavel (1986), and Randall Eberts and Joe Stone (1986). Card (1986b) provides an elegant synthesis of the various models in a dynamic context. A fourth class of models is one in which only one side behaves optimally. For a comprehensive review see Farber (1986, pp. 1059–69).

II. The Theoretical Effects of Negotiated Wage Rates on Profits

The essential feature of the theory is a comparison of the shareholders' optimized wealth when (a) the employer maximizes shareholders' wealth using the contract wage rate as the price of labor, and (b) the union and the employer jointly maximize the value of the enterprise and divide the resulting quasi-rent. The former will be called "inefficient" bargaining and the latter "strongly efficient" bargaining.

Consider first the inefficient case. The shareholders' wealth is determined using the contract wage rate, w, as the price of labor. Call the resulting inefficient profit dual $Z^S(w)$. Let $R(L)$ be the firm's revenue function given employment level L. $R(L)$ is increasing in L and strictly concave. Then,

$$(1) \qquad Z^S(w) = \max_L R(L) - wL.$$

Let w^0 represent an initial contract wage and L^0 represent the level of employment that attains the optimum in equation (1). By Hotelling's lemma for the profit dual, $\partial Z^S(w^0)/\partial w = -L^0$. The discrete second-

order approximation to $\Delta Z^S(w)$ is given by:[6]

$$(2) \quad \Delta Z^S \approx -L^0(w-w^0) - \frac{1}{2}\left[\frac{\partial^2 R}{\partial L^2}\right]^{-1}(w-w^0)^2.$$

Equation (2) forms the basis for the empirical tests of Hotelling's lemma and the models of the change in shareholders' wealth under inefficient bargaining. The first-order effect of a change in the wage rate is to change shareholders' wealth in the opposite direction by exactly the change in labor costs. For small changes in the wage rate, a regression of the unexpected change in shareholders' wealth on the unexpected change in labor costs should produce a coefficient of -1. The coefficient on the quadratic term in equation (2) is positive because of the second-order conditions of the maximum problem, which are satisfied because of the concavity of $R(L)$. When the unexpected change in labor costs is large enough and positive, shareholders' wealth decreases by less than the change in labor costs because the firm cuts back on employment. Similarly, when the unexpected change in labor costs is negative, shareholders' wealth increases by more than the absolute value of the change in labor costs because the firm increases employment.

Consider next the strongly efficient bargaining model. The workers face an opportunity cost of time, x. The union members' wealth is $V^U=(w-x)L$. The shareholders' wealth is $V^S=R(L)-wL$. Finally, the total value of the enterprise is the sum of the union members' and shareholders' wealth, $V^E=V^U+V^S=R(L)-xL$. In this model the wage w is simply a device for transferring wealth; it plays no role in allocative decisions.

V^E is maximized over the choice of L using x as the price of labor. The contract wage rate, w, is only determined up to a quasi-rent splitting parameter, γ, which indicates the bargaining strength of the union, and the wage rates at which workers and shareholders have zero wealth (known as threat points in the bargaining literature). Formally, the parties act jointly to choose an employment level to maximize:

$$(3) \quad V^E = R(L)-xL,$$

where

$$w=\gamma w^S+(1-\gamma)w^U,$$

$$w^U=\text{wage at which } V^U=0,$$

$$w^S=\text{wage at which } V^S=0.$$

A strongly efficient wage bargain, the solution to equation (3), divides the value of the enterprise such that $V^U=\gamma V^E$ and $V^S=(1-\gamma)V^E$.[7] As in the inefficient case, let w^0 represent an initial contract wage and L^0 represent the employment that attains V^E in equation (3). Then, $V^U=(w^0-x)L^0$ and $V^S=R(L^0)-w^0L^0$. From the definition of w^U we have that $0=(w^U-x)L^0$, which implies that $w^U=x$. From the definition of w^S we have that $0=R(L^0)-w^SL^0$, which implies that $w^S=R(L^0)/L^0$. The strongly efficient wage settlement, then, is given by

$$(4) \quad w^0=(1-\gamma)x+\gamma\frac{R(L^0)}{L^0}.$$

The value function results are obtained by direct substitution of w^0 into the expressions for V^U and V^S, respectively. A strongly efficient wage bargain implies that the effect of a change in the bargaining strength parameter γ will result in equal and opposite changes in union members' and shareholders' wealth:

$$(5) \quad \frac{\partial V^S}{\partial \gamma}=-\frac{\partial V^U}{\partial \gamma}.$$

[6] I am grateful to David Card for suggesting this simplification of the shareholder value functions. Card (1987) discusses several alternative approaches to the analysis of labor supply and demand.

[7] In contrast, an inefficient bargain dissipates some of the quasi-rents so that the sum of the union members' wealth and the shareholders' wealth is less than the maximized value of the enterprise.

The profit dual $V^S(w)$ is globally linear. Therefore, with bargaining characterized by strong efficiency the change in shareholders' wealth is always:

$$(6) \qquad \Delta V^S(w) = -L^0(w - w^0),$$

which is also the first-order term in equation (2).

Equations (2) and (6) both predict that the first-order effect of an unexpected change in labor costs is a change in shareholders' wealth of equal magnitude and opposite sign. Because the employment level in a strongly efficient bargain does not depend on w; however, equation (6) is globally linear. When bargaining is strongly efficient, an unexpected change in labor costs of any magnitude changes shareholders' wealth by an equal and opposite amount.

The empirical task is to develop a measure of the unexpected change in the wage rate to capture the term $(w - w^0)$ in equations (2) and (6). The unexpected change in labor costs, then, is measured by $\Delta V^U = L^0(w - w^0)$, regardless of the bargaining model. Let ΔV^S be the measured unexpected change in common stock value. Then, the two regression equations of interest are:

$$(7) \quad \Delta V^S = \alpha + \delta \Delta V^U + \varepsilon$$

$$(8) \quad \Delta V^S = \alpha + \delta_- \Delta V^U I(\Delta V^U \leq 0) + \delta_+ \Delta V^U I(\Delta V^U > 0) + \varepsilon$$

where $I(\ )$ is the indicator function, α is the regression intercept, and ε is the regression error term. The hypothesis that tests Hotelling's lemma is $\delta = -1$. The hypothesis that tests strong efficiency is $\delta_- = \delta_+ = -1$.[8]

The statistical tests of Hotelling's lemma and strong efficiency may be sensitive to at least two types of measurement errors in ΔV^U. First, ΔV^U could be systematically over or understated because of a bias in the contractual wage data from which they must be calculated. A biased measure of ΔV^U will translate directly into a biased estimate of δ, δ_-, and δ_+. If ΔV^U is overstated, then the regression coefficients will be biased toward zero. If ΔV^U is understated, then the regression coefficients will be biased toward minus infinity. This means that the test of Hotelling's lemma, which predicts a specific value for δ, is potentially sensitive to changes in the assumptions about the magnitudes of quantities used to estimate actual and unexpected changes in labor costs. However, the implication of strongly efficient contracting, $\delta_- = \delta_+$, is robust to this type of measurement error.

Second, there may be some noise in the decomposition of observed changes in labor costs into expected and unexpected components.[9] The effects to this type of measurement error on the estimated regression coefficients in equations (7) and (8) can be summarized as follows. If the measurement error is independent of the true value of the unexpected change in labor costs, then the estimates of δ, δ_-, and δ_+ are all biased toward zero. If the measurement error is symmetric around zero, then estimates of δ_- and δ_+ are both biased toward zero by the same absolute amount. In the latter case $\delta_- = \delta_+$ remains a prediction of strong efficiency; however, neither $\delta = -1$ nor $\delta_- = \delta_+ = -1$ need hold.

III. Data Preparation for the Measurement of Union Members' Wealth

This section develops the bargaining unit-level information on wage settlements and union employment required for the empirical analysis. These data come from a variety

[8] For both hypotheses the intercept should also equal zero; however, in the empirical analyses the measures of unexpected changes in union members' and shareholders' wealth were constructed with approximately zero means. For this reason the hypothesis $\alpha = 0$ is not tested. For the test of strong efficiency the alternative hypothesis of inefficient bargaining as implied by equation (2) is $\delta_- < -1 < \delta_+$.

[9] The noise in determining the unexpected component of the change in labor costs will be empirically relevant if my models are a poor substitute for information commonly available in the labor market.

of sources. All sources and computations are documented in the Appendix. The data were merged using manual-assisted 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 summaries in the Bureau of National Affairs, Inc. biweekly publication *Collective Bargaining Negotiations and Contracts* over the period from January 1976 to December 1982. There were 10,771 settlements reported over that period. For each contract settlement the BNA reported the company name, company division, union, local, type of bargaining unit(s), number of employees covered, location(s) of the bargaining unit(s), industry, settlement date, contract length, whether there was a strike before settlement, and a variety of measures of the negotiation outcome.[10] The outcome measures include the last wage rate in the old contract (or the first one in the new contract), the initial wage change, all scheduled deferred wage changes, and summary information about the type and timing of any contingent cost of living adjustment.[11]

The union was identified by its BLS number. The industry was identified by its standard industrial classification (two to four digits).

I merged CUSIP identifiers for up to four different employer firms onto the BNA record for every contract with a company or division name that matched a name on the master list maintained by the Center for Research on Security Prices (CRSP) at the University of Chicago. There were 4,212 contracts that could be linked to either the New York Stock Exchange or American Stock Exchange security price data. The major reason for failure to link a contract to financial data was that the contract was negotiated by a multiple employer bargaining unit in the construction industry. All construction contracts were removed from the analyses discussed in this paper. The second major reason for match failure was that the employer was not a publicly held corporation. The third major reason for failure was that the company or division name could not be found on the CRSP master name list.[12] Although security price data were only available for a subset of the contracts in the BNA file, all nonconstruction private sector contracts were used in the analyses that did not require financial data.[13]

For each contract I used the information on the wage settlement to construct an 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. This sequence of expected hourly wage rates, given information available at

[10] 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) were apparently the first to develop and analyze bargaining pair data. Farber (1978b) extended the bargaining pair data of Hamermesh. Wayne Vroman (1982, 1984, 1986) developed bargaining pair data from the *Current Wage Developments*. These data were used by Beverly Hirtle (1985, 1986), who merged security price information, to model strike activity and wage settlements, Joseph Tracy (1984, 1986) developed a bargaining unit data file from the BLS *Bargaining Calendar*, which has strike but not wage settlement information. Wallace Hendricks and Lawrence Kahn (1985) used an extensive bargaining unit data base that includes detailed COLA information but does not have financial information about the firms. For Canada, W. Craig Riddell (1979) and Louis Christofides et al. (1980a,b) make use of the longitudinal wage settlement data collected by Labour Canada.

[11] For about one-third of the contracts the last wage rate from the previous contract was imputed (by the BNA) from the detailed monthly average hourly earnings tables in *Employment and Earnings* using the bargaining unit's SIC and the month of settlement. For the remaining two-thirds of the contracts the last wage rate on the previous contract (or the first wage rate on the current contract) is a representative wage rate from within the bargaining unit. For example, in the UAW contracts with GM, Ford, and Chrysler, the reported wage rate is for a journeyman operative. The BNA reporter is instructed to get a representative wage rate and not the contract base (or lowest) wage rate.

[12] Such employers may have publicly traded common stock available over-the-counter. The CRSP OTC files were not available at the time this work was undertaken.

[13] Standard Industrial Classifications 10-14 and 20-89 were included. SIC's 15-17 (construction) and 90-99 (governmental services) were excluded.

TABLE 1—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[a] 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

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, p. 36). BLS figures exclude expected COLA payments but are employment weighted.

Notes: [a]Nonmanufacturing and All Industries exclude construction and governmental services.

the start of the contract, included all scheduled deferred payments and an estimate of the amount due to contingent COLA payments. The estimated COLA amounts were based on the most recent twelve-month change in the Consumer Price Index on the date of settlement and the table of typical COLA formulas in Hendricks and Kahn (1985, p. 102). The Appendix provides details of this calculation.

Approximately 40 percent of the contracts had missing information on the number of workers covered. These contracts appeared to encompass primarily bargaining units with fewer than 1,000 employees. I developed an imputation formula for the missing number of workers that assigned the conditional expected bargaining unit size given that the unit was less than 1,000 and given the industry of the employer. The reported results use imputed bargaining unit size when this number is missing but measures of precision have not been adjusted to reflect imputation uncertainty.[14]

Using the expected hourly wage rate for each month of the contract, I computed g_t —the compound annual growth rate of the expected hourly wage, inclusive of expected COLA payments, over the life of the contract using the formula:

$$(9) \qquad g_t = \left[\frac{w_{t+12c}}{w_{t-1}}\right]^{1/c} - 1,$$

where t is the first month of the contract, w_{t-1} is the wage rate prevailing in month $t-1$ (the last month of the previous contract), and c is the length of the contract in years. Table 1 presents a summary of this expected wage growth measure by year for major industry groups. Table 1 also shows the published BLS estimates of the expected wage growth for contracts settled during the indicated year.[15] The BLS figures, which I

[14]The imputed bargaining unit size only matters for the estimates of the effects of unexpected union members' wealth changes on shareholders' wealth. These estimates have been calculated using only bargaining units of 1,000 or larger, for which there are no imputed sizes. The results are not materially different from those reported.

[15]From *Current Wage Developments* (December 1983, p. 36).

cannot reproduce or recalculate because the Bureau of Labor Statistics will not release the required data for research purposes, are not strictly comparable for two reasons. First, the BLS makes no estimate of expected COLA payments. Second, the Bureau computes a simple, rather than a compound, average annual growth rate over the expected life of the contract. Table 1 shows that there are substantial differences in the expected wage growth estimates generated using my method and using the BLS method. In general, taking account of expected COLA payments results in higher growth rate estimates.[16] For manufacturing industries, my estimate of the expected annual wage growth is 3.4 percentage points higher over the entire sample period than the BLS estimate. For nonmanufacturing industries my estimate is 1.6 percentage points higher on average.

IV. Estimating the Relation Between Union Members' and Shareholders' Wealth

There are four steps in the analysis of the relation between union members' and shareholders' 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 total labor costs that decomposes the cost of realized collective bargains into expected and unexpected components. Third, I develop an estimate of the unexpected change in shareholders' wealth from security price movements around the time of settlement. Fourth, I relate the unexpected changes in shareholders' wealth to the unexpected changes in union members' wealth using the regression equations developed in Section I. This section discusses each step in turn. The Appendix contains detailed examples of the calculations.

Table 2 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 costs 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 times the BLS estimate of weekly hours plus weekly overtime hours.[17] 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.[18] 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- 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 2 shows, most workers are covered by three-year contracts; however, present values were calculated using the *ex ante* contract length and also 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 the first-, second-, and third-year labor cost of the new

[16] In 1981 my procedure produces a lower estimate for annual wage growth in nonmanufacturing industries than the BLS estimate. This appears to be due to differences in the contract coverage between *Collective Bargaining Negotiations and Contracts* and *Current Wage Developments*.

[17] *Employment and Earnings*, Table C-2, annual averages for two-digit SIC industry groups, March 1977–83.

[18] *Employee Benefits*, Table 6 (Table 4 in early years), employee benefits as a percentage of gross payroll, annual averages for major industry groups (essentially two-digit SIC-based), 1975, 1977–82.

TABLE 2—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[a] BY YEAR

Component of Present Value	1976	1977	1978	1979	1980	1981	1982	All
Old Hourly Wage Rate ($/Hour)[b]	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)[c]	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)[d]	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)[e]	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)

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.

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.

[c] 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 8 and 9 (in the Appendix) for the breakdown of workers and bargaining units by year.

[d] Based on the estimated equation in Table 3, column C.

[e] Based on the estimated equation in Table 3, column G.

contract per worker. This is multiplied by the size of the bargaining unit to obtain an estimate of the present value of labor cost over the life of the collective bargain. The "Old PV per Bargaining Unit" row shows the present value of labor costs 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 the 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 real-

ized when the settlement is announced. To do this 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 forecast horizons and different forecasting equations on the resulting measure of unexpected union wealth change.

Only forecasts of labor costs based on information that is available prior to the day the collective bargaining agreement is settled can generate timely stock market reactions when they are revised. 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 that 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 contracts, f_t.[19] Table 3 presents the summary statistics and least squares regression results (weighted by the size of the bargaining unit) for forecasting equations using three different information sets and both measures of labor cost change.

Table 3, columns A–D, present the results for equations predicting the 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.[20] 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 economywide 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 -0.6 is also consistent with other evidence.[21] 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 the equation; however, the estimated effects of the economy and bargaining unit information are substantially changed. The equation in column D could not have been used by an informed observer to predict wage settlements.

Table 3, columns E–H present the results for equations predicting the percentage change in the present value of labor costs. Column E presents summary statistics. Column F presents the regression coefficients and standard errors for an equation that uses only economywide information. Column G includes the bargaining unit-specific information. Column H includes the indus-

[19] In terms of the items summarized in Table 2 this variable is defined as $100 \times$("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.

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

[21] 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 3—ESTIMATES OF THE EFFECTS OF ECONOMYWIDE, 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 (Std. Dev.)	(B) Coeff. (Std. Error)	(C) Coeff. (Std. Error)	(D) Coeff. (Std. Error)	(E) Mean (Std. Dev.)	(F) Coeff. (Std. Error)	(G) Coeff. (Std. Error)	(H) Coeff. (Std. Error)
Percent Change in Wage Settlement Measure	8.6 (3.2)	Dependent Variable			18.2 (7.4)	Dependent Variable		
Annual Percent Change in Consumer Price Index for Wage and 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)	[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

Sources:

1. Wage Settlements from *Collective Bargaining Negotiations and Contracts*, January 1976 to December 1982.
2. Consumer Price Index for Urban Wage and 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.

Notes:

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

try 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 costs 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 annual percentage growth rate (from Table 3, columns B–D) divided by 100, $\hat{u}_t$ represent the residual from the percentage 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

$$(10) \qquad E\left[V_t^U\right] = \sum_{j=1}^{T} \beta_t^j (1+\hat{g}_t)^j C_t.$$

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

$$(11) \qquad V_t^U - E\left[V_t^U\right] = \sum_{j=1}^{T} \beta_t^j j \hat{u}_t (1+\hat{g}_t)^{j-1} C_t.$$

The sample averages for the expected union wealth and the unexpected change in union wealth based on equations (10) and (11) are summarized in Table 2 in the rows "Expected PV (Growth Method)" and "Unexpected PV (Growth Method)." The standard deviation of the unexpected change is shown in the following row.[22]

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_{t-1}^U 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_t^U represent the present value of T years of labor costs 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 3, 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

$$(12) \qquad E\left[V_t^U\right] = \left(1+\hat{f}_t\right) V_{t-1}^U.$$

The unexpected change in labor cost is:

$$(13) \qquad V_t^U - E\left[V_t^U\right] = \hat{v}_t V_{t-1}^U.$$

The sample averages for the expected union wealth and the unexpected change in union wealth based on equations (12) and (13) are summarized in Table 2 in the rows "Expected PV (Direct Method)" and "Unexpected PV (Direct Method)." The standard deviation of the unexpected change is summarized in the following row.[23]

Consider next the calculation of expected shareholders' wealth and the unexpected change in shareholders' wealth. Expected shareholders' 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 months $t-2$ to t and the value-weighted dividend inclusive return on the New York Stock Exchange during the same months.[24] The unex-

[22] The growth method summary statistics in Table 2 use the equation in Table 3, column C.

[23] The direct method summary statistics in Table 2 use the equation in Table 3, column G.

[24] The measure r_t is called an abnormal return in the financial economics literature. It is conventional to estimate the abnormal return using the residual from the regression of the security return on the market return (the market model). Steven Brown and Jerold Warner (1980) show that a conventional event study using monthly return data is robust to whether the market model residual or the deviation of the security return from the market return is used as the measure of abnormal return. Since firms enter my analysis multiple times with the average interval between settlement dates about three years, the problem of eliminating the event

pected change in shareholder wealth, given market movements over $t-2$ to t, is:

$$(14)\quad V_t^S - E\left[V_t^S\right] = \left((1+r_{t-2})(1+r_{t-1}) \times (1+r_t) - 1\right) E\left[V_t^S\right].$$

See the Appendix for details of this calculation.[25]

Consider, finally, the effect of the new collective bargaining agreement, and the resulting unexpected change in union members' wealth, on shareholders' wealth. Because of the way 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 in equations (7) and (8). That is, these measures 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 costs 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.[26] In a conventional security price event study, one would not expect the average abnormal return in the months surrounding the settlement of a new collective bargain to differ from zero.[27] Analysis of the abnormal returns for the firms involved in my collective bargains confirms this prediction. The average abnormal return in the month of settlement is 0.17 percent (with a standard error of 0.16). The cumulative abnormal return in the three-month period beginning two months before settlement and ending on the settlement month is 0.83 percent (with a standard error of 0.27). Evidently, there is a some favorable information in the fact of settlement alone; however, the magnitude is small.[28]

Regression analysis reveals substantial evidence that the signs and magnitude of the unexpected change in union wealth affect the change in shareholders' wealth. Tables 4 and 5 summarize this evidence. Table 4 reports the summary statistics, regression coefficients, and standard errors for an analysis of the effect of unexpected changes in union members' wealth on unexpected changes in shareholders' wealth when the union wealth change is measured using the wage rate growth method. Table 5 reports similar results when the unexpected change in union members' wealth is measured using the direct present value method. The Panels, Rows, and Columns of both tables have identical interpretations. Panel A shows the results

periods from the market model estimation sample made the use of the simple abnormal return reasonable.

[25] I analyze the unexpected change in shareholder wealth given the movements in the NYSE over the negotiation period. This technique excludes the unexpected change in the NYSE from the unexpected change in shareholder wealth. The unexpected change in shareholder wealth that occurs from general stock market adjustments cannot be explained by firm-specific variation in the unexpected change in labor costs.

[26] This abstracts from the effect of strikes as information signals, if any. See Hirtle (1985), Tracy (1987), and Sheena McConnell (1987) for empirical studies of strikes as information-signaling devices using U.S. data. See Card (1987) for a study using Canadian data.

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

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

when the horizon used to calculate the present value of the unexpected change in union members' 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 members' wealth is varied systematically from one year to nine years for all contracts. Columns A–D report results for unexpected changes based on economywide forecasting information only (from Table 3, columns B and F). Columns E–H report results for unexpected changes based on economy and bargaining unit information (from Table 3, columns C and G). Columns I–L report results for unexpected changes in union wealth based on all information including industry and year effects (from Table 3, columns D and H).

The direct test of Hotelling's lemma is whether or not the coefficient on the unexpected change in union members' wealth is -1. For Panel A of both tables the estimated regression coefficient is within two standard errors of -1 in all cases. The estimated regression coefficient is also within two standard errors of -1 for the Panel B results in both tables when considering a fixed horizon of three years. For other fixed horizons, the estimated regression coefficient on the unexpected change in union members' wealth is sensitive to the technique used to estimate union members' wealth. In Table 4, which is based on the wage rate growth method, the analysis in Panel B shows coefficients on the unexpected change in union members' wealth that decline in absolute value as the horizon lengthens. This result is because the unexpected change in union members' wealth based upon the wage rate growth method is always larger in absolute value the longer is the horizon. (The unexpected change in shareholders' wealth is unaffected by the horizon used for the union wealth calculation). In Table 5, which is based on the direct present value method, there is no systematic relation between the horizon used for the union wealth calculation and the size of the unexpected change in union members' wealth. The horizon of three years corresponds to the average length of a new contract in this sample (see Table 2). The coefficients for this horizon are the most consistent with Hotelling's lemma. As the amount of measurement error in the forecast decreases (going from column B to J in either Table 4 or 5) the estimates get closer to -1.[29]

The direct test of strong efficiency is whether the estimated relations are linear in the unexpected change in union members' wealth. The row of Panel A of both Tables 4 and 5 labeled "*F*-statistic for linearity test" reports the Wald test statistic (with 1 and 2,225 degrees of freedom) for the hypothesis of linearity. Except for the model in column D of Table 4 linearity of the shareholders' wealth response is consistent with all the estimated equations. The row of Panel B of both tables labeled "Linearity *F*-Statistic" reports a similar test statistic for the three-year-fixed horizon model. All of the equations in both tables are consistent with the linearity hypothesis in Panel B. On the basis of these results one cannot reject the model that the shareholders' wealth equation is linear in the change in union members' wealth, which is the prediction of the strong efficiency hypothesis.

There is no information in the expected change in union members' wealth (columns C, G, and K) that is not already reflected in the shareholders' wealth measured at the beginning of the three-month period. The coefficient on the expected change in union wealth is zero.

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

[29]All of the estimated coefficients in Panel A of Tables 4 and 5 and in Panel B using a three-year horizon are between -0.63 and -0.93. The random measurement error model (for the decomposition of union members' wealth changes into expected and unexpected components) implies that these numbers are biased toward zero. If -1 is the correct coefficient, then the signal-to-noise ratio in the unexpected change in union members' wealth is between 5 to 1 and 10 to 1.

TABLE 4—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[a]

Forecast Equation Type:	Excludes BU-specific Information				Includes BU-specific Information				Year and Industry Effects			
Variable Name	(A) Mean (Std. Dev.)	(B) Coeff. (Std. Error)[b]	(C) Coeff. (Std. Error)	(D) Coeff. (Std. Error)	(E) Mean (Std. Dev.)	(F) Coeff. (Std. Error)	(G) Coeff. (Std. Error)	(H) Coeff. (Std. Error)	(I) Mean (Std. Dev.)	(J) Coeff. (Std. Error)	(K) Coeff. (Std. Error)	(L) Coeff. (Std. Error)
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)	Dependent Variable			−11.0 (340.3)	Dependent Variable			−11.0 (340.3)	Dependent Variable		
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)[c]	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)
F-Statistic for Linearity Test[d]				7.24				2.02				0.53

B. Various Fixed Horizons for the Change in Union Wealth

1-Year Horizon Unexpected Change	0.1	−5.57		0.3	−4.77		0.1	−4.97	
in Union Wealth	(7.2)	(1.28)		(7.2)	(1.26)		(5.7)	(2.14)	
Positive Unexpected	0.5		−7.49	0.6		−4.98	0.4		−2.56
Union Wealth Change	(5.2)		(1.75)	(6.0)		(1.50)	(4.3)		(2.86)
Negative Unexpected	−0.4		−3.52	−0.4		−4.40	−0.4		−8.14
Union Wealth Change	(4.8)		(1.92)	(3.8)		(2.35)	(3.7)		(3.32)
3-Year Horizon Unexpected Change	0.5	−0.93		1.5	−0.80		0.5	−0.84	
in Union Wealth	(41.9)	(0.22)		(41.9)	(0.22)		(33.6)	(0.37)	
Positive Unexpected	3.7		−1.23	4.2		−0.84	3.5		−0.47
Union Wealth Change	(31.0)		(0.30)	(35.2)		(0.25)	(25.2)		(0.48)
Negative Unexpected	−3.2		−0.56	−2.7		−0.69	−2.9		−1.33
Union Wealth Change	(27.8)		(0.33)	(22.1)		(0.41)	(21.6)		(0.57)
Linearity *F*-Statistic			2.26			0.10			1.35
9-Year Horizon Unexpected Change	3.0	−0.12		10.0	−0.11	2.9	−0.12		
in Union Wealth	(294.4)	(0.03)		(294.3)	(0.03)	237.6	(0.05)		
Positive Unexpected	26.7		−0.16	29.9		−0.12	24.8		−0.07
Union Wealth Change	(221.8)		(0.05)	(251.4)		(0.04)	(180.4)		(0.07)
Negative Unexpected	−23.7		−0.16	−19.9		−0.09	−21.9		−0.18
Union Wealth Change	(190.3)		(0.04)	(149.1)		(0.06)	(151.1)		(0.08)

Sources:

1. Unexpected changes in union wealth are based on estimated wealth change equations in Table 3.
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.

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.
[d] *F*-Statistics for linearity test are Wald test statistics with 1 and 2,225 degrees of freedom.

TABLE 5—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[a]

Forecast Equation Type:	Excludes BU-specific Information				Includes BU-specific Information				Year and Industry Effects			
Variable Name	(A) Mean (Std. Dev.)	(B) Coeff. (Std. Error)[b]	(C) Coeff. (Std. Error)	(D) Coeff. (Std. Error)	(E) Mean (Std. Dev.)	(F) Coeff. (Std. Error)	(G) Coeff. (Std. Error)	(H) Coeff. (Std. Error)	(I) Mean (Std. Dev.)	(J) Coeff. (Std. Error)	(K) Coeff. (Std. Error)	(L) Coeff. (Std. Error)
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)	Dependent Variable			−11.0 (340.3)	Dependent Variable			−11.0 (340.3)	Dependent Variable		
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)[c]	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)	3.00 (6.73)		−8.54 (7.15)	−9.47 (7.19)	−8.80 (7.20)		1.47 (6.85)	1.47 (6.90)	0.91 (6.91)
F-Statistic for Linearity test[d]				0.10				0.16				0.52

B. Various Fixed Horizons for the Change in Union Wealth

1-Year Horizon Unexpected Change	0.5	−0.62		0.5	−0.32		0.0	−0.90		
in Union Wealth	(12.1)	(0.85)		(13.8)	(0.80)		(9.8)	(1.08)		
Positive Unexpected	1.0		−0.36	1.1		0.01	0.8		−0.23	
Union Wealth Change	(11.0)		(0.93)	(13.1)		(0.85)	(7.9)		(1.32)	
Negative Unexpected	−0.5		−2.05	−0.5		−3.33	−0.7		−2.07	
Union Wealth Change	(4.9)		(2.08)	(4.3)		(2.58)	(5.5)		(1.89)	
3-Year Horizon Unexpected Change	0.9	−0.71		1.7	−0.62		−0.2	−0.79		
in Union Wealth	(42.7)	(0.24)		(43.7)	(0.25)		(34.6)	(0.30)		
Positive Unexpected	4.2		−0.78	4.6		−0.60	3.3		−0.56	
Union Wealth Change	(36.4)		(0.28)	(39.0)		(0.28)	(25.3)		(0.41)	
Negative Unexpected	−3.2		−0.53	−2.9		−0.71	−3.4		−1.06	
Union Wealth Change	(21.6)		(0.47)	(19.0)		(0.58)	(23.1)		(0.45)	
Linearity *F*-Statistic			0.21			0.20			0.67	
9-Year Horizon Unexpected Change	3.3	−0.23		5.6	−0.26		−1.1		−0.35	
in Union Wealth	(184.3)	(0.06)		(172.1)	(0.06)		(132.5)		(0.08)	
Positive Unexpected	15.0		−0.24	15.8		−0.27	11.3		−0.30	
Union Wealth Change	(171.5)		(0.06)	(159.6)		(0.18)	(102.5)		(0.10)	
Negative Unexpected	−11.6		−0.15	−10.1		−0.26	−12.3		−0.44	
Union Wealth Change	(64.9)		(0.16)	(61.8)		(0.07)	(82.3)		(0.13)	

Sources:

1. Unexpected changes in union wealth are based on estimated wealth change equations in Table 3.
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.

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.

[d] *F*-Statistics for linearity test are Wald test statistics with 1 and 2,225 degrees of freedom.

TABLE 6—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 Shareholder Wealth Change ($ mil)	Expected Shareholder 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, Sal.	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 1982.

in Panel B of Tables 4 and 5. The results for the three-year horizon are essentially identical to the results in Panel A for both types of forecasting methods. The results are consistent with Hotelling's lemma and the strong efficiency bargaining model. The results for one-year and nine-year horizons are also consistent with the strong efficiency model in the sense that they pass the linearity test.[30] The magnitude of the estimated effect of changes in union members' wealth, 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 4 and 5 show statistical evidence that is consistent with an inverse relation between shareholder value and labor compensation, there is some evidence that unexpected union wealth increases result in larger shareholder wealth losses than unexpected union wealth decreases produce in shareholder gains. This would be inconsistent with both of the bargaining models discussed in Section II. Table 6 shows the reason for this result. The table lists the ten bargaining units associated with the largest unexpected increases in union members' wealth and the ten units associated with the largest unexpected decreases in union mem-

[30]Statistics are available from the author on request.

bers' wealth. The units associated with the ten largest union wealth increases are very consistent with both Hotelling's lemma and 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. However, shareholder wealth does not increase for these agreements, which is inconsistent with both of the models set out here. 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.

V. Interpretation and Conclusion

My analysis of the relation between changes in union members' wealth and changes in shareholders' wealth provides empirical support for the view that investors behave as if they believe that managers make profit-maximizing employment decisions. Furthermore, one cannot reject the strong efficiency model for most of the analyses, including all models that use bargaining unit-specific information in the forecasting equation. This is consistent with resource allocation decisions *within existing bargaining units* that maximize the sum of union members' wealth and shareholders' wealth. The sample of agreements analyzed is broadly representative and not restricted to a single industry.[31]

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.[32] This finding is also consistent with the emerging literature on unions as rent-seeking organizations.[33] 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 labor cost increases.[34] Finally, my finding that share prices move in response to significant labor cost changes expands the growing literature that directly measures the effects of industrial relations activity on shareholders' wealth.[35]

The results are consistent with managerial decisions that maximize the present value of profits (not sales revenue or the utility of managers), the absence of efficiency wages (since there is no expected productivity effect from higher union wages), and informationally efficient stock markets. Of course, it may also be possible to reconcile these results with other models; however, that would not reduce the consistency of the present results with the classical economic theory of the firm. The empirical support for the strongly efficient contracting environment suggests that although union members and shareholders are fundamentally at odds over

[31] The analysis of Dertouzos and Pencavel (1981), Dertouzos 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.

[32] See Kim Clark (1984), Ruback and Zimmerman (1984), Richard Freeman and James Medoff (1984, ch. 12), Barry Hirsch and John Addison (1986, ch. 7).

[33] See Michael Salinger (1984), Nancy Rose (1985, 1987), Stephen Bronars and Donald Deere (1986), Robert Connolly et al. (1986), and Paula Voos and Lawrence Mishel (1986), and Hirsch and Connolly (1987).

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

[35] George Neumann (1980) finds no significant shareholder wealth effects from strikes. However, Brian Becker and Craig Olsen (1986) use methods similar to those used here and do find such effects. Susan Liberty and Jerold Zimmerman (1986) find no effect of the 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. Becker and Olsen (1987) summarize a variety of new evidence on the relation between shareholder valuations and industrial relations events.

the division of the quasi-rents within the firm, there is no presumption that they leave potential gains to trade unexploited.

APPENDIX

This Appendix describes the data sources and methods used to measure (1) the change in the present value of bargaining unit labor cost as estimated from the historical archive of the Bureau of National Affairs' *Collective Bargaining Negotiations and Contracts* data file and (2) the change in the present value of shareholders' wealth around the date of settlement as estimated from the Center for Research in Security Prices' *Monthly Stock Returns* data file. The analysis data was created by merging information from many sources into a set of related computer files using both manual and computer-assisted methods. The resulting merged file was checked against the original published sources for a sample of the bargaining pairs.

To illustrate how the calculations were performed, I have selected a listing from the published data (the General Electric settlement shown in Table 6 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, p. 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 70,000 employees.
—OLD RATE: $6.74 per hour.
—OTHER PROVISIONS: First dental plan, improved 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 and 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: 90,000 (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 preceded settlement)

Settlement Records

Settlement Date: Missing
Wage Rate: 6.74
Source: O (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, p. 102). Of all manufacturing collective bargains settled in 1979 that contained contingent COLA provisions, 42.8 percent used one of the three major formulas. Of those agreements, 51.9 percent used the 1¢ per 0.3 change in the CPI formula, 39.0 percent used the 1¢ per 0.4 change in the CPI formula, and 9.1 percent used the equal percentage formula. In July 1979, the most recent twelve-month change in the CPI was 21.0 points (10.86 percent). 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 0.091 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 7. 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 $100\times((8.78/6.74)^{(1/3)}-1)=9.21$ percent per year. This is the dependent variable in the growth rate forecasting equations (Table 3, columns A–D).

TABLE 7—SUMMARY OF PROJECTED WAGE RATES FOR THE GENERAL ELECTRIC AGREEMENT WITH THE ELECTRICAL WORKERS' UNIONS (IUE and UE-Ind) in July 1979

Month / Year	July	Aug.	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June
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

Source:
1. Wage settlement data from *Collective Bargaining Negotiations and Contracts* for GE and IUE and author's calculations.

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, p. 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 (employers' share); and other items 1979, electrical equipment industry: 23.2 percent (*Employee Benefits* 1979, Table 4, p. 11, sum of lines 1, 2, and 5).

Yield on Moody's Baa rated corporate bonds, July 1979: 10.29 percent 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 $(40.3+1.5\times2.7)\times7.18\times1.232\times52.1424\times90{,}000 = \$1{,}841$ 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 $1{,}841/1.1029^{0.5} = \$1{,}753$ million. The estimated present value of labor cost over the life of the contract is $1{,}841/1.1029^{0.5} + 2{,}048/1.1029^{1.5} + 2{,}251/1.1029^{2.5} = \$5{,}284$ million, where \$2,048 and \$2,251 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 3, columns A–D) and the present value forecasting equations (Table 3, 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-U April 1978 to April 1979: 10.66 percent (Data Resources, Inc., university data base, not seasonally adjusted).

Percentage change in real GNP first quarter 1978 to first quarter 1979: 2.24 percent (same as above, not seasonally adjusted).

Civilian unemployment rate April 1979: 5.8 percent (*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 percent (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 3, is 10.60 percent and the unexpected change in the compound annual growth rate revealed on the date of settlement is $9.21-10.60 = -1.39$ percent. The present value of expected labor cost over the three-year contract is $1{,}728\times(1.106/1.1029^{0.5}+1.106^2/1.1029^{1.5}+1.106^3/1.1029^{2.5}) = \$5{,}475$ million. (This number appears in the "Expected Union Wealth" column of Table 6). The present value of unexpected labor cost over the three-year period is $1.728\times-0.0139\times(1/1.1029^{0.5}+2\times1.106/1.1029^{1.5}+3\times1.106^2/1.1029^{2.5}) = -\$137$ million. (This number appears in the "Unexpected Union Wealth Change" column of Table 6). This unexpected change in union wealth is the independent variable in Table 4, Panel A. In Table 4, 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 percent per year and discounts at 10.29 percent 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 $\$1{,}728\times(1/1.1029^{0.5}+1/1.1029^{1.5}+1/1.1029^{2.5}) = \$4{,}491$ million. The percentage change in present value revealed on the date of settlement is $100\times(5{,}284/4{,}491-1) = 17.67$ percent. This is the dependent variable in the present value forecasting equations (Table 3, columns E–H). The expected percentage change in present value based on Table 3, column G is 22.98 percent and the unexpected percentage change in present value revealed on the date of settlement is $17.67-22.98 = -5.31$ percent. In dollars the expected present value is $1.2298\times$

TABLE 8—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[a] 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

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

Notes:
[a]Nonmanufacturing and All Industries exclude construction and governmental services.

TABLE 9—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[a] 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

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

Notes:
[a]Nonmanufacturing and All Industries exclude construction and governmental services.

4,491 = \$5,522 million and the unexpected change in present value is $-0.0531 \times 4{,}491 = -\$238$ million. This unexpected change is used as the independent variable in Table 5, Panel A. The independent variable in Table 5, 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 (\$8.78 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 Prices' *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 percent, 1.78 percent, 3.50 percent. Dividend inclusive return on the (value-weighted) NYSE during the same months: −1.49 percent, 4.48 percent, 1.52 percent.

Adjusted GE return during May, June, and July: 2.91 percent, −2.70 percent, 1.98 percent.

The adjusted return is defined as the difference between the dividend inclusive stock return and the dividend inclusive return on the value weighted NYSE index. The expected shareholder wealth at the end of the month three months before the settlement date is $49.125 \times 228.036 = \$11{,}202$ million. (This number appears in text Table 6 in the "Expected Shareholder Wealth" column). The unexpected change in shareholder wealth, adjusted for market movements is $11{,}202 \times ((1.0291 \times 0.9730 \times 1.0198) - 1) = \$237$ million. (This number appears in Table 6 in the "Unexpected Shareholder Wealth Change" column). The unexpected change in shareholder wealth is the dependent variable in Tables 4 and 5.

The regression analysis in Table 3 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 4 and 5 are heteroscedasticity corrected estimates using firms as the unit of analysis. The means, standard deviations, and regression statistics represent a typical unionized firm. 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 $1 + 8\exp(-|\text{unexpected change in union wealth}|)$. This weight implies that the standard deviation of the shareholder wealth residual around an unexpected union wealth change of zero is three times larger than the standard deviation of the shareholder wealth residual around an unexpected union wealth change of 200 million. The three-to-one ratio of these standard deviations corresponds to the observed heteroscedasticity in the sample. This weighting factor induces homoscedasticity on the residual variance but has an imperceptible effect on the regression coefficients. For example, the equation in column (B) of Table 4 has an estimated coefficient of -0.64 with a reported standard error of 0.14 in the ordinary least squares analysis (as compared to the coefficient of -0.64 with a standard error of 0.18 reported in Table 4). Ordinary least squares results are available from the author on request. No correction to the standard errors is required because the unexpected change in union wealth is estimated (see Adrian Pagan, 1984). Results for bargaining units larger than 1,000 workers, which have no imputed bargaining unit sizes, are also available on request from the author.

Table 8 contains a summary of the number of workers covered in the BNA collective bargaining agreements by major industry group and year of settlement. The BNA agreements cover a maximum of 2.7 million workers (in 1976) and a minimum of 1.6 million workers (1981). 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. The number of workers covered by expiring contracts is derived from the BLS *Bargaining Calendar* (formerly, *Wage Calendar*) for the years 1976 to 1982. The BLS only follows bargaining situations that involve 1,000 or more workers. The number of workers covered by BNA settlements follows the general pattern of bargaining found in BLS statistics. The only major discrepancy occurs in 1982. In this year several major expiring contracts were not settled until 1983.

Table 9 shows the number of collective bargaining agreements by major industry group and year of settlement. The overall sample consists of approximately 60 percent manufacturing agreements and 40 percent private nonmanufacturing (and nonconstruction) agreements. The manufacturing agreements represent all major industrial groups. The nonmanufacturing agreements are concentrated in the transportation, communication, regulated utility, retail trade, and service industry groups. The largest number of contracts settle in 1977; the smallest number settle in 1979. Comparable numbers from the BLS *Bargaining Calendar* are also reported in the table.

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