A Firm-Level Study of Strike Propensity in Ireland*

ANTHONY BARLOW
University College Cork

and

AONGUS BUCKLEY
GNI Ltd., London

Abstract: This paper presents a wage-bargaining model in which strikes occur due to imperfect information. The predictions are tested on a unique Irish firm-level data set which is based on the 25th wage round. The results indicate that firm size affects strike activity in the form of an inverted U. They also indicate that strike activity is inversely related to strike cost

I INTRODUCTION

E conomists have had great difficulty in explaining why strikes occur. Given that both parties incur losses in arriving at the post-strike wage outcome, it is in the interest of both to agree on this outcome, and avoid a dispute. This has become known as the Hicks paradox (Hicks, 1963). Ways of avoiding this paradox centre on the assumption that one, or both of the parties is imperfectly informed. In a seminal article, Ashenfelter and Johnson (1969) held that the employer and the union leadership are perfectly informed, while the union membership relies on its leadership for all of its information. Here the strike is a weapon used by the union leadership to reduce the wage demands of its members without losing political support. In the past decade, most researchers have followed Hayes (1984) and Morton

(1983) in assuming that the employer holds asymmetric information on the true value of their product. In this case the strike is a weapon used by the union to force the employer to pay the wage that is commensurate with this value.

The model in this paper is essentially that of Siebert and Addison (1981). Both parties have imperfect information on their bargaining partner's position. Strikes are caused by mistakes in the negotiating process, and can be caused by either party. Thus, it is less one-sided than either the Ashenfelter and Johnson (1969) or asymmetric information models, in which strikes are always caused by workers. Also, it provides a more general explanation for the occurrence of strikes than either of these models, each of which explains how a specific type of dispute arises.

Another area of difficulty in the study of strikes has been the availability of suitable data. Previous economic studies of strike propensity in Ireland have used data aggregated to the macro, or industry-sector level (Mulvey, 1968; Sapsford, 1979). Aggregation error may thus significantly affect results. Recent studies in north America have used micro-level data sets which are based on labour contract negotiations of large firms (e.g., Tracy, 1987; Vroman, 1989; Fisher, 1991). Ingram, Metcalf and Wadsworth (1993) used firm-level data based on wage-round negotiations in the UK. This paper uses a new sample of wage negotiations which is based on the 25th wage round in Ireland. This data allows examination of the effect of firm-level variables on strike propensity.

Having considered the main determinants of strike propensity in Section II, the theoretical model is presented in Sections III and IV. Sections V and VI describe the data set, while Section VII describes the empirical procedure and results.

II THE DETERMINANTS OF STRIKE PROPENSITY

Models of strike activity have sought to explain two stylised facts which have emerged from the quantitative literature: that some industries are more strike prone than others, and that strike activity is pro-cyclical. Evidence of the former in the case of Ireland has been shown by Sapsford (1979). Some evidence of the cyclical nature of strikes in Ireland has recently been found by Reilly (1996).

Variation in strike propensity was traditionally explained in terms of employee relative bargaining power, following Rees (1952). Workers with greater bargaining power were assumed to act more aggressively when faced with a given grievance, and thus cause more strikes.

Geroski, Hamlin and Knight (1982) presented an alternative view; namely

that employees with high bargaining power are more likely to have their demands met before a strike deadline. They provide the example of firms in oligopolistic industries, which were found not to be "struck" often. They hold that such firms have a great incentive to come to an agreement before the strike deadline as the need to keep market share is very pressing. The high cost of a strike to the employer therefore translates into employee relative bargaining power, which leads to an increase in the wage rate. (Belman and Heywood (1990) provide evidence to suggest that workers in such industries are paid a wage premium.) Reder and Neumann (1980) and Kennan (1980) formalised this idea into the "joint cost" hypothesis. This holds that changes in strike costs affecting one party only can be transferred to the other side through concessions in the negotiating process and will not directly affect strike activity. However, changes in the "joint cost" of strike activity are inversely related to strike propensity.

III THEORETICAL MODEL

Figure 1 presents a model of the wage-negotiating process from a union's point of view (the employer's perspective may be represented using a similar model). It represents what the union expects to gain from each unit of time spent in negotiations. Quadrant I represents the increase in wages expected from the negotiations (ΔW, ΔW^n), the expected costs of keeping a negotiating team together (TC), and the expected cost of a strike per member (pL). Quadrant III presents the marginal cost (MC) and marginal benefit (MB) of the negotiations. The pN curve in Quadrant II represents the union's subjective probability that the negotiations will break down. The position of this curve depends on the ease of communication between the two sides. It will shift outwards when it becomes more difficult for the union to assess the position of the employer, and to signal its own position. It slopes downwards with respect to the horizontal x axis (the figure is inverted) because of the assumption that the purpose of bargaining is to search out more information. As more information becomes available it becomes less likely that mistakes will be made. It slopes downwards at a diminishing rate because of the assumption of diminishing returns to information search within any institutional framework (Stigler, 1961, p. 215).

The ΔW curve in Quadrant 1 represents the wage increase expected by the union for various lengths of negotiations, N. This curve slopes upwards as the union expects that taking care in negotiations will yield benefits. It does so at a diminishing rate as these returns are assumed to diminish as the negotiations proceed. This curve will shift upwards with an increase in union relative bargaining power. (A similar curve, representing the expected profit
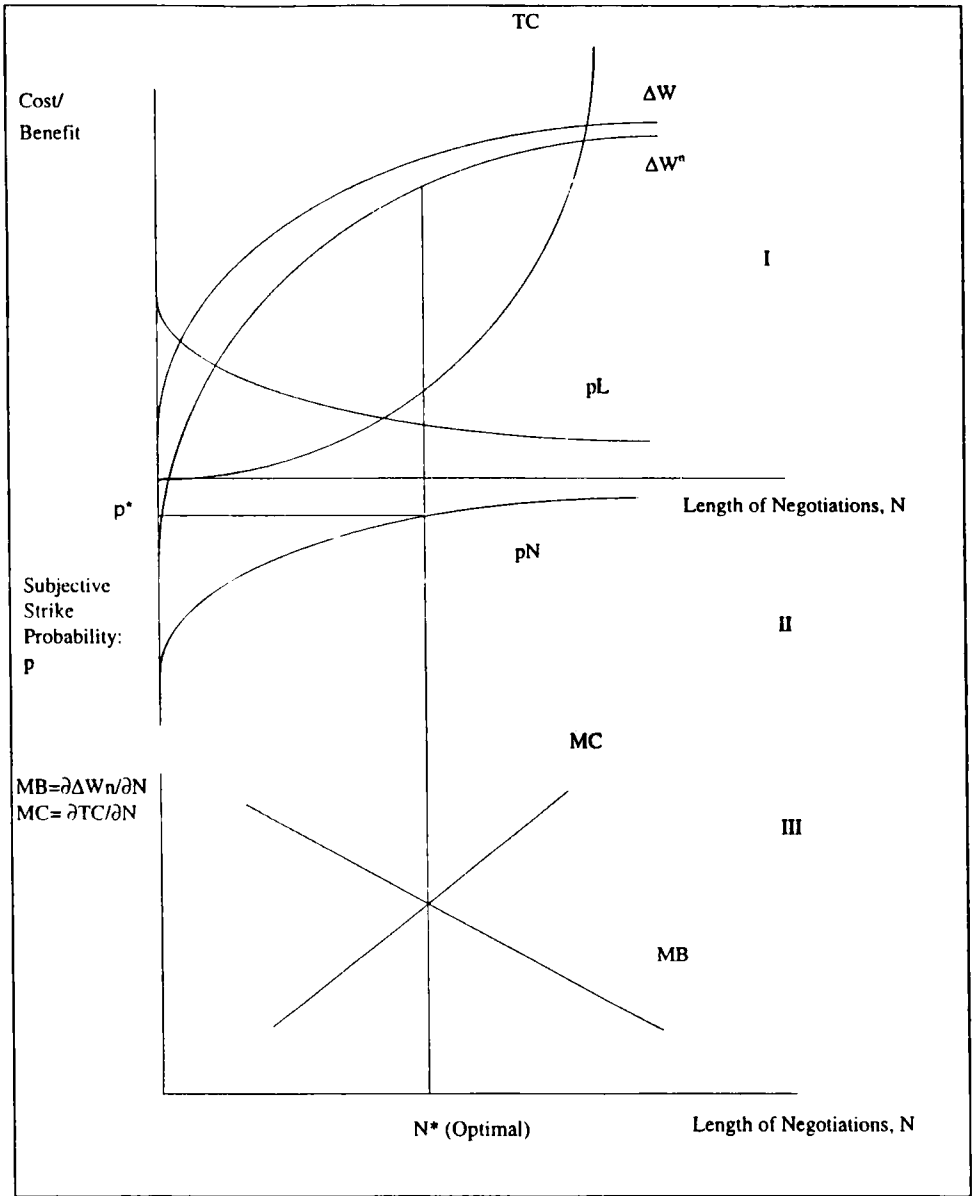
Figure 1: *Wage-Negotiation and Risk of Strike (Union Side)*

increase per period of negotiations, $\Delta\Pi$, may be drawn for the employer. It is possible for both the ΔW and $\Delta\Pi$ curves to slope upwards because of the assumption that careful negotiating will make both sides better off.)

The union is assumed to have an estimate of the losses per member L, which will be incurred in the event of a strike (this remains constant

throughout the negotiations). The product of L and the strike probability schedule, pN, gives the expected loss per member, which is represented by the pL curve in Quadrant I. The union subtracts pL from the expected gross wage increase, ΔW, to get the net expected wage increase, which is represented by the ΔW^n curve in Quadrant I.

Finally, during negotiations the union incurs the costs of maintaining a negotiating team, which is represented by the TC curve in Quadrant I. The TC curve slopes upwards at an increasing rate because costs are assumed to rise more quickly the longer negotiations proceed.

The union chooses N* in Quadrant III as its optimum negotiating period. At this point the marginal benefit of further negotiations is equal to their marginal cost. N* has a corresponding subjective strike probability p*, which is shown in Quadrant II. p* is determined by the length of the negotiations, N*, and the ease of communication between the parties, which is represented by the pN schedule.

If it is assumed that the bargaining pair has negotiated many times in the past, and that their expectations are reasonable, p* becomes a good measure of strike probability. This is clarified by the following: First, parties to a bargaining pair will develop a common optimum negotiation duration N*, as the party wishing to stay longer will offer concessions to the other party in order to get them to remain longer. Second, the parties' pN schedules will be very similar as it pays each party to be correct in their estimate of the probability that the negotiations will break down. The implication of this assumption is that a common optimum N* will have a corresponding common subjective strike probability, p*.

Comparative static results may now be used to identify the causes of variation in p*. As can be seen from Figure 1, p* depends on the slope and position of the pN schedule, the marginal benefit of the negotiations (the slope of the ΔW^n curve), and the marginal cost of the negotiations (the slope of the TC curve). The effect of changes in these three arguments will now be considered separately.

Looking first at the Marginal Cost of the Negotiations: the slope of the TC curve is determined by the rate at which the cost of negotiating rises as negotiations proceed. For example, this slope will be greater at higher levels of inflation where there is uncertainty over the back-dating of wage changes.

Next we turn to the Marginal Benefit of the Negotiations (the slope of the ΔW^n Curve). Ignoring for now the effects of the pN curve, the slope of the ΔW^n curve can be affected by the slope and position of the ΔW and L curves. L is not affected by the length of the negotiations, so its slope does not change. The slope of the ΔW curve, which reflects the union's negotiating skill is also assumed to remain unchanged. Thus, changes in the slope of the ΔW^n curve

are caused by changes in the position of the ΔW and L curves. In other words, they are caused by changes in the union's relative bargaining power and strike costs, respectively.

The effects of a change in L are dependent on whether the change in strike losses affect one party or both parties: if there is a rise in the strike losses of one party only, then that party's relative bargaining power falls. If there is a rise in the strike losses of both parties, then relative bargaining power is unchanged.

Consider first an increase in L which affects both parties. The balance of relative bargaining power is not affected, so ΔW remains unchanged. L shifts upwards and causes ΔW^n to shift downwards, and become steeper. The model predicts that the union chooses a longer negotiating period, and strike probability falls.

Consider next an increase in L which affects the union only. The union's relative bargaining power has fallen so there is a downward shift in ΔW. This causes ΔW^n to shift downwards and become flatter. The rise in L causes ΔW^n to shift downwards, and to become steeper. The net effect on the slope of ΔW^n is ambiguous. Thus, the prediction is that strike probability is not changed considerably. The gross wage increase expected by the union, ΔW, is unambiguously lower.

Turning finally to the pN Curve: The model predicts that changes which improve the ease of communication between the two sides will cause the pN curve to shift inward. This should lower strike probability. However, if the pN curve becomes shallower then so will the ΔW^n curve. Thus, the parties will choose a shorter negotiating period, and strike probability will not be significantly effected.

IV USE OF THE MODEL TO GUIDE EMPIRICAL WORK

To summarise, the main predictions of the model, are as follows. First, factors such as inflation which raise the cost of remaining at the negotiating table increase strike probability. Second, strike probability is inversely related to the "joint cost" of striking. Third, bargaining pairs with poor channels of communication are more likely to experience a strike. As this study uses a cross-section data set it is the latter two predictions which are relevant, and they will be dealt with separately here. The "joint cost" of a strike to a bargaining pair is a difficult variable to represent empirically. Consequently, measures of the cost of a strike to workers and employers will be treated separately. It is assumed here that differences in strike costs to employers are mainly due to differences in output loss suffered during a strike. All other strike costs are assumed to remain constant across firms.

Thus, it is the ability to offset output losses that determines how costly a strike will be. Christenson (1953) highlights two ways in which a firm may do so. First, if a firm can build up buffer stocks in anticipation of a strike, it can use them to satisfy a portion of demand during a strike. The variability of an employer's inventories gives an indication of its ability to do so. The inter-year coefficient of variation of inventories (INV) is expected to have a positive effect on strike probability. Second, if a firm can maintain some level of production during a strike, it can offset a portion of the output loss. The ability to do so is likely to be related to the capital intensity of the firm. The capital to labour ratio (K/L) is therefore expected to have a positive effect on strike probability .

Measures of strike costs to workers can be drawn from the human capital literature. Following Becker (1962), a distinction is drawn here between firm-specific, and general human capital. The kernel of general human capital theory is that employees with higher levels of education are relatively highly productive and can thus be expected to have relatively high earnings. Hanoch (1967) and Mincer (1974) provide strong evidence that this is indeed the case. In addition, the non-monetary benefits of work, such as job satisfaction, are likely to be higher for more highly educated workers. The percentage of all workers who completed their full-time education when aged twenty-one years or over (E21) is used to represent the level of education of the workforce, and is expected to be negatively related to strike probability.

When a bargaining pair invests in firm-specific human capital, the cost of, and return on the investment will be shared between them. Because of this shared investment, the likelihood of either party suspending, or terminating the relationship will be relatively low. This prediction has been used with some success to explain termination of the bargaining relationship (Parsons, 1972). It has not yet been used to explain temporary stoppages. The average annual expenditure on training per employee (TR) is expected to be negatively related to strike probability.

Three variables, not directly predicted by the model, were introduced in an attempt to control for worker attitudes towards striking, which are often referred to as "worker militancy". First, the percentage of workers which is male (M) is expected to be positively related to strike activity. Second, the percentage of workers who work on a part-time basis (PT) is expected to be negatively related to strike activity as their employment contracts are generally less secure than full-time workers, so they are more likely to be dismissed for striking. Third, recent changes in real annual average labour costs per employee (DW) are expected to have a positive effect on strike probability. This is because large increases in the average level of earnings in an industry are likely to disturb established differentials. This in turn is

likely to cause dissent among workers whose earnings have fallen behind. This hypothesis is supported by the finding that "comparability in all its forms is the major test of failure or success in the Irish Bargaining Process" (McCarthy, O'Brien and Dowd, 1975, p. 202).

Bargaining pairs which operate within a large organisation are likely to be less effective at communicating their positions to one another for the following reasons. First, in larger organisations there is likely to be more than one union. When a firm must deal with more than one union during negotiations the potential for misunderstanding is greater. In addition, disagreement between unions may lead to strikes. Ingram, Metcalf and Wadsworth (1993) found multi-unionism to be positively related to strike probability. Second, in the Irish wage-round system of collective bargaining, large firms usually set the trend wage increase for each round, and this trend is followed by smaller firms. The bargaining options are thus more narrowly defined for smaller firms, and each party is likely to have a better appreciation of where the other stands. Consequently, the number of mistakes is likely to be smaller in smaller firms. For these reasons, the number of employees in each firm (EMPL) is expected to have a positive effect on strike probability.

The more an employer's turnover varies, the more difficult it becomes for the union to judge what the level of turnover is at any point in time. Therefore, it becomes more likely that the union will table an unrealistically high wage demand. The coefficient of variation of the employer's turnover (VAR) is thus expected to be positively related to strike probability. This mirrors the main prediction of the asymmetric information models of Tracy (1987) and Fisher (1991). The predictions of the model are presented in Equation (1).

$$P(S)_i = B_1 EMPL_i + B_2 VAR_i + B_3 (K/L)_i + B_4 INV_i$$
$$+ B_5 E21_i + B_6 TR_i + B_7 M + B_8 PT + B_9 DW + u_i. \tag{1}$$

Where the a priori expectation is that B_1, B_2, B_3, B_4, B_7, $B_9 > 0$, and B_5, B_6, $B_8 < 0$.

V DATA COLLECTION

As the purpose of this study is to isolate the firm-level determinants of strike probability, the sample was chosen from the period 1982-1987, during which time wage bargaining in Ireland was not conducted within a nationwide framework. The sample is based on the 25th wage round, which took place in 1985/86.

A list of the names of companies which took part in the 25th wage round was compiled from the following sources. First, *Industrial Relations News* (1986) carried an index of companies which had finalised agreements under the 25th round. Second, the Central Statistics Office gives the reported cause of each strike in its publications on strike activity. The names of companies involved in strikes whose reported cause was the 25th wage round were added to the list. Third, *Industrial Relations News* (1986) also featured Labour Court hearings, and recorded the cause of each impasse. The names of companies which reached impasse with their union(s) due to the 25th wage round were added to the list.

The resulting list was then narrowed down to those companies which appear on the register of Ireland's top companies, which appeared in *Business and Finance* (1986). For each company, this register provided the most recently available turnover figure, the number of people employed, and the main activity of each company. Details on the main activity of each company were used to classify the companies by NACE group (3-digit classification), or, where the information provided was not specific enough, by NACE class (2-digit classification).

The dependent variable includes all of the strikes in the relevant period, rather than just wage strikes. In 1985 the last bargaining pairs to enter a new round did so twenty-one months after the beginning of the round (O'Brien, 1987). As the 25th wage round began in the first quarter of 1985, the relevant sample period is 1985Q1-1986Q4.

VI DESCRIPTION OF THE DATA

Tables 1 and 2 provide summary statistics on the final data set. Table 1 aggregates the sample into fourteen different industry classes. Column 3 shows the number of workers from each industry that is included in the sample. The remaining columns of Table 1 give aggregated values of the variables which were used in the final regression. Table 2 divides the sample into eight groups on the basis of size. This indicates that strike propensity rises with company size, reaching a maximum at 2001-3000 workers.

Twenty-two of the 167 companies experienced a strike(s) in the chosen period. Thus, 13.2 per cent of the negotiations ended in a strike. This figure is similar to those found in comparable micro-level studies of strike activity in North America: Vroman (1989) found a figure of 11.96 per cent, and Gunderson, Kervin and Reid (1986) found it to be 15.7 per cent. Thirty-five of the bargaining pairs in the sample attended a Labour Court hearing during the chosen period (six of those who attended the Labour Court also

Table 1: *Details of the Data Set Aggregated by Industry*

Industry	Strikes	Number of Workers	Strikes/ Thousand Workers	Capital/ Labour Ratio (£'000 in 1980 Prices)[1]	Percentage Educated to Over 21[2]	Per Cent Change in Real Wages Since Last Round[3]	Annual Training Costs/ Employee[4]	Coefficient of Variation of Inventories[5]	Coefficient of Variation of Turnover[6]
Mining, Quarrying and Turf	2	1,790	1.1173	74.54	5.88	16.7	225	30.74	15.645
Metals and Engineering	3	13,461	0.22286	30.06	7.8	32.52	178	11.51	17.226
Chemicals	1	2,390	0.4184	51.14	11.48	9.2	145	11.51	11.57
Wood	0	304	0	12.44	1.7	8.3	485	11.51	16.005
Clay Products	0	615	0	73.44	3.8	6.7	265	11.51	16.728
Other Manufacturing	2	8,866	0.2256	29.85	4.8	14.9	85	11.51	12.051
Drink and Tobacco	1	9,860	0.1014	50.1	4.9	27.7	147	11.51	7.668
Transport, Communications and Storage	3	9,303	0.3225	69.24	5.72	5.9	42	10.93	7.63
Clothing and Footwear	0	638	0	27.82	1.7	0.73	170	11.51	14.176
Food	8	17,778	0.45	50.1	5.59	3.1	66	11.51	12.822
Textiles	0	5,019	0	27.82	3.23	11.33	71	11.51	15.254
Paper and Printing	0	12,400	0	22.76	3.8	1.75	135	11.51	13.053
Commerce	2	10,128	0.1975	12.29	5.48	17.1	160	10.93	13.417
Services	0	1,988	0	35.5	6	15.05	60	10.93	17.865

Notes: 1. Gross fixed capital stock figures for the end of 1984 were taken from Henry (1989: Table 8.1). Data on the number of workers in each industry was taken from the *Labour Force Survey* for 1984 (Irish Central Statistics Office, 1985).
2. Figures on the number of workers who completed their full-time education when aged twenty-one years or older was taken from 1986 Census data (Irish Central Statistics Office, 1992, pp. 64 and 72).
3. Annual average labour costs per employee from *Labour Cost Surveys* carried out in 1981 (Irish Central Statistics Office, 1984) and 1984 (Irish Central Statistics Office, 1987b) were used. The consumer price index was used to deflate the figures.
4. Average annual training costs per employee were obtained from the *Labour Cost Survey* carried out in 1984 (Irish Central Statistics Office, 1987b).
5. Annual inventory data for the years 1973-1984 was obtained from Henry (1989, p. 196).
6. The turnover of each of the companies in the sample was obtained from *Business and Finance* (1986). The consumer price index was used to deflate the figures.

experienced a strike). It is likely that some of these pairs would have experienced a strike had the Labour Court facility not been available.

Table 2: *Size Distribution of the Companies in the Sample*

Size Class	Range in Number of Employees	Number of Companies	Number of Strikes	Average Strikes per Company
1	0-200	84	1	0.012
2	201-400	36	5	0.138
3	401-600	15	5	0.333
4	601-800	5	1	0.2
5	801-1000	6	1	0.166
6	1001-2000	14	6	0.428
7	2001-3000	2	1	0.5
8	over 3000	5	2	0.4

VII ESTIMATION AND RESULTS

As the dependent variable is binary, taking a value of one if a strike (or more than one strike) occurs, the probit model was used. The model may be represented as follows:

$$y_i^* = x_i'B + u_i; \ i = 1,\dots,167$$

$$y_i = 1, \ \text{if} \ y_i^* > 0 \qquad (2)$$

$$= 0, \ \text{otherwise.}$$

Where u_i is assumed to have a mean of zero and a standard deviation of one. y_i^* is a latent, or unobservable variable which determines the outcome observed for the dummy y_i. An LM test proposed by Davidson and McKinnon (1984) indicated that the homoscedasticity assumption cannot be accepted (test statistic = 27.42 > 23.68). Heteroscedasticity in the probit model is similar to misspecification of functional form and omitted variable bias in the classical model (Godfrey, 1988). As the relationship between the number of employees per company and strike activity, which is shown in Table 2 indicates that size has a roughly quadratic influence on strike activity, the square of the number of employees, EMPLSQ, was added to the regression. A repeat of the Davidson and McKinnon test indicates that the homoscedasticity assumption can now be accepted (test statistic = 1.58 < 23.68). The regression results are shown in Table 3. A likelihood ratio test was carried out to test the following hypothesis:

$H_0 = B_1 = B_2 = \ldots B_9 = 0$. LR = 34.1. > 20.09, the critical value of the χ^2 distribution at the 1 per cent level so the null hypothesis can be rejected.

The coefficients of the explanatory variables may now be interpreted.

Table 3: *Final Probit Estimates of Strike Incidence in the 25th Wage Round*

Variable	Coefficient	t-Statistic
Constant	−3.506	(−4.44)**
EMPL*10^{-3}	1.164	(3.27)**
EMPLSQ*10^{-7}	−1.199	(−1.82)*
(K/L)	0.0225	(2.25)**
INV	0.0734	(1.68)*
VAR	0.1391	(1.04)
TR	−0.0064	(−1.97)*
E21	0.0539	(1.16)
DW	0.0135	(1.34)

ln likelihood (l_{ml}): −48.025
ln likelihood with optimal constant only (l_c): −65.067
McFadden's Psuedo $R^2 = (1 - l_{ml}/ l_c) = 0.262$

Notes: ** denotes statistical significance at the 5 per cent level while * denotes statistical significance at the 10 per cent level.

Variability in company turnover, VAR, exerts a positive influence on strike activity as expected although the effect is not statistically significant. The coefficient on the size variable, EMPL, is positive and significant, indicating that strike probability rises with the number of people employed in a firm. This provides evidence that the size effect which has been widely found in the UK, US and Canada (Prais, 1978; Booth and Cressy, 1990; Gunderson, Kervin and Reid, 1986) also applies in the Irish context. The coefficient on the size squared variable is negative and significant at the 10 per cent level, indicating that strike activity within a firm falls after a certain number of employees is surpassed. This echoes Blanchflower and Cubbin (1986), who found that establishment size is positively related to the probability of industrial action in the form of an inverted U, reaching a maximum at 6,279 employees in the UK sample. One explanation for this fall in activity is provided by Shorey (1976), his argument being that larger firms are likely to have a higher quality personnel function per employee because of the economies of scale which may be exploited within this function. Their bargaining teams are thus less likely to make mistakes. Another explanation centres on the fact that company size rather than plant size is used in this sample. Thus, once a certain number of employees is surpassed, it becomes more likely that the company is a multi-plant one. Some of the positive influences on strike activity associated with large plants are therefore likely

to diminish. Due to the small number of companies in the higher size divisions in this sample, however, the conclusion that the level of strike activity falls after a certain point must be a tentative one.

The capital-labour ratio, K/L has a strongly positive effect on strike probability. The sign on the variation in inventories INV, is positive (t-statistic 1.68). These results provide some support for Christensen's offset principle (Reder and Neumann (1980) and Geroski, Hamlin and Knight (1982) also found support for this principle).

TR, the average annual expenditure on training per employee, has a significant negative affect on strike probability at the 10 per cent level. This indicates that bargaining pairs which make a joint investment in training are more reluctant to allow that relationship to break down. Again this finding is notable as, to our knowledge, such a variable has not been used in this context before. E21, the variable representing the educational qualifications of the workforce, does not have the predicted sign, and is insignificant.

PT and M which represent worker militancy were omitted from the final equation as their coefficients were insignificant. A dummy variable, taking a value of one if a company experienced a strike during the previous wage round was also used as a test for worker militancy. As with the other variables, however, it was found to be insignificant. DW, the change in real wages is also insignificant in the final equation.

VIII CONCLUSIONS

To conclude, this study has found firm-level evidence that strike activity in Ireland is positively affected by firm size (the results show that the effects diminish as firm size surpasses a certain level). This result is interpreted as support for the Siebert and Addison model's prediction that strike activity will be higher in bargaining pairs where communication channels are poorer. Effective communication is assumed to be more difficult to achieve in a large organisation.

Evidence has also been found to support the second main conclusion of the theoretical model: namely that strike probability is inversely related to the cost of striking. The capital/labour ratio was found to have a strongly positive affect on strike activity indicating that firms which can cut the cost of a strike by maintaining some level of production are more likely to experience a strike. The coefficient of variation of inventories is also positively related to strike probability. Firms which can build up inventories in anticipation of a strike will lose less from the strike and consequently have a higher strike probability. The average annual training cost per employee was found to have a negative affect on strike probability. This notable finding suggests that

bargaining pairs which invest in training their employees will take more care in preventing strikes.

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