

STRIKE PROPENSITIES AT THE BRITISH WORKPLACE*

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I. INTRODUCTION

Strikes are widely believed to be an important component of the British economic problem both directly in terms of lost output, and because of the poor state of industrial relations of which they are widely regarded as a symptom. This paper draws on a new data source, the Department of Employment/Policy Studies Institute/ESRC Workplace Industrial Relations Survey (1980) to investigate the relative importance of various aspects of the workplace environment in increasing the probability of industrial action in general and strikes in particular.

In Section II we set out our conceptual framework. In Section III we give a brief description of our data sources. Section IV is a detailed discussion of our findings; these are summarized in Section V.

II. THE CONCEPTUAL FRAMEWORK

Strikes have variously been attributed to mistakes, malice, political opportunism, weak management, militant unions, poor institutional arrangements and so on. This gives rise to an indigestible mass of variables that are thought to affect strike propensities. In this section we make use of a number of ideas developed in game theory to provide us with a framework for classifying such variables.

Concepts borrowed from game theory have been widely employed to analyse bargaining between workers and employers (see for example, Coddington (1968) and more recently in Geroski and Knight (1983b)). In such circumstances the bargaining 'game' is rather complex; it is in fact a 'supergame', which consists of an endless (in principle) series of constituent games, each game corresponding to a bargaining round. Unfortunately, theoretical analysis rapidly becomes too complex to yield useful predictions. However, insight into the nature of bargaining games has been provided by experimental work on behaviour within Prisoner's Dilemma settings, especially the classic experiments of

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Fouraker and Seigel (1963) on bilateral monopoly and oligopoly and also the work of Friedman (1969), Lave (1962) and Malouf and Roth (1981). This experimental work has usually been set in the context of games where no *direct* negotiation was involved, because bids were transmitted through an intermediary. Although these results may therefore not be directly translatable to a real-world bargaining situation they do suggest variables relevant to the present study. With incomplete information the non-cooperative solution becomes more likely. Although Friedman found that better information increased the frequency of cooperative solutions, in some oligopoly experiments there was also a greater tendency to engage in price wars. This should inject some caution into the simple belief that more information always improves the quality of bargains.

To obtain a bigger share of the gains from trade, each party must understate its payoff from a settlement; in the present context, its loss from a strike. This produces an incentive for each party to hide or distort information, even though the chances of a perfect bargain may be improved by better information. Indeed, strikes may occur purely for the purpose of demonstrating willingness to take industrial action. This contrasts sharply with the view, put forward by Siebert and Addison (1981) that strikes are essentially accidental.

Skill in playing is generally improved by repeating the game. There seems to be an initial learning period in experimental games before cooperation predominates. Furthermore, the knowledge that the game is to be repeated is important in securing cooperation, for in experimental games when the last move came a large proportion of those previously cooperating reverted to non-cooperative behaviour. (Alternatively, cooperation could be maintained by terminating the game at random with a constant small probability.)

Apart from information, communication, and repetition, an important factor seems to be the number of players. Dolbear *et al.* (1968), Fouraker and Siegel (1963), and Friedman (1969) all found that in (oligopoly) games the more persons (players) involved, the lower the average degree of cooperation. The psychological orientation of the parties may, however, be important. Fouraker and Seigel identify three personality types amongst their subjects – simple maximizers, co-operators and rivalists. As one might expect, simple maximizers and co-operators more readily achieved outcomes than rivalists. This suggests that the objective characteristics of the workplace may be subsidiary to the characteristics of the main protagonists.

To summarize, in a static world, with knowledge of the payoffs, where the game is to be repeated an indefinite number of times in the future, the empirical literature suggests that perfect bargaining is achievable. But the world is not static and payoffs are only imperfectly known. Personalities, issues and the nature of the bargain can all

change. Under these conditions an increase in the numbers playing the game can reduce the perfection of bargaining, as can an increase in the novelty of the situation, and an increase in the number of ways to share the gains.

The framework outlined above suggests some fairly specific causes of strikes when they are considered as non-cooperative outcomes to a set of bargaining moves. For instance, as organizations grow the problems of information and communication become more severe (Williamson, 1967). Either each top manager has to meet more individual workers or there has to be a hierarchy interposed between the management and the shopfloor. Extra layers of hierarchy themselves create communication barriers. Companies which are claimed to be the best run in the US (Peters and Waterman, 1982) and the UK (Goldsmith and Clutterbuck, 1984) have been found to be characterized by good communications in general, and in particular by direct contact between the upper layers of management and the shopfloor. Formal structures are largely replaced by informal contacts ('management by wandering around' – Peters and Waterman). This suggests that formal arrangements for collective bargaining may be a symptom of a management that has failed to produce an atmosphere of cooperation. This is consistent with the finding of Turner *et al.* (1977) amongst 45 manufacturing plants in six industries, that the number of days lost per worker tended to be higher where there were formal collective agreements and conciliation procedures. The above arguments imply that some variables are likely to cause strikes because they act as barriers to cooperation; these factors we refer to as *frictional*.¹ But for a strike to occur we need two other conditions to be met apart from bargaining imperfection; the elements of *organization* and *incentives* must also be present. The question of organization arises from the fact that a strike is a form of collective action. In the absence of organization we can imagine a situation where we get a cooperative solution, but where all the gains from trade are captured by the employer. The bargaining situation only really starts to arise as the workforce becomes organized. (Organization and unionization are, however, not synonymous; workers who are not members of unions can strike and some trade unions are very weak at the shopfloor level.²) Incentives arise because the size of the gains from cooperation determine the elements of the payoff matrix and are likely to be important in determining strategic behaviour.

The precise details of the variables actually used in our empirical estimation and the rationale for selecting them will be given in the next section. The frictional variables include many of the traditional con-

¹ These will include barriers to cooperation within the bargaining context as well as those precipitating a fresh round of bargaining.

² We are grateful to Paul Edwards for pointing this out to us.

cerns of the industrial relations literature; the nature of the working environment, arrangements for setting wage rates and resolving disputes, the number of unions involved, and so on. The organizational variables largely mirror the view implicit in most models of strikes, that union strength is a precondition for a strike.

The incentive variables are closest in spirit to the industrial organization literature, which focuses on the role of strikes in the wage determination process (see, for example, Geroski, Hamlin and Knight, 1981; Geroski and Knight, 1983a). Briefly, the main argument here is that unions can raise wages outside the perfectly competitive sectors of the economy, i.e. where there is free entry and exit and firms have no control over prices. Only in those minority of cases where the union represents a monopoly of a certain kind of labour can it gain monopoly advantages in a competitive product market. Conceding a wage increase above the market determined rate ultimately results in the firm closing down. Where wages are fully market-determined there is no incentive to strike for higher wages. Only in oligopolistic or monopolistic industries does this incentive exist; even within such industries, the incentive is likely to vary with the state of demand and with a particular group of workers' ability to inflict losses on the employer.

An important strand of recent literature on strike propensities has been the attention given to establishment and organizational size. To incorporate this aspect we have included a separate size category which does not fit neatly into any of our frictional, organizational or incentive categories.

III. DATA AND DESCRIPTION OF VARIABLES

The data set used in this paper is the 1980 Workplace Industrial Relations Survey³ sponsored by the Department of Employment, the Policy Studies Institute and the Economic and Social Research Council and includes 2,040 observations at the level of the establishment⁴ distributed throughout England, Scotland and Wales. The sample was drawn from the 1977 Census of Employment; to be included in the sample an establishment had to have 25 or more employees (both full- and part-time) at the time of the 1977 Census and at the time of the survey (April–September 1980). Hence new establishments and those whose size increased from below 25 to 25 or more and those that declined below 25 in the years 1977–80 were excluded from the sample. Omitting these establishments, an extremely high response rate of 75 per cent was achieved. The sample includes establishments drawn from

³ Henceforth WIRS.

⁴ Defined as 'places of employment at a single address or site'. For further details of the correspondence between establishments and Census Units see Daniel and Millward (1983), Appendix B, pp. 321–33.

both manufacturing and services, private and public sectors, although it does exclude agricultural and farming establishments and coal-mining.⁵

This survey was the first of a new series designed to provide information about a broad range of topics within the industrial relations field. The survey incorporated interviews with the senior manager at the establishment who dealt with industrial relations, or in non-industrial establishments, staff or employee relations. In certain cases (165 cases out of 2,040) part of the information was provided by a secondary management respondent with whom an additional short interview was undertaken. In addition, at many establishments, interviews were undertaken with worker representatives up to a maximum of three at any one establishment. In total 2,439 interviews with worker representatives are included in the data set.

This paper restricts itself to data drawn from the management questionnaire (plus that from the 'Basic Workforce Data Sheet', a self-completion questionnaire received by respondents prior to the interview) because all questions used in our analysis were asked of the management respondents, whereas only relatively few of them were asked of the worker representatives. (It is possible to use worker representative responses on the presence of industrial action at the establishment; however, there is a high degree of correspondence between the pattern of responses of the two groups for our dependent variables. Unfortunately this information is only available in 55 per cent of cases for which such a comparison is possible. It was decided, therefore, to limit ourselves to the responses provided by the management respondents.) The sample design incorporated the use of variable sampling fractions according to the number of employees at a Census Unit. In order to ensure that large establishments were numerically well represented in the sample, variable sampling fractions were used; this necessitated a weighting of the data used in this paper, to adjust for the inequalities of selection that were introduced because of the differential sampling of the size bands.⁶

Strike activity, however defined, tends to show considerable fluctuations through time and consequently it is essential to place in context cross-section results such as those reported later in this paper. As we noted above, the interviews for the 1980 WIRS were conducted between April and September 1980. The questions on industrial action, which are the principal concern of this paper, relate to the 12-month period prior to interview. The period under investigation, therefore,

⁵ See Daniel and Millward (1983, p. 5).

⁶ See Lievesley (1984) for a discussion of the weighting system used here, which differs from that applied by Daniel and Millward (1983) and Blanchflower (1984) because of the over-sampling of larger establishments. There is relatively little difference in the results whichever of the two weighting systems are applied.

extends from approximately the second quarter of 1979 to the third quarter of 1980, which was a period of widespread strike activity, with the number of workers in officially recorded strikes being 40 per cent higher than the annual average for the period since 1966.⁷ Since that time there has been a progressive decline in strike activity as unemployment has risen; it will be interesting to see how the results change in a period where there is a low level of strike activity. It is our intention to examine this issue when the data for 1984 becomes available from the second wave of the WIRS series which also includes a longitudinal element.

The independent variables used in our empirical analysis are defined as follows:

- (EMPASS) a (1, 0) dummy if the establishment belongs to an employers' association.
- (SINGLE) a (1, 0) dummy if a single establishment organization.
- (PARTE) the percentage of workers who are part-time.
- (FORMAL) a (1, 0) dummy if there are formal procedures between unions and the employer over pay and conditions, discipline and dismissals and/or individual grievances.
- (COMIT) a (1, 0) dummy if there is a consultative committee between management and employees.
- (PBR) a (1, 0) dummy if there are payments-by-results schemes for some manual employees.
- (SHIFT) a (1, 0) dummy if there is any shiftwork.
- (WATCH) the ratio of supervisors to manual workers.
- (MANE) the percentage of the workforce who are manual.
- (FORE) a (1, 0) dummy if the establishment is foreign owned.
- (PERS) a (1, 0) dummy if there is a qualified personnel manager at the establishment.
- (SKILL) the proportion of the workforce with formal training (apprenticeship or equivalent).
- (REC15) a (1, 0) dummy if manual unions are recognized for bargaining over pay and conditions of employment.
- (STEWARD) a (1, 0) dummy if manual shop stewards are present.
- (SHOP) a (1, 0) dummy if there is a closed-shop for some manual workers.
- (MEMBER) the percentage of full-time manual workers who are union members.
- (NUMBUN) number of manual unions at the establishment.
- (VARY) a (1, 0) dummy if a breakdown or stoppage on one part of the production line brings the whole of that production line to a standstill.

⁷ Daniel and Millward (1983, p. 217).

- (STIME) a (1, 0) dummy if there has been any short-time working over the last year.
- (DEMAND) a dummy variable equal to one if demand for the main products or services of the establishment has increased over the last year, -1 if it has decreased, zero otherwise.
- (CHG2) a (1, 0) dummy if the establishment has reduced total employment over the last five years.
- (OSIZE) the size of the organization to which the establishment belongs.
- (TOTAL) number of employees at the establishment (full- and part-time).
- (PUB) a (1, 0) dummy if the establishment is located in the public sector.
- (MANU) a (1, 0) dummy if the establishment's main activity is manufacturing.
- (ENG) a (1, 0) dummy if the establishment is located in the engineering industry.

The dependent variables are defined as follows:

- (STK1) a (1, 0) dummy if there has been (a) a strike of any length, (b) ban or restriction on overtime, (c) work to rule, (d) go slow, (e) blacking or work, or (f) work in/sit in amongst manual workers.
- (STK2) a (1, 0) dummy if there have been any strikes of less than one day/shift over the last 12 months amongst manual workers.⁸
- (STK3) a (1, 0) dummy if there have been any strikes of one day/shift or more over the last 12 months amongst manual workers.

In Section II of this paper we classified factors that were likely to be determinants of strike action as frictional, organizational, incentive and other. To some extent there are elements of more than one of these in many of the variables used in our empirical analysis. However, we follow this classification here. The reasons for the inclusion of the explanatory variables are as follows

1. *Friction*

Included in this group of variables are factors that are likely to precipitate a strike on the part of the workforce. There is some tradition in the

⁸ To avoid possible misclassification error, establishments which experienced longer strikes but no short strikes were excluded from this analysis. Otherwise the zero category would include both establishments with no strikes and establishments with longer strikes; the independent variables are likely to have a different impact on the chances of being in these two categories. We are grateful to a referee for pointing out this problem.

literature for the inclusion of a payment-by-results variable (e.g. Shorey, 1975, 1976; Geroski, Hamlin and Knight, 1982) in a strike frequency equation. The reason for this is that the presence of PBR schemes is likely to increase the number of occasions at which rates of pay have to be adjusted with new and unknown payoff matrices because of changes in products, working methods, materials, etc. (A note of caution is in order here; payment by results is by no means synonymous with payment by the piece. As Sisson and Brown note: '... there appears to have been a trend away from individual to group and plant-wide incentive schemes' (1983, p. 41).) The operation of shiftwork (SHIFT) is also likely to have a positive impact on strike probabilities. Apart from the fact that shiftwork is inherently stressful disagreement can occur between groups of workers on different shifts, and communications problems across the workforce are possible, especially on a three-shift system.⁹ Conversely, an increase in the ratio of supervisors to operatives should improve (vertical) communications in both directions (WATCH). We expect this variable to have a negative effect on strike probability.

The number of unions at the establishment (NUMBUN) is included as a frictional variable because it is expected that the more unions there are at the workplace the greater is the probability of demarcation disputes between the unions. In addition, negotiations with the employer are likely to be complicated if there are large numbers of parties who must be compliant with an agreement. Similarly, if the establishment is part of a multi-establishment organization (SINGLE) or an employer's association (EMPASS), it is expected that external influences will make it more difficult for management to reach an agreement with unions without a resulting strike. The presence of formal agreements (FORMAL) or joint consultative committees (COMIT) may on the one hand show the willingness of the parties to agree but on the other may indicate a failure of industrial relations.

It is fairly well known that both strike frequencies and the number of working days lost per worker tend to be higher in the manufacturing sector than elsewhere in the economy. On average over the period 1970-79 there were 22 stoppages per 100,000 employees in manufacturing as compared to 12 per 100,000 employees in the (UK) economy as a whole. A similar difference emerges in relation to the number of working days lost. Over the same period, on average, the manufacturing sector lost 1,050 days per 1,000 employees as compared to 571 for the economy as a whole. These differences are plausibly related to conditions in the workplace environment in ways not captured by our other variables; due to the difficulty in explicitly isolating such factors we include a dummy variable if the establishment is located in the

⁹ Shiftwork may also be associated with tasks that are sensitive to disruption, so there could be an incentive effect here as well.

manufacturing sector, to avoid specification bias. We also include a dummy variable (ENG) to pick up the effects of the protracted engineering industry dispute which began in August 1979, as well as a dummy variable to control for the public sector which had also experienced considerable industrial unrest over the relevant period.

2. *Organization*

A number of variables are included to represent the strength of manual unions at the workplace. A union is expected to be stronger if unions are recognized for purposes of bargaining (REC15), if a relatively high proportion of full-time manual workers at the establishment are union members (MEMBER), if any form of manual closed shop operates (SHOP) or if there are manual shop stewards present (STEWARD). These variables take on uncertain signs because, a strong union may not have to resort to strikes, or if it does these may only have to be of a relatively short duration.

3. *Incentives*

There is some evidence that strike activity has a procyclical element (e.g. Pencavel, 1970; Shorey, 1977). Consequently we include two 'incentive to strike' variables; the state of the demand for an establishment's products or services (DEMAND) and a variable to identify those establishments which have seen a contraction of employment since 1975. As an additional 'demand' variable the existence of short-time working at the establishment (STIME) is included as a dummy variable. (These variables were examined by Daniel and Millward (1983) and found not to affect the likelihood of industrial action.)

In addition a dummy variable (VARY) is included if a continuous process of production is used at the establishment. This reflects greater bargaining power, since a strike in these circumstances is likely to inflict more damage. This might result in more or fewer strikes and we have no strong prior beliefs about the sign of this variable.

4. *Size*

There has been considerable interest in the empirical literature over the relationship between strikes and plant size (e.g. Shorey, 1975; Prais, 1978; Edwards, 1980). As noted by George, McNabb and Shorey, one would expect

'... a higher incidence of strikes and other manifestations of labour unrest in large units. Inferior job satisfaction and social relationships will make workers highly wage conscious. Wage demands will tend to be exaggerated and attitudes towards compromise unsympathetic. And the problem of wage determination

may be further accentuated by complicated piecework systems. Attempts to adopt a patient and constructive approach to collective bargaining and grievance settlement may be frustrated by problems of communication. Under such conditions strikes are likely to occur more frequently' (1977, p. 270).

Prais (1978) has suggested that strikes are generated by a random process in which individuals in all establishments are confronted with the same probability of striking, but it is the combination of these probabilities in large establishments that leads to higher observed strike frequencies. This model is unusual in its emphasis on strikes being caused by disagreements between individuals rather than between the central parties to the bargain, i.e. unions and management. This may be more relevant to a model of strikes resulting from day-to-day difficulties at the workplace than it is to a model of *collective* bargaining over pay and general conditions. The size of establishment may therefore be considered to be an 'organizational' variable in so far as it allows for economies of scale in union organization.¹⁰ If we were to follow Prais (1978) then the size of plant should perhaps be considered as a 'frictional' variable.¹¹ However, size does not fit comfortably into any of our frictional, organizational or incentives categories although it is obviously desirable to control for possible size effects.

It is unlikely that the probability of striking is a linear function of size and hence establishment size (TOTAL) and establishment size squared are included as explanatory variables to test for these effects. In addition a size of organization variable is included (OSIZE) to determine if there are any influences of organizations independent of establishment size. It is uncertain what sign this variable will take; there are good arguments on both sides and previous empirical evidence is equivocal.¹² We also include the percentage of the workforce who are manual (MANE) on the grounds that the probability of conflicts involving manual workers is likely to increase as the proportion of manual workers in the workforce increases.

IV. EMPIRICAL ANALYSIS

Most previous empirical work on strikes in Great Britain has generally involved the estimation of strike frequency¹³ or strike duration equa-

¹⁰ In 1980 36 per cent of manual workers who worked in establishments of 25-49 employees were union members, compared with 72 per cent in establishments of 500-999 employees and 84 per cent in establishments of over 5,000 employees. (Source: WIRS data tapes.)

¹¹ Edwards (1980), however, argues that strike proneness will be related to the number of bargaining groups within the establishment, not the number of individuals. Unfortunately we do not have suitable data to test the validity of this argument.

¹² See Marginson (1984) for a discussion of the issues involved.

¹³ Examples are Pencavel (1970); Shorey (1975, 1976, 1977); Smith *et al.* (1978); Geroski, Hamlin and Knight (1982).

tions¹⁴ (both cross-section and time series) using data at a highly aggregated level. However, in a recent paper Edwards (1981) examined strike propensities of manual workers in manufacturing plants using disaggregated data from a survey of 970 establishments, carried out for the Industrial Relations Research Unit at the University of Warwick in 1977-78. The information on industrial action obtained from that survey was considerably more detailed than had been available to previous authors who, when strike frequency equations were estimated, had been obliged (because of inadequate data) to define strike frequency as the number of occurrences of strikes of one day or more over a particular period, usually a year. Edwards was able to estimate a frequency equation where the dependent variable included the occurrences of *any* form of industrial action, including strikes of any length as well as actions which fall short of strikes such as overtime bans, workings to rule, go slows and work/sit ins, etc. The use of 'micro' data at the level of the plant also permitted more complete controls for characteristics of the workplace which were likely to affect strike activity than had been possible in previous studies. Plant size was found to have the strongest influence on strike frequency; in addition the proportion of manual workers who were union members and reductions in the size of the workforce in the preceding period also had positive, significant effects. However, Edwards does warn that his results 'should be treated as exploratory' (1981, p. 145).

The availability of WIRS meant that the applicability of Edwards' results could be tested on a much wider sample of establishments. Unlike the Warwick sample which used 50 full-time employees as the truncation point, the WIRS sample as noted above, was truncated at 25 employees (full- and part-time). It also includes establishments in both public and private non-manufacturing as well as manufacturing. The questions used to obtain information on industrial action were very similar in both cases, covering industrial action of *all* types, although in WIRS the period to which the question relates is 12 months compared with the 24 months in the Warwick survey. The present study restricts itself to an analysis of industrial action amongst manual workers.

Daniel and Millward (1983) have examined the WIRS data in considerable detail; indeed, they devoted a whole chapter (chapter nine) to an examination of the incidence of industrial action. Their method of analysis involved the use of cross-tabulations to examine the association between industrial action and several of the variables discussed in this paper. Multiple correlations between a number of these variables makes it impossible to unravel their separate contributions using that approach. There is therefore a suspicion of specification bias in their method; in this paper we adopt a more preferable multivariate approach.

¹⁴ Examples are Smith *et al.* (1978) and Geroski and Knight (1983).

TABLE 1
Means and Standard Deviations

<i>Variable</i>	<i>Mean</i>	<i>Std. dev.</i>
<i>All</i>		
EMPASS	0.260	(0.439)
SINGLE	0.212	(0.409)
PARTE	16.635	(49.978)
FORMAL	0.847	(0.360)
COMIT	0.336	(0.472)
PBR	0.236	(0.425)
SHIFT	0.370	(0.483)
WATCH	0.233	(1.050)
MANE	52.722	(32.046)
FORE	0.050	(0.218)
PERS	0.115	(0.320)
SKILL	16.282	(23.595)
REC15	0.513	(0.500)
STEWARD	0.359	(0.480)
SHOP	0.213	(0.409)
MEMBER	39.375	(44.300)
NUMBUN	1.023	(1.242)
VARY	0.049	(0.217)
STIME	0.077	(0.266)
DEMAND	0.054	(0.678)
CHG2	0.453	(0.498)
OSIZE	7745.971	(7891.689)
TOTAL	117.820	(294.662)
PUB	0.319	(0.466)
MANU	0.251	(0.434)
ENG	0.072	(0.259)
<i>Dependent variables</i>		
STK1	0.121	(0.326)
STK2	0.033	(0.180)
STK3	0.056	(0.229)

As can be seen from Table 1, 12 per cent of all establishments experienced some form of industrial action over the 12-month period prior to interview, whilst only 6 per cent of establishments experienced a strike of more than one day. It is perfectly feasible to estimate a strike frequency equation from the available data. However, we consider it to be more appropriate to separate the sample into those establishments which had experienced a particular form of action from those which had not. Our primary concern in this paper is to identify those work-

place characteristics which increase the probability of industrial action. The use of frequency as a dependent variable imposes an additivity in strike propensity which is probably unjustified. Factors explaining second and subsequent stoppages may well be different from factors determining whether an establishment experienced a strike or not. The latter is the subject of the current paper.

Industrial action is defined in this paper in three ways:

- (i) any form of industrial action including strikes, overtime bans, workings to rule, blackings of work, go-slows and work/sit ins; but excluding lock-outs;
- (ii) strikes of less than one day;
- (iii) strikes of one day/shift or more.

Dummy variables are constructed so that if an establishment reports that it experienced one or more occurrences of this particular form of action over the preceding 12 months, then the variable is set equal to 1, 0 otherwise. The data analysed here are much more comprehensive than the officially published data on strikes from the Department of Employment which seriously understate the extent of strikes of less than one day and do not deal at all with non-strike action.¹⁵ Moreover, these data are more comprehensive than any other cross-section previously analysed; for instance the Warwick survey used by Edwards (1981) only covered the manufacturing sector and excluded establishments with less than 50 employees.

The estimation procedure that is used in this paper is probit analysis; this procedure was selected rather than OLS primarily because predicted probabilities may lie outside the (0, 1) interval.¹⁶ The probit procedure involves a monotonic transformation into the cumulative probability function which itself lies across the (0, 1) interval.¹⁷ The model relates the expected proportion ρ to some vector of variables x by

$$\rho = \phi(\alpha + \beta x)$$

where ϕ is the normal cumulative distribution function and α and β are parameters to be estimated. The exact details of the procedure are set

¹⁵ See Edwards (1983) for a fuller discussion.

¹⁶ The residuals are also heteroscedastic. Assuming the model is

$$y_i = B'x_i + \mu_i \text{ in this case } \text{Var}(\mu_i) = B'x_i(1-B'x_i)^2 + (1-B'x_i)(B'x_i) = B'x_i(1-B'x_i) \\ = E(y_i)[1-E(y_i)]$$

See Maddala (1983, p. 16).

¹⁷ In contrast with the logit model which is based on the cumulative logistic probability function. These two distributions are very close to each other and it is difficult to distinguish them statistically. See Maddala (1983, p. 23) and Amemaya (1981).

TABLE 2
All Industries

Variable	Any action (1)		Short strikes (2)		Longer strikes (3)	
	Coeff.	S. error	Coeff.	S. error	Coeff.	S. error
EMPASS	0.1981 ^a	0.1033	0.1469	0.1552	0.1838	0.1286
SINGLE	-0.3834 ^b	0.1540	-0.6038 ^b	0.2538	0.04946	0.1951
PARTE*10 ⁻²	-0.1547	0.1215	-0.1912	0.1655	-0.2129	0.1639
FORMAL	0.5166 ^a	0.1914	0.3627	0.2816	0.4216 ^a	0.2552
COMIT	0.1749 ^a	0.09912	0.04539	0.1504	0.1871	0.1240
PBR	0.3936 ^c	0.1028	0.2864 ^a	0.1485	0.4163 ^c	0.1295
SHIFT	0.00069	0.1055	0.1562	0.1558	-0.2889 ^b	0.1379
WATCH	-0.04951	0.09442	-0.04447	0.2171	0.00153	0.07012
MANE*10 ⁻²	0.1624	0.2357	0.7908 ^b	0.3660	0.09381	0.3047
FORE	-0.05183	0.2174	-0.2934	0.3524	0.08732	0.2521
PERS	-0.05745	0.1347	-0.0060	0.1945	-0.009614	0.1605
SKILL*10 ⁻²	0.1840	0.2083	-0.0393	0.3057	-0.2073	0.2778
REC15	0.2931 ^a	0.1767	-0.7260 ^b	0.3316	0.7592 ^c	0.2701
STEWARD	0.3270 ^b	0.1386	0.6801 ^b	0.3036	0.1881	0.1710
SHOP	0.1364	0.1108	-0.07557	0.1725	0.09202	0.1345
MEMBER*10 ⁻²	0.2896 ^b	0.1315	0.2622	0.1721	0.3357 ^b	0.1609
NUMBUN	0.09580 ^b	0.04313	0.1000 ^a	0.0590	0.02865	0.05314
VARY	0.2454	0.1793	-0.09152	0.2838	0.2573	0.2042
STIME	-0.04067	0.1653	-0.02000	0.2441	0.1203	0.1915
DEMAND	-0.0800	0.07010	-0.06319	0.1060	-0.08952	0.08976
CHG2	-0.06089	0.09910	0.08624	0.1454	-0.07675	0.1282
OSIZE*10 ⁻⁴	-0.1914 ^c	0.07434	-0.1640	0.1091	-0.00569	0.09456
TOTAL*10 ⁻³	0.8150 ^c	0.2647	0.8857 ^c	0.3354	0.6652 ^b	0.2684
TOTAL ² *10 ⁻⁷	-0.6490 ^a	0.3775	-0.6762	0.5876	-0.4985	0.3508
PUB	-0.3445 ^b	0.1387	-0.3081	0.2008	-0.4771 ^b	0.1882
MANU	0.3605 ^b	0.1425	0.1218	0.2141	0.4533 ^b	0.1925
ENG	0.4023 ^b	0.1714	0.5042 ^b	0.2576	0.5920 ^c	0.1925
Constant	-2.890 ^c	0.2730	-3.174 ^c	0.4058	-3.661 ^c	0.4049
Deviance	914.8		382.2		551.3	
DF	1651		1443		1651	

Notes: a. Significant at 10%; b. at 5%; c. at 1% on a two-tailed test.

out in Amemiya (1981), McCullough and Nelder (1983) and Maddala (1984). Empirical estimation used the probit procedure from the GLIM package at Queen Mary College.

Empirical results are reported in Table 2. Firstly, we consider the equation for any industrial action and then examine separately the equations for short and longer strikes.

1. *Any Industrial Action*

High levels of statistical significance were found in equation (1) in Table 2 with 15 variables significant at 10 per cent or better on a two-tailed test; where we had strong priors they were generally confirmed. There is evidence that payment by results, membership of employers' associations, and the presence of multi-unionism all have positive, significant effects upon the probability of industrial action. In addition if the establishment is a single independent organization this tends to reduce the probability of industrial action. These findings provide strong support for our frictional hypothesis. Payment by results schemes are perhaps the archetypal source of friction. Frequent re-negotiation in itself should produce greater cooperation. It is the fact that the available payoffs are unknown because each new situation has unique elements that, from a game theory perspective, gives rise to problems. Membership of employers' associations and multi-unionism both increase the number of effective participants, which reduces the prospects of cooperation.

As expected, the manufacturing sector, public sector and engineering industry dummies are also statistically significant with a positive coefficient. The significant positive signs on the presence of consultative committees and formal procedures strongly suggests that these are symptoms of strike-proneness. It does seem possible that the usefulness of formal procedures has been exaggerated; our results are consistent with the earlier findings of Turner *et al.* (1977). High quality, informal lines of communication may be much more effective, especially where agreement needs to be reached speedily.

Our results confirm the importance of organizational factors. Union recognition, the presence of shop stewards and the proportion of manual workers who are union members, are all associated with a greater propensity for industrial action. The first and third of these are indicative of the strength of the union, both as an organization and *vis-à-vis* the management. The role of the shop steward is a debatable one; although the stereotype is of an agitator and trouble-maker, in many instances a good shop steward can act as part of the 'high quality informal line of communication' mentioned above. This seems to have been the view of the Donovan Commission (1968); our results are consistent with the view that the presence of shop stewards is as much a symptom of poor communication as of exogenous militancy.

Turning now to the size of establishment variables, it does appear 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. This suggests that as establishment size increases the rate of increase in the incidence of industrial action not only slows down, but also becomes negative. (However, since there are so few observa-

tions in the 6,000+ employees range, the possibility of a negative effect should not be taken too seriously.)

Our conceptual framework leads us to no strong prior belief on the effect of firm size on the probability of industrial action, once plant size is controlled for. Previous authors using average industry firm size have argued the case each way (Shorey, 1975, 1977; Millward and Creigh, 1977; Marginson, 1983). In equation (1) the coefficient on this variable has a significant negative sign as it does in the short strikes equation (2); it is not significant in either the short or the longer strike equations.

By contrast, none of the 'incentive' variables show statistical significance. In addition, a number of our other variables were insignificant. Most surprising, perhaps, is the lack of significance of the coefficients of the shiftworking, part-time workers, and the ratio of supervisory staff variables. One reason seems to be the aggregate nature of the dependent variable, which groups short strikes and longer strikes together with other forms of industrial action. As the results of disaggregation will show, there are important differences in the determinants of the two kinds of strike, whilst non-strike action may have yet another set of determinants.

2. Short and Longer Strikes

Short strikes were defined in the survey as those stoppages lasting less than one shift or working day. Strikes capable of swift resolution are likely to have arisen for rather different reasons than longer strikes. For example, strikes resulting from a breakdown of national pay negotiations are unlikely to end within one shift. Where the source of dispute is, for example, management's unwillingness to hold a meeting to discuss a particular grievance, or some purely local problem of no strategic significance and involving no great issue of principle, it is more likely that a quick settlement can be reached. This is not to imply that our two variables categorize perfectly, tactical and strategic strikes, but we believe there is enough difference for such distinctions to be useful.

The differences in the determinants of short and longer strikes may be seen by comparing equations (2) and (3). Equation (2) compares establishments having short strikes with those having no strikes at all, whilst equation (3) compares establishments experiencing longer strikes with those that were strike free or suffered only a short strike. The hypothesis that organizational factors will increase strike propensities receives slightly stronger support in the short strikes equation than it does in that for longer strikes, in the latter equation only the coefficients of the MEMBER and REC15 variables are significant. It is interesting to note the difference in sign of the coefficient of the REC15 variable in the short and longer strikes equations; the negative sign in

the former case may reflect the use of short strikes in attempts to gain recognition. Longer strikes are more probable with payments by results, union recognition, the presence of formal procedures, high union membership and especially where the establishment is located in the engineering industry. Longer strikes are less likely if the establishment utilizes some form of shiftwork. Shift working may make it more difficult to get solid support for strike action lasting longer than one shift, which suggests that SHIFT is acting as an organizational rather than a frictional variable. Consistent with this is the lack of significance of this variable in the shorter strike equation. Establishment size is significant in both equations (2) and (3) but we find little or no evidence of flattening in either case.

By comparison, short strikes seem to be dominated by the organizational variables. Supporting the hypothesis that short strikes are disproportionately concerned with local issues, the coefficient on STEWARD

TABLE 3
Predicted Strike Probabilities: The Effects of Unionization

	<i>Establishment Size</i>						<i>Values of other variables not set equal to their means</i>
	<i>50</i>	<i>Mean size 118</i>	<i>500</i>	<i>1,000</i>	<i>1,750</i>	<i>2,500</i>	
Non-union*							
Any action	1.6	1.8	3.7	8.4	22.1	43.8	REC15 = 0
Short strikes	1.0	1.2	2.7	6.9	20.6	43.9	STEWARD = 0
Longer strikes	0.2	0.2	0.5	1.3	4.1	10.6	SHOP = 0 MEMBER = 0 NUMBUN = 0
Recognized unions*							
Any action	9.9	10.9	17.6	30.2	53.7	76.0	REC15 = 1
Short strikes	1.6	1.9	4.1	9.7	26.3	62.9	STEWARD = 1
Longer strikes	4.1	4.6	7.6	13.6	27.3	45.8	SHOP = 0 MEMBER = 50 NUMBUN = 1
Closed shop*							
Any action	15.6	17.0	25.8	40.5	64.6	83.0	REC15 = 1
Short strikes	2.7	3.1	6.3	13.8	33.5	59.5	STEWARD = 1
Longer strikes	7.1	7.6	12.1	19.9	36.5	56.2	SHOP = 1 MEMBER = 100 NUMBUN = 1

* All other variables not referred to set to their mean values.

is significant for short strikes, but not for longer ones. Single establishment enterprises seem to be significantly less likely to experience short strikes than multi-establishment organizations; there are fewer problems of comparability, but more importantly, sufficient authority needed to reach a decision is likely to be available on the spot. Short strikes are, as expected, more likely the higher the proportion of manual workers in the workforce. It is rather puzzling, however, that this effect is not observed in the longer strikes or any action equations of Table 2.

The interpretation of coefficients such as those reported in Table 2 is rather more complex than in traditional regression analysis: they are partial derivatives, not of strike probabilities but of the standard normal deviate which can be translated into probabilities. Examples of this are provided in Table 3. We present separate information for non-union establishments plus those for establishments with recognized unions and those with closed shops. In Table 4 we present information on the effects of formalization. It can be seen from a comparison of these tables that, whilst an increase in formalization increases the probability of industrial action, the effect of union organization has an even larger effect. Although the presentation of results as probabilities is convenient a number of reservations should be borne in mind including the fact that probit analysis imposes a distribution which may not be the most appropriate to the case in question. Moreover, the survey relates to a particular period (1980) and it is well known that strike behaviour varies through time. The availability of the second wave of the WIRS

TABLE 4
Predicted Strike Probabilities: The Effects of Formalization

	<i>Mean size</i>						<i>Values of other variables not set equal to their means</i>
	50	118	500	1,000	1,750	2,500	
No formal agreements*							
Any action	1.6	1.9	3.8	8.5	22.7	44.4	FORMAL = 0
Short strikes	0.5	0.6	1.6	4.4	14.7	35.2	
Longer strikes	0.4	0.4	0.9	2.2	6.3	15.2	COMIT = 0
Formal agreements*							
Any action	7.4	8.2	14.0	24.8	47.4	60.8	FORMAL = 1
Short strikes	1.6	1.9	4.1	9.7	26.1	51.0	
Longer strikes	2.0	2.2	4.0	7.8	17.9	33.6	COMIT = 1

* All other variables not referred to set to their mean values.

survey (1984) which includes a longitudinal element will be useful in testing the robustness of our conclusions.

V. CONCLUSIONS

Most previous empirical work on strikes in Great Britain has been limited to the use of aggregate data for the manufacturing sector. In this paper we have used a new data set which has a much greater coverage of the economy, and which allows us to distinguish between various forms of industrial action in both the manufacturing and non-manufacturing sectors. Many aspects of the data set have previously been examined by Daniel and Millward, including a detailed analysis, using cross-tabulations, of the incidence of industrial action. Where we have used the same variables our multivariate results broadly confirm their findings.¹⁸ Our separate treatment of short and longer strikes, which proved to be a useful distinction, has no equivalent in Daniel and Millward. We regard our taxonomy of the factors determining strikes according to frictional, organizational, incentive and size characteristics and its underlying game-theoretic framework, as a useful starting point in sorting out the myriad of possible influences on strike propensities. In particular we believe this game theoretic framework is superior to the notion of strikes as accidents as propounded by Siebert and Addison (1981). On the theoretical side, strikes may be a deliberate aspect of bargaining strategy employed by either party as a means of altering the other's expectations. On the empirical side, Siebert and Addison suggest that more formal procedures analogous to 'rules of the road', will reduce accidents. The findings here suggest that the opposite is the case; these procedures may well represent an institutionalization of conflict. Formal procedures may be necessary in resolving disputes once they have arisen, but do nothing to prevent the disputes arising in the first place.

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¹⁸ The comparisons are limited to the 'any industrial action' equation in general and to the following list of variables in particular: FORMAL, STIME, COMIT, PBR, REC15, STEWARD, MEMBER, MANU, PARTE, DEMAND and NUMBUN.

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