THE IMPACT OF STRIKES ON SHAREHOLDER EQUITY

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From an analysis of data for 1962–82, the authors find that strikes substantially affect shareholder equity as measured by the change in stock prices associated with strikes. Over that period the average strike involving 1,000 or more workers resulted in a 4.1 percent drop in shareholder equity, representing a decline of $72–87 million in 1980 dollars. Costs varied widely across industries. The authors also find that capital markets are usually able to anticipate whether an impending contract deadline will result in a strike or settlement. In the prestrike period, however, the stock market consistently underestimates the cost of a strike to shareholders, as evidenced by the fact that nearly two-thirds of the total decline in returns (2.7 percent) occurs after the strike is announced.

THE study of strikes has a long and rich tradition in the literature of labor economics and industrial relations.[1] Impasse, of course, is an integral part of the bargaining process and would naturally be of interest to any student of trade unionism. Perhaps a more compelling consideration is that work stoppages are the most visible manifestation of any inefficiencies associated with collective bargaining. As Ashenfelter and Johnson have observed, "because of their relatively frequent disruption of key sectors of the economy, work stoppages are the most important public policy issue raised by the existence of trade unions" (1969:35). Yet despite the fact that the substantial growth in the strike literature has at least in part been motivated by the apparent public and private costs associated with work stoppage, until recently little attention has been given to an assessment of the magnitude of these costs. As Neumann and Reder observe, "the plain fact is that we do not know whether [the losses caused by labor disputes] are big or small, or even if there are any."[2]

The purpose of this paper is to address this gap in the literature by examining the economic costs to the firm of work stoppages. A secondary purpose is to illustrate how the behavior of capital markets can be an important measure of collective bargaining outcomes. Although the latter topic has received little attention in the industrial and labor relations literature, we believe it holds considerable promise for analyzing a wide range of labor issues.[3] As a measure

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[1]See Shalev (1980) for an excellent review of this literature.

[2]Neumann and Reder (1984:198). Although Neumann and Reder go on to show that strikes have no apparent effect on industry output, they do not consider *participant* costs, which they predict are "appreciably larger than the industry costs" (p. 211).

[3]The relationship between labor and capital markets is the subject of a number of recent studies. See Neumann (1980); Baldwin (1983); Ruback and Zimmerman (1984); and Greer, Martin, and Reusser (1980).

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of union effects, this approach is particularly valuable since it focuses on a level of analysis—the firm—often missing in such studies. Finally, this study should contribute to the growing field of strategic industrial relations, since changes in shareholder equity can be taken as a measure of the strategic impact of collective bargaining.

A Measure of Economic Impact

The study of union effects has largely concentrated on the gains of unionized employees relative to their nonunion counterparts.[4] Considerably less emphasis has been given to measuring the direct effects on unionized firms. Where such firm effects have been examined, the focus has been on productivity changes or changes in labor costs (Brown and Medoff 1978; Clark 1980a, 1980b). Granted that it is important to understand the process by which unions influence the economic position of the firm, an equally important question is whether organized firms experience a permanent change in profitability. Recent research suggests that union wage and benefit increases are at least partially offset by capital substitution, increased employee stability, and improved labor quality. Once these different effects have been identified, however, their eventual impact on the firm's financial position must be determined.[5] This effect of unions on the "bottom line" is perhaps the most important measure of their economic impact on the firm. Drawing on the finance literature, this section describes such a measure and its applicability to strikes.

A central assumption in the finance literature is that because capital markets are efficient, the prices of capital assets are unbiased estimates of the present value of future profit streams generated by those assets.[6] Since a firm can be viewed as a "bundle" of capital assets, its present value is a function of its expected future cash flow and the variance (risk) in this cash flow. The firm's economic value at time t to shareholders is simply the price (p_t) of an individual share of common stock multiplied by the number of shares outstanding.[7] If the stock market is efficient, changes in stock prices can be interpreted as an estimate of the change in the value of the firm caused by new information regarding the future profitability of the firm.

For the purposes of this paper the new information expected to affect the present value of the firm, and hence stock prices, is the occurrence, duration, and outcome of work stoppages. The change in stock prices associated with a strike reflects both the magnitude of strike costs and the timing of those costs. The smaller the profit impact of a strike and the further in the future it will be realized, the less stock prices will fall.[8]

The methodology for evaluating events such as a strike on the value of a firm is well developed in the finance literature and involves determining whether or not observed returns surrounding an event are significantly different from the returns that would be expected had the event not occurred.[9] More formally, changes in common stock prices that occur between two points in time plus dividends paid during the period define the investment return (R_{it}) for the particular time period.

To determine the estimated impact of a strike, the observed return when a strike begins must be compared with what would be expected without a strike:

$$\text{(1)} \quad \text{Strike Effect} = R_{it} - E(R_{it}|\text{No Strike})$$

If strikes are costly and completely unan-

[4]For a review of this literature, see Freeman and Medoff (1981).

[5]Recent work by Ruback and Zimmerman (1984) is an example of such research. They show that successful union elections result in a 3.8 percent decline in shareholder equity of those organized firms (p. 20).

[6]The following discussion of the finance literature draws heavily on Fama (1976) and Schwert (1981).

[7]The full economic value of the firm at time t is the market value of the stock plus the market value of all bonds. Our estimates of "economic impact" refer only to shareholder equity.

[8]Normally most strike costs would be absorbed during the period of the strike. Exceptions might include continued worker discontent or lasting changes in sales due to changes in product loyalty that may have occurred as a result of production shutdowns.

[9]The basic methodology was first developed in Fama, Jensen, and Roll (1969).

ticipated, stock prices will drop on the day of the strike, so $R_{it} < 0$. Since this drop in price is observed on the day of the strike, one need only determine the return that would have been expected in the absence of a strike (i.e., $E[R_{it}|\text{No Strike}]$) to obtain an estimate of the strike effect.

A variety of methods could be used to estimate the expected return in the absence of a strike. The conventional method, referred to as the "market model," posits that the expected return on a particular stock in the absence of a strike is simply a function of the return on the entire market:

$$(2) \quad (R_{it}|\text{No Strike, Market Returns}) = B_1 + B_i R_{mt} + e,$$

where R_{mt} = the rate of return on a value-weighted portfolio of stocks between time t and $t - 1$ and B_i is the risk of investing in firm i relative to the risk of investing in the entire market. Where $B_i = 1.00$, the expected return for firm i equals the expected return in the market, because investing in the firm is no more or less risky than investing in the entire market. Alternatively, over a given period, the stock of those firms with $B_i < 1.00$ (>1.00) would be expected to rise proportionately less (more) than the market to compensate investors for assuming less (more) risk than overall market risk. Conventionally, the error term (e) is assumed to be normally distributed, with zero mean and constant variance, and temporally independent.

Although Equation (2) is an apparently simple model, it represents a complete specification of the relationship of interest. In a competitive market the systematic determinants of an individual firm's rate of return are the firm risk (B_i) and changes in the market return. If there were other systematic influences on R_{it}, investors could regularly reap substantial gains based on this information. The evidence suggests, in fact, that changes in R_{it} beyond those described in Equation (2) represent firm-specific events that were unanticipated by the market. In other words, in the absence of new information affecting firm performance, the difference between expected returns and actual returns is simply due to random firm-specific events.

Although the prediction error, R_{it} $E(R_{it}|\text{No Strike, Market})$, may be nonzero for any particular period, the $E(e_{it})$ will be zero for any period unless significant new information affecting the performance of the firm becomes available during period t. In such instances we would expect $R_{it} - E(R_{it}|\text{No Strike, Market})$ to be significantly different from what was expected given the variance on e_{it}. Given the assumption of independence and normality of e, the prediction error can be tested for statistical significance using a simple t-test and an estimate of σ_e^2. Such a deviation is referred to as an excess or abnormal return and reflects the new information about the expected costs of a strike. When the procedure just described is applied to a particular strike, each firm serves as its own control for what would have happened in the absence of a strike. This is possible because Equation (2) is estimated using pre-strike return data for the firm and market.[10]

There is a problem with using the prediction errors from the market model as a measure of abnormal performance if the market can anticipate strike events before the period in which abnormal returns are measured. To consider (1) as an unbiased measure of strike costs assumes that the market cannot anticipate the occurrence, duration, or outcome of a strike before the strike day. Relaxing these assumptions means that (2), which provides estimates of expected returns in the absence of a strike, must be calculated over a period before strike events might be anticipated. Therefore, in this study, if a strike begins on day t, Equation (2) is estimated over the 100 trading days from $t - 81$ to $t - 180$. This is not to argue that the possibility of a strike would not have been considered before day $t - 81$, but only that the level of uncertainty about such information would be so high that it would be heavily discounted

[10]This methodology is superior to computing the value of Equation (2) for a sample of struck and non-struck firms because firms that experience a strike may be riskier investments than firms than do not. If this is the case, an estimate of the strike effect (abnormal returns) will be biased toward zero since $E(R_{it}|\text{No Strike, Market})$ for the sample of struck firms will be greater than $E(R_{it}|\text{No Strike, Market})$ in the sample that is not struck.

and would not significantly affect the OLS estimates.

"Abnormal returns" on day t, however, are likely to understate the *total effect* of work stoppages if the strike events are anticipated before day t. In other words, if the impact of the strike is reflected in price changes before the strike, $R_{it} - E(R_{it}|\text{No Strike, Market})$ will understate the total expected effect of the strike. Because a strike is not wholly unanticipated, the prediction errors over the pre-event period are summed up to estimate the expected impact of the strike. The sum of these prediction errors for an individual strike is referred to as a cumulative excess return (CER). Likewise, a CER for each strike is also calculated for the period during and after the strike. The reasoning for this procedure is straightforward. Returns associated with completely unanticipated events are totally captured on the day of the event. Given the assumption that e_{it} in Equation (2) is a random variable with mean zero, the sum of the prediction errors up to day t should not be significantly different from zero if the strike is unanticipated. To the extent that a strike is anticipated by investors, the sum of the prediction errors before the strike will differ significantly from zero, and the abnormal returns observed on the strike day will fall relative to what would have been observed if the market had not anticipated the strike.[11]

In summary, the following estimates were developed to evaluate the expected change in future profit stream associated with a strike announcement. (1) The "market model" was estimated over the period d_{t-81} and d_{t-180} for *each* firm of interest. (2) The variance in the prediction errors was calculated using data from 31 days through 80 days before the strike began. (3) For each strike, expected or "normal" returns were then calculated for each day from 30 days before the first strike day through 30 days after the settlement day. These expected returns were subtracted from actual returns to obtain "excess returns." (4) The prediction errors or excess returns calculated from step (3) and the var(e) calculated in step (2) were used to test hypotheses about strikes that are developed later in the paper.

The Nature of Strike Effects

The methodology described above is used to determine the costs of a strike and the ability of capital markets to anticipate key events in the negotiations. Specifically, we will focus on three questions: What is the total economic cost to the firm of a work stoppage? To what extent does the market anticipate strike costs? and How accurately can capital markets *anticipate* the beginning of the strike? Each of these questions suggests several hypotheses, which are developed in the following section.

As we discuss the hypotheses and results, we will compare our analysis to a 1980 study by Neumann. Although the Neumann study focuses primarily on the ability of the capital market to predict strikes, it does provide rough estimates of strike effects on shareholder equity. We believe that our study, because of improved sampling, design, and estimation procedures, pro-

[11]A second potential problem encountered in this study occurs because daily rather than weekly or monthly returns are used to evaluate the effects of strikes. The problem created by the use of daily returns is caused by what is referred to as "nonsynchronous trading" in the finance literature. Because the stock of many firms is not traded continuously during a trading day, the last sale of a firm's stock on a particular day will typically occur before the market closes. Since daily market returns used to estimate Equation (2) are based on closing prices, the time period used to calculate market returns does not correspond to the true time period over which firm returns are determined. This introduces measurement error in market returns and biases the OLS estimates of Equation (2).

Scholes and Williams formally demonstrate this result and develop consistent estimates of Equation (2) that account for this problem. Since the bias in the OLS estimates created by nonsynchronous trading does not necessarily create false inferences about market anticipation of strike events, however, we use the prediction errors from both the OLS and Scholes-Williams estimates of the market model. The results using the Scholes-Williams estimates were not substantially different from the OLS results. We therefore report only results using the OLS model. Results using the Scholes-Williams estimates are available from the authors. See Brown and Warner (1983) and Scholes and Williams (1977).

vides a better estimate of both strike costs and the predictability of strikes.[12]

Strike costs. The total cost of a strike can be estimated on the basis of the abnormal return data constructed from the steps described earlier. The prior discussion suggests the following null hypothesis:

H_1: Strikes are not costly to shareholders.

The mean CER for all strikes over the interval from 30 days before the strike through 30 days after the settlement day (event period) is used as a measure of the total cost to shareholders of a strike. This average, referred to as the cumulative average return (CAR), is used to construct two tests of H_1. H_1 is rejected by the first test if the CAR is less than zero. H_1 is rejected by the second test if the CAR in the strike sample is less than the mean CAR in the sample of settlements that occurred without a strike. If H_1 is not rejected by the second test, then the CAR in the strike sample primarily reflects settlement costs rather than strike costs.

The preceding analysis is in contrast to Neumann's earlier work on this same issue. For example, since Neumann did not report the CAR (and its standard error) for the subsample of strikes for which both a beginning and ending strike date were available, he failed to test H_1. Although he did report changes in returns for strikes of one, two, and three weeks, no significance tests were reported for either these changes in returns or the CAR over the event period. Finally, such tests would very likely understate total strike costs if the market were able to anticipate the strike before the very brief pre-strike period (14 days) used by Neumann.

The anticipation of strike costs. Tests of H_1 provide an overall estimate of the impact of strikes, but it is also useful to determine if the market can consistently anticipate these costs in the pre-strike period. The hypothesis is:

H_2: The market can consistently anticipate strike costs in the pre-strike period.

H_2 is tested by examining the CAR over the period from the second day of the strike through 30 days after the settlement. If the market is efficient, and therefore can consistently predict strike costs, CARs after the first day of the strike will *not* be significantly different from zero. If the market consistently overpredicts strike costs and this overprediction exceeds trading costs, investors could make above-normal returns by buying stock in a company on the first day of the strike. Alternatively, if the market, on average, underpredicts strike costs, then above-normal returns could be made by "selling short."

Predictability of strikes. An analysis of the timing of market anticipation of strike costs raises the question of whether or not the stock market can predict the *occurrence* of a strike. For example, before the strike deadline investors *may* have information about the firmness with which the parties hold their respective positions (concession rates) or the "distance" between the positions of the parties. In the only previous study of this kind, based on a sample of strikes reported in the *Wall Street Journal*, Neumann finds significant negative returns on the first day of the strike and 2 and 13 days before the strike began. Neumann concludes from this evidence that the market can anticipate, though not perfectly, the occurrence of a strike.

These results raise a number of questions and, in some cases, there are plausible alternative explanations. One very reasonable interpretation of Neumann's results for the period through the first day of the strike is that the market *cannot* predict the occurrence of a strike. This is a plausible explanation because Neumann did not have the data necessary to adequately test whether or not capital markets can predict strikes. As he observed, "There is clearly a need for an examination of the security price behavior of firms that settled rather than struck," because negative returns before the contract expiration date may simply reflect the *threat* of a strike and may well be observed for both struck and non-

[12] Work by Greer, Martin, and Reusser (1980) has also examined the relationship between strikes and shareholder equity. That study, however, includes only 91 strikes and provides no statistical tests of strike costs (that is, CARs).

struck firms (Neumann 1980:531). In addition, if the market cannot perfectly anticipate a strike, negative returns will be observed on the first day of the strike and positive returns will be observed when a settlement is announced in a sample of peaceful settlements.

One last potential problem with Neumann's study is an apparent oversampling of long-duration strikes. In his sample, 70 percent of the strikes lasted longer than three weeks, whereas in our sample, which is based on BLS strike reports, only 44 percent of the strikes lasted longer than three weeks. If the market is better able to predict the occurrence of long strikes than of short strikes, the Neumann results overstate the market's ability to anticipate strikes in general.

We do not necessarily disagree with Neumann's conclusion that the market anticipates, with error, the occurrence of a strike, but we argue that, based on his data, such a conclusion does not necessarily follow. A better test of the market's ability to predict the occurrence of a strike requires a sample of peaceful settlements. We have collected such a sample, and we test the following hypotheses:

H_3: Abnormal returns prior to the strike deadline in a sample of struck firms are less than abnormal returns in a sample of peaceful settlements.

H_4: Abnormal returns on the day after the expiration date in the peaceful settlement sample will equal returns on the first day of a strike in the strike sample.

The Sample

The sample of strikes is drawn from the preliminary reports of *Current Work Stoppages* compiled by the Bureau of Labor Statistics, and covers strikes involving 1,000 or more workers. To correspond with the first year of the University of Chicago Center for Research in Security Prices (CRSP) data, we include strikes from 1962 through 1982. The actual number of strikes available for analysis was considerably smaller than the total reported by BLS, since only firms listed on the New York or American Stock Exchange could be included. Therefore a substantial number of stoppages in construction, the public sector, and multiemployer bargaining units were excluded.

The sample was further reduced by excluding those strikes for which the pre-event period overlapped the event period for another strike against the same firm. This was a particular problem in the auto industry, and consequently few auto strikes were included. These adjustments ensured that estimates of the market model for a strike were not based on return data that could be affected by an earlier strike.

The final sample included 699 strikes, for which the mean number of workers involved was 5,500, the mean duration was 32 days, and the mean number of lost work days per strike was 175,000. The strike data are generally representative of U.S. manufacturing. Firms experiencing the greatest incidence of strikes in the sample were ALCOA (7), Allied Chemical (7), AVCO (8), COLT Industries (7), International Harvester (7), and the Sperry Corporation (7). Eighteen percent of all strikes occurred in companies with five or more strikes over the period.

In addition, a sample of nonstrike settlements was also constructed. These data were taken from the *Current Contract Settlements* (Bureau of National Affairs) and represent contracts expiring during the 1977–80 period. The settlements were then checked against the strike data to eliminate any settlements that occurred after a strike. There are 96 observations in the sample of peaceful settlements.

Results

The cost of a strike to shareholders. Judging from two tests of H_1, we conclude that strikes are costly to shareholders. Over the event period, the CAR in the sample using the OLS estimates of the market model was −4.16 percent and significantly less than zero at the .01 significance level (t = 5.559).[13] The reader should recall, how-

[13] Three variations on the model and sample were also estimated. First, the abnormal returns were estimated using the Scholes-Williams estimation procedure. Second, the estimated variance in the CERs was calculated after correcting for first, second, and third order autocorrelation. Finally, the estimates were cal-

ever, that although the CAR is approximately −4 percent, the CER for a particular strike can differ substantially from the mean.

To differentiate between strike costs and the cost of the new contract terms, we compared the mean CAR in the strike sample with the CAR from the sample of peaceful settlements during the 1977–80 period. The CAR in the peaceful settlement sample was 3.03 percent and not significantly different from zero at conventional significance levels ($t = 1.56$). But both the 4.16 percent decline in the entire period (1962–82) and the 1.53 percent decline for those strikes occurring during 1977–80 were significantly less ($\alpha = .05$, one tail) than the CAR in the sample of peaceful settlements. This suggests that the decline in stockholder equity observed over the event period was primarily due to strike costs and not to unanticipated settlement costs.[14]

The excess returns observed over the event period were translated into estimated dollar losses to stockholders using information from Standard and Poor's Compustat file. The pre-event market value of the firm for 535 strikes was approximated using the number of outstanding shares of common stock and the average of the high and low opening and closing stock prices in the year preceding the strike. This value was then converted to 1980 dollars and used to calculate the average cost of a strike, the average cost per striking worker, the average cost per day, and the average cost per 10,000 lost workdays. A weighted and unweighted dollar cost was computed for each of these four measured "units" of strike activity. The formulas for the weighted and unweighted averages are, respectively,

$$\frac{\sum_{i=1}^{N} ([\text{CER/strike unit}]_i \times \text{Value}_i)}{N}$$

and

$$\frac{\sum_{i=1}^{N} [\text{CER/strike unit}]_i}{N} \times \frac{\sum_{i=1}^{N} [\text{Value/strike unit}]_i}{N}$$

The first formula calculates the dollar loss for each strike and averages across strikes, and the second formula multiplies the average CER (i.e., CAR) from the sample by the average firm value in the sample. The two calculations will give different dollar estimates when there is substantial sample variation in firm values and CERs. Table 1 shows the results using both of these calculations.[15]

Estimates of the average dollar losses to stockholders are striking (see Table 1, penultimate row of data). Depending on the formula used, the average strike costs stockholders \$72–87 million. For the other

culated excluding strikes during Phases I and II of the Nixon wage and price controls (8/71–12/72). Results from these variations are not reported because they were not substantially different from the results reported in the text.

[14]For example, suppose there were two strikes in an industry against two different firms. For firm "A" the CER was −5.00 percent and stockholder equity preceding the strike was \$10 million. The CER for firm "B" was 1.00 percent and stockholder equity was \$100 million. Using the weighted formula the average dollar "cost" per strike was −\$.25 million. Using the unweighted formula the average cost was \$1.1 million dollars. The weighted average shows the dollar value of the gains achieved by stockholders in the larger firm exceeded stockholder losses in the smaller firm. The unweighted average shows the expected effect if a firm of average size (\$55 million) experienced an average strike; stockholders could expect to lose \$1.1 million or 2 percent of their equity. In this example, the weighted average is greater than the unweighted average because of the positive correlation between CER and firm value. Both figures are reported because neither measure is clearly superior to the other.

[15]For two of the measures (cost per strike and cost per striker), the losses are lower in the sample of 535 strikes than in the total sample of 699 (see the last two rows of data in Table 1). For these two measures, however, the difference between the point estimates in the 535 sample is not significantly different from the point estimates for the 164 strikes against firms not included on the *Compustat* file. For the other two measures, the cost per day and the cost per 10,000 lost workdays, the losses are significantly higher in the 535 sample than in the 164 sample. In addition, since inclusion in the *Compustat* file was positively correlated with firm size, the dollar losses reported in the table for all the measures are larger than the estimates one would obtain if firm market value estimates were readily available for all 699 strikes.

Table 1. Estimated Average Strike Costs to Stockholders.

		Average Cost			
Industry[a]	*No. of Strikes*	*Per Strike*[b]	*Per Striker*[c]	*Per Day*[d]	*Per 10,000 LWD*[e]
Paper, Paper Containers (26)	26	−.831% [−10.09] (3.54)	−.00024% [−2.87] (5.77)	.173% [2.10] (.59)	1.023% [12.43] (3.71)
Chemicals (28)	38	−1.684 [−44.98] (−.60)	−.00222 [−59.17] (−46.28)	.657 [17.53] (11.88)	4.079 [108.9] (63.95)
Tires and Rubber Goods (30)	27	−2.209 [−24.65] (−20.81)	−.00447 [−49.87] (−47.17)	.198 [2.21] (5.09)	−2.152 [−24.02] (−.96)
Steel, Copper, and Aluminum (33)**	44	5.156 [72.65] (122.2)	.00416 [58.64] (107.5)	−.062 [−.88] (.72)	.416 [5.86] (61.17)
Machinery and Machine Tools (35)**	85	5.046 [60.21] (18.68)	.00311 [37.09] (−0.6)	−.192 [−2.285] (−2.60)	.769 [9.18] (−8.61)
Electrical Products (36)*	33	6.711 [287.1] (18.39)	.00492 [210.6] (13.64)	1.963 [83.98] (−12.18)	6.824 [291.9] (−60.15)
Automobiles, Trucks, and Aerospace (37)	89	2.059 [43.82] (15.05)	.00010 [2.19] (−19.85)	.612 [13.02] (−15.67)	3.226 [68.66] (11.39)
Air Transport (45)**	22	14.74 [91.37] (63.31)	.00586 [36.35] (15.49)	6.038 [37.43] (27.07)	13.92 [86.26] (45.32)
Electric and Gas Utilities (49)*	34	4.885 [47.07] (40.11)	.00227 [21.85] (14.30)	.010 [.095] (−1.19)	.634 [6.10] (1.09)
Compustat Sample***	535	3.686 [87.15] (72.29)	.00161 [38.15] (14.65)	.569 [13.46] (−2.10)	2.537 [59.98] (9.86)
Total Sample***	699	4.155 [NA] (NA)	.00184 [NA] (NA)	.412 [NA] (NA)	1.798 [NA] (NA)

Notes: The first number in each cell is the percentage loss to shareholders (gains to shareholders are positive), the second figure (in brackets) is the "unweighted" average dollar loss (adjusted to 1980 dollars using the CPI), and the third number (in parentheses) is the "weighted" average dollar loss.

[a]The industry classification numbers refer to the first two digits of *Standard and Poor*'s industry classification scheme. The classification of firms into industry by *Standard and Poor* is designed to match the SIC classification scheme. To correct for heteroscedasticity, the significance levels are based on a t-value calculated after standardizing each CER by its standard error. Because of this standardization, the t-values are the same across all four measures of strike activity. The formula can be found in Ruback and Zimmerman (1984).

[b]Dollar loss figures are in millions.

[c]Dollar loss figures are in thousands.

[d]Dollar loss figures are in millions.

[e]Dollar loss figures are in millions. "LWD" = lost workdays.

*Significant at the .05 level, one tail.

**Significant at the .01 level, one tail.

***Significant at the .001 level, one tail.

three measures of strike activity, the differences between the weighted and unweighted averages are more substantial. The average cost per striker is $38,000 using the unweighted average and almost $15,000 using the weighted average. On a per–strike day basis, the unweighted average shows a loss of $13 million per day, whereas the weighted average shows a firm gain of slightly more than $2 million per day. Finally, for average costs per 10,000 lost workdays, the weighted average is 16 percent of the unweighted average.

Since firm value remains constant across all four measures of strike activity, the differences between the two averages across the four measures reflects changes in the "CER/strike unit" and its correlation with firm size. Because the weighted average is less than the unweighted average across all four measures, the percent cost per strike unit is positively correlated with firm size (see footnote 14). In other words, regardless of the strike measure, smaller firms tended to have higher average strike costs.

Except for the steel industry, this pattern of observing higher average strike costs in smaller firms holds in each of the individual industries listed in Table 1 that had statistically significant strike costs. In the steel, copper, and aluminum industries the larger firms tended to experience the larger percentage losses. Note that for some industries and some measures of strike activity, the costs obtained from the unweighted average turn to firm gains when the weighted average is calculated (for example, average cost per day in the auto, truck, and aerospace industries). This means that in the case of some strikes against large firms, stockholders realized an average gain each day of the strike and the dollar value of these gains more than offset the dollar losses in the other strikes in the industry.

The sizes of the estimated participant costs are not inconsistent with the Neumann-Reder finding (1984) that industry-wide effects are quite small. We do not, however, test the hypothesis that these participant costs are captured as gains by non-struck firms in the industry. Such an estimate would require a sample of non-struck firms and an analysis of the returns for these firms during the period of the strike.

The Market Anticipation of Strike Costs

As we argued earlier, if capital markets are efficient, investors should consistently anticipate the costs of a strike. Thus, although the market may underpredict costs in some strikes and overpredict costs in other strikes, on average, these expectations should sum to zero and H_3 should be rejected. Surprisingly, however, over the entire period the results do not appear to be consistent with the efficient market hypothesis. After the first day of the strike through 30 days after the settlement, prices fell by an average of 2.73 percent, a decline that was significantly different from zero ($t = 4.43$). Moreover, the absolute value of this decline was significantly greater than trading costs up to 1.7 percent ($\alpha = .05$, one-tail).[16] These results suggest that the investors could have made above-normal returns during this period by taking a short trading position on the first day of the strike.

Two caveats should be noted. First, recent work by Joseph Tracy suggests that strikes occur because of the asymmetric nature of the information available to management and unions before a strike. Strikes serve as a learning mechanism for unions by reducing uncertainty about the economic position of the firm (Tracy 1984). As the union approaches the strike deadline, it conditions its last offer on, among other things, its estimate of the future profitability of the firm. If the offer is rejected and a strike occurs, the union knows the expected future profitability of the firm is less than the union's prestrike expectations. Therefore, at least part of the shareholder losses associated with strikes may simply represent the "new information" about the firm's economic position that is communicated by the strike to investors as well as workers. Stock prices may fall in part, that is, not because of strike costs but because investors have

[16]To test whether or not the market consistently underestimates the costs of all strikes, regardless of duration, post-CERs were regressed on strike duration after correcting for heteroskedasticity. The coefficient on duration was not significant.

learned that the firm's future profitability is not as promising as they had assumed.

A second concern is that what we regard as strike costs may in part represent unanticipated settlement costs. Because the sample of peaceful settlements indicates no significant costs to shareholders, however, one would have to have a plausible explanation for why the market accurately anticipated peaceful settlement costs but underestimated settlements following a strike. Though we have no obvious explanation for such a phenomenon, as with the first caveat, it cannot be ruled out empirically. To address both of these issues we are currently collecting the data necessary to model strike costs as a function of lost revenue during the strike period and a measure of the uncertainty surrounding the firm's profitability.

Since the rejection of H_2 is not consistent with the prevailing view in finance, additional analyses were performed on the CARs after the beginning of the strike. First, to confirm that the CAR of −2.73 was not simply caused by a few large, negative outliers, a sign test was performed on the excess returns to determine if the number of negative CERs was significantly greater than the number of positive CERs. The results from this test, shown in row 1 of Table 2, were consistent with the estimate of the CAR. There were significantly more negative than positive CERs after the first day of the strike.

Although the preceding results suggest that investors could make above-normal returns over the entire 20-year period, these estimates are deceiving because transaction costs varied over this period. On May 1, 1975, the SEC deregulated brokerage commissions, which led to a decline in trading costs. Thus, it is possible that both before and after deregulation excess returns were greater than zero but not greater than the trading costs applicable to the time period. To evaluate this possibility, the CAR after the first day of the strike was calculated for various subperiods. First, the 20-year interval was divided into four periods such that a comparable number of strikes began in each period. Second, the sample was divided into strikes ending before May 1, 1975, and beginning after May 1, 1975.

Table 2. Cumulative Average Returns from the First Day of the Strike to 30 Days After the Strike, for Various Time Periods. (absolute t-values in parentheses)

Time Period	*N*	*CAR*	*No. of CAR < 0*
1/1/63–12/31/82	699	−2.734** (4.432)	403**
1/1/63–12/31/67	151	−2.257* (2.278)	89
1/1/68–12/31/72	179	−5.021** (4.057)	113**
1/1/73–12/31/76	188	−2.987* (2.149)	111*
1/1/77–12/31/82	181	.514 (.439)	86
Before and After the Deregulation of Trading Costs			
1/1/63–5/1/75	446	−3.500** (4.529)	264*
5/2/75–12/31/82	250	−2.658** (2.634)	139

*Significant at the .05 level, two tails.
**Significant at the .01 level, two tails.

Rows 2 through 5 of Table 2 show the results for the four subperiods. In all but the last period, which begins in 1977, mean excess returns were negative and significantly different from zero. The finding that abnormal returns could not be made after 1977 suggests that the market eroded the excess returns that were present in earlier years. On the other hand, there is no general downward trend in the excess returns over the 20-year period, a trend that we might expect to occur if we assume that investors were becoming more knowledgeable about the cost of strikes. The apparent inconsistency with the efficient market hypothesis is resolved if we examine changes in trading costs.[17]

The last two lines of Table 2 show that although abnormal returns are nonzero

[17]By trading costs we mean the brokerage fees investors pay to buy and sell stocks. Although these costs vary with the number of shares purchased and the value of the transaction, a fair approximation of these costs would be 2 percent or greater before deregulation and 1 percent after deregulation. See Coates (1978:438–42).

both before and after commissions were deregulated, they do not exceed trading costs in either period. The difference in excess returns of .84 percent before and after deregulation is not statistically significant but is consistent with lower trading costs after May 1, 1975. Moreover, the abnormal returns calculated for the two periods are not significantly greater (absolute value, $\alpha = .05$, one tail) than trading costs of 2.7 percent before deregulation and 1.00 percent after deregulation.

Even though our results indicate that abnormal returns are not large enough to yield a profitable trading strategy, given period-specific trading costs, the failure of the market to fully anticipate strike costs raises some interesting questions about the bargaining process. What is it about the bargaining process that leads outside observers to consistently underestimate strike costs? In view of our findings, several alternative explanations are plausible. First, management may publicly understate the magnitude of potential strike costs in order to present a strong bargaining position to the union, and since this public information is also the only information about potential strike costs available to most investors, they may be misled by management and underestimate strike costs. Though misleading to investors, such a strategy may still maximize stockholder wealth.

A second explanation suggests management is not acting in the best interest of stockholders. To maximize stockholder wealth at any point during the strike, the decision to continue the strike should be based on an assessment of how the future profitability of the firm is affected by either continuing the strike or making the concessions necessary to settle the strike. The losses or "sunk costs" already incurred as a result of a strike should not be a factor when deciding whether or not to invest additional resources to continue the strike. There is, however, considerable experimental evidence showing a positive relationship between the additional resources subjects are willing to commit to a project and the resources already committed (Staw 1976; Bazerman 1983; Bazerman, Giuliano, and Appelman 1984). If these experimental results generalize to negotiations during a strike, then managers will frequently allow strikes to continue beyond the point of greatest benefit to stockholders. Our results showing a significant average decline in stockholder equity after the strikes have begun is consistent with this explanation. The decline is the financial market's signal that the total costs of a strike were greater than what they should have been if managers ignored sunk costs.

This intepretation can be further tested by looking at the relationship between CERs through the first day of the strike (pre-CER) and CERs after the first day of the strike (post-CER). Pre-CER is the market's estimate of total strike costs, and post-CER reflects the additional resources invested in the strike that were not anticipated by the market. If pre-CER is a good proxy for what the market expects a strike to cost when management ignores sunk costs, then a positive correlation between pre-CER and post-CER is evidence that managers do consider sunk strike costs when deciding whether or not to continue the strike. These data are consistent with such an interpretation. The nonparametric, Spearman's rank order correlation between pre-CER and post-CER is equal to .3 and significant at the .001 level ($t = 9.47$).

The Predictability of Strikes

As mentioned earlier, the market's ability to anticipate strike costs is directly related to the question of whether or not the market can predict strikes. The results reported in Table 3 suggest the market can predict the occurrence of a strike. As explained earlier, however, a better test of the market's ability to anticipate a strike requires a comparison between the strike sample and a sample of peaceful settlements. Such a comparison ensures that any observed decline in the strike sample is due to the market's ability to predict a strike and not simply to the threat of a strike, which also exists in a sample of negotiations that eventually reach a peaceful settlement.

To test H_3 we compared abnormal returns for struck firms in the prestrike period with abnormal returns in the presettlement period for firms that settled peacefully. The analysis is based on two

Table 3. Cumulative Average Returns Before the Strike (N = 699).
(absolute t-values are in parentheses)

Pre-Strike Period[a]	*CAR*	*No. of CERs < 0*[b]
$Day_{-26,-30}$	.097% (.550)	382**
$Day_{-21,-25}$	−.322* (1.831)	380**
$Day_{-16,-20}$	−.297* (1.692)	364
$Day_{-11,-15}$	−.133 (.757)	367
$Day_{-6,-10}$	.011 (.063)	366
$Day_{-1,-5}$	−.552** (3.148)	382**
$Day_{-1,-30}$	−1.382** (3.231)	392**

[a]The days before the strike are identified by the row heading indicating a particular pre-strike subperiod indexed relative to the day of the strike (day_0). $Day_{-26,-30}$, for example, reflects the period from the 30th day before the strike through the 26th day before the strike.

[b]The significance levels reported in this column are based on a sign test of the alternative hypothesis that the number of positive CARs is greater than the number of negative CARs.

*Significant at the .05 level, one tail.

**Significant at the .01 level, one tail.

samples of struck firms: the total strike sample and the subsample of strikes corresponding to the same dates (1/1/77–11/30/80) as the peaceful settments. The comparison between the strike subsample and the peaceful settlement sample is a weak test of the market's ability to predict the beginning of a strike, however, because of the low average cost of the strikes during the period 1/1/77–11/30/80. As noted at the beginning of the results section, the estimated average cost of the strikes occurring during this interval was not significantly different from zero. Since using the changes in returns preceding a strike as evidence of the market's ability to predict the occurrence of a strike *assumes* strikes are costly, the comparison between the peaceful settlement and strike subsample is not a very powerful test of H_3. Therefore, although our discussion includes comparisons across all three samples, the comparison between the total strike sample and the peaceful settlement sample provides a better test of the market's ability to predict the beginning of a strike.

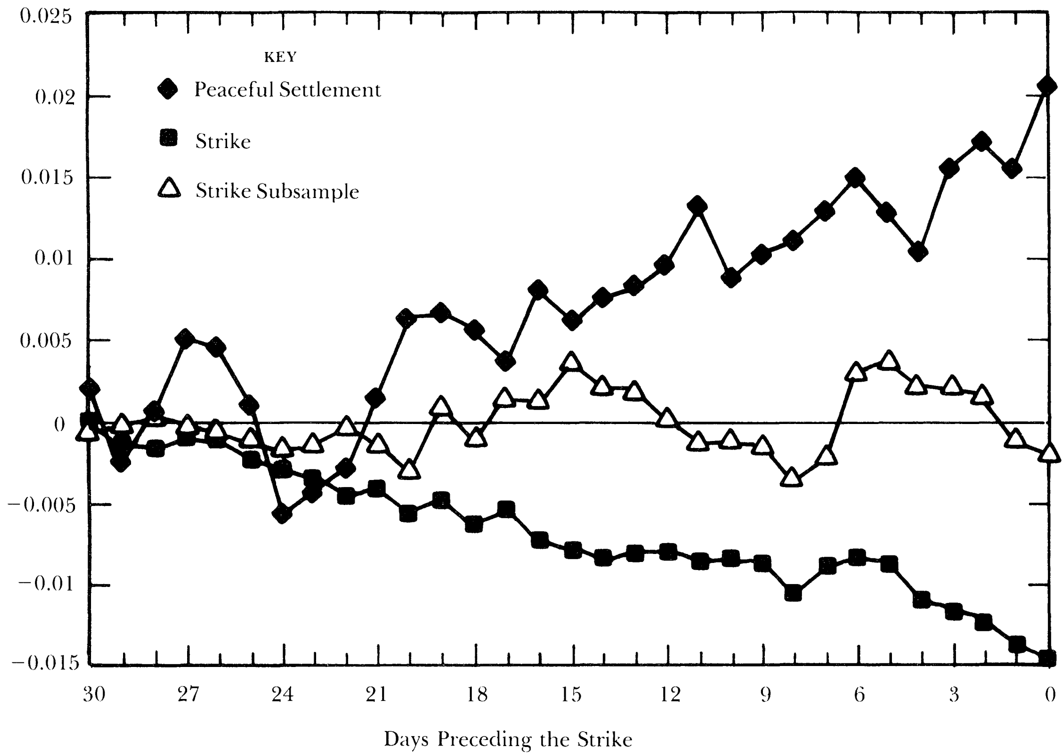
Figure 1 is a plot of the CARs for the 30 days preceding the strike for each of the three samples. The 1.5 percent increase in returns in the peaceful settlement sample is not significantly different from zero (t = 1.136) but is greater than the 1.38 percent decline in the total strike sample (t = 2.068). These results confirm the conclusion drawn from a visual inspection of Figure 1: the market can predict the occurrence of a strike.[18]

Figure 1 suggests the market's ability to anticipate a strike occurs in the final three days before the strike deadline. During this period returns rise in the peaceful sample and drop in the two strike samples. Statistical tests performed on these changes show that the .5 percent increase in returns in the peaceful sample was significantly greater than the decline in the strike samples (t = 1.723 for the total sample and t = 1.667 for the subsample). Examination of the market reaction the day after the old contract expired shows that this prediction is uncertain, however. If the market could predict strikes with perfect accuracy, there would be no difference between the market's reaction on the first day of the strike and its reaction on the day of the peaceful settlements. We find, however, that the day after the contract expired returns rose significantly in the peaceful settlement sample (.5 percent, t = 2.089) and declined in the two strike samples. Although the declines in the two strike samples were not significantly different from zero, they were significantly less than the increase in returns in the peaceful settlement sample.

In summary, we believe these results demonstrate the market can, subject to significant error, predict the occurrence of a strike. The overall drop in returns predicting the strike in the entire strike sample was significantly less than the change in returns in the peaceful settlement sample. Furthermore, the market appears to receive information that allows it to predict the

[18]The .12 percent decline in the strike subsample was not significantly different from either zero (t = .146) or the mean CAR for the peace sample (t = 1.04).

Figure 1. Cumulative Average Returns Preceding the Strike Deadline.



occurrence of a strike immediately before the strike deadline (1–3 days) *and* four weeks before the strike.[19] Since returns on the day after the contract has expired are significantly higher in the peaceful settlement sample, however, the market does not have perfect foresight.

Conclusion

We find that strikes do represent substantial economic costs for a firm. These costs vary widely over industries, however, and, on average, have declined dramatically in recent years. Given the market's positive reaction to peaceful settlements, it seems likely that the bulk of these costs are associated with the strike experience rather than the terms of a new contract. Our results are consistent with Neumann and Reder's hypothesis that the absence of industry strike costs is attributable to gains by nonstriking firms in the industry, although we have not directly tested that hypothesis.

We also find that the market can, subject to error, anticipate the occurrence of a strike. Before the strike deadline, investment returns dropped significantly in the strike sample but did not change significantly in the sample that settled without a strike. These results confirm Neumann's results, which were based on only a strike sample. Although the market did anticipate some of the costs associated with a strike, surprisingly it significantly underpredicted the costs of a strike during most of the 20-year period. The bias is not large enough to allow above-normal investment returns, but its direction raises questions

[19]Directly comparing mean abnormal returns in the total strike sample with the mean abnormal returns in the peaceful settlement samples shows there was a significant difference on four days ($\alpha = .05$, two tails) and on three of these days $\overline{AR}$ was larger in the peaceful settlement sample. One of these three days, however, was in the final three-day period discussed earlier. Comparison of the CAR reported in Table 3 with the corresponding CAR for the peaceful settlement sample showed that only the decline in the fourth week before the strike was significantly less than the equivalent CAR in the peaceful settlement sample.

both about investors' understanding of the collective bargaining process and about the congruence of management decisions and stockholder interests. A positive correlation between prestrike cumulative average residuals and the size of the bias supports the interpretation that managers do consider sunk costs when deciding to prolong a strike.

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