# The Spillover Effects of Industrial Action on Firm Profitability

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## Abstract

While it is generally accepted that industrial action can have a negative impact on a firm's performance, the direct effects of a strike on the affected firm may be only one component of the total impact resulting from the action. The existence of indirect or 'spillover' effects can also have important implications for the economic performance of competing firms. This paper uses a panel dataset of firm-level financial and industrial disputes data on a large sample of firms in Australian manufacturing to determine the extent of direct and spillover effects of industrial action.

## 1. Introduction

Industrial action in Australia has attracted considerable attention from business leaders, government, and the media, and the incidence of industrial action has had a significant influence on the development of past and current industrial relations policy. However, in Australia, very little is known about the nature and magnitude of effect of industrial action on affected firms, and in particular, it is not known whether the effects are even significant in the longer term. Aside from anecdotal evidence reported in the media and specific industry case studies, there has been no previous work done in Australia on the impact of industrial action on firm performance.

Assessing the impact of industrial action is complicated by the fact that strikes at a particular firm may affect the performance of other firms that are not directly involved in the dispute. Specifically, disruptions to production at one firm arising from a strike may actually improve the profitability of competing firms by temporarily or permanently increasing the market share of those firms. If so, then the impact of a strike on the performance of the affected firm will overstate the impact of the dispute at the industry level.[1]

This paper aims to address the limitations of the existing literature by estimating both the direct and indirect effects of industrial action on firm profitability. The paper adapts a standard oligopoly model to allow industrial action to affect the profitability of firms and their competitors, and then tests the predictions of the model by analyzing a unique Australian firm level dataset that includes details of individual firms' strike activity. The dataset contains data on both economic characteristics of firm activity and on industrial disputes, and spans a large panel of firms in Australian manufacturing industries over the period 1984-1993.

Estimation results are consistent with predictions from the model. Industrial action increases the profitability of competing firms, with the magnitude of the impact dependent on both the firm's market share and the industry concentration of the firm's industry. Industrial action at

[1] There may also be negative spillover effects of industrial action that may understate the impact of a strike on the broader economy. This may occur when disruptions to production at a firm also impact negatively on firms that either supply the affected firm with inputs or depend on the affected firm for outputs. This dimension of the problem is not considered further in the current paper, but is the subject of ongoing research by the authors.

a firm is found to reduce the firm's own profitability, although this result is sensitive to the specification of the model.

The outline of the paper is as follows. First, following a brief review of the existing research on the impact of industrial action on firm performance, a standard model of firm profitability is extended to allow for the possible effects of industrial action. Second, the panel dataset underlying the analysis is described and the generation of the various explanatory variables is outlined. Third, predictions of the model are tested using the panel dataset developed, and the robustness of the results to alternative specifications is examined.

## 2. Industrial Action and Firm Profitability: A Brief Review

Although there is a large body of research on the causes of industrial action, considerably less research has examined the impact that industrial action has on affected firms. Most of the previous work on industrial action and profitability has been based on U.S. data, where the effects of strikes on firm profitability have been analyzed primarily through the impact of a strike on the affected firm's share price (for example, Neumann, 1980, or Becker and Olsen, 1986). These studies have employed event analysis of firm-specific data where excess stock market returns for firms experiencing industrial action before, during, and after a contract strike are compared with results from a sample of firms experiencing peaceful contract negotiations. It is generally found that strikes substantially reduce shareholder equity, although most of the strike costs are incurred during the period of the strike. However, the main limitation of these studies is that samples on which the results are based are typically quite small.

Other authors in the U.S. have used regression analysis to examine the effects of strikes on measures other than profitability, such as output (Neuman and Reder, 1984, Paarsch, 1990), prices, production and sales (Gunderson and Melino, 1987), and labour productivity (McHugh, 1991). Most of these studies have used industry-level data rather than firm level data, and have generally found that strikes have only small and short run effects on the various measures of industry performance examined. Neuman and Reder (1984) note that industry-level analyses obscure the effects of industrial action on affected firms, which they predict are appreciably larger than the costs to the industry. Thus, the industry level results are consistent with the results using firm-level stock price data, since the possibility exists for

other firms in the industry to adjust production and recoup some of the losses of the affected firm.

Recent work from the U.S. has taken up this issue by attempting to measure the spillover effects of industrial action. DeFusco and Fuess (1991) and Kramer and Vasconcellos (1996) use event studies to determine the impact of strikes on the share price of competing firms. DeFusco and Fuess (1991) find that strikes at particular firms in the American airline industry have a positive impact on the share prices of other airlines. Kramer and Vasconcellos (1996) use a larger dataset based on a matched sample of firms experiencing contract strikes and their closest competitors, but find no significant spillover effects of the strikes on the share price of the affected firms' competitors. However, no study has yet used econometric methods to investigate the links between industrial action at particular firms and the profitability of those firms' competitors.[2]

In Australia, studies of the determinants of industry profitability have not examined the role of labour market variables such as the incidence of industrial disputes or union density, focusing instead on market structure and foreign competition (see, for example, Round, 1978, 1980, Dixon, 1987, Ratnayke, 1990, or Bhattacharya and Bloch, 1997). In addition, all of these papers have examined determinants of profitability at an aggregate industry level rather than at the level of the individual firm. A comprehensive analysis of the determinants of firm profitability in Australian manufacturing industries is contained in a companion paper (McDonald, 1997), and provides an empirical foundation for the current paper.

## 3. An Extension of the Cowling-Waterson Model

Much of the previous empirical work on the determinants of profitability has been based on versions of a homogeneous product oligopoly model outlined in Cowling and Waterson (1976). In this model, the price-cost margin for firm i is the proportional difference between output price P per unit and the marginal cost of firm i ($MC_i$) producing an additional unit, and can be expressed as a function of firm i's market share ($MS_i$), the industry price elasticity of

[2] McHugh (1991) studies another dimension of strike spillovers by examining the extent to which strikes impair industry-level productivity in industries linked as suppliers or purchasers to the struck industries. He finds that strikes are associated with more significant declines in productivity in the linked industries than in the industries experiencing the strike.

demand ($\varepsilon$) and a conjectural variation term ($\alpha_i$) that represents the output changes firm i would expect from its rivals if it altered its own output,

$$\frac{P-MC_i}{P} = [(1-MS_i)\alpha_i + MS_i]/\varepsilon \quad (1)$$

By its nature, industrial action at a firm disrupts the firm's efficient production of output, and so leads to a disturbance of the equilibrium condition in (1):

$$\frac{P-MC_i}{P} = [(1-MS_i)\alpha_i + MS_i]/\varepsilon + \delta_i \quad (2)$$

where $\delta_i = \delta(A_i)$ is a function of the incidence of industrial action at firm i. During a dispute, it may be possible for a firm to maintain production at close to its previous level by redeploying staff, hiring casual or contract labour, and/or increasing the overtime of workers not directly involved in the dispute. Since such changes will increase the firm's operating costs, through for example, overtime premia, hiring costs and administrative costs, there will be a decline in profit share for a given level of production or market share.

Alternatively, the firm may be unable to continue to supply output during the dispute, and in response may run down inventories to meet its obligations. On resumption of work, the firm will need to implement similar staffing changes in order to restock inventories depleted during the dispute, and so will incur additional production costs.[3] For a given market share, the more frequent (or more protracted) is the industrial action, the greater will be the extent of the disequilibrium, and so the more negative will be the effect on the firm's profit margins.[4]

The disequilibrium arising at a firm due to industrial action can also have an impact on the profit margins of competing firms. Whether action increases marginal costs at the affected firm or interrupts supply, the net effect is for the firm's output to fall at any given output

[3] Current disruption may also jeopardize market share if customers switch to suppliers that they may perceive as being more reliable. In a related vein, Clark (1996) suggests that a firm's failure to meet demand during a strike will lead to a loss of market share and so reduced profitability.

[4] Other papers citing a relationship between strikes and market share although with a focus different to that of the current paper include Geroski and Knight (1982) and Abowd and Tracy (1989).

price. Competing firms thus can expect their own market shares to rise, at least in the short run, and will adjust their current profit margins accordingly.[5] This implies:

$$\frac{P-MC_i}{P} = [(1 - MS^*_i)\alpha_i + MS^*_i]/\varepsilon + \delta_i \quad (3)$$

where

$$MS^*_i = Ms_i \ \theta(C_i) \quad (4)$$

and $C_i$ is the incidence of industrial action at firms that are competitors to firm i. Thus, MS* is a measure of expected market share that reflects the firm's actual market share as well as any increase in market share expected to arise from competing firms' industrial action.[6] Substituting (4) into (3) and expanding yields:

$$\frac{P-MC_i}{P} = [\alpha_i - MS_i\theta_i\alpha_i + MS_i\theta_i]/\varepsilon + \delta_i \quad (5)$$

Thus, (5) suggests that the impact of competing firm strike activity will depend on both the firm's own market share and the conjectural variation term $\alpha$.

To obtain an estimable version of (5), the approach adopted is to follow Kwoka and Ravenscraft (1986) and Machin and Van Reenen (1993) and specify $\alpha$ to be a time-varying function of variables (denoted by the vector $X_j$) reflecting measures of concentration, import intensity and union power in the industry to which the firm belongs. As well, define $\theta$ to be:

$$\theta_i = (1 + \lambda \cdot C_i) \quad (6)$$

so that when competing firm strike incidence is zero, expected market share equals actual market share, MS* = MS. Finally, define the disturbance term $\delta$ to be a function of the firm's

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[5] An alternative rationale for a link between strikes and the economic performance of competing firms is outlined in Kramer and Vasconcellos (1996). Shareholder gains at competing firms may result from investor optimism that those firms will be able to secure union concessions similar to those obtained by management at the affected firm in the course of resolving the dispute. Effects would be likely to be stronger in industries characterized by widespread pattern bargaining, such as the American automotive industry.

[6] It is possible that persistent industrial action at a particular firm will lead to a permanent increase in the market share of competing firms, as customers switch to more reliable sources of supply. If so, then current actual market share also will be a function of past industrial action at competing firms.

own industrial action, the incidence of industrial action at competing firms, plus a firm-specific idiosyncratic component,

$$\delta_i = \eta_i + \rho \cdot C_i + \nu \cdot A_i \qquad (7)$$

Competing firm strike incidence may affect margins directly as well as through expected market share if, for example, firms temporarily raise their own prices in response to strike action at other firms.

Making these substitutions and adding an additional subscript for time yields the estimating equation:

$$PCM_{it} = \gamma_i + \beta_1 MS_{it} + X_{jt}'\beta_2 + \beta_3(MS_{it} \cdot C_{it}) + MS_{it} \cdot X_{jt}'\beta_4 +$$

$$MS_{it} \cdot C_{it} \cdot X_{jt}'\beta_5 + \beta_6 \cdot A_{it} + \eta_{it} \qquad (8)$$

The model indicates that competing firm strike action is interacted both with market share and with industry characteristics, although no interactions of firms' own strike action is implied.

Empirical analyses of profit margins in the literature often include a lagged dependent variable in the estimating specification. Machin and van Reenen (1993) assume that lagged profitability will affect the firm's conjectural variation, so that an equation such as (8) would be expanded to include lagged PCM plus interactions of this variable with other covariates. An additional justification for the inclusion of a lagged dependent variable is to allow for partial adjustment to shocks in the persistence of profits, as discussed in Levy (1986) and Geroski and Jacquemin (1988), in which case lagged profitability would enter the disturbance term. (Lagged PCM may also reflect firm-specific omitted variables in the empirical specification.) It is expected that lagged PCM, market share, and industry concentration should positively affect price-cost margins, while import penetration and union density should negatively affect price-cost margins. A firm's own industrial action should reduce profit margins. The overall effect of competing firms' industrial action should be to increase margins, but the magnitude of the effect will depend on the firm's market share and industry characteristics.

Previous empirical work from the U.S. and the U.K. indicates that profit margins are also sensitive to business cycle conditions, as proxied by the aggregate unemployment rate or some measure of excess capacity. Further, the magnitude and direction of the cyclical effect has been found to depend on the degree of industry concentration (see Domowitz et.al, 1986, 1988 for the U.S. and Haskel and Martin, 1992, 1995, for the U.K.).[7] In a companion paper to the current work, McDonald (1997) finds that profit margins are procyclical for Australian manufacturing firms in concentrated industries. Thus, equation (8) can also be expanded to include macroeconomic effects.

## 4. The Database

The dataset used for the analysis is based on the merged contents of two large micro-level databases. First, annual financial and operations data on large Australian firms of at least $20 million market capitalization are available from 1982 to 1995 from the IBIS Firm Database. This database contains data on private firms, publicly traded enterprises, government enterprises and foreign-owned companies operating in Australia, and is discussed extensively in Kells and Worswick (1997). Second, industrial action data by firm are available from a dispute-level database compiled by one of the authors from Department of Industrial Relations *Reports on Industrial Disputes*. This dispute level dataset is the only dataset of industrial action of its kind in Australia, and includes detailed data on 6637 disputes that occurred in Australian mining and manufacturing industries over the period 1983-1993. Data recorded for each dispute include the firm(s) and union(s) involved, duration, cause, nature of the action, settlement details, and the two-digit industry in which the dispute occurred. Characteristics of the dispute database and comparability with published statistics from other sources are contained in McDonald (1995).[8]

In order to maintain consistency with the majority of previous studies on the determinants of firm profitability (and since reliable firm-level strike data are only available for

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[7] Machin and van Reenen (1993) include a series of year dummy variables to reflect changing macroeconomic conditions over their sample period, and so cannot test whether the cyclicality of profit margins is sensitive to the degree of industry concentration.

[8] Comparison of aggregated measures of strike incidence and working days lost derived from the database with published ABS statistics indicates a high degree of correlation between the datasets.

manufacturing), the analysis is restricted to firms engaged in manufacturing activity. From the IBIS database, a dataset is compiled that includes annual data on all firms with manufacturing activity over the period 1983-93. This yields a total of 7483 annual observations, for 1408 companies.[9] One important characteristic of the IBIS database is that the number of firms on which data have been collected has increased steadily over the sample period, so that the sample is unbalanced and increasingly reflects the presence of smaller firms across later years.[10]

From the dispute database, a total of 4619 disputes are recorded as having occurred in manufacturing industries over the sample period. For each dispute, a search is conducted of the firm and subsidiary IBIS databases to determine the appropriate parent company at which the dispute occurs.[11] It is possible to determine the parent company for 3695 (80%) of the disputes. The remaining 924 disputes are omitted from the database. (Of these, 230 are multiple-firm disputes and 222 occurred at the Department of Defence Garden Island Dockyard.) The total number of strikes occurring is then computed for each firm in the database, for each year of the sample. It should be noted that the measure of strike incidence constructed from the data is likely to understate the true incidence of industrial action at diversified firms since it does not include disputes occurring in non-manufacturing industries. Thus, what the analysis will reflect is the impact of manufacturing disputes on the profitability of firms with manufacturing activity.[12]

The next stage in the development of the database is the derivation of an index of strike action at competing firms. First, the four digit ASIC industries in which each firm operates

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[9] Given the diversified nature of some Australian firms, certain firms are included in the dataset that have substantial manufacturing activity but are primarily engaged in activities outside of the manufacturing industry. Implications of this are discussed later in the paper.

[10] The systematic nature of the sample selection across years may lead to bias in the econometric results, if smaller firms differ from larger firms in the determination of profit margins. To allow investigation of this possibility, a balanced panel is drawn from the larger dataset that consists of all firms for which financial data are available for each year of the period 1984-1993, with 2480 observations on 248 firms.

[11] The organizational level of the 'firm' listed as experiencing a particular dispute in the DIR Reports varies across disputes, and includes corporate parents, subsidiaries, or particular plants.

[12] It is also possible to derive additional measures of industrial action to reflect different dimensions of strike intensity, such as the number of strike days and the number of working days lost. Although the indices of industrial action are likely to be highly correlated, each will reflect different facets of the strike action at a firm.

are identified, and then assigned a weight based on the proportion of the firm's total manufacturing revenue in that industry group.[13] Then, for each four-digit code for each firm, the number of strikes at every other firm with activity in the same four-digit code is computed, but including only those strikes that are reported to have occurred in the associated two-digit industry. (This is the finest level of disaggregation available from the DIR Reports.) For example, if firm X has manufacturing activity in ASIC code C2941, strikes occurring in industry C29 in all other firms also with activity in C2941 are included. Thus, some double counting will arise since a firm's strikes in a particular two-digit industry will be counted as competing strikes in each of the firm's associated four-digit industries. The final step is to compute a weighted competitor strike incidence measure for each firm by multiplying each four-digit competing firm strike incidence by the appropriate four-digit industry weight for that firm, then summing the weighted terms across the firm's four-digit groups. The outcome of this method is an annual competing-firm strike incidence index for each firm in the sample.

The last stage of the development of the data involves using relevant industry data to compute each firm's market share and associated industry-level measures of industry concentration, import intensity and union density. Owing to data limitations, these measures are constructed at the two-digit industry level. The first step is to compute for each firm a series of two-digit weights that are based on the proportion of the firm's total manufacturing revenue in each two-digit industry. These weights are then used to construct market share and the industry-level variables for each firm. For market share, the weights are first used to impute segment revenue for each firm over time, and then the imputed market share for each segment is determined as the ratio of segment revenue to the appropriate two-digit industry revenue.[14] Then, average market share is computed as the weighted average of the imputed market shares, using the same weights. The degree of competition is proxied by the 4-firm industry concentration ratio, while union presence is proxied by union density, both at the 2-digit

[13] Since segment revenue is not available from the IBIS databases prior to 1989, time-invariant weights are computed that are based on the average distribution of revenue over the 1990s, and assumed to apply over the whole sample period.

[14] Ideally, market share would be constructed at the four digit industry level, using the set of four-digit industry weights outlined earlier. This is problematic due to substantial gaps in the published ABS data at this level of aggregation, but is the subject of ongoing work.

manufacturing industry level.[15] Import penetration is computed as the proportion of imports to total sales by 2-digit industry group. In each case, weighted two-digit values are computed for each firm based on the firm's two-digit segment weights.

Since the industry data will correspond only to the manufacturing segments of diversified companies' total activities, a potential classification error with the market share variable and industry level variables may arise for these firms. However, it is possible to check the robustness of empirical results by conditioning on firms that are primarily engaged in manufacturing.

## 5. Estimation Methods and Results

### 5.1 Econometric Methodology

The panel nature of the dataset means that it is possible to control for potentially important firm-specific but unobservable determinants of profitability. However, the econometric methodology is complicated by the fact that some of the explanatory variables in (8) are determined jointly with the dependent variable, and this precludes the use of standard econometric techniques such as the fixed-effects estimator. (See, Keane and Runkle, 1992, for further discussion.)

If unobservable firm-specific effects are not important, then the specification (8) can be estimated in levels and variables lagged at least one period will be valid instruments for endogenous variables in the specification (as long as the disturbance term is free from autocorrelation). Alternatively, if firm-specific effects are significant determinants of firm profitability, then one option is to apply a first difference transformation to (8) and use instrumental variables estimation on the transformed model. (See Anderson and Hsiao, 1981, or Arellano and Bond, 1991, among others.) Values of the dependent variable and endogenous regressors lagged at least two periods will be valid instruments in estimating the first-differenced specification, as long as there is no higher order autocorrelation in the transformed disturbance term. This approach is problematic in practice, however, since firms' market shares and a number of the industry variables exhibit little variation over the

[15] Since industry concentration and union density are available only for 5 and 4 of the 10 sample years respectively, time-invariant average values at the two-digit level are computed for each variable.

sample period. Applying a first-difference transformation may amplify the impact of measurement error in the market share variable and lead to misleading inferences about the regressors. Thus, as an initial step, the approach adopted in this paper is to focus on estimation of the model in levels.

A number of additional econometric issues are also relevant. First, although the appropriate empirical measurement of the dependent variable arising from the theory is a contentious issue, limitations with the data necessitate using the ratio of net profits to revenue as a proxy for the price-cost margin. Machin (1991) and Machin and van Reenen (1993) use the ratio of net profits to sales. However, sales data in the IBIS databases have a large number of missing values, so that firm revenue is used instead.[16] Since firm revenue is used both in the construction of market share and profit margins, a spurious negative correlation may result which may necessitate the construction of alternative measures of market share.

Second, although the potential simultaneity of profit and firm-level explanatory variables such as market share is a well known problem in the literature (see Round, 1980, and Ratnayke, 1990, for results based on Australian data), there are also theoretical and empirical grounds to expect the incidence of industrial action at the firm to be an endogenous determinant of the firm's profits. Asymmetric information models suggest that a firm's financial performance is a significant determinant of industrial action (see, for example, Tracy, 1987), while aggregate time series studies for Australia also suggest that profitability is one determinant of the incidence of strike action (see Beggs and Chapman, 1987).

Third, preliminary investigation of the data indicates that there is a significant positive correlation between firm size (as proxied by number of employees) and the incidence of strike activity. To avoid spurious correlation between a firm's own strike incidence and profitability from a size effect, the number of strikes occurring at each firm is deflated by the number of the firm's employees to obtain a measure of strike intensity that is free from

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[16] A caveat is that the particular definition of the profit variable used may have important implications for the econometric results obtained; see, for example, Dowrick (1990) and Conyon and Machin (1991) for UK data, and Bhattacharya and Bloch (1997) using Australian industry-level data.

correlation with firm size. Competing firm strikes do not appear to be correlated with either firm or relevant two-digit industry employment levels.[17]

## 5.2 Estimation Results

Table 1 reports coefficient estimates of various specifications based on equation (8), estimated in levels. Results in the first column correspond to a static specification of the PCM model that includes the strike terms but excludes interactions of strikes with other variables. The coefficients on the strike variables are consistent with expectations. Higher strike incidence at a firm reduces the firm's profit margins, but higher strike incidence at competing firms increases the firm's profit margins. The signs of the non-strike variables also generally accord with expectations and previous results. Profit margins are higher when industry concentration is higher, when import penetration is lower, and when union density is lower. However, it appears that a firm's market share is positively related to its profit margins only in relatively concentrated industries, although the negative coefficient on the market share variable may be due to spurious correlation as outlined earlier. This issue is examined empirically below through inclusion of an alternative market share variable.

Since the model predicts that the impact of competing strikes will depend on the firm's market share and its interaction with other covariates, columns 1.2 and 1.3 include additional interaction terms. In column 1.2, it can be seen that including market share interacted with competing strikes has little effect on the estimates. However, when market share interacted with competing strikes and industry concentration is also included, the competing strikes variable and both interactions are significantly different from zero. Further, the signs of the coefficients are consistent with what the model suggests. Firms with greater market share benefit more from strikes at competing firms, but the impact is reduced by the degree of industry concentration. The results indicate that for firms in unconcentrated industries, increases in their equilibrium or long run market share reduce profit margins. However, a larger market share also indicates that such firms expect to be better placed to capitalize on the disruption to production at competing firms, which will improve profitability.

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[17] The simple correlation coefficient between firm employment and firm's own strike incidence is 0.4, while the correlation coefficient between firm employment and strike intensity (number of strikes per employee) is less than 0.03.

An explanation for the observed results may be that firms with larger market shares more naturally stand to benefit from production disruption at competing firms because of their more prominent position in the market. Thus, they are better placed to attract customers from disrupted firms. However, if there is collusion among competing producers (as proxied by the concentration ratio), this may entail tacit agreements not to poach business from firms affected by strike action. Collusion may be more easily sustained in concentrated industries, implying the positive effects of competitors' strikes are lower.

**Table 1: Dependent Variable PCM**

| Regressor | 1.1 IV | 1.2 IV | 1.3 IV |
|---|---|---|---|
| Imports/Sales | -.0319 | -.0320 | -.0313 |
| | (-6.95) | (-6.96) | (-6.77) |
| Concentration | .0577 | .0563 | .0561 |
| (CONC) | (3.11) | (3.01) | (3.00) |
| Union Density | -.0985 | -.0990 | -.0977 |
| | (-4.35) | (-4.36) | (-4.30) |
| Market Share (MS) | -.2296 | -.2394 | -.3318 |
| | (-4.42) | (-4.56) | (-5.20) |
| MS* CONC | .8010 | .8629 | 1.108 |
| | (4.63) | (4.38) | (5.22) |
| Number of Strikes at the Firm | -6.762 | -6.674 | -7.385 |
| per employee | (-1.83) | (-1.83) | (-1.81) |
| Number of Strikes at | .0007 | .0007 | .0006 |
| Competing Firms (CNSTR) | (4.44) | (4.09) | (3.69) |
| MS * CNSTR | | -.0013 | .0155 |
| | | (-.484) | (1.98) |
| MS * CONC * | | | -.0353 |
| CNSTR | | | (-2.59) |
| Sample Size | 4590 | 4590 | 4590 |
| $R^2$ | .025 | .025 | .024 |

*Notes:*

*1. Heteroskedastic-consistent t-statistics are in parentheses.*

*2. Instruments included current and lagged measures of industry-level variables (including other variables such as the import/export ratio and industry level capital intensity) and lagged firm-level variables.*

*3. The estimation sample was reduced to 4590 observations after the omission of data on firms for which only one year of data was available, omission of observations where values of the dependent or firm-level independent variables were missing, and omission of data on firms for which four-digit industry activity was unavailable.*

Since lagged profit margins and business cycle effects have been found to be significant determinants of profit margins (McDonald, 1997), it is possible that the strike variables may

in fact be reflecting omitted variables. Thus, it is important to investigate the robustness of the strike results to the inclusion of these additional variables. In the second column of Table 2, results are based on estimation of the model after including a lagged dependent variable (column 1 repeats the results of column 1.3 of Table 1 for comparison). Lagged profit margins are seen to be highly significant determinants of current margins, and although the inclusion of this variable has a significant impact on the magnitudes of the other results, the directions of effect of most variables are unchanged. The notable exception is that the coefficient on the firm's own strike activity becomes positively signed but very poorly determined.[18] However, the set of competing strike variables are qualitatively unchanged compared with the previous results.

Column 2.3 includes the aggregate unemployment rate and the unemployment rate interacted with industry concentration as additional regressors. When these variables are included, the coefficient on competing strikes is marginally smaller and is no longer significant, although still positively signed. It may be that the competing strike days variable is partly reflecting the changing macroeconomic conditions over the period, for example if both strike incidence and profit margins are procyclical. The interactions of competing strikes with market share and concentration retain their significance and are reduced in magnitude by only a small amount.[19]

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[18] This may be due to multicollinearity between lagged profits and current strike activity, which may arise if previous profits impact on current strike incidence. When margins lagged two periods are included instead, the firm's own strike action takes a negative sign while the other coefficient estimates are not significantly affected.

[19] It is also true that strike activity exhibits a strong downward (and acyclical) trend over the sample period (see McDonald, 1995), and this may be another element underlying the reported results. However, neither including a trend term in the regression nor detrending the competing strike variable qualitatively changes the results, although levels of significance are reduced. Interestingly, the inclusion of a time trend in the specification gives rise to a negative (but still insignificant) coefficient on the firm's own strike intensity.

**Table 2: Dependent Variable PCM**

| Regressor | 2.1 IV | 2.2 IV | 2.3 IV | 2.4 IV | 2.5 IV (new MS) |
|---|---|---|---|---|---|
| PCM(-1) | | .5550 | .5523 | .5795 | .5551 |
| | | (16.7) | (16.6) | (16.9) | (16.7) |
| Imports/Sales | -.0313 | -.0134 | -.0137 | -.0135 | -.0139 |
| | (-6.77) | (-3.56) | (-3.62) | (-3.57) | (-2.31) |
| Concentration | .0561 | .0247 | .1515 | .0228 | .0285 |
| (CONC) | (3.00) | (1.59) | (2.57) | (1.40) | (1.83) |
| Union Density | -.0977 | -.0469 | -.0477 | -.0493 | -.0531 |
| | (-4.30) | (-2.51) | (-2.54) | (-2.38) | (-2.41) |
| UE Rate | | | .2280 | | |
| | | | (1.27) | | |
| UE Rate * CONC | | | -1.443 | | |
| | | | (-2.21) | | |
| Market Share (MS) | -.3318 | -.1809 | -.1839 | -.1453 | -31.80 |
| | (-5.20) | (-2.72) | (-2.78) | (-1.81) | (-2.31) |
| MS* CONC | 1.108 | .5602 | .5652 | .4216 | 111.5 |
| | (5.22) | (2.80) | (2.85) | (2.17) | (2.65) |
| Number of Strikes at the Firm per employee | -7.385 | .5290 | .0417 | .0359 | .5241 |
| | (-1.81) | (.280) | (.024) | (.020) | (.280) |
| Number of Strikes at Competing Firms (CNSTR) | .0006 | .0003 | .0002 | .0003 | .0003 |
| | (3.69) | (2.12) | (1.49) | (2.03) | (2.25) |
| MS * CNSTR | .0155 | .0127 | .0134 | .0157 | 3.254 |
| | (1.98) | (2.35) | (2.45) | (1.88) | (2.60) |
| MS * CONC * CNSTR | -.0353 | -.0252 | -.0267 | -.0291 | -6.688 |
| | (-2.59) | (-2.53) | (-2.68) | (-2.00) | (-2.90) |
| Sample Size | 4590 | 4590 | 4590 | 3957 | 4590 |
| $R^2$ | .024 | .344 | .345 | .371 | .345 |

*Notes:*

*1. Instrumented variables include MS, Capital/Sales in the balanced panel, and dispute variables. Instruments used were lagged values of explanatory variables, industry strike statistics, industry employment, industry import/export ratio, and industry capital/sales ratio in the balanced panel.*

*2. Heteroskedastic-consistent t-statistics in parentheses.*

*3. Observations where PCM or PCM(-1) could not be computed due to missing values were omitted from the sample.*

*4. The validity of the instruments depends on the disturbance term being free of autocorrelation. The null hypothesis of no first or second order autocorrelation could not be rejected by a Box-Ljung Q-test for specifications including the lagged dependent variable (Q= 2.05 compared with a critical value of $\chi 2(2,.05)=5.99$ for the specification contained in Column 2.3).*

The final two columns of Table 2 present results from two additional robustness checks. First, since the sample of firms is specified to include all firms in the IBIS database that have some manufacturing activity, some large firms with significant activity in industries other than manufacturing will also be included. To determine whether this affects the estimated results (particularly market share and the variables interacted with it), the sample is further restricted to include only those firms with greater than 70% of activity in manufacturing as indicated by the IBIS segments database. Results are contained in the fourth column of Table 2, and suggest that imposing this restriction has little impact on the coefficient estimates.[20]

Second, since firm revenue enters both the denominator of the profit margin variable and the numerator of the market share variable, it is possible that the results are contaminated by spurious negative correlation between these terms. Column 5 of Table 2 presents estimates based on an alternative measure of market share constructed from employment data rather than revenue data, and indicates that changing the market share variable does not qualitatively alter the main results. (The substantially larger magnitudes of the coefficients on terms involving market share reflect the fact that average employment based market share is significantly smaller than the revenue based measure.)

### 5.3 The Magnitude of the Estimated Effects

Although competitors' strike days appear to be a statistically significant determinant of firm profitability, it is important to assess the magnitude of the impact on profit margins that results from a change in strike incidence at competing firms. In order to unscramble the various effects, Table 3 shows the marginal impact on profit margins of an extra strike at a competing firm for various combinations of firm market share and industry concentration (based on coefficient estimates contained in column 2.3 of Table 2). Cells of the table in which market share is larger than industry concentration are omitted. From the table, it can be seen that the marginal effects increase with market share for firms in all industries except those where industry concentration is highest. Further, for any given market share, the more

[20] Since the model predicts that interactions of market share and competing strikes with other regressors might also be important, a number of more general specifications are tested. Additional interaction terms are not significant. Similarly, interactions of firms' own strike activity and the other regressors are also not significant.

concentrated the industry, the smaller is the marginal effect on profitability of an increase in competitors' strikes.

For a hypothetical firm with a market share equal to the sample average of 0.05 and industry concentration equal to 0.20, if seven strikes (the average number of competing firm strikes) occur at competing firms during the year, the profit margin for the firm is around 0.4% higher than if no strikes occurred. Assuming an annual revenue of $50,000,000 and a profit margin of 5%, this represents an increase in profit in the order of $200,000 (assuming no change in revenue for illustration). For a firm of the same dimensions but in an industry where concentration is equal to 0.40, the impact on profit margins is only half as large.

Since the average number of competing firm strike days varies substantially across industry groups, from around 1 per year in textiles to 19 per year in basic metal manufacturing, the potential impact on the margins of competing firms may also vary substantially across industry group. However, since basic metal manufacturing is also the most concentrated industry in manufacturing, the effect of this level of strike activity is to increase profit margins by around 0.3%[21]

**Table 3: Marginal Effect on PCM of an Increase in Competitors' Strikes (Percent)**

| | Market Share | | | | | | |
|---|---|---|---|---|---|---|---|
| Concentration | 0.001 | 0.01 | 0.05 | 0.1 | 0.15 | 0.2 | 0.25 |
| 0.1 | 0.021 | 0.031 | 0.074 | | | | |
| 0.2 | 0.021 | 0.028 | 0.060 | 0.101 | | | |
| 0.3 | 0.021 | 0.025 | 0.047 | 0.074 | 0.101 | | |
| 0.4 | 0.020 | 0.023 | 0.034 | 0.047 | 0.061 | 0.074 | |
| 0.5 | 0.020 | 0.020 | 0.020 | 0.021 | 0.021 | 0.021 | 0.021 |
| 0.6 | 0.020 | 0.017 | 0.007 | -0.006 | -0.019 | -0.032 | -0.046 |

## 6. Conclusions

This study represents the first formal econometric analysis of the direct and spillover effects of industrial action on firm profitability. The theme of the research is that the industrial

action that occurs at a firm may not necessarily be neutral to other firms that have linkages to the affected firm. One dimension of these spillover effects is that a firm may benefit financially from industrial action that disrupts production at the firm's competitors. Evidence is found that strike activity at competing firms has a small but statistically significant positive impact on firm profit margins, but that the magnitude of the impact for a firm depends both on the firm's market share and on the degree of concentration that characterizes the industry in which the firm is located. Where firms are in a more prominent position in the market due to a relatively large market share, the degree to which they benefit from strikes at competing firms is larger. However, this is tempered by the magnitude of industry concentration, which may indicate a degree of collusion that reduces the spillover effects to colluding firms.

The main implication of the results is that focusing on the impact of industrial action only at the affected firm may overstate the extent of the losses, since competing firms may benefit financially from the disruption to the firm's production. A firm's own strike incidence is found to be negatively associated with profit margins, but the coefficient estimate is highly sensitive to the specification of the model. When a lagged dependent variable is included, strike incidence has no statistically significant impact on margins.

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[21] The results imply (perhaps unrealistically) that strikes at firms of any size in an industry will affect competing firms' profit margins in a similar fashion. However, in practice the majority of strikes occur only at the larger firms, so that ceteris paribus, their impact on other firms in the industry is potentially relatively large.

## Data Appendix

**Table A1: Means and Standard Deviations of Variables**

| Variable | Mean | Std Dev |
|---|---|---|
| PCM | 0.051 | 0.113 |
| Market Share (revenue based) | 0.025 | 0.049 |
| Market Share (employment based) | 0.00012 | 0.00027 |
| Union Density | 0.476 | 0.097 |
| Concentration | 0.246 | 0.140 |
| Imports/Sales | 0.464 | 0.404 |
| Aggregate UE Rate | 0.087 | 0.017 |
| Number of Strikes | 0.484 | 5.31 |
| Number of Strikes divided by firm employment | 0.0002 | 0.001 |
| Number of Strikes at Competing Firms | 7.20 | 11.8 |

**Proportion of Observations by ASIC Industry Classification (7438 Obs.)***

| 2-Digit Industry | Firms | Observations |
|---|---|---|
| Food, Beverages, Tobacco | 282 | 1424 |
| Textiles | 54 | 237 |
| Clothing and Footwear | 42 | 163 |
| Wood and Wood Products | 57 | 269 |
| Paper, Printing and Publishing | 116 | 567 |
| Chemical, Petroleum, Coal Prods. | 198 | 1185 |
| Non-Metallic Mineral Products | 58 | 331 |
| Basic Metal Manufacturing | 69 | 422 |
| Fabricated Metal Manufacturing | 80 | 353 |
| Transport Equipment | 100 | 510 |
| Other Machinery and Equipment | 318 | 1593 |
| Miscellaneous Manufacturing | 75 | 384 |

** Assigned industry based on firm segment with largest share of revenue*

**Sources for ABS data**

1. 4-Firm Industry Concentration: ABS 8221.0, 8203.0, 8204.0

2. Trade Union Density: ABS 6325.0

3. Imports, Industry Sales, Industry Employment: *Australian Manufacturing Industry and International Trade Data 1968-69 to 1992-93*, Industry Commission Information Paper, 1995. (Data based on ABS statistics). Series extrapolated to 1993-94 using ABS manufacturing industry data converted from ANZIC to ASIC classifications.

4. Aggregate Unemployment Rate: ABS 6203.0

**References**

Abowd, J. and J. Tracy (1989), 'Market Structure, Strike Activity, and Union Wage Settlements', *Industrial Relations*, 28(2), 227-50.

Anderson, T. and C. Hsiao (1982), 'Formulation and Estimation of Dynamic Models using Panel Data', *Journal of Econometrics*, 18, 47-82.

Arellano, M. and S. Bond (1991), 'Some Tests of Specification for Panel Data: Monte Carlo Evidence and an Application to Employment Equations', *Review of Economic Studies*, 58, 277-298.

Becker, B. and C. Olson (1986), 'The Impact of Strikes on Shareholder Equity', *Industrial and Labor Relations Review*, 39(3), 425-438.

Beggs, J. and B. Chapman (1987), 'An Empirical Analysis of Australian Strike Activity: Estimating the Industrial Relations Effect of the First Three Years of the Prices and Incomes Accord', *Economic Record*, 63(1), 46-60.

Bhattacharya, M and H. Bloch (1997), 'Specification and Testing the Profit-Concentration Relationship in Australian Manufacturing', *Review of Industrial Organization*, 12, 219-230.

Clark, Simon (1996) 'Strike Behaviour When Market Share Matters', *Oxford Economic Papers*, 48(4), 618-39.

Cowling, K. and M. Waterson (1976) 'Price-Cost Margins and Market Structure', *Economica*, 49, 277-87.

Dawkins, P. and M. Wooden (1993), 'Understanding Industrial Action in Australian Workplaces' in *The Economics and Labour Relations of Australian Workplaces: Quantitative Approaches*, ACIRRT Monograph 10, University of Sydney.

Dixon, R. (1987), 'Structural Change in Oligopolistic Manufacturing', Research Paper #168, Department of Economics, University of Melbourne.

Domowitz, I., R.G. Hubbard and B. Petersen (1986), 'Business Cycles and the Relationship Between Concentration and Price-cost Margins', *Rand Journal of Economics*, 17, 1-17.

De Fusco, R. and S. Fuess (1991), 'The Effects of Airline Strikes on Struck and Nonstruck Carriers', *Industrial and Labor Relations Review*, 44(2), 324-333.

Geroski, P. and A. Jacquemin (1988), 'The Persistence of Profits: An International Comparison', *Economic Journal*, 98, 375-379.

Geroski, P. and K. Knight (1982), 'Wages, Strikes and Market Structure', *Oxford Economic Papers*, 34(2), 276-91.

Gunderson, M. and A. Melino (1987), 'Estimating Strike Effects in a General Model of Prices and Quantities', *Journal of Labor Economics*, 5(1), 1-19.

Haskel, J. and C. Martin (1992), 'Margins, Concentration, Unions and the Business Cycle', *International Journal of Industrial Organization*, 10, 611-632.

Keane, M. and D. Runkle (1992), 'On the Estimation of Panel-Data Models with Serial Correlation when Instruments are not Strictly Exogenous', *Journal of Business and Economic Statistics*, 10, 1-9.

Kells, S. and C. Worswick (1997), 'An Overview of the Dynamics of Large Australian Firms', unpublished paper.

Kramer, J. and G. Vasconcellos (1996), 'The Economic Effect of Strikes on the Shareholders of Nonstruck Competitors', *Industrial and Labor Relations Review*, 49(2), 213-222.

Kwoka, J. and D. Ravenscraft (1986), 'Cooperation v. Rivalry: Price-cost Margins by Line of Business', *Economica*, 53, 351-63.

Levy, D. (1986), 'The Speed of the Invisible Hand', *International Journal of Industrial Organization*, 5, 79-92.

Machin, S. and J. Van Reenen (1993), 'Profit Margins and the Business Cycle: Evidence from UK Manufacturing Firms', *Journal of Industrial Economics*, 16(1), pp. 29-49.

McDonald, J. (1995), 'A Micro-Level View of Industrial Action in Australian Mining and Manufacturing Industries, 1983-1992', Department of Economics Discussion Paper 458, University of Melbourne.

McDonald, J. (1997) 'The Determinants of Firm Profitability in Australian Manufacturing', Proceedings of the 1997 Econometric Society Australasian Meetings, University of Melbourne, July 1997.

McHugh, R. (1991), 'Productivity Effects of Strikes in Struck and Nonstruck Industries', *Industrial and Labor Relations Review*, 44(4), 722-732.

Neumann, G. and M. Reder (1984), 'Output and Strike Activity in US Manufacturing: How Large are the Losses?', *Industrial and Labor Relations Review*, 37(2), 722-732.

Paarsch, H. (1990), 'Work Stoppages and the Theory of the Offset Factor: Evidence from the British Columbian Lumber Industry', *Journal of Labor Economics*, 8, 387-419.

Ratnayake, R. (1990), *Foreign Trade Linkages and the Structure, Conduct, and Performance of Australian Manufacturing*, Unpublished Ph.D. Thesis, LaTrobe University, Melbourne, Australia.

Reder, M. and G. Neumann (1980), 'Conflict and Contract: The Case of Strikes', *Journal of Political Economy*, 88(4), 867-86.

Round, D.K. (1978), 'Price cost Margins, Industry Structure and Foreign Competition in Australian

Manufacturing, 1968-69 to 1972-73', *Industrial Organization Review*, 6, 151-66.

Round, D.K. (1980), 'The Determinants of Profitability and Tariffs in Australian Manufacturing', *Malayan Economic Review*, 25(2), 63-80.

Tracy, J. (1987), 'An Empirical Test of an Asymmetric Information Model of Strikes', *Journal of Labor Economics*; 5(2), 149-73.