An Economic Analysis of Industrial Disputation in Australia

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Abstract

Australia may present a special case in the analysis of strikes because, for most of the Twentieth Century, the Australian Industrial Relations Commission has acted as an industrial "umpire" charged with keeping the industrial peace. We begin with a review of major contributions to the theory of strikes, and re-estimations and evaluations of the time-series models of previous Australian researchers.

We then develop theoretical models of strikes and non-strike industrial action, stemming from Marshall's (1920) contribution to the theory of wages. If higher real wages lead to lower levels of employment, union demands are likely to be greater, and industrial action more frequent, when the duration of unemployment of retrenched workers is shorter. Important determinants of the opportunity costs of wage demands to employees, are wage losses of retrenched employees during unemployment and in subsequent re-employment. Critical in the union's decision to threaten a strike or a non-strike action, is a permanent loss of market share directly associated with strikes.

The model of strikes is tested, along with variables suggested by other theories, using time-series data from the period 3:1959 to 4:1992. We show that the model is robust and out-performs modified versions of other Australian models. We find that the Prices and Incomes Accord is associated with a reduction in strike activity, but that other researchers have over-estimated its impact.

Australian Workplace Industrial Relations Survey data is used to produce cross-sectional models of strikes and non-strike actions in unionised workplaces. We test the importance of the opportunity costs of wage demands and strikes, using variables describing the firm's competitive environment and local labour market conditions. Because the objectives of workplaces differ, we estimate separate models for privately owned workplaces, government non-commercial establishments and government business enterprises. All empirical models are broadly consistent with the predictions of our theoretical model.

Acknowledgments

I am sure, for many reasons, that a Ph. D. is best completed before the candidate is thirty years old or has children. Alas, my thirty years have well and truly passed but, on the positive side, my four sons have all left home to follow their own careers.

The economic analysis of industrial disputes seemed to be a promising topic; I had taught labour economics at the undergraduate level and have been interested in the applications of econometrics for some time. Although public interest in strikes appears to have waned somewhat during the 1990s, people always have a view; indeed many, on learning the topic of my thesis, have offered me the advice, *gratis*, that the cause is simply the "bloody-mindedness" of unions but, unfortunately, they are never able to explain satisfactorily why unions appear to be sometimes more "bloody-minded" than at other times. In short, this is what the thesis seeks to reveal, but we prefer the term "militancy".

The Victoria University of Technology has encouraged its staff to take higher degrees and I thank all those involved for the many concessions which have assisted me in my endeavours. I give special thanks to my supervisor, Professor Ken Wilson, whose enthusiasm and energy are extraordinary. A good supervisor, of course, should have some expertise in the field and know what is expected by examiners. But more importantly, supervisors must encourage confidence and rapport and, above all, they must *care* about whether the candidate completes the project. Without these things, the outlook is bleak for those embarking on a research degree, but Ken has all these qualities for which I am truly grateful.

Thank you, too, to my wife, Maggy, who has enriched my life in so many ways and encouraged me in this work. To my mother, Eleanor, and my father, Alexander, four years gone, thank you for making me understand the importance of education, although I may have appeared a little recalcitrant in this regard as an adolescent. And thank you to my uncle, George, now long gone, who guided me back to education when evening classes at RMIT seemed much too hard, and other things too interesting, to an eighteen year old.

Table of Contents

List of Tables

List of Figures

1. Introduction

Analyses of strikes are not uncommon in the international labour economics literature, but Australian strikes present what, at first sight, appears to be a special case. For most of the Twentieth Century, the Australian Industrial Relations Commission has acted as an industrial "umpire" charged with keeping the industrial peace. Its success in this regard is arguable; compared with the US and Britain, Australian strikes are shorter, but their frequency is greater. This raises the question of whether the factors which explain strikes in other institutional settings, also explain strikes in Australia.

Strikes are anathema to conservative politicians, the popular media and, perhaps, to many in the community not directly participating in strikes. Although the *Left* champions the entitlement of employees to strike, it is often embarrassed when strikes occur and erode electoral support; indeed, the Hawke and Keating Labor governments claimed that one of the successes of their Prices and Incomes Accord (the Accord) was its reduction of strike activity. Despite angst commonly associated with strikes, it is doubtful that the cost of strikes to the economy is larger than the costs of several other industrial problems, such as workplace accidents and absenteeism, which receive considerably less media attention. Although working days lost due to strikes may be an imperfect measure of the costs of strikes to the economy, over the period 3:1959 to 4:1992 which we use to estimate a time-series strikes model, strikes cause an average loss of 0.29 days per employee per annum.

Although the literature contains an extensive range of models of strikes, there is scant reference to common forms of non-strike industrial action. These actions, which include stop work meetings, overtime and other bans, go slow tactics, and work to rules campaigns, seem to be in frequent use in Australia, but there is little statistical data available for purposes of analysis. There appear to be no theoretical or empirical economic models of non-strike industrial action which explain why particular forms of action are chosen by unions. This neglect of non-strike industrial action is a serious omission from the labour economics literature and labour market statistics.

It is arguable that strikes are more important than other industrial actions. Strikes halt production and often bring about further costs in other workplaces, whereas non-strike actions may be less costly, because they tend to reduce output or raise costs, rather than bring work to a stop. Australian strikes, however, are typically of short duration, so it is possible that prolonged non-strike actions cause greater costs than strikes.

At the outset, it is worth pointing out that strike theories attempt to describe general principles which predispose employees to take industrial action. We know, of course, that a multitude of idiosyncratic factors are likely to impact on decisions to strike at particular workplaces, but these factors are unlikely to form the basis of a coherent general theory. A casual inspection of macroeconomic strikes data, in Australia and elsewhere, shows pro-cyclical strike activity, and this suggests very strongly that general economic conditions must play a critical part in any theory of strikes.

This thesis is organised as follows. In Chapter 2 we outline the major theoretical and empirical contributions to the theory of strikes found in the international literature. Following the seminal work of Ashenfelter and Johnson

(1969), the approach widely used is the postulation of the behavioural characteristics of the parties in a wage bargaining process and, after this, optimality conditions are derived mathematically. These conditions then form a set of hypotheses which are tested using observed strikes data with econometric techniques.

In Chapter 3 we present a brief description of the Australian arbitration system. The main focus, however, is on producing an up-to-date evaluation of the empirical time-series strike models of Australian researchers. Re-estimated models are used to gauge the impact of the Accord on strikes after March 1983.

In Chapter 4 we develop theoretical models of strikes and non-strike industrial action, stemming from Marshall's (1920) contribution to the theory of wages and, more recently, from efficiency wage models. We argue that if higher real wages lead to lower levels of employment, union demands are likely to be greater, and industrial action more frequent, when the duration of unemployment of retrenched workers is shorter. Important factors in determining the opportunity costs of wage demands and industrial actions, are the wage losses of retrenched employees during unemployment and in subsequent re-employment. Critical in the union's decision to threaten a strike or a non-strike action, is a permanent loss of market share directly associated with strikes, when customers turn to more reliable suppliers.

In Chapter 5 we produce an empirical time-series model of Australian strikes, using variables suggested by our theoretical framework, and including other variables derived from alternative economic models. The model uses quarterly data spanning more than thirty three years, and is subjected to more rigorous diagnostic testing than has been seen in Australian strikes models hitherto. We use the model to assess the effect of the Accord, and although we find that it is associated with a reduction in strike activity, the model suggests that other researchers have considerably over-estimated its impact.

In Chapter 6 we use Australian Workplace Industrial Relations Survey data to produce cross-sectional models of strikes. We use variables derived from our theoretical model, and others suggested by imperfect information and asymmetric information theories. The cross-sectional analysis permits us to test the importance of the opportunity costs of wage demands and strikes contained in our theory, using variables describing the firm's competitive environment and local labour market conditions. Very importantly, because the objectives of workplaces differ, we estimate separate models for privately owned workplaces, government non-commercial establishments and government business enterprises.

In Chapter 7 we use Australian Workplace Industrial Relations Survey data to produce cross-sectional models of all non-strike action (excluding stop work meetings), then separate models for the use of overtime bans, go slow tactics, work to rules campaigns, and other bans. Again we produce models which differ according to ownership status. We use variables suggested by our theoretical model of non-strike action, and others derived from alternative economic theories *of strikes*.

Finally, in Chapter 8, we present a brief overview of the success of our empirical models in supporting our theoretical addition to the strikes literature, and of what is, perhaps, the first contribution to a theory of non-strike industrial action.

2 Literature Review

In this chapter we outline the main contributions to the economic analysis of strikes of overseas researchers, mainly from the US and Britain. We describe some important theoretical and empirical models from different schools of thought, but we do not attempt to cover all models. Although Australian writers have produced some important work, we leave a review of the Australian literature until Chapter 3 where we also attempt to re-estimate the models using a longer and more recently terminating data set.

2.1 Background of Economic Models of Strikes

The economic and econometric literature which investigates the causes of strikes, deals largely with explanations of variation in strike incidence and strike duration. The motivation of unions in striking is, for the most part, seen as attempts by employees, acting through industrial unions, to secure greater shares of the profits of firms.

The US literature deals with wage negotiations which take place towards the end of labour contract periods. Failure to reach an agreement prior to the conclusion of a contract leads to a strike or lock-out, and work recommences when a new agreement is reached. In US workplaces, therefore, there are periodic negotiations regarding wages, and in which strikes are reasonably likely to occur. In Australia, terminating contracts are rare, and negotiations occur on a less regular basis.

It is clear from an examination of Australian strike statistics, that there are a large number of strikes which apparently are not, at least according to Australian Bureau of Statistics (ABS) definitions, directly associated with wage issues; we discuss this in Chapter 3. Mostly the causes are related to general conditions of work, but, in some instances, strikes have been taken in support of political concerns which extend beyond matters of immediate relevance to particular workplaces.

Although we return to this later, it is worth pointing out here that strikes theories attempt to describe general principles which predispose employees to take strike action. We know, of course, that a multitude of idiosyncratic factors are likely to impact on decisions to strike at particular workplaces, but these factors are unlikely to form the basis of a coherent general theory. A cursory inspection of macroeconomic time-series of strikes in Australia and elsewhere shows pro-cyclical strike activity, and this suggests very strongly that general economic conditions must play a critical part in any theory of strikes.

2.2 Economic Models of Strikes

Prior to the seminal work of Ashenfelter and Johnson (1969), almost all of the economic analyses of strikes examine and attempt to rationalise, the variation in strike activity which are observed during different phases of the business cycle. Following Ashenfelter and Johnson, the approach widely seen in the labour economics literature, is the postulation of the behavioural characteristics of the parties in the bargaining process, together with the bargaining procedure; after this, optimality conditions are derived mathematically. These conditions then form a set of hypotheses which are tested using observed strike data and econometric techniques.

Although Ashenfelter and Johnson are criticised for their relative neglect of the bargaining process, their work revives interest in the role of information, first noted by Hicks (1932), in explaining strikes. From this emerges two important sets of strike models: first, those based on the parties in negotiations acting with imperfect information; and second, those focussing on asymmetries in the information available to the parties.

Not all analyses of strikes are in this essentially neo-classical tradition. A considerable alternative literature exists which variously regards strikes as arising from class conflict, institutional rigidities and behavioural factors; we do not examine these alternative views in this thesis.

2.2.1 Early Business Cycle Models

Model 1: Hansen

The first writers who examine strikes attempt to explain the observed behaviour of strike frequency through the phases of the business cycle. Hansen (1921) examines US strike data from the period 1881-1919, and uses the wholesale price index as a business cycle indicator. He finds that strike frequency is counter-cyclical during the depressed years of 1881-97, and pro-cyclical in the more prosperous period of 1898-1919. He argues that, in the former period, strikes are a response by unions to attempts by firms to cut wages in the face of declining profits; in the latter, strikes result from bids by unions to secure greater shares of increasing profits.

Many writers following Hansen use data from different periods and different countries, and generally conclude that strike frequency is pro-cyclical, and argue that the quest for higher wages is the principal cause of strikes. Some of these writers are Douglas (1923), Douty (1932), Griffin (1939), Gomberg (1944), and Jurkat and Jurkat (1949).

Model 2: Rees

Rees (1952) continues in the time-series analysis tradition, and uses US monthly strikes data from the period 1915-50, and the reference cycle of the National Bureau of Economic Research as a business cycle indicator. He finds that in a deseasonalised strike series there is

> a high correlation between strike cycles and the business cycle for the period 1915-38 and very little correspondence for the war and postwar years, 1939-50. [p 373]

Rees also observes that in the earlier period, the upper turning points of the strike series tend to lead the business cycle, while the lower turning points tend to lag it; this, he notes, 'illustrates the danger of using annual data'. [p 374]

In his explanation of this cyclical behaviour, Rees proposes that the business cycle brings about changes in the propensity to strike, the numbers of workplaces organised by unions, and the scope of strikes (meaning the types of workplaces effected). He argues that statistical evidence does not support either of the latter two causes, and finds that the state of the labour market is the principal economic factor. He explains this by claiming that the upswing

> offers the unions a variety of strategic advantages: The employer's reluctance to lose his share of the expanding market, and his observation of rising wages elsewhere lowers his resistance to union wage demands. His ability to replace strikers with nonstrikers diminishes. [p 381]

Rees advances an early variant of contemporary mis-information models; he speculates that the strike peak precedes the business cycle peak because the former 'represents a maximum in the divergence of expectations between employers and unions'. [p 381]

What is a common factor in this business cycle analysis of strikes, is that the models are driven by the data. In other words, reasonable explanations are sought for the patterns observed in time-series strikes data. This is in sharp contrast with modern practice in which theoretical models, based on the assumptions of profit maximisation of firms and utility maximisation of unions, appear to be the main focus; empirical testing is often a secondary concern.

2.2.2 Early Theoretical Models

Model 3: Hicks

The first important theoretical contribution to the economic analysis of strikes is that of Hicks (1932). Unlike the time-series analysts, Hicks centres his analysis on strike duration rather than strike frequency. He proposes, in essence, that a strike threat is used as an attempt by a union to extract a wage greater than would otherwise be paid; to be successful, a union must threaten to impose a cost of lost production, greater than that associated with the extra wage cost.

It is argued that the employer has a concession curve which describes the relationship between the highest wage that the firm is willing to pay to avoid a strike of a given expected length. The relationship is positive, and bounded above by the wage rate which would force the closure of the firm. It is argued further, that the union has a resistance curve which describes the relationship between the minimum wage it would accept rather than endure a strike of a given expected length. The relationship is negative, and bounded below by the wage level which would cause labour to quit the firm permanently, and seek employment elsewhere.

Hicks' analysis shows that if the employer and union have perfect information regarding each other's curves, then a strike will not normally occur. The wage rate is struck at the intersection of the curves, and 'is the highest wage which skilful negotiations can extract from the employer'. [p 144] If the parties do not have perfect information, and the union demands a wage rate less than that at the intersection, then the employer agrees immediately and a strike does not occur. On the other hand, if the union demands a higher rate, the employer does not agree and a strike ensues; this continues until the union's wage demand is reduced sufficiently to achieve a settlement.

One of Hicks' main contributions, and one still in evidence in modern analyses of strikes, is that his model shows that strikes are a consequence of unions and employers bargaining without having sufficient information of their adversaries' true positions. He proposes that the wage bargaining behaviour observed in the real world, is part of the way in which unions and employers seek this information. He notes that

> it may sometimes happen that a better settlement .... is secured by striking than could have been achieved without a strike, the general presumption is that a strike is a sign of failure on the part of the Union officials.' [p 146]

Hicks also proposes that strikes do not always result from failures to negotiate successfully, and might, on some occasions, be acts of deliberate choice to demonstrate to the employer the power of the union, and sometimes referred to as "muscle flexing". Unions might strike

> not so much to secure greater gains ....but in order to keep their weapon burnished for future use, and to keep employers thoroughly conscious of the Union's power. [p 146]

Strikes of this type do not, of course, imply that wages are not crucial in explaining strikes; what is suggested is that these strikes make future strike threats more potent in supporting wage demands.

2.2.3 Origins of the Modern Era of Strike Models

Model 4: Ashenfelter and Johnson

Ashenfelter and Johnson (1969) are the first writers of the modern era of the economic analysis of strikes. With this work the method of analysis shifts to the construction of theoretical models of strikes, and to the derivation of testable hypotheses which can be evaluated using econometric procedures. Prior to this time, empirical analysis uses what is now regarded as naive time-series analysis and simple correlations.

Ashenfelter and Johnson's model is sometimes called political because it sees union officials as having different objectives from those of rank and file members; the former pursue survival and growth of the union and their own continuation in its leadership, and the latter seek improvements in wages and conditions. The union leadership is assumed to assess the possible outcomes of negotiations more accurately than the rank and file, and whose expectations may be unrealistically high. Should this occur, a strike called by the union leadership, might lower the aspirations of union members and bring them more into line with what the employer is prepared to concede. In other words, strikes may sometimes be used by union leaders to educate their members about what wage increases are achievable.

According to this model, the employer, facing a wage claim, balances the cost of lost profits during a possible strike, against the extra labour costs the firm would incur in the future for any given wage increase. The union's concession curve is Hicksian (called a *resistance* curve by Hicks) in that it specifies a negative relationship between the minimum union-acceptable wage increase and the expected strike duration, and is bounded below by a wage increase which would cause the permanent withdrawal of labour. Ashenfelter and Johnson define the present value of future profit (V) as

$$V = \int_0^\infty \pi e^{-rt} dt \qquad (2.1)$$

where π is profit at time t, and r the firm's discount rate. It is assumed that the firm chooses the strike length S which maximises V subject to the constraint of the union's concession curve. The union's concession curve is assumed to take the form

$$y_A = y_* + (y_0 - y_*) e^{-\tau S} \qquad (2.2)$$

where y_A is the wage increase acceptable to rank and file unionists, y_* the minimum wage increase after an indefinitely long strike, y_0 the strike-free demand at the expiration of a contract, and τ the rate of decay of union resistance.

From this they derive the optimal strike length and use this to conclude that a strike is more likely, other things being equal, the higher is the union's wage demand at the expiry of a labour contract and the greater is the rate at which union resistance decays during a strike, and the lower is the firm's product price. The probability of a strike is negatively associated with the firm's labour productivity, its discount rate for future profits, and the minimum increase which would lead rank and file unionists to withdraw their labour permanently.

Ashenfelter and Johnson test their model using quarterly US data for the period 1952-67. Because the variables specified in the theoretical model are not directly observable, a range of proxy variables are used as regressors in their econometric model, (a procedure afterwards widely used in economic strike models). They argue that the decay rate of the union's concession curve, the employer's discount rate, and the minimum acceptable wage increase, viewed in macroeconomic terms, change slowly over time, and therefore time itself may be used as a proxy for these variables. The strike-free wage demand at the end of a contract would, they claim, depend on the current unemployment rate, a distributed lag function of recent real wage increases, and the ratio of profits to the wage bill in the previous period, and all of which are employed as proxies for y_0.

Their most satisfactory model is[1]

$$
\begin{aligned}
\hat{S}_t = \; & \underset{(68.4)}{1570.4} \; - \underset{(9.8)}{135.3\, U_t} \; - \underset{(11.5)}{62.9\, \Sigma\, \Delta R_{t-1}} \\
& + \underset{(27.3)}{225.7\, N_1} \; + \underset{(25.8)}{598.7\, N_2} \; + \underset{(25.8)}{460.5\, N_3} \\
& - \underset{(0.6)}{2.3\, T} \; + \underset{(30.9)}{87.8\, LG} \qquad (2.3) \\
& \bar{R}^2 = 0.946 \quad DW = 1.61 \quad SSE = 70.7
\end{aligned}
$$

where U_t is the unemployment rate, $\Sigma\Delta R_{t-i}$ an Almon lag function of changes in real wages, N_i seasonal dummies, T a linear trend, and LG, a dummy to control for the effects of the Landrum-Griffin Act.[2] All variables, excepting profit, have significant t ratios at the 0.05 level, and they are able to conclude that aggregate strike activity is related to tightness of the labour market, and to previous changes in real wage levels.

The model developed by Ashenfelter and Johnson model is applied and adapted by many writers in the 1970s. Phipps (1977), in analysing the impact of

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[1]Standard errors in parentheses.

[2]The Landrum-Griffin Act of 1959 sought to ensure union democracy, and in so doing, may have given greater voice to more militant groups, and have made union leaders more likely to pursue rank and file aspirations with greater vigour.

inflation on strike activity in Australia, uses the model for a strikes equation in a simultaneous equations system model. From it he concludes that strikes may be explained in part as attempts by unions to maintain relativities of wages to prices in periods of high inflation. Others use the model with mixed empirical success; for example, Pencavel (1970), using British data produces results broadly in accord with those of Ashenfelter and Johnson, however Hunter (1974), points out that the model performs poorly over a longer span of data.

Ashenfelter and Johnson's model has been attacked for its assumption that a strike, when it occurs, is the consequence of an employer's optimisation of profits, subject to the constraint of the union's concession curve. The union's role is secondary; given the union's concession curve, its own revenue schedule, cost structure and discount rate, the firm chooses the wage increase. The union then decides whether or not to strike, and if it does, the duration of the strike is determined by the characteristics of the concession curve.

Ashenfelter and Johnson's approach is also criticised because of its neglect of the importance of the bargaining process which occurs prior to, and during strikes. Hamermesh (1973), stresses the importance of the bargaining process, and particularly the bluffing which is used by both sides. According to Hamermesh, unions bluff, probably to a greater extent than do employers, to hide the true nature of their concession curves, which in the Ashenfelter and Johnson model are assumed to be known with certainty by employers.

Model 5: Farber

Farber (1978), develops Ashenfelter and Johnson's model so that wage outcomes and the occurrence, or non-occurrence, of strikes, are jointly determined. Again the firm maximises its own present value subject to the union's concession curve, however an important difference is that the firm considers the trade-off between lost profits during a strike, and the extra wage costs after an agreement has been reached. Conditions are derived under which strikes do, or do not, occur; specifically, a strike is more likely if the costs associated with lengthy strikes is high relative to the cost of a wage increase, and if the union's concession curve decays only slowly with increasing strike duration. Farber argues that the decay rate depends on per capita union funds, the unemployment rate, profits in the previous period, labour's share of total sales revenue, and the rate of change of real wages over the period of the previous contract. The minimum acceptable wage increase is specified as a function of the unemployment rate, and dummy variables to control for inter-industry differences. In addition to describing conditions which would bring about a strike, Farber shows that the firm could achieve higher profits, and the union higher wages through negotiation, and the avoidance of a strike; failure to do so he attributes to 'the intransigence of union members'. [p 263]

Farber uses cross-sectional/time-series data from ten large US firms during the period 1954-70. His estimated model is[3]

$$
\begin{aligned}
\hat{a}_{it} = \; & \underset{(0.8666)}{4.141} + \underset{(0.0066)}{0.0075}\, FB_{it} + \underset{(0.0729)}{0.0262}\, U_t \\
& - \underset{(1.470)}{0.1582}\, \pi_{it-1} + \underset{(0.1826)}{0.3137}\, PC_t - \underset{(2.469)}{8.579}\, S_{Lit} \\
& + \underset{(2.314)}{0.8129}\, DRW_{it}
\end{aligned}
\tag{2.4}
$$

[3]Standard errors in parentheses.

where a_{it} is the concession rate of union i in year t, FB_{it} union funds per member, U_t the unemployment rate, π_{it-1} the rate of return on assets for firm i at time t-1, PC_t a dummy for the period 1962-66[4], S_{Lit} labour's share of total sales, and DRW_{it} the average annual rate of change of real earnings over the life of the previous contract. Unlike almost all other empirical models of strikes, Farber's dependent variable is not a measure of strike frequency, duration or cost; rather it is the unions rate of concession from its initial demand with respect to the length of the strike. Although Farber claims that his empirical results 'lend support to virtually all ... hypotheses concerning the structure of the model' [p 271], a more realistic assessment based on the model's t statistics, is that the empirical results are disappointing.

Model 6: Rabinovitch and Swary

Rabinovitch and Swary (1976), adapt Ashenfelter and Johnson's framework, but include the assumption that the union maximises its expected gains from settlement, with or without a strike; in this process the union attempts to guess the true position of the firm and its reaction to a strike. The procedure is iterative, with each side formulating a new optimal stance following an unsuccessful meeting, and based on the most recent assessment of the opponent's position. They claim that

> the occurrence of a strike or its continuation is explained by the lack of information about some real intention of the other side and as the result of an optimisation process, by each side separately, under uncertainty. [p 683]

They derive the union's optimal wage demand, Δw_1^{u*}, at time $t = 1$ as

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[4]Period of voluntary wage guidelines.

$$\Delta w_1^{u^*} = \frac{\Delta w_m}{2} + \left[\frac{G_1^{u^*} - L_1^{u^*}}{2Q(1-\eta)\,Vm(j)} \right] \qquad (2.3)$$

where Δw_m is the minimum wage demand which the union believes would cause a strike with certainty, G_I^{u*} and L_I^{u*} are the union's gain and loss functions from a strike, Q the volume of employment, η the elasticity of demand for labour, and $Vm(j)$ the union's discount factor over m periods at rate j. The employer's optimal wage offer, Δw_I^{E*}, is

$$\Delta w_1^{E^*} = \frac{\Delta w_{f_1}^{E^*}}{2} \left[\frac{L_1^{2E^*}}{L_1^{1E^*} + L_1^{2E^*}} \right]^{-1} \qquad (2.4)$$

where Δw_{fI}^{E*} is the employer's estimation of the optimal first round wage offer, and L_I^{1E*} and L_I^{2E*} are the costs of a strike and cost of a settlement. If $\Delta W_I^{u*} > \Delta W_I^{E*}$ then a strike occurs.

In highlighting the importance of uncertainty, Rabinovitch and Swary reject the proposition that strikes are necessarily irrational in the sense of being mistakes that lead to sub-optimal outcomes for both parties; although they do not test their model empirically, they state that a strike is

> not so irrational as it seems to be within a Hicksian framework. In a world of uncertainty a strike action follows rational behaviour based on assumptions about uncertain information. [p 683]

Model 7: Kaufman

Kaufman (1981), derives a model which assumes maximising behaviour applies to both parties in a wage dispute, and that there is an interdependency between the concessions and demands made by the parties. He argues that strikes

> increase the costs of disagreement until both labor and management find it economically advantageous to compromise their demands ..... rather than continue to hold out. [p 339]

Kaufman, like Rabinovich and Swary (1976), dispute the proposition of Hicks (1932) regarding the irrationality of strikes. The final wage settlement is unlikely to be the same as the *ex ante* equilibrium implied by the concession and resistance curves, which are themselves based on 'overoptimistic expectations as to the benefits .... from continued bargaining'. [p 340] Furthermore, if either side attempts, at the outset, to move directly to what would eventually be the *ex post* equilibrium, the curves would then adjust as a consequence, and bring about a different final outcome.

Kaufman's estimating model for strikes in US manufacturing from 1:1954 to 4:1975 is

$$
\begin{aligned}
lnSt_t,\ lnWk_t = {} & \beta_1 + \beta_2 lnC_t + \beta_3 Time_t + \beta_4 WP_t + \beta_5 Un_t + \beta_6 Un_t.\dot{W}_t \\
& + \beta_7 Un_t.\dot{P}_t + \beta_8 \dot{\pi}_t + \beta_9 \dot{W}_t + \beta_{10}\dot{P}_t + \beta_{11} ESC_t.\dot{W}_t \\
& + \beta_{12} ESC_t.\dot{P}_t + \beta_{13}\dot{P}_t^e + \beta_{14}\dot{P}_t^e.\Delta\dot{P}_t^e + \beta_{15} Vote_t + \epsilon_t \qquad (2.5)
\end{aligned}
$$

where the dependent variables are St_t, the number of strikes, and Wk_t, the number of workers involved. The regressors are C_t, the number of contract expirations (for St_t) or the number of workers involved in contract expirations (for Wk_t), WP_t a dummy for wage-price controls, Un_t the unemployment rate for males aged twenty years or more, $\dot{W}_t$ the percentage change of nominal wages over the previous contract period, $\dot{\pi}_t$ the change in corporate profits, $\dot{P}_t$ the change in the CPI over the previous contract period, ESC_t the percentage of contracts with escalation clauses, $\dot{P}_t^e$ the expected rate of inflation over the next year, and $Vote_t$ a variable denoting the "political climate" based on voting patterns in Congress. Kaufman claims to show that the most important factor in the rise in strike activity in US manufacturing during the sample period is 'the disrupting influence of inflation on collective bargaining'. [p 353]

Model 8: Siebert, Bertrand and Addison

Siebert *et al* (1985), revisit the model of Farber (1978), but make the assumption that the union optimises its own utility, v, subject to the employer's concession curve, Y_A. Here

$$v = \int_s^\infty W(Y_g - Y_0)\, e^{-rt}\, dt - \int_0^s W(1 + Y_0)\, e^{-rt}\, dt \qquad (2.6)$$

where W is the pre-strike wage, Y_0 is the final pre-strike wage increase offered by the employer, Y_g the increase claimed by the union, r the discount rate, and s the expected strike length. This is subject to the constraint that

$$Y_A = Y_* - (Y_* - Y_0)\, e^{-as} \qquad (2.7)$$

where Y_A is the wage increase the employer will accept after a strike of length s, a the employer's rate of concession, and Y_* the employer's limiting wage increase after a "long" strike.

In essence, the only difference from Farber's model is that here the union is the optimising agent, whereas in Farber's it is the employer. In this model, strikes are the consequence of poor negotiation skills on the part of the employer. Siebert *et al* test their model using Farber's data, and find that it has approximately the same statistical support as Farber's model. Their model appears to have been constructed not as an attempt to model industrial disputes in the real world, but rather as a means of showing that one sided optimisation models are unsatisfactory, irrespective on which side is assumed to optimise. Indeed, they conclude their discussion by saying that

> the fact remains that there are two parties .... which possess information of relevance to each other (and this) returns us to a more conventionally assumptioned bargaining model in which parties repeatedly interact. [p 33]

2.4.4 Imperfect Information Models of Strikes

Model 9: Mauro

Many of the most recent treatments of strikes assign a critical role to mis-information in determining strike frequency and duration. Mauro (1982) revisits Hicks' (1932) model with its employer concession curve and union resistance curve, and the proposition that strikes are a consequence of faulty bargaining. He argues that, for both sides engaged in wage negotiations, information is neither perfect nor costless. A strike is more likely to occur in a bargaining situation in which one party makes an incorrect assessment of the other's true wage-strike trade-off curve. This may occur when a variable which is a factor in, say, the union's resistance curve, is not a factor in the employer's concession curve; when this variable changes the union expects both curves to shift and the same real wage to result; only the union's curve, however, actually shifts. There is, as a result, a divergence of views about the equilibrium real wage rate, and the probability of a strike occurring varies with this divergence; therefore, the probability of a strike occurring varies with changes in variables which are used as a basis of a bargaining position by one party only, and is described by the general model

$$p(s) = f((C\dot{P}I - \dot{M}), X_1, Y_1) \qquad (2.8)$$

where $p(s)$ is the probability of a strike, $(C\dot{P}I - \dot{M})$ the divergence between price inflation and the rate of change of the firm's product price, X_I the set of variables in the firm's concession function unknown to the union, and Y_I the set of variables in the union's concession function unknown to the firm.

Mauro proposes that strikes are an efficient means of gaining information because

> since information is costly to obtain, correcting these misconceptions requires the use of resources. Strikes then become a method to transmit the information necessary to correct the parties misconceptions about each other. [p 536]

Using a sample of fourteen US firms covering 149 contract expirations, Mauro develops logit models which lead him to conclude that there is support for the general thrust of his theoretical model. In particular, strikes are less likely when bargaining practices follow a regular pattern, and where the parties have prior experience of strikes; he states that in both cases, the parties are better informed, and the gap in expectations smaller.

Model 10: Cousineau and Lacroix

Cousineau and Lacroix (1986) argue that it is difficult to understand how each bargaining party can remain uninformed regarding the indicators used by the other, when there is a history of bargaining between them. The imperfect information which is relevant is the uncertainty each bargainer has about its own relative bargaining power; strikes occur not because of actual differences in bargaining power, but because of imperfect information about it.

Their estimated model uses Canadian manufacturing data from the period 1967-82, and is[5]

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[5] *t* values in parentheses.

$$\begin{aligned}\widehat{Probit}(DSTRIKE) = {} & \underset{(-5.33)}{-\,0.444\,S} \quad \underset{(1.69)}{+\,13.410\,HB} \\ & \underset{(2.81)}{+\,0.00004\,NEMPL} \quad \underset{(3.64)}{+\,0.156\,DUR} \\ & \underset{(-0.91)}{-\,0.318\,CIS} \quad \underset{(4.50)}{+\,2.046\,CUR} \quad \underset{(2.62)}{+\,0.479\,CVR} \\ & \underset{(1.88)}{+\,0.723\,CSPI} \quad \underset{(3.40)}{+\,0.084\,INFL} \\ & \underset{(-1.45)}{-\,0.139\,CONTR} \quad \underset{(-9.67)}{-\,2.458} \end{aligned} \qquad (2.9)$$

where *DSTRIKE* is a strike occurrence dummy, *S* a sheltered industry dummy, *HB* a seller concentration index, *NEMPL* the number of employees in a bargaining unit, *DUR* the duration of the previous contract, *CIS, CUR, CVR* and *CSPI* the coefficients of variation of, respectively, the ratio of inventories to sales, capacity utilisation, the job vacancies rate, and the selling price index, *INFL* the inflation rate, and *CONTR* a wages control dummy. They claim that their model demonstrates that 'strikes result essentially from misjudgment in a world of imperfect information' [p 385], and that variations in protection, bargaining unit size, duration of the preceding contract, and wage controls, are more powerful determinants of strikes than are inter-industry differences in relative bargaining power.

Model 11: Gramm

Gramm (1986) proposes that in the absence of perfect information regarding the adversary's final offer, each party is likely to exaggerate its opening demand in the bargaining process. This carries with it the risk of a strike with attendant costs to both parties, but both risk a strike if their own expected costs of striking are less than their expected costs of not striking. This leads to a model of employer behaviour which is

$$P(RISK\ STRIKE_C = 1) = f[MPL, MS, FS, E(C^u)] \qquad (2.10)$$

where *MPL* is the marginal profit loss per day of strike, *MS* and *FS* the firm's ability to maintain market share and solvency during a strike, and $E(C^u)$ the expected union concession rate. The corresponding model of union behaviour which is

$$P(RISK\ STRIKE_u = 1)$$
$$= g[WAGE, E(C^c), DI, JL, SI, EXPECT] \qquad (2.11)$$

where *WAGE* is the wage loss per day of strike, $E(C^c)$ the expected employer's concession rate, *DI* the workers' demand for current income, *JL* the threat of permanent job loss through replacement, *SI* substitute income during a strike, and *EXPECT* rank and file expectations.

Gramm uses a probit model for strike incidence, and a tobit model for strikes for duration; US manufacturing data from the period 1971-80 is used for estimation. She finds that strikes are positively associated with the proportion of males amongst unionists, the number of employees in the bargaining unit and regional union density; strikes are negatively associated with increases in real wages over the previous contract. She finds no evidence that inflation and unemployment influence strike activity.

Model 12: Gramm, Hendricks and Kahn

Gramm *et al* (1988) argue that even when parties have complete certainty regarding bargaining power, strikes may result from general uncertainty about the future. In particular, expectational differences between the parties, and differences in views regarding the range of scenarios that should be considered in drawing up an agreement, tend to increase the probability of strikes occurring. This is couched in terms of the general model

$$Prob(Strike) = Prob(x_c - x_u < \delta) \qquad (2.12)$$

where x_c is the company's predicted rate of inflation, x_u the union's predicted rate of inflation, and δ the minimum difference necessary to generate a dispute. They find that inflation uncertainty increases both the incidence of strikes and their severity in US manufacturing for the period 1971-80, after introducing a wide range of firm-specific and more general economic control variables.

2.4.5 Asymmetric Information Models of Strikes

Another stream of modern writers who deal with mis-information problems see the key factor in explaining strikes as the asymmetric information available to the bargainers. In essence, the employer has more relevant information than the union, typically concerning the firm's current and future profitability. The bargaining process, and any ensuing strikes, is seen as a means by which the union attempts to discover the firm's true position.

Model 13: Hayes

Tracey (1987) attributes the first asymmetric information model of strikes to Hayes (1984), however Hayes cites Azariadas (1975), Hall and Lilien (1979), Chari (1983), Green and Kahn (1983), and Grossman and Hart (1983) as having dealt with asymmetric information in the context of bargaining. Hayes constructs a model derived from games theory in which a monopoly firm maximises profit, and the union maximises utility which is a function of wages, employment levels and strike length. When bargaining

> the union takes account of the firm's reaction function in its maximising problem. The equilibrium concept will be a Nash equilibrium in expected strategies. [p 61]

In the model, the relevant state of nature, the level of profit, is known only to the employer, and strikes are used by the union as a means of gaining information about the true state. The problem confronting the union is to maximise the expected value of its utility over the period of a contract *T*, after allowing for a strike of length *s*. This leads to the model

$$\max p_h(T - s_h)\, U(w_h, L_h(w_h)) + p_l(T - s_l)\, U(w_l, L_l(w_l)) \qquad (2.13)$$

where p_h and p_l are probabilities of high and low states of nature (profits), and *U* is utility which is a function of the *w* wage level agreed upon, and *L(w)* the consequential level of employment.

Hayes' model shows that strikes are more likely to occur when firms are in low profit states, in apparent contradiction to business cycle models; she notes, however, that profits at the level of the firm are more important than at a macroeconomic level. In what appears to be an endorsement of the views of Mauro (1982), she observes that strikes may occur when unions base their expectations of a particular employer's profit, on economy-wide profits, and when that firm may be performing less well than the average firm. Hayes' model produces some intuitively appealing results based on behavioural assumptions, but the model is not tested empirically.

Model 14: Tracy

Tracy (1987) proposes a model similar to that of Hayes, where rounds of bargaining are explained as attempts by a union to ascertain the firm's true future profitability. It is assumed that the employer knows this with certainty, but the union is uncertain and believes profit to be located within a finite interval, and has a uniform probability distribution. In the rounds of bargaining, the union is able to reduce the width of this interval by inference derived from the employer's responses to its wage demands; this process continues until its information is sufficiently accurate that an agreement can be reached. Two important points are made in this analysis: first, disputes are concerned with securing shares of rents, hence both the product market and the labour market must, at least to some extent, be monopolised; and second, following the work of Rubenstein (1982), if both parties begin with full information regarding the size of the rents and each others preferences, and both have positive rates of time preference, then agreement occurs at the first round of bargaining. Given the assumptions of the model, Tracy is able to show that both the probability of a strike occurring after a first round wage offer is

$$Pr(Strike) = (\hat{P}(w_1^*) - \underline{P})/(\bar{P} - \underline{P}) \qquad (2.14)$$

where $[\underline{P}, \bar{P}]$ is the interval in which the union believes, at the outset, contains the true value of profit, and $\hat{P}(w_1^*)$ the profit associated the union's wage demand w_1^*. Both the probability of a strike occurring, and the unconditional mean duration of strikes, are directly related to the union's degree of uncertainty and employees' alternative wage opportunities, and inversely related to the size of the expected rents to be shared.

Tracy uses US Bureau of Labor Statistics data concerning major contracts during the period 1973-77 to test the model empirically. A logistic model of strike probability, and a proportional hazard function model of strike duration, both support the significance of uncertainty in explaining strikes.

Model 15: Booth and Cressy

Booth and Cressy (1987) produce a two period asymmetric information model in which a wage demand is accepted or rejected at the start of the first period; if rejected, a strike is a possible outcome. If the union does strike, a new demand is made at the beginning of the second period; if this demand is not accepted, labour withdraws and the game ends. They define the union's discounted returns to striking V_S as

$$V_S(w_1^*) = u + \delta w_1^* = u + \delta \underline{P} \qquad (2.15)$$

and the returns to not striking as

$$V_{NS}(\underline{w}) = \underline{w}(1 + \delta) \qquad (2.16)$$

where u is the union's leisure value, δ the discount rate, w_1^* the union's demand in the second period, and $\underline{P}$ the union's minimum estimate of the firm's rent per unit of labour. Indifference to a strike on the part of the union requires $V_S = V_{NS}$, and solving this for $\hat{u}$ yields a value which is a point of demarcation between potentially strike-prone ($u > \hat{u}$), and strike-free unions. The firm's discounted returns π_A to accepting the first period wage offer w_0 are

$$\pi_A(w_0, P) = (P - w_0)(1 + \delta) \qquad (2.17)$$

and to resisting, π_R, are

$$\pi_R(w_0, P) = 0 + \delta(P - w_1^*), \quad u > \hat{u} \qquad (2.18)$$

and

$$\pi_R = (p - \underline{w})(1 + \delta), \quad u \leq \hat{u} \qquad (2.19)$$

where P is the firm's actual rent per unit of labour and $\underline{w}$ the existing wage.

Although this model appears very restricting in assuming that information gathering process has been completed prior to the commencement of bargaining, however it does introduce the pre-existing wage rate as determinant of strike probability, which is arguably an important addition to Tracey's model. Although economists have long recognised that individuals derive benefits from leisure, it seems odd to ascribe a significant role in the union's utility function to utility derived from periods of idleness, when it is clear that long strikes cause extreme hardships for employees and their families. Nevertheless Booth and Cressy derive useful testable hypotheses which have some intuitive appeal: first, strike incidence decreases with reductions in the union's and firm's discount rates, with increases in the pre-existing wage rate, and with reductions in union expectations regarding the firm's profitability; second, the effects of increases in the degree of union uncertainty are ambiguous because it raises the cost of striking to the union, and, at the same time, produce a climate in which the firm is likely to be more resistant.

Booth and Cressy use data from the 1984 British Workplace Industrial Relations Survey (WIRS) to estimate probit models. They use a simultaneous equations model of long strikes, because the occurrence of a long strike is conditional on any strike occurring. Although they express some reservations regarding the extent to which strong empirical support is found for their theoretical model, they claim that the estimated model shows that strike incidence increased with establishment size, union density, and labour as a proportion of total costs; it decreases with capacity utilisation.

Model 16: Hart

Hart (1989) argues that the asymmetric information model is unable to explain the occurrence of lengthy strikes, and indeed, if there are no delays between rounds of bargaining, then agreement should occur very quickly so that there should be few, if any, strikes. He claims that two additional assumptions are necessary to explain the average duration of strikes actually observed: first, that there are significant delays inherent in bargaining brought about by the way bargainers operate both organisationally and technologically; and second, that the future profitability of the firm declines with the length of a strike. This latter effect on profitability encompasses more than simply the losses of output during the strike period, and takes into account the possible impact of consequential long term losses of market share. Because this cost increases significantly when inventories become exhausted, a union has an incentive to hold out until close to this point in order to increase its leverage on the firm. Hart offers no empirical analysis to support his theoretical model.

2.4.5 Other Economic Models of Strikes

Few modern theorists, at least amongst labour economists, deny the significance of mis-information in explaining strike activity; not all, however, regard mis-information as the most important factor.

Model 17: Hieser

Hieser (1970) develops a model of wage determination under bilateral monopoly in the labour market, and although it is not a strikes model *per se*, it includes the costs of strikes in the determination of the equilibrium wage.[6] It is assumed that the firm maximises profit and the union maximises the total wage bill. The workplace is a closed shop, and fixed technical coefficients require that a change in sales brought about by a price increase, has the same proportional impact on union employment.

Hieser makes the important point that for the owners of the firm, all adjustments are marginal; for union members, 'an increase ... may represent higher incomes for some workers, zero incomes for others'. [p 58] He identifies an "area of bargaining" which is the interval bounded below by the competitive labour market wage rate, and above by the wage which maximises the wage bill. Under the assumptions of the model, he shows that the maximum wage bill cannot exceed two-thirds of the firm's value added.

Hieser defines a union cost of a strike function as the loss of wages during a strike, plus a supplementary utility, $U(s,W)$,to describe additional hardships associated with a strike of length s, where W is the prior wage rate; these difficulties occur as 'workers' savings dry up, strike funds tend to exhaustion, (and) credit becomes increasingly difficult'. [p 62] His union gain function from a strike-free wage increase, is the present value of the increases to employees who retain their jobs, minus the wage losses to those who are retrenched. The union is indifferent to accepting a wage offer, ΔW, when

$$\Delta W = \frac{sW + U(s,W)}{(1-\eta)\,V_m(j)} \qquad (2.20)$$

[6]Although Hieser writes in the *Economic Record*, the model is theoretical and contains nothing that is peculiarly Australian, so we outline his model here, rather than amongst the review of Australian research in Chapter 3.

where η is the elasticity of demand for labour and $V_m(j)$ is the union's discount factor.

The firm's loss function for a strike is the loss of profit directly associated with the strike, plus a supplementary function, $F(s,W)$, to describe losses of good will and financial stringency. Its loss from any wage increase is $Q.\Delta W$ where Q is the pre-increase level of employment.[7] The firm is indifferent between resistance and concession when

$$\Delta W = \frac{1}{V_n(i)}\left[\frac{sW}{\epsilon - 1} + F(s,W)\right] \qquad (2.21)$$

where ϵ is the elasticity of demand in the product market and $V_n(i)$ is firm's discount factor.

Using the indifference curves between ΔW and s, implied by Equations (2.20) and (2.21), Hieser derives an equilibrium wage. Bargaining is assumed to occur, but it appears that a strike is always avoided; this is consistent with views extending back to Hicks (1932), that strikes are "mistakes". The equilibrium wage is negatively associated with the elasticity of demand in the product market and the union's supplementary loss function, $U(s,W)$; it is positively associated with the ratio of firm's discount factor to the union's, $V_n(i)/V_m(j)$, and the firms supplementary loss function, $U(s,W)$.

Model 18: Johnston

Johnston (1972) extends Hieser's (1970) model which examines some of the costs and benefits of resistance and concession to wage demands. He criticises Hieser because his model does not deal with expectations and uncertainty, the

[7]This is derived from "old profit" = $Q(P - W)$ and "new profit" = $[Q - \Delta Q][(P + \Delta P) - (W - \Delta W)]$ where P is the product price per unit of labour.

failure of bargaining and the occurrence of strikes, and bluffing and "second guessing".

Johnston identifies three critical wage offers by the firm: first, an opening offer ΔW_0, second, an upper limit, $\Delta W_1 > \Delta W_0$, which if not accepted by the union, leads to the firm's acceptance of a strike; and third, the increase necessary to settle a strike, ΔW_2. The firm's problem is to choose the value of ΔW_1 which minimises its costs. The firm believes that if ΔW_1 is small, a strike is inevitable, but the probability of the rejection of the offer and a strike occurring decreases as ΔW_1 increases. The firm's expected value calculation uses the cost functions of Hieser, and assume a Hicksian union resistance curve in which strike duration declines as the firm's wage offer increases.

Johnston has little to say regarding the maximisation problem of the union; he writes

> The actual size of the claim is not a very important factor ... because the employer will almost certainly "discount" it to arrive at an assessment of the "real claim", ΔW^{re}, which is his estimate of the wage offer needed to reduce the strike probability to negligible proportions. [p 847]

Unions believe that the firm's offer depends not only on ΔW^{re}, but on the firm's expectations regarding the strike probability function; therefore it is important, from the union's perspective, to be perceived by the firm to be strong, militant and able to organise a strike efficiently. The crux of whether a strike occurs depends on the union pushing their wage demand up to the "sticking point", and whether the expected gain to the union from striking, exceeds the gains available to it by accepting the firm's current offer. When a strike is in progress, essentially the same calculations are used to determine whether a revision of demands and offers will lead to the acceptance of a new offer and the cessation of the strike.

Model 19: Snyder

Snyder (1977) claims that variation in US strikes during the first half of the twentieth century can be explained by changes in union organisation and political variables, and that economic factors are, at most, peripheral. Indeed, he argues that US economic models are 'theoretically inadequate ... and empirically misspecified'. [p 340]

His estimating model is

$$S_t = \beta_0 + \beta_1 U_t + \beta_2 W_{t-i} + \beta_3 M_t + \beta_4 P_t + \beta_5 D_t + \beta_6 T_t + \epsilon_t \qquad (2.22)$$

where S_t is a measure of strike activity, U_t the unemployment rate, W_{t-i} a six-year lagged moving average of changes in real wages, M_t union density, P_t a Democrat President dummy, D_t the percentage of Democrats in the Congress, and T_t a time trend. Compared with the other regressors, the union density regressor appears to perform well in US strike models during the period 1900-48, and in Canadian models in the period 1912-48. Snyder argues that the lack of significance of this variable in the post-war models is because

> union recognition, collective bargaining and labor-management contractual agreements are relatively well established (and) short run economic costs and benefits are more salient to labor. [p 340]

Skeels (1982) modifies Snyder's 1900-48 US models to take account of what he claims is a simultaneity problem, brought about by union density responding to the same economic factors as strikes. In it, economic factors re-emerged as important explanators of strikes, however the union density variable, which is defined as the residual in a union density equation[8], remains as a significant regressor.

Model 20: Crouch

Crouch (1980) argues that institutional arrangements of society are important in explaining levels of industrial conflict. He claims that in societies where labour has a real share of political power, there is less industrial conflict. This argument is clearly relevant to the case of Australia after the election of the Hawke Labor government in 1983, and the operation of the Prices and Incomes Accord in which the Australian Council of Trade Unions is involved in deliberations regarding economic policy. We explore this further in Chapters 3 and 5.

Model 21: Paldham and Pedersen

Paldam and Pedersen (1982) adapt Ashenfelter and Johnson's (1969) model, to investigate strike frequency in seventeen countries, including Australia, during the period 1948-75. Two important additions to the model are: first, whether or not the year is an election year; and second whether the orientation of the government is comparatively left or right wing. Their estimated models are disappointing in that several exhibit autocorrelation, and the economic variables have, in many instances, coefficients whose signs differ from those suggested by theory. The election year dummy is insignificant in all models tested, and six models of seven with significant political orientation variables, show that higher

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[8]*Pun* = *f(Unemp, Rwchg, Pres, Pdems, Trend)* where *Pun* is union density, *Unemp* the unemployment rate, *Pres* a Democrat President dummy, *Pdems* the percentage of Democrats in the Congress, and *Trend* a time trend.

incidences of strikes are more likely under left wing governments. Their Australian model is[9]

$$\hat{S}_t = \underset{(9.0)}{15.10} - \underset{(2.2)}{1.54\, u_t} + \underset{(1.8)}{0.47\, w_t^*} - \underset{(3.2)}{3.33\, g_t} \qquad (2.23)$$

$$\bar{R}^2 = 0.53 \qquad DW = 0.92$$

where S_t is the number of strikes, u_t the unemployment rate, w_t^* the increase in real wages, and g_t a government dummy variable (-1 for left, +1 for right, 0 for mixed).

Although the quality of the econometrics clouds the statistical validity of this conclusion, Paldam and Pederson argue that

> workers are likely to have higher wage expectations under left-wing than under right-wing governments. At least in the short-run, left-wing governments are clearly in no position to fulfil these expectations. In fact, they are often confronted with signs of lower business confidence, such as falling share prices and falling foreign exchange reserves. Thus, wage expectations, which have been "whetted", are likely to be frustrated. [p 516]

Model 22: Reder and Neumann

Reder and Neumann (1980) produce a joint cost minimisation model. They propose that strikes impose costs in the form of lost profits of employers, and lost wages of employees, and that bargaining pairs develop protocols which minimise the expected total of these costs. A protocol is a set of procedures and rules which facilitate agreement between the parties, and

> most importantly, a protocol relates to wage rates, fringes, etc., ... to those set in certain other collective-bargaining agreements and to movements of the cost of living. In some cases, this relation is very "tight", virtually reducing contract negotiation to application of a formula. [p 871]

[9] *t* values in parentheses.

Unlike the approach taken in many economic strike models in which wage rates and strike duration are key decision variables, Reder and Neumann propose that the choice variable is the structure of the protocol. The optimal protocol is that which minimises total strike costs over time, and over possible states of nature. Protocols themselves are not without cost, and they are developed up to the point at which additional expected strike cost savings are equal to the increased costs of developing and using a more complex protocol. From this model they argue that

> differences in strike activity across industries are believed to reflect primarily the effect of differences in bargaining protocols of experienced bargaining pairs. [p 870]

Reder and Neumann use changes in inventory and shipment data, and the relative value added per worker per day, as proxies for strike costs; the presence of union elections is used as an indicator of more uncertainty in protocol arrangements. In the case of the first two of these, they claim that large variations in these variables reflect an ability of the firm to reduce the costs of strikes by making inter-temporal substitutions via inventories, and contemporaneous substitutions from plants which are not strike bound.

Their estimating equation is

$$\alpha_{it} = \alpha_0 + \alpha_1\, Inv_{it} + \alpha_2\, Ship_{it} + \alpha_3\, (W_i/W)_{it} + \alpha_4\, Elections_{it} + \alpha_5\, Unemployment_{it} + V_{it} \qquad (2.24)$$

where α_{it} is the strike measure in industry i at time t, Inv_{it} and $Ship_{it}$ are intra-year coefficients of variation of inventories and shipments, $(W_i/W)_{it}$ an index of relative wages, $Elections_{it}$ the number of union elections within an industry, $Unemployment_{it}$ unemployment in industry i, and V_{it} a random error term. Using three different measures of strikes in the US manufacturing sector during the period 1953-73, Reder and Neumann claim to show that as the cost of strike activity rises, strike activity decreases; furthermore, less experienced bargainers (those with less well established protocols) are more likely to be involved in strikes.

Model 23: Gunderson, Kervin and Reid

Gunderson *et al* (1986) test the joint cost hypothesis suggested by Reder and Neumann using Canadian contract data from the period 1971-83. Their model also incorporates imperfect information and asymmmetic information variables, and is of the form

$$\begin{aligned} Logit(Strike) = \alpha_0 &+ \Sigma \beta_i CONTRACT_i + \gamma\, UNEMP + \delta RISK \\ &+ \Sigma \zeta_j IND_j + \Sigma \eta_k SEASON_k + \Sigma\, \theta_l REGION_l \\ &+ \Sigma\, \lambda_m UN_m + \Sigma\, \mu_n POLICY_n \end{aligned} \qquad (2.23)$$

where *Strike* is a strike occurrence dummy, $CONTRACT_i$ a set of contract specific variables, *UNEMP* the unemployment rate, *RISK* the percentage of payroll of the Workman's Compensation Board, IND_j industry dummies, $SEASON_k$ seasonal dummies, $REGION_l$ regional dummies, UN_m specific union dummies, and $POLICY_n$ a set of variables describing the characteristics of negotiations and agreements at workplaces.

They claim to find empirical support for the joint cost hypothesis, and assert that

> strikes are less likely to occur when their joint costs to both parties is high relative to the costs of alternative mechanisms (e.g., joint committees, continuous bargaining, voluntary arbitration, and grievance procedures) that can be used to achieve the same purpose. [p 273]

Model 24: Blanchflower and Cubbin

Blanchflower and Cubbin (1986) use 1980 British WIRS data to investigate factors in workplace environments which increased the probability of strikes, and other forms of industrial action amongst manual workers.[10] They note that strikes have, in the literature, been attributed to a wide range of factors which include 'mistakes, malice, political opportunism, weak management, militant unions, (and) poor institutional arrangements' [p 19]; they claim that this gives rise to a need for a large number of variables in microeconomic empirical models.

They argue that some of the concepts of games theory are useful in categorising possible explanatory variables, but that these models are unable to capture all of the critical factors at work in the real world of industrial bargaining, and therefore are unlikely to produce useful predictions. Nevertheless, simple games theory models and experiments suggest the importance of mis-information variables; incomplete information clearly makes non-cooperative outcomes more likely, yet in order to secure larger shares of future profits, bargainers are likely to misrepresent their own positions to their adversaries.

They argue, too, that instead of being mistakes, strikes may sometimes be used by union as a means of signalling the seriousness of their intent. Games theory experiments suggest that bargainers learn from experience, and that co-operative solutions are more likely when it is known that there will be further rounds of the game. It is hypothesised, therefore, that industrial action is less likely when bargaining is, more or less, an on-going process.

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[10]This is the only paper we find in the literature that deals with non-strike industrial action. It does not, however, attempt to develop a separate model for these actions, either in aggregate, or for the various forms of non-strike action described in WIRS.

Blanchflower and Cubbin note that cooperation is less likely when the number of players increases, and make the obvious point that the psychology of the players may also be important. They refer to Fouraker and Siegel (1963) who suggest that there are three types of players of games; they are simple maximisers, cooperators and rivalists. The third category is less likely to achieve a cooperative solution and are more strike-prone.

In discussing the impact of workplace size and "layers of hierarchy", Blanchflower and Cubbin argue that the significance of formal bargaining structures in empirical models, which, *prima facie*, one might expect to facilitate better information, is ambiguous. These variables which they term "frictional" may signal the presence of forums which facilitate cooperative outcomes, but could instead be evidence of management's failure to achieve a mood of cooperation at the workplace. Strikes are likely only in the presence of organisation, and further, there must be an incentive, meaning that the firm has monopoly profits which may be shared with employees.

Blanchflower and Cubbin specify three probit models: first, for any form of industrial action (excluding lock-outs) in the survey period: second, for any strike of less than one day; and third, for any strike of one day or more. Each model uses the same set of frictional, organisational and incentive regressors. Because they do not report parsimonious versions of their models, we do not reproduce their equations, and only note their significant results.

In the model describing any industrial action, they claim some support for the frictional hypothesis; the presence of payment by results, membership of an employers' association, and multi-unionism has a positive impact on the probability of industrial action occurring. The model suggests that the presence of consultative councils and formal procedures are symptoms of strike-proneness, rather than being facilitators of cooperation. Three organisational factors are significant; union recognition, the presence of a shop steward, and union density are significantly and positively associated with the probability of industrial action occurring. None of the incentive variables is significant.

In drawing comparisons between the shorter and longer strikes, Blanchflower and Cubbin claim that the former may be associated with attempts to achieve recognition, and that they 'seem to be dominated by organisational variables'. [p 35]

2.4.6 Non-economic Theories of Strikes

Economic models of strikes rest on the fundamental assumption that agents involved in industrial bargaining are optimisers; employees weigh up the costs and benefits of striking, and employers evaluate the costs and benefits of conceding to employees' demands. This is so whether the parties are competent bargainers, and regardless of their stock of information *via-à-vis* that of their adversaries, or how costs and benefits are actually calculated. There are, however, alternatives to these neo-classical views regarding the underlying mechanisms which bring about strikes, but since our focus is on economic models in later chapters, our reference to these, with one exception, is brief.

The institutionalism school regards industrial bargaining as a manifestation of the democratic process in which rules and systems are developed to resolve conflicts of interest between labour and capital, and in ways which preserve the integrity of the social order; see for example Dunlop (1958), Kerr (1964), and

Clegg (1976). On the other hand, the political school views strikes as stemming from conflict between labour and capital, and their incidence depends on the distribution of power between these groups; see for example Shorter and Tilly (1974), Hibbs (1978), and Korpi and Shalev (1979). Behavioural writers of various persuasions argue that strikes result from employees' hostility to managerial policies, organisational problems within bargaining systems, union politics, and personal hostilities; see for example Kochan and Katz (1988), and Anderson and Gunderson (1989).

Model 25: Goddard

Goddard (1992) claims that models which ascribe the principal cause of strikes to imperfect or asymmetric information problems, fail to give sufficient recognition to 'sociological, psychological and political considerations forming the behavioural context within which negotiations occur.' [p 161]

He attributes this neglect to a lack, in the behavioural literature, of a coherent framework within which strike activity can be analysed.

Goddard suggests a 'collective voice' approach based on three fundamental propositions: first, it is normally the case that unions decide to strike or not to strike; second, strikes impose costs on individual employees so group solidarity must be mobilised if strike action is to be taken; and third, employees are subordinate to management authority. It follows, he claims, that strikes are 'manifestations of collective voice by workers and their agents'. [p 162]

Goddard does not see strikes as being the result of any particular optimising behaviour by either side, but rather as springing from deep seated conflicts between labour and capital, and which are more general in scope than disputes over profit shares. He puts forward five propositions regarding factors likely to increase the probability of strikes occurring, and their duration: first, increases in employee discontent and solidarity; second, management focus on costs and efficiency, rather than on stability and accommodation; third, the extent to which strikes are viewed by employees as an efficient means of pursuing objectives relative to other means; fourth, the extent of militancy amongst unionists; and fifth, the extent of uncertainty and imperfect information in the hands of bargainers. The last of these propositions is, of course, a conclusion reached in many economic models of strikes, and although derived from a different set of assumptions, Goddard sees this as 'the neoclassical approach within a broader, more comprehensive framework'. [p 164]

Models of strike incidence and duration are tested using probit and tobit analysis, and use data collected by Goddard in a survey of Canadian unionised firms. The survey enables the use of industrial relations variables, and information regarding the particular circumstances of firms not normally available in secondary sources. The general form of the model is

$$S = \alpha_0 + \Sigma \beta_i MAN_i + \Sigma \gamma_j STR_j + \Sigma \delta_k BARG_k + \Sigma \zeta_l CON_l + \epsilon \quad (2.25)$$

where S is a strike variable, MAN_i a set of management variables, STR_j structural variables, $BARG_k$ bargaining variables, CON_l control variables, and ϵ a random error term.

Goddard finds mixed support for behavioural models of strikes; his empirical results conflict with

> the industrialism thesis, which argues that the more advanced technologies emergent in the last stages of industrialisation should be associated with decreased industrial conflict (and) the dual economy thesis, which argues

> that when the unionisation rate is high and product market conditions are favourable, management is more averse to strike activity and hence more willing to "buy off" discontent. [p 173]

He claims to find support for the collective voice model, but that this does not controvert information-based models, because these are embedded in his own model via the fifth proposition, and his mis-information variables are significant.

2.6 Summary

Early models of strikes see the business cycle as the principal determinant, and couch explanations in terms of profit shares and labour market tightness. In the 1980s, models emerge which give a central role to information problems confronting bargainers. Mis-information models, whether or not they incorporate other economic explanations of strikes, often appear to neglect seemingly important institutional and behavioural factors. At a macroeconomic level, these factors may be of limited consequence because it is likely that they evolve slowly over time, at least in aggregate; when they are relevant, their effects may be modelled, albeit imperfectly, with time trends and dummy variables. Institutional differences may be more germane to international comparisons, as we see in the general down-turn in strike activity in the 1980s.

At a microeconomic level, it is intuitively clear that non-economic variables are important in explaining why some workplaces are more strike-prone than others. A serious problem confronting researchers is that some of the most promising variables, for example, employee frustration and union-management personality clashes, are not measurable and require the use of fairly unconvincing proxies. What economic models attempt to do, of course, is to identify common economic factors which predispose workplaces to be more strike-prone, and for bargaining to result in strikes. All econometric models of strikes accommodate a "white noise" variable, which in microeconomic models proxies unmeasurable differences between workplaces; although residual variation is typically large, the models nevertheless lend some support to economic theories which endeavour to explain strikes. In macroeconomic time-series models, residual variation is typically less; because the strikes series which are used are not obviously trended, it is unlikely that this is the result of spurious regressions sometimes seen in the time-series models of the past. The comparatively small residual variation is more likely to be the result of aggregation and the implied averaging which masks the effects of workplace-to-workplace variation.

It is clear that the empirical modelling of strikes has paid scant attention to testing whether estimated models are successful in making out of sample predictions. This is a damning criticism of strike analysts who produce quantitative models, yet seem reluctant to forecast strike activity. Almost exclusively, empirical models are used, instead, to test whether *theoretical* models are substantiated by observed data. Interestingly, the same data appears to give some support to different theories of strikes, but few researchers use econometric tests to choose between those theories; Mumford (1993), in attempting to compare the models of Ashenfelter and Johnson (1969), Reder and Neumann (1980), Hayes (1984) and Tracey (1986) finds that[11]

> there is a substantial gap between the theory and variable specification ... which results in the prescription of very similar sets of independent variables, so much so that a clear statistical ranking across the models is not found. [pp 308-09]

[11]Mumford uses annual data from the New South Wales coal industry for the period 1952-87. Although this is an interesting exercise, different conclusions might be drawn using different data.

The controversy surrounding the worth of different strikes models is argued, for the most part, theoretically.

Debate focuses on whether the assumptions of models match observations of how bargaining takes place in the real world, what issues are in dispute during bargaining, and what are the costs and benefits of resistance and concession. No theoretical researcher, as far as we are aware, bases assumptions on empirical data analysis, save personal observations and impressions. In the literature, we see no convincing case supported by statistical analysis, that firms' responses to wage demands are governed by profit maximising behaviour; nor do we find evidence that unions base their decisions to strike on maximising the expected value of their members' utility. Although profit maximisation may be a reasonable approximation of the firm's behaviour, we argue in Chapter 4 the union is unlikely to be guided by expected value calculations, given the probability that its actions will lead to a strike.[12] We show that different behavioural assumptions appear not to negate the role of the business cycle and mis-information in explaining strikes.

[12]In essence, maximisation of expected value is not a reasonable strategy when a game is played infrequently.

3 Time-Series Models of Models of Australian Strikes

3.1 Introduction

In this chapter we review Australian economic time-series models of strikes.[1] Following this, we attempt to re-estimate these models to determine how well they fit a lengthier and more recently terminating data set.[2] In particular, we investigate whether the same regressors remain statistically significant, and further, we use these models in an attempt to gauge the effect of the Prices and Incomes Accord in explaining the observed reduction in the incidence of Australian strikes in the 1980s. We defer a discussion of the few Australian cross-sectional microeconomic analyses of strikes until Chapter 6.

Although we note some deficiencies in these models, we do not attempt to rank these models in the style of Mumford (1993), either in their ability to explain strikes, or to satisfy diagnostic tests. In Chapter 5, where we develop a new empirical time-series model of Australian strikes, we perform a series of non-nested tests which compare each of these re-estimated models with the new model.

Prior to this review of the Australian strikes literature, we outline the role of the Australian Industrial Relations Commission (hereinafter the Commission), and the incidence of strike and non-strike industrial action.

3.2 The Institutional Context of Australian Industrial Disputes

It is noted by many observers of industrial relations systems, that the existence of the Commission makes the Australian system unique. For most of the Twentieth Century, the Commission has acted as an industrial "umpire" charged

[1]We exclude Morris and Wilson (1994 and 1995) since these models were, at the time of publication, work in progress towards the model presented in Chapter 5.

[2]The analysis of Oxnam (1953) does not use econometric techniques.

with keeping the industrial peace. Clearly, models which attempt to explain strikes in the US and Britain, as a consequence of wage bargaining between employees and industrial unions, but involving no third party, correctly describe the most fundamental characteristic of the bargaining process. In Australian economic models of strikes, scant attention is given to the role of the Commission; in examining the writings of Australian researchers, the Commission appears to be treated either as an irrelevancy, or perhaps important but having a constant effect and not, therefore, readily amenable to statistical analysis. Business cycle, mis-information, joint cost and other explanations of strikes which appear in the overseas literature, are assumed, at least implicitly, to apply to the Australian system and are independent of the Commission's presence.

3.2.1 Australian Strikes

Theories of strikes found in the literature are generally couched in terms of conflict between management and employees represented by a union. There is no third party in the bargaining process, although in some empirical studies the effects of incomes policies and political orientation of the national government have been incorporated.[3] In others, employees and union officials are assumed to have different objectives; the former pursue better wages and other conditions of work, and the latter seek to retain their positions.[4]

For almost a century, Australian industrial negotiations and disputes have occurred in a system in which an industrial tribunal has been an actual or potential participant. The Commission has, since its inception in 1904 (as the

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[3]See, for example, Farber (1978), Paldam and Pedersen (1982), Kaufman (1982), Gramm (1986), and McConnell (1989).

[4]See, for example, Ashenfelter and Johnson (1969).

Commonwealth Court of Conciliation and Arbitration), been seen, according to Hamilton (1991) as

> the Australian institutional response to the social problem of strikes, bans, limitations, or pickets engaged in by employees in support of collective claims relating to the employment relationship. [p 340]

Indeed, pursuing the goal of minimising industrial disputation has been the Commission's *raison d'être*; intervention in wage determination processes has been one of the mechanisms used, but has not been regarded as its primary objective.

The Commission has had wide-ranging discretionary powers which it could use in attempting to forestall strikes, or to bring about settlements after strikes have commenced. In many respects the Commission has acted as an arbiter which has sought to balance the conflicting claims of managements and unions. Its decisions, set down in awards, have been legally binding on both parties, and very considerable sanctions have been available to the Commission to enforce their implementation.

There have been few attempts in Australia to develop a consensual incomes policy of the type adopted in some European countries. Irrespective of the presence of a longstanding centralised industrial relations system in Australia, the Commission's activities in wage settlements and industrial disputes, cannot be seen as part of a formal incomes policy, and an instrument of the government's management of macroeconomic activity. The Commission's use of regular cost of living adjustments from its inception until 1953, and wage indexation between 1975 and 1981, is, at most, a limited form of incomes policy.

With the election of the Hawke Labor government in 1983, a major change occurred when, for the first time, an Australian government embraced the concept of an incomes policy; this was the Prices and Incomes Accord (hereinafter the Accord), which is an incomes policy of the corporatist type. Newell and Symons (1987) describe this as

> a set of institutions where the interests of organisations of labour are brought together in a framework with the state in which a high level of employment is sought by limitation of wage demands. [p 578]

The Accord encompassed many aspects of economic and social policy including a "social wage" brought about principally through the social security and public health systems. A central element of the Accord has been its industrial relations policy, which specified the use of conciliation to settle industrial disputes between employers and unions, without recourse to the penal sanctions of the Commission, or the use of the common law. At the time of its adoption it was claimed by its advocates that an important outcome would be lower levels of industrial disputation throughout Australian industry.[5] Although the Accord has undergone several changes, both the Federal Government and the union movement continued to claim that it has delivered very low levels of industrial disputation.[6]

Clearly, institutional arrangements in the Australia labour market are quite different from those in the US and Britain; the question at issue, however, is whether the forces at work and the bargaining outcomes are fundamentally different. Whether the Accord has reduced strike activity in Australia has been tested empirically[7]; more contentious, however, is the question of what modifications, if any, to collective bargaining models of strikes are required to

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[5]See Department of Employment and Industrial Relations (1986).

[6]See Willis (1991).

[7]See Beggs and Chapman (1987a and b), Chapman and Gruen (1991) and Morris and Wilson (1994 and 1995).

accommodate Australia's unique institutional circumstances.

International comparisons of strike statistics are well known to be problematic and give little indication of how to proceed. Beggs and Chapman (1987b) describe very considerable differences in definitions of strikes and methods of collection of information, and Shalev (1968) refers to international strike statistics as 'some of the most over-abused and least understood'. [p 1] Differences in industrial structure, political systems and social attitudes, are likely to produce differences in relationships between strikes and wages (and other causes). Notwithstanding these reservations, Table 3.1 shows that over the period 1962-81, and prior to the Accord, the average number of working days lost per employee does not differ greatly between Australia, the US and Britain. While this suggests that different institutional arrangements may not be of great moment, Table 3.1 also indicates that, in Australia, the average number of strikes per employee is considerably greater, and the average duration of strikes much less.

The influence of the Commission in moderating strike activity is not at all clear from these statistics. Although the relatively low duration statistic might be *prima facie* evidence of a facilitating role in bringing about speedy settlements after strikes have been initiated, it is difficult to reconcile the relatively higher Australian strikes frequency with the Commission's primary role as a preventer of strikes.

It is argued by Norris (1983), that in its intervention in the labour market, the Commission may, at least with respect to wages policy, have acted as an 'agent through which the (market) forces are translated into wage changes'. [p 199] The basis of this contention is that the history of Australian wage inflation exhibits similar patterns to those observed in countries where collective bargaining, rather than arbitration, is the norm. Although the evidence is less convincing for strikes, it is possible to argue that the cost of strikes, measured as working days lost per employee, is not particularly sensitive to differences in industrial relations systems.

Because the Commission has been in existence since before useful strike statistics became available in Australia, it is not possible to test empirically whether the incidence and cost of strikes may have been greater in the absence of a Commission.[8] Oxnam (1953) suggests that the system has failed to fulfil expectations in claiming that

> the elaborate and comprehensive system of arbitration .... over the past half century has not succeeded in reducing the number of strikes from any of the causes listed in the official statistics. This is not to say that arbitration has not reduced the number of strikes which would have occurred in the absence of arbitration. [p 83]

In what may seem to be a contradiction, he also notes that the relatively low reported incidence of strikes caused by issues associated wage and hours of work, might be evidence of the Commission's relative success in reducing strikes.[9]

Oxnam (1975) notes that the average duration of Australian strikes decreased fairly steadily during the period 1913-63, and wrote

> No longer are strikes being employed mainly as trials of strength between the disputing parties; instead they are being increasingly employed as media for ventilating protests against managerial policies and practices, decisions of governments ....and also as instruments of bargaining for over award payments and other fringe benefits. [p 30]

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[8]This is a different question to whether strikes have been sensitive to changes in the stance of the Commission which has changed from time to time.

[9]We note below that the causes of strikes recorded by the Australian Bureau of Statistic may be misleading.

Beggs and Chapman (1987a) claim that there is a consensus that short term strikes are 'signalling devices aimed at demonstrating the seriousness of the conflict'. [p 48] This view is consistent with the observation that work is resumed after many strikes, without negotiations taking place or agreements reached.

Table 3.2 shows that in the period 1982-92, approximately forty percent of strikes, whether measured as numbers of strikes or working days lost, are attributed to 'managerial policy'.[10] Strikes in pursuit of wage claims, the principal focus of all economic models of strikes, appear to be of modest importance; however in assessing the relative importance of causes, it is arguable that the categories 'hours of work', 'leave, pensions and compensation' and 'physical working conditions' are wage-like in character; improvements in any of these imply an increase in the employee's utility. It seems reasonable, therefore, to aggregate these categories to gain an assessment of the relative importance of wage issues, loosely defined.

Deery and Plowman (1985) point out that the causes of strikes shown in Australian Bureau of Statistics (ABS) surveys should be treated with some caution. They note that

> many strikes are multi-causal, yet must be recorded as having one cause. The imputed cause ... is usually the immediate cause of the cessation of work. Often less immediate factors may have been more important. [p 42]

This suggests that the relatively low reported frequency of wages as a cause of strikes may understate its true importance, leaving aside the distinction between wage issues and wage-like issues. The most frequently cited immediate cause,

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[10]Disputes over managerial policy encompass those concerning computation of wages, hours and leave of individuals, disciplinary matters including dismissals, promotion procedures, and production quotas.

namely 'managerial policy', may often mean that employees at a workplace are generally dissatisfied with their conditions of work, and with management's response to requests for improvements.[11]

While is difficult to mount a convincing case that 'managerial policy' is unambiguously different from wage-like issues, 'trade unionism' issues appear, *prima facie*, to be different. Table 3.2 shows this to be the immediate cause of 13.6 percent of strikes. Like 'managerial policy', 'trade unionism' suggests a range of specific issues, and which include demarcation disputes and the like; demarcation issues have clear implications for the employment opportunities of groups of employees at particular workplaces, so it is reasonable to argue that some of the strikes attributed to 'trade unionism' have wage-like causes, at least in the long-run.

In summary, the reported causes of strikes shown in Table 3.2 do not persuade us that models which hypothesise bargaining over wages, are inappropriate in Australia. We suggest that wage-like issues defined to be the reported categories 'wages', 'hours of work', 'physical working conditions' and 'other', and which account for 44.5 percent of strikes and 54.9 percent of working days lost in the period 1982-92, are the principal causes of strikes. The ambiguous nature of the categories 'managerial policy' and 'trade unionism' intimate that these statistics are under-estimates.

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[11] Indeed, it seems implausible that a group of employees who are satisfied with their conditions of work (including their wages), would strike in protest at some aspect of managerial policy unrelated to working conditions.

3.3 Previous Australian Time-Series Models

3.3.1 Model 26: Oxnam

Oxnam (1953) examines the relationship between Australian strikes and the business cycle during the period 1913-51, and finds pro-cyclical activity similar to that observed in early US and British analyses, and described in Chapter 2. He notes that many strikes are of short duration, and most are concentrated in a few strike-prone industries, principally mining, but also stevedoring, metal trades, meat processing and public transport. Comparatively few strikes are reported to be associated with wage issues, and less than ten percent are settled by arbitration. Later, Oxnam (1975) explains the cyclical behaviour of strikes by remarking that

> economic change necessitates a revision of the rules of work, a process in which a certain amount of conflict is inevitable .... therefore strikes represent mere frictions in the process of rule making in response. [p 29]

He argues, in essence, that the pro-cyclical nature of strikes occurs because economic prosperity confers more power to unions, at the same time as it enlarges the range of disputable issues at workplaces.

Oxnam (1953) pre-dates the now common use of econometric analysis of strikes data, and his investigation depends largely on observations of the general movement of strikes series over time, the apparent causes of strikes and methods of settlement. No statistical correlations between strike series and any business cycle series are presented; nor is any reference cycle offered, although some general references to periods of "full employment" and "under-employment" are made in support of the business cycle hypothesis.

Oxnam (1975), in a more detailed and what is essentially an up-dated version of the approach taken in the 1953 paper, again concludes that strikes are pro-cyclical. In support of this, he states

> the frequency of strikes increased markedly during the first world war and immediate post war years, and remained moderately high during most of the twenties, a period of considerable economic growth of the Australian economy. From 1929 onwards strikes became less frequent as business conditions worsened, reaching a record low in 1933 ..... With economic recovery strikes increased again and continued to increase almost continuously until 1952, which marked the end of the phase of over full employment.[12] [p 27-28]

Of some interest is Oxnam's failure in his second paper, to note the work of Bentley and Hughes (1970) which gives some econometric support to the business cycle hypothesis in explaining Australian strikes. By 1975, econometric analysis was in widespread use in the analysis of strikes data in the US and Britain.

3.3.2 Model 27: Bentley and Hughes

Bentley and Hughes (1970) perform the first econometric analysis of Australian strikes. They develop models of strike frequency, strike duration and working days lost, during the period 1952-68 and using quarterly data. The focus of each model is the relationship between strikes and business cycle proxies. Their estimating equation is

$$S_t = \alpha_0 + \alpha_1 U_t + \alpha_2 \Delta U_t + \alpha_3 T_t + \beta_i D_{it} + \mu_t \qquad (3.1)$$

where S_t is a strikes indicator, U_t the unemployment rate, T_t a time trend, D_{it} a set of seasonal dummies, and μ_t a random error term. They claim that U_t and ΔU_t captured 'broad cyclical influences on strike activity' [p 157], and argue that although other time-series which measure the business cycle might be relevant,

[12] This observation by Oxnam is *not* a summary of any statistical analysis, and appears to be based on no more than the observation of broad movements in strikes series during periods of high and low economic growth.

their inclusion in the model would risk multicollinearity amongst the regressors.

Bentley and Hughes propose that the apparent pro-cyclical behaviour of strikes has three underlying causes: first, the frequency of strikable issues rises during boom periods, because the number hours of work per period rises; second, the effectiveness of strike protests are greater during the boom, since firms are likely to experience higher profits while carrying lower levels of inventory; and third, the willingness to strike rises during the boom since "respect and dignity" are superior goods, and wage losses are more readily made up through the availability of overtime following strikes.

After removing the strike-prone coal sector, their estimated strike frequency equation is[13]

$$\begin{aligned} \hat{S}_t = 121.5 \quad & \underset{(5.47)}{-\,46.2\,U_t} \quad \underset{(1.26)}{-\,26.1\,\Delta U_t} \quad \underset{(16.33)}{+\,3.7\,T} \\ & \underset{(1.26)}{+\,14.9\,D_1} \quad \underset{(0.95)}{+\,11.2\,D_2} \quad \underset{(3.71)}{+\,43.8\,D_3} \qquad (3.2) \\ & R^2 = 0.83 \qquad DW = 1.24 \end{aligned}$$

Although the coefficients of both business cycle variables have expected negative signs, ΔU_t is not significant at the five percent level. Some caution is required in interpreting this regression since the model appears to be plagued by autocorrelation.[14]

The model for strike duration in the non-coal sector is more problematic; it is

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[13]In this chapter absolute t statistics are shown in parentheses immediately below coefficient estimates unless otherwise stated.

[14]The one percent lower critical value of the Durbin-Watson statistic, d_L, is approximately 1.283 for $n = 70$ and $k = 6$.

$$\hat{S}_t = 2.598 \underset{(1.13)}{- 0.188\, U_t} \underset{(2.88)}{+ 1.067\, \Delta U_t} \underset{(3.28)}{- 0.013\, T}$$
$$\underset{(5.64)}{+ 3.567\, SD_1} \underset{(6.36)}{+ 4.016\, SD_2} \underset{(6.30)}{+ 4.164\, SD_3}$$
$$\underset{(4.59)}{+ 2.849\, SD_4} \qquad (3.3)$$
$$R^2 = 0.73 \qquad DW = 1.75$$

SD_i are dummies which control for four unusually large strikes and which are used to improve the goodness of fit of the model.[15]

The coefficient of U_t is not significantly different from zero at the five percent level, but that of ΔU_t is significant at the one percent level and has a counter-intuitive positive sign. When the model is re-estimated using annual data, the coefficient of U_t is significant at the one percent level, while that of ΔU_t ceases to be significant but retains a positive sign. Bentley and Hughes attempt to rationalise the positive sign of the coefficient of ΔU_t by suggesting that

> it is tied to specific labour market changes, such as redundancies, whereas the unemployment variable acts as more of an environmental variable which sets an atmosphere for the strike climate. [p 163]

Their employment loss model in the non-coal sector is

$$\hat{S}_t = 7.23 \underset{(3.99)}{- 2.61\, U_t} \underset{(1.84)}{+ 2.73\, \Delta U_t} \underset{(1.68)}{+ 1.50\, D_1} \underset{(0.63)}{+ 1.75\, D_2}$$
$$\underset{(1.93)}{+ 1.75\, D_3} \underset{(1.57)}{+ 4.14\, SD_1} \underset{(2.33)}{+ 6.13\, SD_2} \underset{(1.86)}{+ 5.07\, SD_3}$$
$$\underset{(1.37)}{+ 6.09\, SD_4} \qquad (3.4)$$
$$R^2 = 0.44 \qquad DW = 1.75$$

This, too, has a counter-intuitively signed coefficient of ΔU_t, but again it is not significantly different from zero at the five percent level. In what appears to be a

[15]Bentley and Hughes state that without these dummies, only the trend term is significant.

second attempt to explain the positive sign, they suggest that strike duration may depend on a distributed lag function of unemployment, and that ΔU_t is a proxy for past conditions. Neither this explanation, nor the one noted above, is convincing; an alternative explanation is that the coefficient of ΔU_t is positively biased due to the omission of an important explanatory variable, perhaps the change in real wages.[16]

Bentley and Hughes (1971) use the empirical results of their previous paper to examine the recorded causes of strikes and methods of settlement. They conclude that although the causes of some strikes can not be attributed to effects of the business cycle, they nevertheless state that

> there remains a hard core of issues .... dependent upon the state of the cycle (for example) grievances resulting from hiring, overtime, technological change and speed-ups in work, and disappointment due to frustrated wage expectations. [p 361]

They note that Australian strikes have typically been of short duration and see these strikes as performing three functions: first, to draw issues to the notice of management and full-time union officials; second, to make known employees' dissatisfaction at their position of comparative powerlessness in employer-employee relationships; and third, to relieve pent-up tension resulting from relatively long-standing grievances.

3.3.3 Model 28: Phipps

Phipps (1977) modifies Ashenfelter and Johnson's (1969) model in two ways. First, he models strikes in pursuit of wage and non-wage issues separately.

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[16]The importance of changes in real wages in explaining strikes, stems from the work of Ashenfelter and Johnson (1969). We argue that the coefficient of a variable denoting changes in real wages has a negative sign, and further the correlation between changes in real wages and changes in unemployment is negative. The omitted variable bias in the estimated coefficient of ΔU_t brought about by the non-inclusion of a real wages variable is, therefore, positive.

Second, he introduces the proposition that divergences in employers' and employees' expectations regarding price inflation, tends to increase strike activity, and these divergences are more likely in times of rapid inflation. Phipps shows that, on the assumption that the firm maximise profit subject to a union concession curve, strikes over wages are more likely when the increase in money wages initially demanded by rank and file union members is greater, and when the rate of decay of union resistance is larger; strikes are negatively associated with the rate of inflation expected by management, the minimum acceptable wage increase of unionists, the firm's discount rate, and the firms' previous levels of profit.

In modelling strikes caused by non-wage issues, Phipps uses a business cycle model, and cites the reasons advanced by Bentley and Hughes (1970) as his justification. He does not, however, attempt to test either model separately; instead these models are combined to form an aggregate strikes model which takes the form

$$s_t = \alpha_0 + \alpha_1 \sum_{i=0}^{\infty} k_i \, p_{t-i} + \alpha_2 (v-u)_t + \alpha_3 \pi_{t-1} + \epsilon_t \tag{3.5}$$

where s_t is the seasonally adjusted number of strikes per ten thousand employees, p_t the rate of inflation, v_t the seasonally adjusted vacancies rate, u_t the seasonally adjusted unemployment rate, π_t the ratio of profits to the wages bill, and ϵ_t a random error term.

This model is specified as part of a simultaneous equations system with, separate equations for strikes, wage inflation, and price inflation. The model is estimated using both two stage and three stage least squares, with quarterly data from the period 1960-72. The results are disappointing; for example, in the strikes equation, the excess demand for labour variable, one essential to the non-wage aspect of the model, is statistically significant but its coefficient has a counter-intuitive negative sign, and is therefore deleted from the final estimated model. Phipps attributes the counter-intuitive sign to 'high collinearity between p_t and $(v-u)_t$' [p 314], however we find this explanation to be unconvincing, and suspect the problem to be one of omitted variable bias.[17]

The two stage least squares equation for s_t, the number of strikes per 100,000 employees (seasonally adjusted) is

$$\hat{s}_t = \underset{(0.05)}{0.01} + \underset{(3.01)}{0.04\, p_t} + \underset{(2.69)}{2.40\, \pi_{t-1}} + \underset{(5.05)}{0.009\, t} \qquad (3.6)$$

$$R^2 = 0.75 \qquad DW = 1.15$$

In addition to the model's inability to detect the pro-cyclical strike activity observed by other researchers, Phipps analysis is criticised by Perry (1978a), and Beggs and Chapman (1987a), for its use of the number of strikes per employee as the dependent variable in the strikes equation; this variable, they argue, captures neither the number of workers involved, nor the duration of strikes, and therefore gives a poor indication of militancy, and little indication of the cost of strikes.[18]

Phipps concludes that his model demonstrates that strike 'activity may be seen as an attempt to ensure that rising prices are translated into rising money wages, [p 316], and that 'strikes reconcile divergences between rank and file expectations, and management expectations, of the future rate of price changes' [p 317].

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[17]Again we question the absence of a real wages variable. We find the Pearson correlation coefficient between p_t and $(v-u)_t$ to be 0.37 for the period 1:1960 to 4:1972, which is not sufficiently large to suggest collinearity problems.

[18]We argue later, that strike measures of whatever type, are not measures of union militancy. In short, militancy may cause employers to acquiesce to demands to avoid strikes.

3.3.4 Model 29: Perry

Perry (1978a) investigates whether Australia's strike record is consistent with Hines' hypothesis that the principal cause of British wage inflation in the twentieth century, is trade union militancy. Hines (1968), in an analysis of British wage inflation over the period 1862-1963, concludes that

> excluding the years 1893 to 1912 .... demand as measured by the level and rate of change of unemployment has made a negligible contribution to the explanation of the variance in money wage rates. Moreover, other variables such as the rate of change of unionisation offer a better rationalisation of the data. [p 66]

Unlike other models discussed here, Perry's principal interest is wage inflation. He specifies a wages equation as follows:

$$\dot{w} = g(S); \quad g' > 0, \quad g'' <=> 0 \tag{3.7}$$

and a strikes equation:

$$S = h(x, \dot{p}); \; h_1' > 0, \quad h_1'' >= 0, \quad h_2' > 0, \quad h_2'' >=< 0 \tag{3.8}$$

where $\dot{w}$ is the rate of change of money wages, S is working days lost per employee, x a measure of excess demand for labour, and $\dot{p}$ the rate of inflation. The second equation is the employees' aggregate reaction function to x and $\dot{p}$, which he broadens to include the possible effects of changes in union density, ΔT, on strikes. Perry includes the inflation variable to capture 'employee militancy over price changes, reflecting a hypothesised sensitivity to real wage movements' [p 40], and the union density variable because 'stronger unions are in a better position to act militantly in support of worker wage demands'. [p 43]

The model uses annual data from 1953-76, and 1947-61.[19] Perry's

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[19]In the model using 1947-76 data, a dummy is included to control for the effects of the Korean War wool boom in 1951-52. The results are similar to those from the 1953-76 model.

preferred wages and strikes equations for the period 1953-76, are respectively:

$$\dot{w}_t = \underset{(2.157)}{1.363} + \underset{(12.478)}{17.427\, S_t} \qquad (3.9)$$

$$\bar{R}^2 = 0.876 \quad DW = 1.867 \ SER = 1.805$$

and

$$S_t = \underset{(4.393)}{0.2113} \ \underset{(-2.726)}{- 0.0894\, u_{t-1/4}} + \underset{(8.947)}{0.0630\, \dot{p}_t} + \underset{(2.104)}{0.0515\, \Delta T_t} \qquad (3.10)$$

$$\bar{R}^2 = 0.835 \quad DW = 2.104 \ SER = 0.117$$

where u_t is the unemployment rate.

The second equation shows strikes to be pro-cyclical, and positively associated with inflation and trade union density. Perry asserts that working days lost per employee is a good proxy for union militancy, and so his conclusions referred to the relationship between militancy and the business cycle, inflation and union density.[20]

Perry substitutes S_t from Equation (3.10), into Equation (3.9) to obtain a 'more or less conventional Phillips curve' [p 45], which is

$$\dot{w}_t = 5.045 - 1.558\, u_{t-1/4} + 1.098\, \dot{p}_t + 0.8975\, \Delta T_t \qquad (3.11)$$

From this he deduces the natural unemployment rate to be

$$u^e = 3.238 + 0.063\, \dot{w} - 0.705\, \dot{q} + 0.576\, \Delta T \qquad (3.12)$$

where $\dot{q}$ is the rate of change of productivity. Perry concludes that the natural rate of unemployment is positively associated with wage inflation and increases in union density, and negatively associated with the rate of change of productivity.

[20]Perry (1978b) considers the matter of appropriate indicators of militancy. They are (i) trade union density and its rate of change, (ii) working days lost per employee, (iii) number of industrial disputes per employee, (iv) workers involved per employee, (v) working days lost per worker involved, and (vi) working days lost per strike. Perry argues that working days lost per employee is the most satisfactory, *a priori*, and it is a good predictor (along with working days lost per strike) of wage inflation.

3.3.5 Model 30: Beggs and Chapman 1

Beggs and Chapman (1987a) test the impact of the Prices and Incomes Accord on Australian strike activity. Their model tests *mis-information* hypotheses which we discussed in Chapter 2. This, in essence, proposes that strikes are more likely to occur when bargainers have imperfect or asymmetric information regarding the true positions of their adversaries. They argue first, and following Phipps (1977), that the incidence of strikes is positively associated with higher levels of inflation, INF_t, because this leads to uncertainty over future real wages, and in particular, to differences in expectations between employees and employers.

Second, they argue that unionists might over-estimate profits when overtime is higher than average, and when profits are, in fact, below average; in other words, unionists associate high levels of overtime with high profits. In these circumstances, Beggs and Chapman expected an 'increased likelihood of wage demands by workers and an increased likelihood of resistance to them by firms'. [p 50] In order to capture this phenomenon, they construct the variable OP_t, the interaction of profits, $PROF_t$, and overtime, OT_t.[21]

In addition, profit appears to be used as a third mis-information variable on the grounds that when profits are low, employees are more likely to over-estimate them. Others use profit variables as proxies for factors other than mis-information; Ashenfelter and Johnson (1969), for example, claim that the union's strike-free wage demand is positively associated with profits, and that the employer's willingness to concede is negatively associated. This is of some moment because

[21] *OP* is defined as the residual of profit from its trend when negative, multiplied by the residual of overtime from its trend when positive, and zero otherwise.

the mis-information view of Beggs and Chapman suggests a negatively signed coefficient, whereas Ashenfelter and Johnson argue that the sign is indeterminate.[22]

Following Hicks (1932), Beggs and Chapman propose that union *muscle-flexing* is the cause of some strikes. Overtime, OT_t, is used as a proxy for the willingness of unions to engage in muscle flexing; they argue that muscle flexing is timed to minimise strike costs to employees when 'overtime is plentiful and lost wages are recovered relatively painlessly'. [p 48] It is not clear, however, why costs to employees should be minimised when overtime is high; indeed, Beggs and Chapman note that striking unionists forego greater earnings in these circumstances, and the role of overtime is, therefore, ambiguous. A stronger argument, perhaps, and one not advanced by Beggs and Chapman, is that when overtime is high, strike costs to firms are higher since inventories are likely to be low, and firms may find difficulty in meeting orders; so when overtime is high, strikes have a more severe impact on profits, and this reinforces in the minds of employers the powerfulness of unions.

Beggs and Chapman also propose that some strikes may be the result of *employer provocation* as a means of halting production to run down unwanted inventories. They noted that 'little modelling of this process has been undertaken in the literature' [p 48], but, following Ford and Hearn (1980), suggest that this conjecture has "potential". Beggs and Chapman use inventories as a proportion of gross domestic product, INV_t, to test this hypothesis. This argument appears to be

---

[22]Ashenfelter and Johnson (1969), in their estimated model, find the coefficient to be positive, but not significantly different from zero.

weak since it is well known that Australian strikes are usually of short duration[23], and so the impact on inventories would, in most instances, be negligible. More convincing is the suggestion of Reder and Neumann (1980), that the incidence of strikes varies inversely with the total cost of strikes; high levels of inventories reduce strike costs to firms since it enables them to hold out longer against union demands and strike action. Both hypotheses suggest a positive association, so regression equations are unable to discriminate between these theories.

Beggs and Chapman argue that working days lost per unionist, $(WDL/U)_t$, is the broadest measure of union militancy, and that this can be separated into working days lost per worker involved (average duration), $(WDL/WI)_t$, and workers involved per unionist (incidence), $(WI/U)_t$ because

$$(WDL/U)_t = (WDL/WI)_t \times (WI/U)_t \qquad (3.13)$$

Separate regression models are produced for strike incidence and average strike duration.

The estimating model for strike incidence uses the mis-information, muscle-flexing and employer provocation variables outlined above, and is

$$\begin{aligned}(WI/U)_t = \beta_0 + \beta_1\, INF_t + \beta_2\, INV_t + \beta_3\, OP_t \\ + \beta_4\, OT_t + \beta_5\, PROF_t + \epsilon_t \qquad (3.14)\end{aligned}$$

where ϵ_t is a random error term; the expected signs of the coefficients are β_1, β_2, $\beta_4 > 0$, and β_3, $\beta_5 < 0$.

In the average strike duration model, duration is specified as a positive function of inflation, and a negative function of profits. In addition, high levels of

[23]Beggs and Chapman state that "Australian strikes are overwhelmingly of short duration and that work is typically resumed without negotiation" [p 48] as evidence which supports the muscle-flexing hypothesis.

inventories enable firms to resist union demands for longer periods, and high levels of job vacancies, VAC_t, increase the prospects of strikers finding temporary work during lengthy strikes. The estimating model for average strike duration is

$$
\begin{aligned}
(WDL/WI)_t = {} & \gamma_0 + \gamma_1 INF_t + \gamma_2 INV_t + \gamma_3 PROF_t \\
& + \gamma_4 VAC_t + \mu_t
\end{aligned}
\qquad (3.15)
$$

where μ_t is a random error term; the expected signs of the coefficients are γ_1, γ_2, $\gamma_4 > 0$, and $\gamma_3 < 0$.

Both models are estimated using quarterly data from the period 3:1959 to 1:1983. The preferred estimated model, for incidence, is[24]

$$
\begin{aligned}
(W\hat{I}/U)_t = {} & \underset{(1.61)}{-172.588} + \underset{(2.08)}{1122.781}\, INF_t + \underset{(1.70)}{239.502}\, INV_t \\
& + \underset{(2.88)}{74.936}\, OT_t - \underset{(1.49)}{192.801}\, OP_t - \underset{(1.98)}{26.006}\, S_1 \\
& + \underset{(0.82)}{10.882}\, S_3 - \underset{(1.90)}{25.056}\, S_4 + \underset{(5.04)}{227.461}\, P_{692} \\
& + \underset{(8.81)}{394.835}\, P_{763} + \underset{(7.59)}{3421.581} P_{792} - \underset{(0.90)}{0.380} T_t
\end{aligned}
\qquad (3.16)
$$

and, for average duration, is

$$
\begin{aligned}
(WD\hat{L}/WI)_t = {} & \underset{(2.73)}{3.795} - \underset{(2.43)}{0.413}\, PROF_t + \underset{(2.76)}{82.986}\, VAC_t \\
& + \underset{(1.08)}{0.232}\, S_{1t} + \underset{(0.79)}{0.172}\, S_{3t} + \underset{(1.31)}{0.282}\, S_{4t} \\
& - \underset{(0.53)}{0.392}\, P_{692} - \underset{(1.46)}{1.080}\, P_{763} - \underset{(1.11)}{0.825}\, P_{792} \\
& + \underset{(3.70)}{0.01253}\, T_t
\end{aligned}
\qquad (3.17)
$$

[24]White's heteroskedastic consistent and bootstrap t statistics are also presented, but do not differ greatly from the OLS version.

S_{it} are seasonal dummies, P_{jt} political strike dummies[25], and T_t a time trend.

In the incidence model, inflation, inventories, overtime and OP_t are significant; in the duration model, profits, vacancies and the time trend are significant. Beggs and Chapman subject their models to more rigorous diagnostic testing than that seen in earlier Australian models; importantly, they use a Hausman test to conclude that overtime, profits and inflation are contemporaneously exogenous to strike activity. We suspect, however, that the incidence model exhibits a high degree of multicollinearity between INV_t and T_t, thereby clouding the inferences drawn from the regression.[26]

The incidence and average duration are used to make two sets of forecasts for the period 2:1983 to 1:1986. First, they use the values of the regressors that actually occurred during the forecast period, and second, use their averages over the period 1:1976 to 1:1983. These forecasts are compared with strike statistics from the forecast period, and it is concluded that

> strike activity fell markedly in this time in a way which cannot be explained by macroeconomic conditions. It is not unreasonable to attribute some part of this experience to the Accord. [p 57-58]

The principal purpose of Beggs and Chapman is to produce a statistically robust eclectic model as a basis for evaluating the impact of the Accord on strikes. In testing the three hypothesised causes of strikes, however, the worth of the results are equivocal; indeed, Beggs and Chapman observe that 'Importantly, these

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[25] P_{692} for the protest at the gaoling of union official Clarrie O'Shea in 2:1969, (ii) P_{763} for the Medibank protest in 3:1976, (iii) P_{792} for the protests over the gaoling of several Western Australian union officials in 2:1979.

[26] We are not confident of being able to replicate Beggs and Chapman's inventories series, and instead use one derived from NIF-10. Using the same sample period as Beggs and Chapman, we find that the Pearson correlation coefficient between INV_t and T_t is -0.90.

results should not be taken as definitive evidence for the original hypotheses as they may be consistent with alternative explanations'. [p 53]

In particular, it is clear that the significance of inflation, inventories and overtime in the incidence model, and profits and job vacancies in the average duration model, also support a simple business cycle explanation of strikes. The only regressor which is unambiguously a mis-information variable is OP_t, and its significance in the incidence model is marginal. The significance of the inventories variable in the incidence model is consistent with Reder and Neumann's (1980) strike cost hypothesis, as it is with the less plausible employer provocation hypothesis.

3.3.6 Model 31: Beggs and Chapman 2

Beggs and Chapman (1987b) investigate whether the observed decline in Australian strikes during the 1980s, is simply part of a "common international phenomenon", or whether the Australian experience is "idiosyncratic" and can be explained by the presence of the Accord. Due largely to the limitations of international data sources, they produce a more circumscribed model than that of their earlier paper. Inflation is used as a proxy for mis-information and unemployment as a business cycle indicator. The estimated Australian model of working days lost per employee, WDL/E_t, using annual data for 1964-85 is[27]

$$\begin{aligned} \widehat{WDL/E_t} = \; & \underset{(9.53)}{-1.867} \quad \underset{(3.71)}{+\,0.583\, INF_t} \quad \underset{(3.91)}{-\,1.00\, UN_t} \\ & \underset{(3.12)}{+\,0.107\, TIME_t} \quad \underset{(3.71)}{-\,0.621\, D8385_t} \qquad (3.18) \\ & \bar{R}^2 = 0.66 \qquad DW = 1.98 \end{aligned}$$

[27]White's heteroskedastic consistent absolute t values in parentheses.

where INF_t is the inflation rate, UN_t is the unemployment rate, $TIME_t$ is a trend term, and $D8385_t$ is a dummy for the period 1983-85.[28]

If we accept inflation and unemployment as satisfactory proxies for mis-information and the business cycle respectively, the model lends strong support to the mis-information hypothesis, and confirms the pro-cyclical behaviour of Australian strikes. Beggs and Chapman conclude that the model suggests that, after the introduction of the Accord, strikes decrease by 62 percent[29], on average, and after controlling for other factors, and that 'Australian strike activity decreases in the 1983-85 (Accord) period were large, and substantially greater than for Canada, the UK and the US'. [p 337]

Chapman and Gruen (1991), perform a similar analysis, but with extended data, and find that

> the Australian experience after 1982 was unique (and) the fall in the rest of the world is about 40 per cent, the Australia diminution in strike activity, at around 70 per cent, is clearly much greater than this [p 197-198].[30]

3.4 Re-estimation of Australian Time-Series Strike Models

It is noted in Chapter 2, that although Ashenfelter and Johnson's (1969) model is regarded by many as a watershed in the analysis of strikes, others claim that this model performs poorly when estimated using data from different time frames and institutional settings. In this section we seek to determine the extent to which the Australian models described earlier in this chapter, are able to explain

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[28] *WDL/E*, *INF* and *UN* are logarithmic transformations.

[29] Their interpretation of the coefficient is in error. The coefficient of $D345_t$ is -0.621 which implies a multiplicative impact equal to exp(-0.621) = 0.5374, which attributes a 46.3 percent reduction to the Accord. Kennedy (1981) suggests that the exponential of the coefficient produces an over-estimate.

[30] This estimate of the impact of the Accord appears to repeat the error of Beggs and Chapman (1987b), and noted in footnote 30.

strikes using a lengthy, and recently ending, data set. We use quarterly data from the period 3:1959 to 4:1992, which is also the statistical basis for a time-series model we construct in Chapter 5. The main data source for the regressors are the NIF-10 data base[31], and other sources are shown in Table 5.1.

In all instances excepting one[32], we begin with the linear models and the same economic regressors specified by those authors, and for the most part, the same dependent variables.[33] We do not incorporate any other economic regressors, since our aim is to examine how well the economic factors proposed by these researchers, explain strikes over this thirty-three year period. We are primarily interested in whether the relationships between strikes and the factors found to be significant in those earlier models, remain significant. When a model fails to perform satisfactorily in diagnostic tests, we explore whether the use of logarithmic transformations of the economic variables improve its performance. Where possible, we use the same symbols and names of the economic variables used in the original publications.

We also test whether the accommodation of structural breaks in particular relationships, improve the models. We examine two possible break points: first, at the onset of stagflation in the early 1970s[34], since this marked the end of a long period of low unemployment and steady growth of real wages; and second, at the

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[31]ABS Catalogue Number 1343.0.

[32]Beggs and Chapman (1987b and c) report a logarithmic model, and we follow their specification.

[33]We abandon the dependent variable, number of strikes per thousand employees, used by Phipps (1977), in favour of working days lost per thousand employees.

[34]Somewhat arbitrarily, we select 1:1973 which is also the first full quarter of the Whitlam government (1972-75).

commencement of the Accord when, it is argued, the Australian industrial relations system adopted a formal consensus-based incomes policy. We use the method suggested by Johnson (1984), and to do so, define a stagflation dummy, SF_t, and an Accord dummy, AC_t.[35] In doing this, we allow the relationship between the dependent variable and any regressor to change at these break points, and so do not require coefficients to be constant over the full sample period.

Following Pencavel (1970), Shorey (1974), Snyder (1977), Paldam and Petersen (1982) and others who suggest that the political orientation of the national government might have some impact on strike activity, we test the significance of dummies which control for different Australian governments. Following Snyder (1975), we test whether the closeness of a federal election may effect strikes.[36] Further, following Watts and Mitchell (1990a) who argue that wage guidelines policies moderate wage demands in the 1970s, we use dummy variables to control for different phases of the Wage Guidelines during 1975-81, and for the Wages Pause in 1983.[37] Next, following Beggs and Chapman (1987b and c), and Morris and Wilson (1994), we introduce a dummy variable to control for the Accord.

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[35] AC_t is defined to be 1 for the period 3:1983 to 4:1992, and 0 otherwise, and SF_t is 1 for the period 1:1973 to 2:1983, and 0 otherwise.

[36] Since these are numerous, we report them only when they are significant at the five percent level when entered, one at a time, into a model.

[37] Watts and Mitchell (1990b) use: phase 1, 2:1975 to 2:1976, full quarterly indexation; phase 2, 3:1976 to 2:1978, partial and plateau quarterly indexation; phase 3, 3:1978 to 3:1979 full half-yearly indexation; phase 4, 4:1979 to 2:1981, partial half-yearly indexation. In the wages pause, 1:1983 and 2:1983, all wage increases were strongly discouraged.

Finally, we use a set of dummy variables to control for political strikes[38] and we also include seasonal dummies. All models are estimated using Microfit3 software.

3.4.1 Re-estimation of Bentley and Hughes' Model 27

The only changes we make to the model described in Equation (3.1), apart from those noted above, are to use working days lost per thousand employees for S_t, in place of their working days lost per hundred employees.[39] A linear model fails a Jarque-Bera test for the normality of residuals[40]; this deficiency persists in models which accommodate structural breaks, and which included pre-election, government and industrial relations policy dummies.

We then regress the logarithm of working days lost per thousand employees, LS_t, on the logarithm of the unemployment rate, LU_t, and changes in the logarithm of the unemployment rate, ΔLU_t. Although this model performs satisfactorily in the Jarque-Bera test, there is strong evidence of first order autocorrelation[41]; therefore, we re-estimate the model using the Cochrane-Orcutt procedure, and show the results in Table 3.3.

It is clear that neither LU_t nor ΔLU_t perform well in explaining variation in strikes. We then test the model for structural breaks and the parsimonious model derived from this procedure is shown in Table 3.4. We find no evidence of structural changes having occurred in the coefficients of the two unemployment

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[38]We include the three political strikes used by Beggs and Chapman (1987a), and described in footnote 26. We also include a dummy for the strike in protest at the introduction of the 1991 N.S.W. Industrial Relations Bill in 4:1991, and another for the state-wide protest in Victoria directed at proposed changes in state industrial relations policy in 4:1992.

[39]This change re-scales the parameters of the model, but does not affect whether any regressor is significant.

[40]$CHI\text{-}SQ_2$ = 449.7147[.000]).

[41]DW = 0.87326, $CHI\text{-}SQ_1$ = 47.8696[.000] and $F_{1,121}$ = 68.0395[.000].

regressors, but we find the stagflation intercept dummy, SF_t, to be significant, and the association with strikes to be positive. The coefficient of LU_t is negative and significantly different from zero at the one percent level, which gives some support to the business cycle hypothesis; we are unable, however, to find any evidence of the significance of ΔLU_t.[42]

The coefficient of SF_t suggests that working days lost per employee are, on average, higher in the stagflation period, after controlling for other factors; viewed another way, the Accord period which follows coincides with an average reduction of 61.8 percent.[43] This Accord impact is broadly consistent with the estimates of Beggs and Chapman (1987b and c) and Morris and Wilson (1994).

3.4.2 Re-estimation of Phipps' Model 28

We attempt to re-estimate Phipps' theoretically derived strikes model

$$s_t = \alpha_0 + \alpha_1 \sum_{i=0}^{\infty} k_i p_{t-i} + \alpha_2 (v-u)_t + \alpha_3 \pi_{t-1} + \alpha_4 T_t + \epsilon_t \qquad (3.21)$$

where for s_t, we replace the much criticised seasonally adjusted number of strikes per ten thousand employees, with working days lost per thousand employees, and use dummy variables to control for seasonality. p_t is the rate of inflation, v_t the job vacancies rate, u_t the unemployment rate, and π_t the ratio of profits to the wages bill. A trend term, T_t, is added, to, as Phipps put it, 'gauge whether or not there had been an increase in trade union militancy'. [p 313] We also include the political strike dummy variables used in the re-estimation of Bentley and Hughes' model.

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[42]Estimation using the Cochrane-Orcutt procedure assuming a first order autoregressive error process with $\rho = 0.3984$, produces $t = -0.0394[.969]$ in a variable addition test.

[43]The multiplicative impact of $SF_t = 1$ is exp(0.96278) = 2.6190. The implied multiplicative impact after stagflation is 1/exp(0.96278) = 0.3818, so that reduction is 1 - 0.3818 = 0.6182 or 61.82 percent.

Although Phipps' strikes equation is part of a simultaneous equations model which he estimates using both 2SLS and 3SLS, the version reported in Table 3.5 uses OLS. We contend that his strikes equation does not exhibit problems of endogeneity and, therefore, estimation within a simultaneous equations framework is unwarranted. Clearly, strikes in the current period, S_t, do not affect profit lagged one quarter, π_{t-1}, nor is there a strong case that strikes have any impact on inflation, vacancies and unemployment, at least contemporaneously.[44]

The initial estimation the model shows evidence of first order autocorrelation.[45] We attempt to remedy this problem by assuming a structural break with the onset of stagflation, and with the introduction of the Accord, however the model remains plagued by non-normality of residuals, heteroskedasticity, and problems of functional form.[46]

A logarithmic version of the model also exhibits first order autocorrelation[47], however introducing a structural break via the inclusion of the Accord dummy, AC_t, and an interaction term between the trend and the Accord dummy, $AC*Time_t$, appears to rectify this problem. The use of a dummy for the second phase of the wages guidelines, G_{2t}, also improves the model.

The parsimonious version of the model is shown in Table 3.5. It should be noted that, whereas Phipps finds the coefficient of $(v-u)_t$ to be significantly

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[44]Nevertheless, we test the null hypothesis that inflation and the labour market variables are exogenous, and record a Wu-Hausman statistic in Table 3.5.

[45]DW = 1.4205, CHI-SQ$_1$ = 11.4919[.001], $F_{1,119}$ = 11.2547[.001].

[46]Jarque-Bera test, CHI-SQ$_2$ = 229.3894[.000]; heteroskedasticity test, CHI-SQ$_1$ = 11.3721[.001] and $F_{1,131}$ = 12.2484[.001]; RESET test, CHI-SQ$_1$ = 10.7293[.001] and $F_{1,111}$ = 9.7403[.002].

[47]DW = 1.4339, CHI-SQ$_1$ = 11.6609[.001], $F_{1,121}$ = 11.5333[.001].

different from zero, but with a counter-intuitive negative sign, the model we use here indicates that $L(v/u)_t$[48] is significant, and is positively signed. Further, the coefficient of the profit variable, $L\pi_{t-1}$, is not significantly different from zero[49], in contrast to Phipps, whose lagged profit variable, π_{t-1}, is significant. Although Phipp's theoretical model specified a distributed lag function of inflation, we follow his approach in his estimated equation in reporting only the use of Lp_t.

We use AC_t and $AC*Time_t$ to estimate the impact of the Accord on working days lost per employee. From the first quarter of the Accord onwards, there is a shift corresponding to an average reduction of 49.5 percent, and an additional reduction of 2.0 percent per quarter, on average[50]; the model suggests an initial decrease in strike activity, and a reversal of the rising trend evident in the pre-Accord period.

3.4.3 Re-estimation of Perry's Model 29

The model proposed by Perry is of the form

$$S = h(x,\ \dot{p},\ \Delta T) \tag{3.19}$$

where S is working days lost per worker per annum, x measures excess demand for labour, $\dot{p}$ the rate of change of prices, and ΔT the change in union density. In this re-estimation we use quarterly data, and include seasonal dummies, together with the five political dummies referred to earlier. Perry claims that the

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[48] $(v\text{-}u)_t$ takes on negative values for some periods, therefore we use the difference of the logarithms $Log(v_t) - Log(u_t) = Log(v_t/u_t) = L(v/u)_t$.

[49] t = -0.4214[.674] in a variable addition test.

[50] In period t = 97 (3:1983), the first quarter of the Accord, the multiplicative impact is exp(-0.041139 × 97 + 3.3072) = 0.5050. The coefficients of $TIME_t$ and $AC*TIME_t$ together imply a quarterly growth factor exp(0.021100 - 0.041139) = 0.9802, that is a negative growth of 1.98 percent per quarter.

unemployment rate lagged on quarter, $u_{t-1/4}$, and the difference between the job vacancies rate and the unemployment rate, also lagged one quarter, $(v-u)_{t-1/4}$, are equally good in explaining strikes; we use the former on the grounds of preferring simplicity.

In estimating a linear version of this model we find autocorrelation of the residuals.[51] The introduction of dummy variables to control for the impacts of stagflation, SF_t, the second phase of the wage guidelines, G_{2t}, the Accord, AC_t, and the 1974 federal election, P_{74t}, eliminates this autocorrelation; a Jarque-Bera test, however, indicates that the residuals are not normally distributed.[52] Therefore, we estimate a logarithmic variant of the model, and find that the residuals also show some evidence of autocorrelation[53], although other regression diagnostics appear to be satisfactory when OLS is used. We re-estimate this model using the Cochrane-Orcutt procedure, assuming first order autocorrelation of the residuals, and show the results in Table 3.6.

Perry's regressors remain significant over our longer sample period, and after changing from annual data to quarterly data. The addition of political regime, pre-election and industrial relations policy dummy variables, do not improve the goodness of fit of this model, but the inclusion of the stagflation dummy, SF_t, enhances the model's performance. This model is shown in Table 3.7.

Since we have defined SF_{t1} to take zero values from the commencement of the Accord onwards, the model suggests that the Accord reduces strikes to their

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[51] DW = 1.4270, CHI-SQ$_1$ = 11.4525[.001], $F_{1,120}$ = 11.3067[.001].

[52] CHI-SQ$_2$ = 565.3499[.000].

[53] DW = 1.5662, CHI-SQ$_1$ = 6.5041[.011], $F_{1,120}$ = 6.170[.014].

pre-stagflation level, after controlling for the effects of inflation, unemployment and changes in union density. The implied impact of the Accord is a reduction of strike activity of 42.8 percent[54], and this is in broad agreement with other estimates noted above.

3.4.4 Re-estimation of Beggs and Chapman's Model 30

In attempting to re-estimate Beggs and Chapman's preferred models for working days lost per thousand unionists, $(WI/U)_t$, and working days lost per worker involved, $(WDL/WI)_t$, we note that inventories, INV_t, is highly correlated with the time trend term, $TIME_t$[55]; consequently, we replace INV_t with its residual from trend, $INVRES_t$, to reduce multicollinearity amongst the regressors. The strikes incidence model we estimate is

$$(WI/U)_t = \beta_0 + \beta_1 INF_t + \beta_2 INVRES_t + \beta_3 OP_t + \beta_4 OT_t + \beta_5 TIME_t + \epsilon_t \qquad (3.20)$$

and the average strike duration model is

$$(WDL/WI)_t = \gamma_0 + \gamma_1 PROF_t + \gamma_2 VAC_t + \gamma_3 TIME_t + \mu_t \qquad (3.21)$$

to which we add seasonal and political strike dummies, and the Accord dummy AC_t. In both linear estimated models, Jarque-Bera tests suggest strongly that the residuals are not normally distributed[56]; therefore, we estimate logarithmic models which appear to mitigate this problem.

Beggs and Chapman test the hypothesis that inflation, profit and overtime

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[54]The multiplicative impact of the Accord is 1/exp(0.55877) = 0.572, so the reduction is 1 - 0.527 = 0.428 or 48.2 percent.

[55]The Pearson correlation coefficient between INV_t and $TIME_t$ is -0.9603, over the period 3:1959 to 4:1992.

[56]For $(WI/U)_t$, $CHI\text{-}SQ_2$ = 76.4220[.000], and for $(WDL/WI)_t$, $CHI\text{-}SQ_2$ = 47.0295[.000]. Beggs and Chapman appear not to have tested the normality of their residuals.

are exogenous; we repeat these tests and conclude that endogeneity does not emerge as a problem when the data is extended beyond that used in their model.[57]

In the model of workers involved per thousand unionists, shown in Table 3.8, we find that the coefficients of the inflation, inventories and overtime regressors, have the signs expected *a priori*, and are significantly different from zero at the one percent level on one sided tests. The mis-information variable, LOP_t, performs poorly although its coefficient has the expected negative sign. Several factors may contribute to this difference between our finding, and that in the original Beggs and Chapman (1987a) paper: first, neither $LPROF_t$ nor LOT_t are trended in our data set, so LOP_t is the product of deviations from means, rather than from trends; second, we suspect Beggs and Chapman do not interpolate when constructing quarterly union membership, U_t, from the annual series; third, we utilise the NIF-10 inventories variable, INV_t, and use its residuals from trend, $LINVRES_t$; and fourth, we are unable to replicate the pre-1966 part of their series for overtime.[58] We note, however, that when the sample is restricted to that used by Beggs and Chapman, LOP_t is significant at the ten percent level on a one sided test.[59]

We delete the time trend, $TIME_t$, since it is not significant[60], and has no clearly identifiable theoretical justification. We improve the goodness of fit of the

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[57]We show the Wu-Hausman statistics in Tables 3.6-8.

[58]See Table 5.1 for details of the series we use.

[59]t = -1.60. The corresponding statistic recorded by Beggs and Chapman is t = -1.49, using OLS. In a linear version, we obtain t = -1.64.

[60]t = 1.0965[.275].

model by adding dummies for the second phase of the wage guidelines, G_{2t}, the wages pause, PA_t[61], and the Accord, AC_t.[62] We also explore the consequences of adding the profit variable, $LPROF_t$, which is specified in Beggs and Chapman's estimating model, but not contained in their preferred model; the coefficient is significantly different from zero at the ten percent level.[63]

In the logarithmic model of average strike duration shown in Table 3.9, we add an interaction term $AC*TIME_t$ to improve the goodness of fit. Although the Jarque-Bera statistic is better than in the linear model, there is overwhelming evidence that the residuals are not normally distributed, and this casts doubt on the validity of the t values. This aside, the coefficients of $LPROF_t$ and $LVAC_t$ are significantly different from zero at the five and ten percent levels, respectively, on one sided tests, and both have the signs expected *a priori*. Since Beggs and Chapman find these regressors to be significant at the one percent level, we re-estimate the model restricting the sample to the pre-Accord period; both variables are significant at the five percent level.[64]

We find support for the positive trend in average strike duration identified by Beggs and Chapman, prior to the Accord period, but note that a reversal appears to have occurred during the Accord period. In the earlier period the trend

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[61]PA_t = 1 for 1:1983 and 2:1983, 0 otherwise.

[62]Although R^2 in this model is much less than the 0.74 reported by Beggs and Chapman, much of the difference occurs because we use a logarithmic specification. The *quasi*-R^2 in our model is 0.72.

[63]t = 1.8310[.070]. When we add $LPROF_t$ to the logarithmic version of Beggs and Chapman's original model, and restrict the sample to the pre-Accord period, t = 2.7068[.008]; so the profit variable is highly significant, with a positive sign which is contrary to their hypothesised negative sign.

[64]For $LPROF_t$, t = -2.15[.0316], and for $LVAC_t$, t = 2.03[.0424]. The corresponding statistics of Beggs and Chapman in their linear model are t = -2.43[.0150] and t = 2.76[.0058].

rate of growth is 0.88 percent per quarter, and in the latter, -1.71 percent per quarter.[65]

We test whether the inclusion of the inflation and inventories variables suggested by Beggs and Chapman in their estimating model, but not used in their preferred model, might improve the goodness of fit. Both $LINF_t$ and $LINVRES_t$ are not significant, and their coefficients are opposite in sign to those expected *a priori*.[66]

Finally, we estimate a logarithmic version of the model of working days lost per unionist, $L(WDL/U)_t$, implied by Beggs and Chapman's separate models of $(WI/U)_t$ and $(WDL/WI)_t$. The model is

$$L(WDL/U)_t = \beta_0 + \beta_1 LINF_t + \beta_2 LINVRES_t + \beta_3 LOP_t + \beta_4 LOT_t + \beta_5 LPROF_t + \beta_6 LVAC_t + \beta_7 TIME_t + \epsilon_t \qquad (3.25)$$

and is augmented by political and seasonal dummies, industrial relations policy dummies, and an interaction term $AC{*}TIME_t$, to improve the goodness of fit. The expected coefficient signs are β_1, β_2, β_4, $\beta_6 > 0$, and β_3 and $\beta_5 < 0$.

The estimated model is shown in Table 3.10. All but one of the economic regressors are significant at the five percent level on one sided tests, and the signs of the coefficients are those expected by Beggs and Chapman; the exception is $LPROF_t$, the coefficient of which is positive.

This model suggests that the second phase of the wage guidelines reduced

[65]In the pre-Accord period, the multiplicative impact is exp(0.0087462) = 1.0088 or 0.88 percent per quarter, and during the Accord period, exp(0.0087462 - 0.026026) = 0.9829 or -1.71 percent per quarter. The coefficient of AC_t indicates an increase in strike duration in the first few quarters of the Accord; in the first quarter, exp(2.6179 - 0.026026 $\times$ 97) = 1.098, indicating a 9.8 percent increase.

[66]For $LINF_t$, t = -0.2782[.781], and for $LINVRES_t$, t = -1.5129[.133].

working days lost per unionist by 36.1 percent[67], on average and after controlling for other factors. The introduction of the Accord coincides with a reduction of 49.8 percent in the first quarter, and following this, a declining trend of 0.4 percent per quarter.[68]

3.4.5 Re-estimation of the Beggs and Chapman's Model 31

We re-estimate the model proposed by Beggs and Chapman (1987b and c) which they use for international comparisons of strikes during the first three years of the Accord. The model of working days lost per thousand employees, $L(WDL/E)_t$, is

$$L(WDL/E)_t = \beta_0 + \beta_1 L(INF)_t + \beta_2 L(UN)_t + \beta_3 TIME_t + \beta_4 AC_t + \epsilon_t \qquad (3.26)$$

where $L(INF)_t$ is the logarithm of the inflation rate[69], and $L(UN)_t$ the logarithm of the unemployment rate. Since we use quarterly data, in contrast to the annual data used in the original model, we add seasonal dummies, and the political strikes dummies noted earlier.

We replace their dummy, $D8385_{it}$, used to control for an hypothesised world-wide autonomous reduction in strikes during 1983-85 in thirteen OECD countries, with the Accord dummy, AC_t. We note a structural break in the trend at the commencement of the Accord, and introduce the interaction term $AC{*}TIME_t$,

[67]The multiplicative impact of G_{2t} is exp(-0.4485) = 0.6385 or a 36.15 percent decrease.

[68]The multiplicative impact in 3:1983 is exp(1.6503 - 0.024121 × 97) = 0.5019 or a -49.81 percent decrease. The quarterly impact of the trend is exp(0.019825 - 0.024121) = 0.9957 or -0.43 percent per quarter.

[69]In the quarterly model, since INF_t is not always positive, we define $L(INF_t) = Log(CPI_t) - Log(CPI_{t-1}) = Log(CPI_t/CPI_{t-1}) = Log(1 + INF_t)$ where INF_t is the rate of inflation.

which improves the goodness of fit of the model substantially.[70]

The estimated model is shown in Table 3.11. The coefficients of both *L(INF$_t$)* and *L(UN$_t$)* are significantly different from zero at the one percent level, and have the signs expected *a priori*. The coefficients of the Accord dummy, AC_t, and interaction variable, $AC*TIME_t$, suggest that the impact of the Accord is a reduction in working days lost per employee of 41.1 percent in the first quarter, and afterwards declining by 2.3 percent per quarter, on average, and after controlling for other factors.[71]

3.5 Summary

In this Chapter we set out to summarise and make some observations regarding previous Australian time-series models of strikes; in particular we examine the evidence regarding theories of strikes embodied in those models. This, of course, is problematic since, as Mumford (1993) points out, the significance of any proxy may be claimed to support more than one hypothesis.

Bentley and Hughes (1970) use a comparatively simple regression model to show that strike activity in Australia is pro-cyclical. They then advance some intuitively appealing reasons which underlie this observed phenomenon. Oxnam (1953) adopts a similar approach, but his work pre-dates the common usage of regression models and his statistical analysis is rudimentary.

Unlike other Australian researchers, Phipps (1977) follows the approach

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[70]Adjusted-R^2 increases from 0.5570 to 0.6269, and the regression standard error decreases from 0.4840 to 0.4448. The model not including $AC*TIME_t$ appears to exhibit first order autocorrelation (DW = 1.6081, $CHI\text{-}SQ_1$ = 5.7122[.017], and $F_{1,120}$ = 5.3432[.023]), and is therefore estimated using the Cochrane-Orcutt procedure.

[71]The multiplicative impact in the first period of the Accord is exp(3.8759 - 0.04542 × 97) = 0.5887 or a reduction of 41.13 percent. Afterwards, the extra impact is exp(0.02181 - 0.04542) = 0.9767 or -2.33 percent per quarter.

established by Ashenfelter and Johnson (1969) in which behavioural assumptions regarding employers and unions are made, and from which conditions that determine the probability of a strike occurring are derived mathematically. Phipps assumes that firms maximise profit subject to a constraint imposed by a union concession curve, and introduces the proposition that strikes are more likely to occur when there is a difference in expectations regarding inflation between employers and employees. Following this, he selects proxies to formulate an "empirical counterpart" and estimates a regression equation to model strikes.

After Phipps, we observe what may be reasonably described as the eclectic approaches of Perry (1978a and b), Beggs and Chapman (1987a), Beggs and Chapman (1987b and c), and Chapman and Gruen (1991). In these we see regression equations based on various business cycle proxies, and which are augmented by regressors derived from other theoretical models. Perry includes a union density variable to model changes in union power, Beggs and Chapman (1987a) embrace mis-information, muscle-flexing and employer provocation proxies, and Beggs and Chapman (1987b and c) and Chapman and Gruen (1991) use mis-information variables. The observation that these researchers do not develop and test a new theory of strikes is not a criticism of their work, because this is not their purpose. Perry seeks to establish whether Australian data supports Hines' hypothesis, while later Australian models investigate the impact of the Accord on strikes; none of this suggests that a new model is required, nor that an eclectic approach is not the most appropriate.

Following a review of previous Australian work, we attempt to re-estimate as closely as possible these models, using data from the period 3:1959 to 4:1992.

Due to difficulties in reconstructing some of the original data sets, we do not reproduce the regressions shown in Section 3.3. We are, therefore, denied the interesting task of subjecting those regressions to the diagnostic tests which are now *de rigueur*. This, of course, is not an implied condemnation of researchers of the past, who were constrained to use what are now thought to be primitive computing techniques, and were unable to use modern diagnostic procedures; however, the question remains as to whether the original data would still support the hypotheses of those researchers.

In a bid to confirm the significance of the variables in these models, we use different, but similar, data, and make reasonable adjustments to the models to satisfy diagnostic tests. Broadly, we find verification of the original results, however we note several differences. A comparison is summarised in Table 3.12. In Bentley and Hughes' Model 27, the change in the unemployment rate is not significant, so eliminating the need for a creative explanation of the positive and significant coefficient originally found. In Phipps Model 28, we confirm the significance of inflation, and profit lagged one quarter. Importantly, the labour market variable which Phipps rejects because its coefficient is significant, but negatively signed, we find to be significant and having a positive sign consistent with *a priori* expectations. In Perry's Model 29, the same variables, namely inflation, unemployment and changes in union density, are significant and have coefficients with the same signs.

In Beggs and Chapman's Model 30, in the incidence equation we confirm the significance of inflation, inventories and overtime, however the mis-information variable, OP_t, which is significant at the ten percent level in the original model, performs poorly in the re-estimated version. In the average duration equation, we verify the significance of profits, but find that the job vacancies variable is only significant at the ten percent level, compared with one percent in the original estimation. In Beggs and Chapman's Model 31, we corroborate the significance of the unemployment and inflation variables.

Our inability to refute, fully, the worth of any model, is strongly suggestive of the value of using an eclective modelling framework and that, theoretically, strikes have no single cause (which, of course, should not cause surprise). Taken together, these re-estimations provide general support for the propositions that the business cycle, mis-information and changes in union density are important in explaining Australian strikes.

All re-estimated models strongly support the proposition that the Accord reduces the incidence of Australian strikes, and there is some evidence that the second phase of the wages guidelines has a similar effect. The estimated reductions (percent) in strike activity attributed to the Accord in the re-estimated models are as follows:

Model	Dep Var	Constant	Per Quarter
27 Bentley and Hughes	*WDL/E*	61.8	
28 Phipps	*WDL/E*	49.5	2.0
29 Perry	*WDL/E*	42.8	
30 Beggs and Chapman	*WI/U*	40.5	
30 Beggs and Chapman	*WDL/WI*	-9.8	2.3
30 Beggs and Chapman	*WDL/U*	49.8	0.4
31 Beggs and Chapman	*WDL/E*	41.1	2.3

The impact of the Accord suggested by these models is a reduction in strike activity of between 40 and 60 percent, in broad terms and after controlling for other factors in the models; this, of course, does not establish cause and effect. In Chapter 5, however, we suggest that these results overstate the true impact of the Accord.

There is little indication in these models that some federal governments have been more strike-prone than others, and little evidence that federal elections have been important in either moderating or intensifying strike activity.

In the next chapter, we develop a theoretical model of strikes which proposes that an important consideration for a union contemplating a strike action, is the possible shedding of labour if higher wages and strikes lead to reduced sales. This cost depends on the likely duration of the unemployment of retrenched employees, and wage losses during unemployment and subsequent re-employment. Bentley and Hughes (1970), Phipps (1977), Perry (1978), Beggs and Chapman (1987b and c) and Chapman and Gruen (1991) all include unemployment variables in their estimated models, as do many overseas researchers; in all instances, unemployment is used as a business cycle proxy with the underlying rationale that in the boom, union power is greater and the potential for securing higher earnings is increased.

In this and the previous chapter, we describe important contributions to economic explanations of strikes beginning with business cycle analyses, followed by the wage determination model of Hicks (1932), the "political" model of Ashenfelter and Johnson (1969), imperfect and asymmetric information models, and joint cost models. None of these give more than passing reference to the relationship between strikes, wage increases and employment levels. Hieser (1970) and Johnston (1972) make explicit the prospect of labour shedding, but make the improbable assumption that retrenched employees remain unemployed and receive no income. As far as we are aware, no theoretical model hitherto uses an unemployment variable to model strike costs to displaced employees. This neglect is surprising on at least two counts: first, it is a tenet of microeconomic theory, that "union wages" lead to lower levels of employment in unionised workplaces; and second, in many instances the cost of lost earnings during a strike may be small, whereas the cost of retrenchments may be substantial.

Also in Chapter, 4 we extend the theoretical model of strikes to include other forms of industrial actions. In Chapter 5 we develop a macroeconomic time-series model of Australian strikes. In Chapter 6 we produce microeconomic cross-sectional models which enable us to focus on retrenchment costs suggested by local labour market conditions, and to examine differences according to the ownership status of the workplace. In Chapter 7 we construct microeconomic cross-sectional models of industrial action and different kinds of non-strike industrial action. In these chapters we take an eclectic approach to empirical modelling, and include variables suggested by the new model in Chapter 4.

Table 3.1: Australian, US and British Strikes, 1962-81

Country	Working Days Lost per 100,000 employees	Number of Strikes per 1,000 employees	Working Days Lost per Worker Involved
Australia	4.79	0.45	2.1
US	4.74	0.06	17.3
Britain	3.86	0.11	6.2

Source: Hancock (1985) [p 133].

Table 3.2: Causes of Australian Strikes: 1982-92

Cause	Frequency (%)	Working Days Lost (%)
Wages	13.4	23.3
Hours of Work	2.8	4.7
Managerial Policy	41.9	40.2
Physical Working Conditions	20.1	10.6
Trade Unionism	13.6	4.9
Other (Including Leave)	8.2	16.3
Total	100.0	100.0
Wage-like Issues[1]	36.3	38.6
Wage-like Issues[2]	44.5	54.9

Source: ABS, Cat. No. 6332.0.

Notes: 1 Wages, hours of work and physical working conditions.

2 Wages, hours of work, physical working conditions and other.

Table 3.3: Bentley and Hughes' Model 27
Dependent Variable: LS_t
Estimation Method: Cochrane-Orcutt

Regressor	Coefficient	Std Error	t-Ratio[Prob]
INPT	3.4587	0.7156	4.8330[.000]
LU_t	-0.2800	0.2164	-1.2938[.198]
ΔLU_t	-0.0512	0.4914	-0.1040[.917]
P_{1t}	1.0246	0.4527	2.2630[.025]
P_{2t}	1.0859	0.4559	2.3821[.019]
P_{3t}	0.9254	0.4525	2.0450[.043]
P_{4t}	1.4288	0.4526	3.1567[.002]
P_{5t}	2.2088	0.5799	3.8088[.000]
S_{1t}	-0.3417	0.0978	-3.4942[.001]
S_{3t}	0.1068	0.0986	1.0831[.281]
S_{4t}	-0.1873	0.11311	-1.6561[.100]

R-Sq	0.4950	$F_{11,120}$	10.6942[.000]
Adj R-Sq	0.4487	SE	0.5383
Resid SS	34.7713	Mean Dep Var	4.3045
SD Dep Var	0.7273	Max Log-likelihood	-99.2552
DW	2.4729		

Diagnostic Tests

Test Statistics	LM Version		F Version	
Serial Cor(1)	CHI-SQ_1	8.0039[.005]	$F_{1,120}$	7.7459[.006]
Serial Cor(4)	CHI-SQ_4	22.8097[.000]	$F_{4,117}$	6.1103[.000]
Funct Form	CHI-SQ_1	2.9510[.086]	$F_{1,120}$	2.7440[.100]
Normality	CHI-SQ_2	6.7218[.035]	Not applicable	
Hetero	CHI-SQ_1	0.6462[.421]	$F_{1,130}$	0.6396[.425]
ARCH(1)	CHI-SQ_1	0.2231E-4[.996]	$F_{1,120}$	0.2028E-4[.996]
ARCH(4)	CHI-SQ_4	0.2182[.994]	$F_{4,117}$	0.0484[.996]

Autoregressive Error Specification, t-Ratio[Prob] in parenthesis

$$\mu_t = \underset{(9.22)[.000]}{0.67974}\ \mu_{t-1} + \epsilon_t$$

Notes: 1 Logarithmic transformations of the economic variables in the original model are used.

2 Diagnostic test statistics are those found by estimating the model using OLS, after transforming all variables according to $VAR_t^* = VAR_t - 0.67974\ VAR_{t-1}$.

Table 3.4: Bentley and Hughes' Model 27 - Parsimonious Version
Dependent Variable: LS_t
Estimation Method: Cochrane-Orcutt

Regressor	Coefficient	Std Error	t-Ratio[Prob]
$INPT$	3.0911	0.38943	7.9375[.000]
LU_t	-0.2948	0.1117	-2.6381[.009]
P_{1t}	1.0803	0.4674	2.3112[.022]
P_{2t}	0.9918	0.4669	2.1244[.036]
P_{3t}	0.9459	0.4664	2.0281[.045]
P_{4t}	1.3307	0.4671	2.8488[.005]
P_{5t}	1.8351	0.5366	3.4193[.001]
S_{1t}	-0.3385	0.1025	-3.3024[.001]
S_{3t}	0.1402	0.1036	1.3528[.179]
S_{4t}	-0.1648	0.1154	-1.4277[.156]
SF_t	0.9627	0.1577	6.1053[.000]

R-Sq	0.5750	$F_{11,121}$	14.8846[.000]
Adjn R-Sq	0.5364	SE	0.4951
Resid SS	29.6679	Mean Dep Var	4.2982
SD Dep Var	0.7281	Max Log-likelihood	-88.9500
DW	2.1909		

Diagnostic Tests

Test Statistics	LM Version		F Version	
Serial Cor(1)	CHI-SQ$_1$	1.4174[.234]	$F_{1,121}$	1.3034[.256]
Serial Cor(4)	CHI-SQ$_4$	12.1593[.016]	$F_{4,118}$	2.9684[.022]
Funct Form	CHI-SQ$_1$	1.5251[.217]	$F_{1,121}$	1.4036[.238]
Normality	CHI-SQ$_2$	2.5186[.284]	Not applicable	
Hetero	CHI-SQ$_1$	1.8394[.175]	$F_{1,131}$	1.8371[.178]
ARCH(1)	CHI-SQ$_1$	0.2007[.654]	$F_{1,121}$	0.1829[.670]
ARCH(4)	CHI-SQ$_4$	3.1587[.532]	$F_{4,118}$	0.7176[.581]

Autoregressive Error Specification, t-Ratio[Prob] in parenthesis

$$\mu_t = \underset{(4.68)[.000]}{0.41014}\ \mu_{t-1} + \epsilon_t$$

Notes: 1 We accommodate a structural break in the period 1:1973 to 2:1983.

2 Diagnostic test statistics are those found by estimating the model using OLS, after transforming all variables according to $VAR_t^* = VAR_t - 0.41014\ VAR_{t-1}$.

Table 3.5: Phipps' Model 28 - Parsimonious Version
Dependent Variable: Ls_t
Estimation Method: Ordinary Least Squares

Regressor	**Coefficient**	**Std Error**	***t*-Ratio[Prob]**
INPT	3.5061	0.1240	28.2602[.000]
Lp_t	13.4052	4.6057	2.9106[.004]
$L(v/u)_t$	0.2911	0.0644	4.5165[.000]
$Time_t$	0.0211	0.0031	6.6704[.000]
$AC*Time_t$	-0.0411	0.0077	-5.2855[.000]
P_{1t}	0.9119	0.4462	2.0437[.043]
P_{2t}	1.4578	0.4701	3.1009[.002]
P_{3t}	0.9730	0.4460	2.1813[.031]
P_{4t}	1.5048	0.4616	3.2595[.001]
P_{5t}	1.7291	0.4688	3.6877[.000]
S_{1t}	-0.3116	0.1094	-2.8484[.005]
S_{3t}	0.0912	0.1088	0.83868[.403]
S_{4t}	-0.2511	0.1108	-2.2654[.025]
G_{2t}	-0.3825	0.1797	-2.1286[.035]
AC_t	3.3072	0.8458	3.9100[.000]

R-Sq	0.6821	$F_{14,119}$	18.2390[.000]
Adj R-Sq	0.6447	SE Regression	0.4340
Resid SS	22.4181	Mean Dep Var	4.2982
SD Dep Var	0.7281	Max Log-likelihood	-70.3437
DW	1.8183		

Diagnostic Tests

Test Statistics	**LM Version**		***F* Version**	
Serial Corr(1)	$CHI\text{-}SQ_1$	1.1816[.277]	$F_{1,118}$	1.0498[.308]
Serial Corr(4)	$CHI\text{-}SQ_4$	4.1733[.383]	$F_{4,115}$	0.9241[.453]
Funct Form	$CHI\text{-}SQ_1$	1.3470[.246]	$F_{1,118}$	1.1982[.276]
Normality	$CHI\text{-}SQ_2$	3.2590[.196]	Not applicable	
Hetero	$CHI\text{-}SQ_1$	0.8126[.367]	$F_{1,132}$	0.8053[.371]
ARCH(1)	$CHI\text{-}SQ_1$	0.1563[.693]	$F_{1,118}$	0.1378[.711]
ARCH(4)	$CHI\text{-}SQ_4$	3.8281[.430]	$F_{4,115}$	0.8454[.499]
Wu-Hausman	$CHI\text{-}SQ_2$	2.1615[.339]	$F_{2,115}$	0.9572[.387]

Notes:
1. Logarithmic transformations are taken of the economic variables in the original model.
2. A structural break occurs in the trend at 3:1983
3. A dummy variable is used to control for the impact of the second phase of the wages guidelines during 3:1976 to 2:1978.

Table 3.6: Perry's Model 29
Dependent Variable: LS_t
Estimation Method: Cochrane-Orcutt

Regressor	**Coefficient**	**Standard Error**	***t*-Ratio[Prob]**
$INPT$	3.3462	0.3453	9.6894[.000]
$\Delta L\dot{p}_t$	23.5389	5.1790	4.5450[.000]
Lu_{t-1}	-0.2157	0.0935	-2.3058[.023]
ΔLT_t	10.9833	3.1136	3.5275[.001]
P_{1t}	1.1622	0.4877	2.3830[.019]
P_{2t}	1.3188	0.4882	2.7011[.008]
P_{3t}	1.0661	0.4863	2.1919[.030]
P_{4t}	1.1405	0.4870	2.3416[.021]
P_{5t}	1.9763	0.5320	3.7148[.000]
S_{1t}	-0.2702	0.1097	-2.4632[.015]
S_{3t}	0.1204	0.1098	1.0967[.275]
S_{4t}	-0.2469	0.1224	-2.0164[.046]

R-Sq	0.5735	$F_{12,119}$	13.3369[.000]
Adj R-Sq	0.5305	SE	0.4967
Resid SS	29.3649	Mean Dep Var	4.3045
SD Dep Var	0.7272	Max Log-likelihood	-88.1018
DW	2.0844		

Diagnostic Tests

Test Statistics	**LM Version**		***F* Version**	
Serial Cor(1)	CHI-SQ$_1$	0.2902[.590]	$F_{1,119}$	0.2622[.610]
Serial Cor(4)	CHI-SQ$_4$	6.4462[.168]	$F_{4,116}$	1.4889[.210]
Funct Form	CHI-SQ$_1$	2.9686[.085]	$F_{1,119}$	2.7378[.101]
Normality	CHI-SQ$_2$	2.0077[.366]	Not applicable	
Hetero	CHI-SQ$_1$	0.3275[.567]	$F_{1,130}$	0.3233[.571]
ARCH(1)	CHI-SQ$_1$	0.8762[.349]	$F_{1,119}$	0.7952[.374]
ARCH(4)	CHI-SQ$_4$	2.0907[.719]	$F_{4,116}$	0.4667[.760]

Autoregressive Error Specification, t-Ratio[Prob] in parenthesis

$$\mu_t = \underset{(3.06)[.003]}{0.29051}\ \mu_{t-1} + \epsilon_t$$

Notes: 1 Logarithmic transformations are taken of the economic variables in the original model.

2 Diagnostic test statistics are those found by estimating the model using OLS, after transforming all variables according to $VAR_t^* = VAR_t - 0.29051\ VAR_{t-1}$.

Table 3.7: Perry's Model 29 - Parsimonious Version
Dependent Variable: LS_t
Estimation Method: Cochrane-Orcutt

Regressor	**Coefficient**	**Standard Error**	***t*-Ratio[Prob]**
$INPT$	3.1000	0.3187	9.7271[.000]
$\Delta L\dot{p}_t$	15.3623	5.4128	2.8381[.005]
Lu_{t-1}	-0.2688	0.0854	-3.1452[.002]
ΔLT_t	7.4993	3.0095	2.4919[.014]
P_{1t}	1.1777	0.4714	2.4980[.014]
P_{2t}	1.0993	0.4733	2.3226[.022]
P_{3t}	0.9996	0.4702	2.1259[.036]
P_{4t}	1.1848	0.4712	2.5144[.013]
P_{5t}	1.8672	0.5129	3.6403[.000]
S_{1t}	-0.2909	0.1070	-2.7175[.008]
S_{3t}	0.1376	0.1071	1.2847[.201]
S_{4t}	-0.2081	0.1187	-1.7529[.082]
SF_t	0.5587	0.1562	3.5762[.001]

R-Sq	0.6150	$F_{13,118}$	14.5051[.000]
Adj R-Sq	0.5726	SE	0.4739
Residual SS	26.5039	Mean Dep Var	4.3045
SD Dep Var	0.7272	Max Log-likelihood	-81.3362
DW	2.0620		

Diagnostic Tests

Test Statistics	**LM Version**		***F* Version**	
Serial Cor(1)	$CHI\text{-}SQ_1$	0.1529[.696]	$F_{1,118}$	0.1368[.712]
Serial Cor(4)	$CHI\text{-}SQ_4$	4.5932[.332]	$F_{4,115}$	1.0365[.392]
Funct Form	$CHI\text{-}SQ_1$	2.9111[.088]	$F_{1,118}$	2.6610[.106]
Normality	$CHI\text{-}SQ_2$	0.3582[.836]	Not applicable	
Hetero	$CHI\text{-}SQ_1$	0.5375[.463]	$F_{1,130}$	0.5315[.467]
ARCH(1)	$CHI\text{-}SQ_1$	0.7952[.373]	$F_{1,118}$	0.7151[.399]
ARCH(4)	$CHI\text{-}SQ_4$	2.3512[.671]	$F_{4,115}$	0.5213[.720]

Autoregressive Error Specification, *t*-Ratio[Prob] in parenthesis

$$\mu_t = 0.24323\,\mu_{t-1} + \epsilon_t$$
(2.59)[.011]

Notes: 1 The model accommodates a structural break during the period 1:1973 to 2:1983.

2 Diagnostic test statistics are those found by estimating the model using OLS, after transforming all variables according to $VAR_t^* = VAR_t - 0.24323\ VAR_{t-1}$.

Table 3.8: Beggs and Chapman's Model 30 - Strike Incidence
Dependent Variable: *L(WI/U)*,
Estimation Method: Ordinary Least Squares

Regressor	Coefficient	Standard Error	*t*-Ratio[Prob]
$INPT$	4.1786	0.1123	37.1789[.000]
$LINF_t$	16.8618	3.9718	4.2454[.000]
$LINVRES_t$	2.7440	1.1644	2.3566[.020]
LOP_t	-0.0196	0.0262	-0.7489[.455]
LOT_t	0.7026	0.2803	2.5066[.014]
P_{1t}	1.3970	0.4632	3.0159[.003]
P_{2t}	2.0978	0.4929	4.2555[.000]
P_{3t}	1.2648	0.4662	2.7126[.008]
P_{4t}	1.8799	0.4713	3.9884[.000]
P_{5t}	2.3270	0.4760	4.8877[.000]
S_{1t}	-0.3733	0.1141	-3.2719[.001]
S_{3t}	0.0316	0.1141	0.2776[.782]
S_{4t}	-.41808	0.1158	-3.6100[.000]
G_{2t}	-0.5517	0.1945	-2.8365[.005]
PA_t	-0.9688	0.3340	-2.9002[.004]
AC_t	-0.5197	0.0995	-5.2222[.000]

R-Sq	0.6066	$F_{15,118}$	12.1315[.000]
Adj R-Sq	0.5566	SE	0.4533
Resid SS	24.2538	Mean Dep Var	4.2525
SD Dep Var	0.6808	Max Log-likelihood	-75.6168
DW	1.7362		

Diagnostic Tests

Test Statistics	LM Version		F Version	
Serial Cor(1)	CHI-SQ$_1$	2.2359[.135]	$F_{1,117}$	1.9853[.161]
Serial Cor(4)	CHI-SQ$_4$	7.0032[.136]	$F_{4,114}$	1.5716[.187]
Funct Form	CHI-SQ$_1$	0.6132[.434]	$F_{1,117}$	0.5379[.465]
Normality	CHI-SQ$_2$	1.7544[.416]	Not applicable	
Hetero	CHI-SQ$_1$	0.9681[.325]	$F_{1,132}$	0.9606[.329]
ARCH(1)	CHI-SQ$_1$	2.8959[.089]	$F_{1,117}$	2.5843[.111]
ARCH(4)	CHI-SQ$_4$	6.6205[.157]	$F_{4,114}$	1.4813[.212]
Wu-Hausman	CHI-SQ$_2$	2.7974[.247]	$F_{2,114}$	1.2341[.295]

Notes: 1 Logarithmic transformations of the economic variables are taken.

2 Inventories are replaced by its residual from trend.

Table 3.9:	Beggs and Chapman's Model 30 - Average Strike Duration Dependent Variable: $L(WDL/WI)_t$ Estimation Method: Ordinary Least Squares		
Regressor	**Coefficient**	**Standard Error**	***t*-Ratio[Prob]**
INPT	-0.3188	0.4359	-0.7314[.466]
$LPROF_t$	-0.6956	0.3482	-1.9976[.048]
$LVAC_t$	0.1267	0.0813	1.5577[.122]
P_{1t}	-0.1952	0.3301	-0.5913[.555]
P_{2t}	-0.4757	0.3286	-1.4477[.150]
P_{3t}	-0.4868	0.3296	-1.4769[.142]
P_{4t}	-0.3317	0.3426	-0.9681[.335]
P_{5t}	-0.4070	0.3467	-1.1740[.243]
S_{1t}	0.0677	0.0805	0.8409[.402]
S_{3t}	0.0331	0.0806	0.4108[.682]
S_{4t}	0.1311	0.0819	1.6000[.112]
$TIME_t$	0.0087	0.0016	5.2445[.000]
AC_t	2.6179	0.5915	4.4253[.000]
$AC{*}TIME_t$	-0.0260	0.0053	-4.8587[.000]

R-Sq	0.4340	$F_{13,120}$	7.0791[.000]
Adj R-Sq	0.3727	SE	0.3217
Resid SS	12.4245	Mean Dep Var	0.6440
SD Dep Var	0.4062	Max Log-likelihood	-30.8004
DW	1.9581		

Diagnostic Tests

Test Statistics	**LM Version**		***F* Version**	
Serial Cor(1)	CHI-SQ$_1$	0.0561[.813]	$F_{1,119}$	0.0499[.824]
Serial Cor(4)	CHI-SQ$_4$	0.6900[.321]	$F_{4,116}$	1.0518[.384]
Funct Form	CHI-SQ$_1$	1.7203[.190]	$F_{1,119}$	1.5476[.216]
Normality	CHI-SQ$_2$	20.8666[.000]	Not applicable	
Hetero	CHI-SQ$_1$	0.0268[.870]	$F_{1,132}$	0.0264[.871]
ARCH(1)	CHI-SQ$_1$	0.1919[.661]	$F_{1,119}$	0.1707[.680]
ARCH(4)	CHI-SQ$_4$	8.0373[.090]	$F_{4,116}$	1.8504[.124]
Wu-Hausman	CHI-SQ$_1$	0.4627[.496]	$F_{1,117}$	0.4116[.522]

Notes: 1 Logarithmic transformations of the economic variables are taken.

2 A structural break in the trend occurs at 3:1983.

Table 3.10: Beggs and Chapman's Model 30 - Direct Estimation of Working Days Lost per Unionist
Dependent Variable: *L(WDL/U)*,
Estimation Method: Ordinary Least Squares

Regressor	Coefficient	Standard Error	*t*-Ratio[Prob]
INPT	8.2678	0.9823	8.4165[.000]
$LINF_t$	10.6296	5.1659	2.0576[.042]
$LINVRES_t$	2.4874	1.5040	1.6538[.101]
LOP_t	-0.0564	0.0260	-2.1664[.032]
LOT_t	-0.7358	0.3662	-2.0091[.047]
$LPROF_t$	0.8342	0.6324	1.3190[.190]
$LVAC_t$	0.7116	0.1483	4.7976[.000]
P_{1t}	0.9485	0.4373	2.1688[.032]
P_{2t}	1.5426	0.4636	3.3268[.001]
P_{3t}	1.0376	0.4387	2.3647[.020]
P_{4t}	1.5308	0.4539	3.3718[.001]
P_{5t}	1.8042	0.4644	3.8851[.000]
S_{1t}	-0.3504	0.1076	-3.2550[.001]
S_{3t}	0.0759	0.1067	0.7117[.478]
S_{4t}	-0.3010	0.1093	-2.7543[.007]
$TIME_t$	0.0198	0.0033	5.8479[.000]
G_{2t}	-0.4485	0.1869	-2.3992[.018]
AC_t	1.6503	0.9037	1.8260[.070]
$AC{*}TIME_t$	-0.0241	0.0088	-2.7230[.007]

R-Sq	0.7074	$F_{18,115}$	15.4483[.000]
Adj R-Sq	0.6616	SE	0.4242
Resid SS	20.7000	Mean Dep Var	4.8965
SD Dep Var	0.7293	Max Log-likelihood	-65.0016
DW	1.8514		

Diagnostic Tests

Test Statistics	LM Version		*F* Version	
Serial Cor(1)	CHI-SQ$_1$	0.8290[.363]	$F_{1,114}$	0.7097[.401]
Serial Cor(4)	CHI-SQ$_4$	4.7794[.311]	$F_{4,111}$	1.0264[.397]
Funct Form	CHI-SQ$_1$	1.4628[.226]	$F_{1,114}$	1.2582[.264]
Normality	CHI-SQ$_2$	2.1050[.349]	Not applicable	
Hetero	CHI-SQ$_1$	1.0906[.296]	$F_{1,132}$	1.0831[.300]
ARCH(1)	CHI-SQ$_1$	0.0551[.814]	$F_{1,114}$	0.0469[.829]
ARCH(4)	CHI-SQ$_4$	2.2550[.689]	$F_{4,111}$	0.4749[.754]
Wu-Hausman	CHI-SQ$_3$	0.7954[.851]	$F_{3,110}$	0.2223[.881]

Notes: 1 Logarithmic transformations of the economic variables are taken.

2 A structural break in the trend occurs at 3:1983.

3 Inventories are replaced with the residual of inventories from trend.

Table 3.11: Beggs and Chapman's Model 3[1]
Dependent Variable: $L(WDL/E)_t$
Estimation Method: Ordinary Least Squares

Regressor	Coefficient	Standard Error	t-Ratio[Prob]
$INPT$	0.8951	0.6305	1.4196[.158]
$L(INF_t)$	15.6163	4.5272	3.4494[.001]
$L(UN_t)$	-0.6563	0.1427	-4.5989[.000]
P_{1t}	0.9146	0.4575	1.9990[.048]
P_{2t}	1.1328	0.4548	2.4905[.014]
P_{3t}	1.0857	0.4564	2.3786[.019]
P_{4t}	1.4573	0.4720	3.0875[.003]
P_{5t}	1.7806	0.4812	3.6996[.000]
S_{1t}	-0.2917	0.1119	-2.6065[.010]
S_{3t}	0.1155	0.1113	1.0377[.301]
S_{4t}	-0.2192	0.1136	-1.9301[.056]
$TIME_t$	0.0218	0.0034	6.3408[.000]
AC_t	3.8759	0.9008	4.3027[.000]
$AC*TIME_t$	-0.0454	0.0083	-5.4713[.000]

R-Sq	0.6634	$F_{13,120}$	18.1924[.000]
Adj R-Sq	0.6269	SE	0.4447
Resid SS	23.7380	Mean Dep Var	4.2982
SD Dep Var	0.7281	Max Log-likelihood	-74.1767
DW	1.7617		

Diagnostic Tests

Test Statistics	LM Version		F Version	
Serial Cor(1)	CHI-SQ_1	2.0403[.153]	$F_{1,119}$	1.8399[.178]
Serial Cor(4)	CHI-SQ_4	6.7700[.149]	$F_{4,116}$	1.5431[.194]
Funct Form	CHI-SQ_1	1.4973[.221]	$F_{1,119}$	1.3447[.249]
Normality	CHI-SQ_2	3.7964[.150]	Not applicable	
Hetero	CHI-SQ_1	0.5129[.474]	$F_{1,132}$	0.5072[.478]
ARCH(1)	CHI-SQ_1	0.0596[.807]	$F_{1,119}$	0.0529[.818]
ARCH(4)	CHI-SQ_4	1.7355[.784]	$F_{4,116}$	0.3805[.822]

Notes: 1 Logarithmic transformations of the economic variables are taken.

2 There is a structural break in the trend at 3:1983.

Table 3.12: Economic Variables Used in Australian Strikes Estimating Models, Signs of Coefficients and Confirmation in Re-estimated Models, Sample 3:1959-4:1992

	Bentley and Hughes	**Phipps**	**Perry**	**Beggs and Chapman 1**	**Beggs and Chapman 1**	**Beggs and Chapman 2**
Original Sample	1:1952-4:1968	1:1960-4:1972	1953-1976	3:1959-1:1983	3:1959-1:1983	1964-1985
Dependent Variable	*Days Lost per Employee*	*Strikes per Employee*	*Days Lost per Employee*	*Workers Involved per Unionist*	*Average Duration*	*Days Lost per Employee*
Regressor						
Unemploy-ment rate	negative *confirmed*[1]		negative *confirmed*			negative *confirmed*
Change in unemploy-ment rate	negative insignificant *not confirmed*[2]					
Vacancy rate					positive *not confirmed*	
Vacancy rate minus Unemploy-ment rate		negative deleted *confirmed*				
Ratio of Profit to Wages		positive *not confirmed*		deleted[3] *not confirmed*	negative *confirmed*	
Inflation		positive *confirmed*	positive *confirmed*	positive *confirmed*	deleted *not confirmed*	positive *confirmed*
Union Density			positive *confirmed*			
Inventories				positive *confirmed*	deleted *not confirmed*	
Overtime				positive *confirmed*		
Profit and Overtime interaction				negative *not confirmed*[4]		
Trend	positive *not confirmed*	positive *confirmed*		negative insignificant *not confirmed*	positive *confirmed*	positive *confirmed*

Notes: 1 *confirmed* means significant in the re-estimated model and coefficient has the *a priori* sign.

2 *not confirmed* means not significant in the re-estimated model.

4. A Marshallian Approach to Modelling Industrial Disputes

4.1 Introduction

In this chapter we advance a new model of strikes and other forms of industrial action, based on some ideas suggested by Marshall (1920), and later, by efficiency wage models of the labour market. We do not, of course, claim to construct a general unified theory of industrial action; in particular, we do not attempt to explain union tactics which might best be regarded as short-term harassing manoeuvres prior to serious negotiations, or those concerned with union politics. Although the relationship between union wages and employment is well known, many contemporary bargaining models of strikes pay little attention to this matter; in this model we give it a pivotal role. We adapt the model to explain the use of non-strike action, and examine how unions choose between strike and non-strike action.

Marshall (1920) shows that unions trade employment losses for wage increases, and argues that unions are more likely to be successful when it is difficult to substitute other inputs for labour, demand in the product market is inelastic, union labour costs are a small proportion of total costs, and the supply of substitute inputs is inelastic. His assertion regarding the relationship between union wages and employment levels is accepted as lore by generations of neo-classical economists, but it is not a key part of strikes theories in much of the labour economics literature.

Ashenfelter and Johnson (1969) make an oblique reference to the employment effects of strikes, in noting that

> It is possible to increase the realism of this model substantially without drastically altering its implications. Introduction of the possibility of

> employment effects from wage increases, ... [p 39]

In discussing the relationship between unemployment and the strike-free wage demand, y_0, they state that

> the (union) leadership will be less likely to try to reduce y_0 when unemployment is low because the employment effects of a large wage increase will have little effect on their political structure. [p 40]

This matter, however, is not pursued in their model.

The notion of an efficiency wage is introduced by Leibenstein (1957) who explores the relationship between wages, nutrition and labour productivity, and their association with under-employment in densely populated backward areas. More recently, efficiency wages models are used to explain why, typically, labour markets do not clear in modern western economies, and why money wages are "sticky"; this provides a theoretical basis for an assertion that retrenched primary sector employees are unlikely to find speedy re-employment in similar jobs. Solow (1979) argues that there is a positive relationship between wages and the supply of work effort by individuals; a reduction in the efficiency wage at any workplace reduces the productivity of all its workers; faced with declining sales, the firm's optimal response is to hold wages constant, and to retrench surplus employees. Shapiro and Stiglitz (1984) propose that payment of an efficiency wage in excess of the market clearing wage, is an efficient means of minimising the cost of shirking by employees.

If labour markets clear, the equilibrium wage rate is determined by the equality of labour supply and demand; unemployment is frictional and short-term. In this context, firms and employees are price takers, and industrial action by unions at any workplace in the pursuit of higher wages, simply prices workers out of the market and leads to the failure of the firm. For unions to be successful in raising wages, they must restrict the supply of labour to a point below the market clearing level. In the primary sector of the labour market, whether wages exceed the market clearing rate because of restricted labour supply attributable to union action, or because firms choose to pay an efficiency wage, there is a loss of income to workers who might otherwise have obtained employment in that sector, but are instead paid lower market clearing wages in secondary labour markets, or receive dole payments during unemployment.

If unions are successful in raising wage rates above efficiency rates, or above prior union rates, and these are not absorbed by productivity growth, it is clear that costs and product prices increase, and, consequently, sales decrease.[1] Therefore, in pursuing wage increases, unions must weigh up the benefits of higher wages against the costs of reduced employment levels in the workplaces upon which they make demands. This is argued by Hieser (1970) and Johnston (1972) in their models of wage determination under bilateral monopoly in the labour market, and which are outlined in Chapter 2. When unions strike, it is possible that they bring about losses of employment of their members in addition to those induced by price increases; in particular, strikes may lead the firm's customers to buy from more reliable suppliers, or to switch permanently to other suppliers after using substitute products during the strike.[2] Because non-strike

[1]It is possible to argue that a union wage in excess of an efficiency wage, may encourage greater productivity amongst employees, and allow prices to fall and employment to rise. This, however, relies on the assumption that, prior to the union-imposed wage increase, the firm is mistaken in its view of the true efficiency wage.

[2]This is likely to be important in markets where firms enter into long-term contracts with buyers, for example, coal producers with electricity producers. Drago and Wooden (1990) refer to 'losing reputation as a reliable supplier'. [p 34]

actions do not usually halt production, they are less likely to cause this erosion of the firm's market.

If we accept that increases in real wages in excess of productivity reduce employment levels, the fate of the average retrenched employee is a period of unemployment, followed by re-employment elsewhere, and at wage rate lower than that received prior to the wage increase.[3] We argue that the average duration of unemployment, and the loss of earnings during unemployment, ought to be important elements of any function describing the welfare of employees contemplating a wage demand accompanied by a threat of industrial action.

An unemployment variable is often included in strike models, sometimes as a business cycle proxy, or as a strikers' opportunity cost variable. For example, Ashenfelter and Johnson (1969) argue that

> when unemployment is low the typical worker has an opportunity to move to a higher-paying job. Since the cost of movement may be substantial, however, he will first try to increase his wages in the present job [p 40]

and

> during periods of low unemployment there will be decreased opposition among the rank and file to a militant course of action since there will be part-time job opportunities for potential strikers. [p 40]

Mauro (1982) states that

> by increasing alternative job opportunities for workers and members or their families during a strike, a lower unemployment rate (*UE*) should reduce the union's rate of concession. [p 531]

and

> If a union must occasionally call a strike to convince the firm that it is able to do so, it is likely to choose a time when it is in a relatively strong

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[3]Some retrenched employees may receive large termination benefits which, to some extent, supplement reduced future earnings. Older employees may take early retirement.

> position. This provides another reason to expect the unemployment rate to be negatively related to strike frequency. [p 532]

Hayes (1984) assumes that the union's utility is a function of wages, employment and strike duration, and that the union 'must propose a wage schedule that is dependent on the firm's labour demand schedule'. [p 64] She argues that utility is positively associated with total employment at the workplace, because as total employment rises, the probability that any individual union member will remain employed also increases. Hayes leaves unexplored the nature of the implied disutility of wage increases which lead to lower employment levels; clearly the trade-off between wages and employment is less important, at least to rank and file union members, if alternative employment at similar wages is easy to find.

Notwithstanding models which specify employment levels in the union's utility function, no theoretical strikes model, as far as we are aware, recognises explicitly the costs of retrenchments which are associated with industrial action.[4] Schor and Bowles (1984) produce an empirical strikes model and argue that the cost of job loss is an important determinant of strike frequency; this cost depends on the duration of unemployment and wage loses during and after unemployment. They associate unemployment with strikes but are unclear in describing the mechanism involved; they do not refer to unemployment costs which result from higher labour costs which occur when firms acquiesce to union demands without strikes occurring. Further, they focus on the cost of unemployment to the individual, and neglect the important question of how many employees are likely to be retrenched as the result of union demands and strikes.

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[4]Hieser (1970) and Johnston (1972) formally introduce wage losses, but implicitly assume that retrenched employees remain permanently unemployed and do not receive *any* income subsequently.

We concur with Schor and Bowles that the period of unemployment confronting dismissed employees, replacement wages during unemployment and wages on re-employment, are important factors in determining the union's opportunity cost of unemployment. We claim, however, the cost must also include the quantum of labour shedding, and that this cost impinges both on wage demands and decisions regarding industrial action.

4.2 Behavioural Assumptions

We begin with some assumptions regarding the behaviour of unions and firms, and the bargaining process. In this section our focus is on strikes; later, we modify the model to explore non-strike industrial action.

4.2.1 Unions

It is assumed that unions maximise the expected present value of earnings of the current employees of the firm. This does not imply that the workforce is fully unionised, or that particular occupational groups are fully covered; where there is partial unionisation, it is difficult for firms to discriminate between union and non-union employees with respect to terms and conditions of employment, so that any union demand is effectively made on behalf of all employees. Throughout this chapter we use the term "wage demand" as a convenient shorthand, and include in it all demands relating to wage rates, work practices, hours of work, holidays and other non-pecuniary benefits.

In pursuing demands, union leaders know that higher real wages and strikes erode employment at their workplaces. For each union, there is a maximum acceptable loss of membership; if we assume that firms do not discriminate according to union membership, there is a direct relationship between employment and membership.[5] The maximum acceptable loss is a judgement made by union leaders, and may be determined by the number of members required to maintain the union as a financially viable organisation, or to maintain the credibility of the incumbent union leaders with their members. It is likely that this maximum acceptable loss is positively associated with union density; if density is already low, a further loss of members is less palatable to the union.

We make the assumption common in many strike models, that although the union may consider the impact of its wage demands on employment, bargaining is restricted to wages and does not deal with staffing levels; after the wage has been determined, the firm chooses the level of employment. Clearly, there are disputes over staffing levels, but we do not include these explicitly in the model. Because we presume the firm is a cost minimiser with respect to bargaining, and the union is aware of the impact of real wage increases on the demand for the firm's product, a union demand to maintain staffing levels is tantamount to making a lower wage demand.

Whether or not current employees can find rapid re-employment following retrenchment, depends obviously on the personal characteristics and skills of those individuals, and on local labour market conditions. We assume that the average retrenched employee undergoes a period of unemployment and receives the dole, and later finds permanent re-employment at a rate no greater than the former wage.

We regard ambit claims as part of preliminary skirmishing, and are not

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[5]Retrenchments are, of course, unlikely to be made randomly. More likely are "last on first off" rules, or offers of early retirement to older employees.

part of the model; a demand is a claim over which the union is prepared to take some relatively prolonged form of industrial action. Industrial actions of a short-term nature are treated as harassing manoeuvres which signal seriousness of intent prior to critical negotiations; alternatively, they may be political tactics of union leaders seeking to demonstrate their importance to the rank and file. Neither are likely to have any large impact on the firm's profits, nor have any significant influence on market shares and employment.

In making these assumptions we recognise, of course, that many Australian strikes are of short duration, and may appear to be outside this model. If short strikes indicate a seriousness of intent of unions, firms might reasonably conclude that accompanying demands are not ambit claims, and that unions are prepared to take longer actions to secure favourable outcomes. Indeed, it is commonly argued that strikes are used by unions to obtain better information regarding the firm's true profitability[6], and as a means of lowering the expectations of the rank and file members to realistic levels.[7]

4.2.2 Firms

We restrict the model to firms which are private enterprises or government business enterprises. It is assumed that firms use cost-plus pricing, and that real profit margins are constant. This is a departure from the more usual profit maximising assumption of classical price theory, but is arguably a more realistic

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[6]See, for example, Mauro (1982).

[7]See Ashenfelter and Johnson (1969).

assumption.[8] Perfectly competitive profit maximising firms are effectively cost-plus pricers because, in long run equilibrium, profits are normal irrespective of input prices; we take the view that union activity is likely to be weak in markets which approximate this model.[9] The firms we consider are those with some market power, and which have an ability to pass on cost increases to consumers, albeit with some loss of sales which depends on the elasticity of demand. Whether or not firms ultimately absorb part of any wage increase by reducing profit margins, clearly depends on the elasticity of demand; we make the assumption, however, that in weighing up whether to accept or reject a wage demand, firms base their calculations on the assumption that all cost increases will be passed on.

Firms know that strikes may also erode markets because strike-prone firms could be regarded as unreliable suppliers and receive fewer orders, and customers forced to use substitutes may not revert to using the striking firm's product when it is again available. This is an important part of the models of Hieser (1970) and Johnston (1972), however they see this loss impacting primarily on the firm's profit, but not on union employment. Rabinovitch and Swary (1976) make reference to 'a supplementary function measuring loss of goodwill (loss of market shares for instance)' [p 672], and Hart (1989) notes that a lengthy strike may cause a firm to find 'it has fallen irreversibly behind its competitors'. [p 34][10]

We assume that firms do not resist money wage increases which are cost of

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[8]This makes little difference to the argument. It is easy to show that, if the firm is a profit maximiser and *not* a price taker, its mark-up on marginal cost is $1/(\eta - 1)$ where η is the absolute value of the price elasticity of demand, and $\eta > 1$. Assuming that elasticity is constant, at least over a small range, a constant proportion of any increase in marginal costs is passed on to consumers.

[9]The Australian shearers' strikes of the 1890s present interesting exceptions to the rule.

[10]The focus in both papers is on the effect on the firm's profit, rather than on employment levels.

living adjustments (COLA), and do not oppose real wage increases commensurate with productivity increases, because neither of these reduce real profit. We regard industrial action in apparent pursuit of COLA or real productivity payments, as either the result of bargaining ineptitude, or that these actions are, in fact, used for a different agenda (perhaps union politics or muscle flexing). These assumptions regarding COLA and productivity are broadly compatible with National Wage guidelines in Australia during the post World War 2 period.[11] We assume that the firm voluntarily pays an efficiency wage, or already agrees to a union wage, both in excess of a market clearing wage.

Strikes place few costs on firms while inventories are available to maintain supply to customers. The firm may, of course, hold inventories, but industrial action may prevent their distribution. We assume that strikes are effective in preventing sales, and cause firms to forego profits during strike periods. Obviously, strikes in the service sector halt sales immediately, unless managerial staff can continue to operate the firm at a reduced level of output.

Fixed technical coefficients are assumed, so that real wage increases in excess of productivity, do not bring about substitutions of capital for labour, and any loss of market leads to an equal (proportional) shedding of labour.[12] We assume that the firm produces only one product, and that labour within the firm is homogeneous.

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[11]Although real wage growth may have lagged productivity since the introduction of the Accord in 1983, it is arguable that this has been compensated by the so-called social wage.

[12]If capital may be substituted for labour, this adds to the employment losses brought about by real price increases; it allows the firm to reduce labour as a share of total cost to minimise the cost of any wage increase.

4.2.3 The Bargaining Procedure

Theories of strikes found in the literature are couched in terms of conflict between management and employees represented by a union. There is no third party in the bargaining process, although in some empirical studies the effects of incomes policies are incorporated into fairly conventional models.[13]

In Chapter 3 we present a brief outline of the role of the Commission in the Australian industrial relations system, and note that the evidence that it has moderated industrial disputation is equivocal. It is possible that the Commission gets disputing parties to the negotiating table more quickly than would otherwise be the case, and resolution may occur more rapidly; this, however, is little more than conjecture. On the other hand, many awards are "consent awards", in which the Commission ratifies voluntary agreements between employers and unions. In this model we assume that what may loosely be called "market forces" determine union demands and employer responses, and accordingly, do not formally include the activities of the Commission in this model.

We dispense with the common assumption of US models that negotiations take place towards the end of labour contracts. In this model, it is proposed that real wage demands in excess of productivity, may be made at any time, but this does not imply that demands are made frequently. The success or partial success of any demand causes the shedding of labour, and moves the firm's employment and union membership towards the critical minimum level; therefore, any new demand is less likely to increase the expected earnings of the (then) current

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[13]See, for example, Farber (1978), Shalev (1980), Kaufman (1982), Gramm (1986), and McConnell (1989).

workforce, and is more likely to violate the employment loss constraint. New demands may be successful when market conditions change, the most obvious of which is an increase in demand for the firm's product.

4.3 Strikes

For the moment we assume that a strike is the only form of industrial action used by the union; later we examine what differences occur when other forms of action are used, and what factors may lead the union to choose one particular form of action over another. The union forms a view regarding the firm's future stream of profits, based on a range of indicators available to it, and suggested by imperfect information models of strikes.[14] If it believes profits are approximately normal, a wage demand is not made because the viability of the firm is at risk. On the other hand, when the union believes profits are sufficiently larger than normal, it may present a wage demand to the firm. In considering this, the union recognises that, in a static product market, a higher real wage will result in some loss of market share, and consequently, employment. Furthermore, if employer resistance leads to a strike, irrespective of the size of the market loss due to the wage induced price increase, there is an additional loss due to the strike itself, and it is assumed that this strike induced loss is permanent.[15]

The union, at the time of presenting a demand for an increase, d, does not know the firm's response. The firm may accept the demand and a strike does not occur; alternatively, the firm may resist and endure a strike of expected length D_E,

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[14]See, for example, Mauro (1982).

[15]Although it may be argued that strike-induced losses probably decay exponentially, this is likely to be caused by other changes in market conditions, and which cast aside the *ceteris paribus* assumption.

and finally settle on an expected increase s_E, where $0 \leq s_E \leq d$. Because both d and s_E are real, and in excess of productivity increases, and d is (by assumption) not an ambit claim, we expect s_E to be relatively small and to take on just a few discrete values. D_E is the subjective judgement of the union of the strike length required to cause the firm to raise its offer to s_E; we propose the conventional positive Hicksian relationship between s_E and D_E.[16] A list of all variables used in the model is shown in Table 4.1.

In what follows we describe first, the optimal wage demand of the union and the net benefit expected, depending on whether the demand is resisted by the firm; and second, the net costs to the firm of accepting or rejecting the union's demand. Prior to this we summarise the steps in the process which may lead to a strike. These are:

(1) The union assesses whether the firm is sufficiently profitable to pay higher wages.

(2) The union evaluates the net benefit of a wage demand, first, assuming that it is accepted by the firm, and second, that it is resisted by the firm and some industrial action is used. A demand is made if the former is positive and the latter is non-negative.

(3) The firm evaluates the costs of accepting or rejecting the demand, and chooses to resist the demand (accept a strike) if its cost is smaller.

(4) When a strike is in progress, the union re-evaluates its demand in accordance with (2), given that the strike has already caused some

[16] See Hicks (1932).

erosion of the firm's market.

(5) The strike ends if, at (3), the firm's cost of settlement is less than the cost of further resistance.

In this process, of course, the firm is likely to make counter offers to the union. Because it is assumed that the initial demand is one over which the union is prepared to strike, a lower offer by the firm at the outset of negotiations, will be rejected by the union; after a strike has been in progress for some time, however, the benefits and costs of further action have changed for both parties. At this stage the firm's offer is, in effect, an indication to the union of what new demand would be immediately acceptable to the firm.

4.3.1 Net Benefit to the Union When a Demand Is Accepted

If the firm concedes to a demand, the union derives a benefit from higher wages paid to continuing employees over their working life, and a cost associated with an expected loss of employment, L_d^E, with retrenched employees finding lower paid work after a period of unemployment U. After discounting future benefits and costs at the union discount rate ζ, the net benefit, NBE_{accept}, to the current workforce of size N, is

$$NBE_{accept} = \int_0^\infty d w_0 N(1 - L_d^E) e^{-\zeta t} dt - \int_0^U l_u w_0 N L_d^E e^{-\zeta t} dt - \int_U^\infty l_a w_0 L_d^E e^{-\zeta t} dt \qquad (4.1)$$

where w_0 is the prior wage rate, and l_u and l_a the proportional wage reductions during unemployment and alternative employment, respectively. Upon integration (4.1) becomes

$$NBE_{accept} = \frac{Nw_0}{\zeta}\,[d(1-L_d^E) - l_u L_d^E(1-e^{-\zeta U}) - l_a L_d^E e^{-\zeta U}] \qquad (4.2)$$

If it is assumed that λ is labour's share of total costs, the union expects the firm to increase its price by proportion λd; if η_E is the union's estimate of the price elasticity of the firm's product, assumed to be constant, then

$$L_d^E = \lambda \eta_E d \qquad (4.3)$$

On substitution in Equation (4.2), and assuming that ζ is small[17],

$$NBE_{accept} = \frac{Nw_0}{\zeta}\,d\,[1 - \lambda\eta_E d - l_u\lambda\eta_E\zeta U - l_a\lambda\eta_E(1-\zeta U)] \qquad (4.4)$$

NBE_{accept} is a quadratic function of d, and is maximised at

$$d_1 = \frac{1}{2}\left[\frac{1}{\lambda\eta_E} + \zeta U(l_a - l_u) - l_a\right] \qquad (4.5)$$

The union is, in essence, trading employment for higher real wages, but we propose earlier that the union's own survival depends upon it having a viable number of members. Therefore there is a maximum loss, L_0, which constrains all wage demands. Using Equation (4.3), the demand associated with this is

$$d_2 = \frac{L_0}{\lambda\eta_E} \qquad (4.6)$$

Because the union's demand must satisfy the maximum loss condition, the optimal demand is

$$d = \min\{d_1, d_2\} \qquad (4.7)$$

It is clear that d is positively associated with the union's maximum acceptable loss of employment, and is negatively associated with labour's share of total cost, the elasticity of demand, wage losses during unemployment, the

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[17] If ζ is small, then $e^{-\zeta t} \approx 1 - \zeta t$. If w_0 measures weekly earnings, and the union discount rate is, say, 10 percent per annum in real terms, then $\zeta \approx 0.002026$.

duration of unemployment, and the union discount rate[18]; it is also negatively associated with the difference between the firm's wage prior to the demand, and alternative wages provided $\zeta U < 1$.

4.3.2 Net Benefit to the Union When the Demand Is Rejected

If the firm resists the wage demand, the union expects a settlement at s_E after a strike of length D_E. In addition to the employment loss, L_s^E, due to a price increase associated with s_E, there is a cost of lost earnings during the strike, and an employment loss, L_D^E, due to a strike induced erosion of the firm's market[19]; the net benefit to the union, NBE_{strike}, is

$$NBE_{strike} = \int_{D_E}^{\infty} s_E w_0 N(1-L^E)e^{-\zeta t}\,dt - \int_{D_E}^{D_E+U} l_u w_0 N L^E e^{-\zeta t}\,dt - \int_{D_E+U}^{\infty} l_a w_0 N L^E e^{-\zeta t}\,dt - \int_0^{D_E} w_0 N e^{-\zeta t}\,dt \quad (4.8)$$

where $L^E = L_s^E + L_D^E$, and which upon integration becomes

$$NBE_{strike} = \frac{Nw_0}{\zeta}\,[s_E(1-L^E)e^{-\zeta D_E} - l_u L^E(e^{-\zeta D_E} - e^{-\zeta(D_E+U)}) - l_a L^E e^{-\zeta(D_E+U)} + e^{-\zeta D_E} - 1] \quad (4.9)$$

Using Equation (4.3), and assuming that ζ is small,

$$NBE_{strike} = \frac{Nw_0}{\zeta}\,[s_E(1-L_D^E-\lambda\eta_E s_E)(1-\zeta D_E) - l_u(L_D^E+\lambda\eta_E s_E)\zeta U - l_a(L_D^E+\lambda\eta_E s_E)(1-\zeta D_E-\zeta U) - \zeta D_E] \quad (4.10)$$

It is clear that the net benefit to the union of any settlement following a strike is negatively associated with the loss of market share due to the strike, the

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[18] The latter two on the reasonable assumption that $l_u > l_a$.

[19] This mirrors the loss of good will that Hieser (1970) and Johnston (1972) describe, but do not include in considerations of the union's utility.

union discount rate, labour's share of total cost, the elasticity of demand, wage losses during unemployment, the duration of unemployment[20], wage losses in alternative employment, and strike duration.[21]

4.3.3 The Union's Strategy

In strikes models which assign probabilities to strikes and wages outcomes, it is commonly assumed that agents seek to maximise the expected value of some utility function.[22] The probability of a strike occurring is positively associated with the union's demand, and negatively associated with the firm's offer. For an expected value approach to be reasonable, it must be assumed, implicitly, that the "game" is played a large number of times, and that although the optimal strategy chosen by an agent may not yield a satisfactory outcome in any particular "game", it produces the best result on average. We doubt that, for any union, wage negotiations occur sufficiently frequently to make credible the assumption that the union maximises the expected value of its utility function.[23]

In the literature, we find no convincing argument regarding the reasonableness of this assumption, and which appears to be regarded as axiomatic. We assert that the assumption that bargainers base their decisions regarding strikes on expected values as manifestly unreasonable; instead, we make the more intuitively appealing assumption that, because demands are likely to be made fairly

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[20]Assuming $l_u > l_a$.

[21]The last of these depends on $s_E(1 - L_D^E - L_s^E) > l_a(L_D^E + L_s^E)$ or $s_E > (s_E + l_a)(L_D^E + L_s^E)$.

[22]See, for example, Rabinovitch and Swary (1976), Tracey (1987), Hayes (1984) and Booth and Cressy (1987).

[23]We note here, as an example, that insurance companies maximise the expected return on their many policies; if, however, policy holders were to base their insurance decisions on maximising expected values, they would never insure because the expected values of their policies are negative. Clearly, policy holders regard maximising expected value as an inappropriate decision criterion.

infrequently, the union uses a maximin strategy.[24] This means that the union will not knowingly make a wage demand that will make the firm's employees, as a group, worse off, irrespective of the firm's response, because in not making any demand, there is no cost to the union.

The net benefits to the union which we describe above, may be interpreted as the expected benefits of any wage demand to an individual employee, dependent on the firm's response.[25] Although the probability of the firm's rejection of a demand is positively associated with the magnitude of the demand, it is unlikely that the union has anything more than a highly subjective basis for determining the probability of rejection; therefore, we have a second strong reason for rejecting calculations of optimal demands and responses based on statistical expectations.

The union makes demand d when NBE_{accept} is positive and NBE_{strike} is non-negative. Further, because there is a maximum loss of membership which the union is prepared to accept, L_0, a third condition on whether it makes a demand, accompanied by a strike threat, is that

$$L_0 \geq L_D^E + L_S^E = L_D^E + \lambda \eta_E s_E \qquad (4.11)$$

4.3.4 Cost to the Firm of Accepting the Union's Demand

Faced with the union's demand, d, the firm may concede immediately, and incur costs associated with loss of market share due to higher real prices, and discounted at the firm's rate δ; by assumption, the firm's profit margin, π, is constant. The firm's gross profit is $qN\pi$, where q is the output/labour ratio. The

[24]In game theory, a maximin strategy is one in which the player selects the action which maximises his minimum pay-off, regardless of the action chosen by the player's opponent.

[25]Although L^E is the union's estimate of the loss of market, on the assumption of a constant output/labour ratio, it is also the probability that an individual employee will be retrenched.

firm's estimate of the cost of conceding to the initial demand, CF_{accept}, and accepting an expected loss of sales, L_d^F, is

$$CF_{accept} = \int_0^\infty qNL_d^F \pi e^{-\delta t}\, dt \qquad (4.12)$$

which upon integration becomes

$$CF_{accept} = \frac{1}{\delta} qNL_d^F \pi \qquad (4.13)$$

4.3.5 Cost to the Firm of Rejecting the Union's Demand

The firm may reject the union's demand and expect to settle at s_F after a strike of duration D_F. Each s_F, D_F combination is the subjective judgement of the firm of the length of a strike required to cause the union to reduce its demand to s_F; we propose the conventional negative Hicksian relationship between s_F and D_F.

If the demand is rejected, in addition to the cost of lost market share, L_s^F, due to higher prices associated with the eventual settlement[26], the firm incurs costs of lost profits during the strike, and market erosion, L_D^F, due to the strike; the cost of rejecting the demand, CF_{strike}, is

$$CF_{strike} = \int_0^{D_F} qN\pi e^{-\delta t}\, dt + \int_{D_F}^\infty qN(L_D^F + L_s^F)\pi e^{-\delta t}\, dt \qquad (4.14)$$

which upon integration becomes

$$CF_{strike} = \frac{1}{\delta} qN\pi [1 - e^{-\delta D_F} + (L_D^F + L_s^F)\, e^{-\delta D_F}] \qquad (4.15)$$

4.3.6 The Firm's Strategy

We assume that, with respect to production decisions, the firm is a cost minimiser. Therefore, the firm accepts the union's demand and avoids a strike if $CF_{strike} \geq CF_{accept}$; a strike occurs when this condition is not met, that is when

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[26]The assumption of cost-plus pricing ensures that profit margins are unaffected.

$$\frac{1}{\delta}qN\pi\,[1 - e^{-\delta D_F} + (L_D^F + L_s^F)e^{-\delta D_F}] < \frac{1}{\delta}qNL_d^F\pi \qquad (4.16)$$

The firm's estimate of the elasticity of demand is η_E, so that

$$L_s^F = \lambda\eta_F s_F \qquad and \qquad L_d^F = \lambda\eta_F d \qquad (4.17)$$

Assuming that δ is small, substituting Equation (4.17) into (4.16), and re-arranging, yields

$$\delta D_F + (L_D^F + \lambda\eta_F s_F)(1 - \delta D_F) < \lambda\eta_F d \qquad (4.18)$$

Inequality (4.18) indicates that the probability of a strike occurring is positively associated with the initial demand of the union, labour's share of total cost, the firm's estimate of the elasticity of demand; it is negatively associated with the firm's assessments of the market erosion resulting from a strike, the length of the strike, the settlement, and the firm's discount rate.

4.3.7 Settlement of a Strike

The question remains as to how the settlement s is determined. Hicks (1932), and others since, point out that if the bargainers are fully informed of their adversaries' concession curves, a strike can be avoided because the equilibrium wage could be agreed upon quickly, without the costs to both parties of a strike. This model does not refute this self-evident result; if the parties both know that for some $s_E = s_F$, that $D_E = D_F$, then immediate settlement can be achieved. What is different in this model, is that immediate settlement not only avoids the costs of lost profits and earnings during a strike, but it also circumvents permanent losses of profit and employment due to the long run impact of a strike on the firm's market.

It is proposed that after a strike has been in progress for some time, but without settlement, there are already costs to both the union and firm because $L_D > 0$. These losses are sunk costs at this point, and the union, in effect, makes a new demand $d' \leq d$, taking into account the possibility of a lower settlement s_E' after a further strike period D_E'; these choices are governed by Equations (4.1) to (4.7). The firm evaluates this new demand and accepts it, and ends the strike, when the cost of accepting is less than cost of rejecting, and described in Inequality (4.18). As we note in Section 4.3, any counter-offer by the firm at any stage, is an indication to the union of a demand which is immediately acceptable.

4.4 Non-Strike Actions

We now assume that the union may use non-strike industrial action which does not cause any loss of wages for its duration.[27] The union makes the same demand d, and if the firm accepts it, the net benefit to employees is independent of the type of action threatened, and is NBE_{accept} which is defined in Equations (4.1) to (4.7).

4.4.1 Net Benefit to the Union When the Demand Is Rejected

If the demand is rejected, a non-strike action is undertaken for an expected duration T_E, after which settlement at s_E occurs. (It is assumed, for convenience, that s_E is independent of the type of non-strike action used.) The union benefit, after settlement, is derived from higher wages, which is partially offset by costs associated with retrenchments due to a loss of market caused by higher prices. The net benefit, NBE_{action}, is

[27] These actions include bans and limitations, work to rules campaigns and go-slow tactics, but exclude overtime bans because they cause the loss of overtime earnings. Since stop work meetings halt production for only a short time, they are not a part of this model.

$$NBE_{action} = \int_{T_E}^{\infty} s_E w_0 N(1-L_s^E)e^{-\zeta t}\,dt - \int_{T_E}^{T_E+U} l_u w_0 N L_s^E e^{-\zeta t}\,dt - \int_{T_E+U}^{\infty} l_a w_0 N L_s^E e^{-\zeta t}\,dt \qquad (4.19)$$

which upon integration becomes

$$NBE_{action} = \frac{Nw_0}{\zeta}[s_E(1-L_s^E)e^{-\zeta T_E} - l_u L_s^E(e^{-\zeta T_E} - e^{-\zeta(T_E+U)}) - l_a L_s^E e^{-\zeta(T_E+U)}] \qquad (4.20)$$

Assuming that ζ is small, substituting Equation (4.3), and re-arranging, yields

$$NBE_{action} = \frac{Nw_0 s_E}{\zeta}[(1-\lambda\eta_E s_E - l_a\lambda\eta_s)(1-\zeta T_E) + \zeta U\lambda\eta_E(l_a - l_u)] \qquad (4.21)$$

NBE_{action} is negatively associated with the union discount rate, the expected length of non-strike action, wage losses during unemployment, the duration of unemployment, wage losses in alternative employment[28], labour's share of total cost, and the estimated elasticity of demand.[29]

4.4.2 Cost to the Firm of Rejecting the Union's Demand

If the firm accepts demand d, the cost is FC_{accept} and is defined in Equations (4.12) and (4.13). If the firm rejects the demand and non-strike industrial action ensues, the additional cost is a proportional reduction in the profit margin, ρ, during the action; the cost rejecting the demand , CF_{action}, is

$$CF_{action} = \int_{0}^{T_F} qN\rho\pi e^{-\delta t}\,dt + \int_{T_F}^{\infty} qN\pi\, L_s^F e^{-\delta t}\,dt \qquad (4.22)$$

which upon integration becomes

[28] If $1 - \zeta T_E > \zeta U$.

[29] The latter two assume $l_u > l_a$.

$$CF_{action} = \frac{qN\pi}{\delta}[\rho(1 - e^{-\delta T_F}) + L_s^F e^{-\delta T_F}] \qquad (4.23)$$

4.4.3 The Firm's Strategy

Again assuming the firm is a cost minimiser, the firm accepts the demand and avoids a non-strike action if $CF_{accept} \leq CF_{action}$. Using Equations (4.22) and (4.23), a non-strike action occurs when

$$\frac{qN\pi}{\delta}[\rho(1 - e^{-\delta T_F}) + L_s^F e^{-\delta T_F}] < \frac{1}{\delta} qNL_{s_F}^F \pi \qquad (4.24)$$

Assuming that δ is small, substituting Equation (4.17), and re-arranging, Inequality (4.24) yields

$$\frac{\rho\delta T_F}{\lambda\eta_F} + s_F(1 - \delta T_F) < d \qquad (4.25)$$

Inequality (4.25) indicates that the probability of the firm's rejection of the demand and a non-strike action occurring, is positively associated with the union's demand, labour's share of total cost and the firm's estimate of the elasticity of demand; it is negatively associated with the firm's estimate of the settlement, the reduction in the profit margin caused by the action, the firm's discount rate, and the expected length of the action.[30]

It is proposed that after a non-strike action has commenced, settlement occurs via the recursive process described above for strikes, and described in Section 4.3.7.

4.5 Choice of Action

We assume that the choice of action is made by the union, and that it is made prior to the union serving a demand upon the firm. In any particular dispute,

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[30]The last two of these requires that $\lambda\eta_E s_E < \rho$.

this choice may depend on past industrial practices, or on workplace structures which influence the union's ability to enforce bans, work to rules, and other non-strike actions. Further, it is likely to depend on union density at the workplace, because sustained industrial action may be difficult to organise if many employees are not union members.[31]

Clearly, all industrial actions are intended to impose costs on firms, and so the action most costly to the firm ought to be chosen, other things being equal; we have argued, however, that different actions do not impact equally on employees. The union's assessment of costs to the firm are germane to the union's choice, and are implicit in D_E and T_E. For any settlement s_E, given a set of alternative actions, D_E and T_E are inversely related to the union's assessment of the costs to the firm of those actions.

Assuming that demand d is rejected by the firm, the union faces a choice of using a strike of length D_E to secure a settlement s_E, or a non-strike action of length T_E. A strike is preferred to non-strike action if $NBE_{strike} > NBE_{action}$. Using Equations (4.2) and (4.20), $L^E = L^E_s + L^E_D$ as shorthand, and some cancellation, this condition becomes

$$\begin{aligned} s_E(1-L^E)e^{-\zeta D_E} - l_u L^E(e^{-\zeta D_E} - e^{-\zeta(D_E+U)}) \\ - l_a L^E e^{-\zeta(D_E+U)} + e^{-\zeta D_E} - 1 \\ > s_E(1-L^E_s)e^{-\zeta T_E} - l_u L^E_s(e^{-\zeta T_E} - e^{-\zeta(T_E+U)}) \\ - l_a L^E_s e^{-\zeta(T_E+U)} \end{aligned} \qquad (4.26)$$

Inequality (4.26) shows that strikes are less likely to be preferred by unions as strike durations rise *vis-à-vis* those of non-strike actions, and when strike

[31]This is regarded by some industrial relations observers as a moot point. It may be argued that it is easier to persuade wavering employees to participate in lengthy non-strike action than relatively short-term strikes.

actions lead to larger erosions of market shares.

It is not possible to make much headway in simplifying condition (4.26) unless some additional assumptions are made. The assumption that retrenched employees are able to find immediate re-employment in secondary labour markets, making $U = 0$, appears to be an over-simplification in view of the average duration of unemployment in Australia in the 1980s and 1990s.

Although loss of wages during strikes form an important part of many strikes models, in most instances it is reasonable to suppose that the durations of *all* forms of industrial action are small compared to the future working life of any employee. Unless employees' discount rates are extraordinarily large, these losses during disputes are likely to be trivial, compared with the future loss of wages of retrenched employees. Because both D_E and T_E are relatively small, their impact on the choice of action may not be great; to accommodate this supposition, we set $D_E = T_E = 0$ in Inequality (4.26) to examine the conditions which make a strike the union's preferred action. This is

$$\begin{aligned} s_E(1 - L_s^E - L_D^E) \; + \; l_u(L_s^E + L_D^E)e^{-\zeta U} \; - \; l_a(L_s^E + L_D^E)e^{-\zeta U} \\ > \; s_E(1 - L_s^E) + l_u L_s^E e^{-\zeta U} - l_a L_s^E e^{-\zeta U} \qquad (4.27) \end{aligned}$$

which after cancellation of common terms, and re-arrangement, becomes

$$L_D^E[-s_E \; - \; l_u(1 - e^{-\zeta U}) \; - \; l_a e^{-\zeta U}] > 0 \qquad (4.28)$$

If we assume that the union's expectation regarding the strike induced erosion of the firm's market, L_D^E, is positive, the left hand side of Inequality (4.28) is clearly negative. From this we can conclude that if the duration of any industrial action is reasonably short, and that the unions believe that strikes erode firms' markets, then unions will prefer non-strike actions to strikes. In other words, if unions regard strikes as having a significant impact on their members' employment opportunities in addition to those brought about by wage increases, other forms of industrial action are more likely to be used.

Inequality (4.28) also suggests that if $L_D^E = 0$, that is the union's estimation of the loss of market share due to a strike is zero, the union is indifferent in its choice between different forms of industrial action. If a strike poses no threat to the firm's market, non-strike action is still preferred even though the durations of both types of actions are comparatively short, because there is no loss of earnings during the dispute.

At this point we might ask why all industrial actions are not of the non-strike kind. We assume that non-strike action is capable of reducing the firm's profit margin; if this was not so, then the firm could minimise its costs by ignoring the union's threat and make no wage concession. We also assume that employees are not stood down without pay if they fail to work as directed by the firm. It is clear that if non-strike action has little impact on the firm's profits, a strike is the only weapon available to the union. It is arguable that if non-strike actions lead to stand downs without pay, there are few differences between strikes and non-strike actions, but the former may produce quicker settlements.

Further to this, we have eliminated short-term preliminary harassing industrial actions from the model, so the frequency of short-term strikes in Australia does not refute the conclusions we draw above. Indeed, the comparative infrequency of long strikes, and reasonably common lengthy non-strike actions, provide some *prima facie* support for this model.[32] The preponderance of short-term action is not incompatible with the view that strikes may be used by unions either to seek information regarding profits, or to moderate the expectations of union members.

4.6 Towards a Testable Model

4.6.1 Strikes

The model proposes that, assuming strikes are the only industrial actions contemplated, they occur when the net benefit to the union, NBE_{strike}, is positive, and the cost to the firm of accepting a strike, CF_{strike}, is less than the cost of accepting the union's demand, CF_{accept}. These conditions are shown in Equation (4.10) and Inequality (4.18).

Equations (4.5) to (4.7) show that the union's demand is positively associated with the union's maximum acceptable loss of employment, and is negatively associated with labour's share of total cost, the elasticity of demand, wage losses during unemployment, the duration of unemployment, wage losses in alternative employment, and the union discount rate. Equation (4.10) implies that the probability that the union is prepared to strike is positively associated with the expected settlement; it is negatively associated with the loss of market share due to a strike, the union discount rate, labour's share of total cost, the elasticity of demand, wage losses during unemployment, the duration of unemployment, wage losses in alternative employment, and strike duration. Inequality (4.11) indicates

[32]During our sample period 3:1959 to 4:1992, the Australian average strike duration is 2.07 days and the standard deviation 0.88 days. No comparable statistics are available concerning non-strike industrial action but, with the exception of stop work meetings, anecdotal reports of these actions suggest larger average durations than those of strikes.

that it is positively associated the union's maximum acceptable employment loss.

Inequality (4.18) suggests that the probability of a strike occurring when the firm faces a strike threat is positively associated with the initial demand of the union, labour's share of total cost, and the elasticity of demand; it is negatively associated with the firm's assessment of the market erosion resulting from a strike, the length of the strike, the settlement, and the discount rate.

These relationships are summarised in columns 2, 3 and 4 of Table 4.2 which shows the *a priori* signs of the coefficients of the variables in the strikes model. For convenience, in this table we make no distinction between the union's and firm's expectations. In column 5 we show factors which affect the firm's propensity to accept a strike by removing the union's demand and substituting the factors which determine it. Higher elasticities of demand and higher shares of labour in total costs lead unions to make smaller demands, but also make firms more resistant to any demand; as a consequence, their impact is indeterminate. Higher values of the union's discount rate, wage losses during unemployment and later re-employment, and the duration of unemployment, all lead the union to make a smaller demand and, therefore, make the firm less likely to accept a strike. The larger is the union's maximum loss of market share, the greater is its demand, and consequently the more likely it is that the firm will accept a strike.

It is clear that strikes only occur when unions make demands accompanied by strike threats, and firms resist those demands. In column 6 of Table 2 we show the factors which affect strike outcomes by combining the relationships shown in columns 2 and 5. High values of discount rates, strike durations and losses of market share due to strikes make both parties more strike averse, so there is a negative relationship between these variables and the probability of a strike occurring. High values of wage losses during unemployment and later re-employment, and the duration of unemployment, make the union more strike averse; because these values also lead to lower demands, the firm is more likely to submit so that there is a negative relationship between these variables and the probability of a strike occurring. The effects of labour's share of total cost and the elasticity of demand are indeterminate; high values of these variables make the union strike more strike averse because they imply large employment losses, but they also make the firm more willing to accept a strike to lower the settlement and subsequent loss of its market via price increases. The higher is the expected settlement, the more likely is a union to be willing to strike to achieve it; on the other hand, if the firm expects a high settlement, one close to the union's initial demand, it may see little to be gained in forcing a strike.

4.6.2 Non-Strike Industrial Actions

The model proposes that, assuming that non-strike actions are the only ones contemplated, they occur when the net benefit to the union, NBE_{action}, is positive, and the cost to the firm of accepting a non-strike action, CF_{action}, is less than the cost of accepting the union's demand, CF_{accept}. These conditions are shown in Equation (4.21) and Inequality (4.25).

Equation (4.21) indicates that the probability the union is prepared to use non-strike action is negatively associated with the union discount rate, the expected length of non-strike action, wage losses during unemployment, the duration of unemployment, wage losses in alternative employment, labour's share of total cost, and the estimated elasticity of demand. Inequality (4.11) indicates that it is positively associated the union's maximum acceptable employment loss.

Inequality (4.25) shows that when the firm faces a demand accompanied by a treat of non-strike action, the probability of the firm resisting is positively associated with the union's demand, labour's share of total cost, and the elasticity of demand; it is negatively associated with the firm's expectation of the likely settlement, the reduction in the profit margin caused by the action, the firm's discount rate, and the expected length of the action. These relationships are summarised in columns 2 and 4 of Table 4.3 which shows the *a priori* signs of the coefficients of the variables in the non-strikes model. Again for convenience, we make no distinction between the union's and firm's expectations. Column 3 shows the variables in Equations (4.5) to (4.7) which determine the union's demand. In column 5 we show the factors which determine the firm's propensity to face a non-strike action, by substituting the factors which determine the union's demand.

Factors which increase the union's propensity to threaten non-strike action and which increase the likelihood of the firm's resistance, increase the probability of a non-strike action occurring; these relationships are shown in column 6 of Table 4.3. The factors which determine the probability of non-strike actions occurring are the same as those in the strikes model, with three exceptions: first, the strike-induced erosion of the market is absent; second, the reduction in the profit margin during non-strike actions is introduced; and third, strike duration is replaced by the duration of non-strike action.

High values of discount rates and the duration of non-strike action make both parties more averse to non-strike action, so there is a negative relationship between these variables and the probability of a non-strike action occurring. High values of wage losses during unemployment and later re-employment, and the duration of unemployment, make the union more averse to taking non-strike action; because these values also lead to lower demands, the firm is more likely to accede so that there is a negative relationship between these variables and the probability of a non-strike action occurring. The effects of labour's share of total cost and the elasticity of demand are indeterminate; high values of these variables make the union more averse to taking action because they imply larger employment losses, but they also make the firm more willing to accept a non-strike action to lower the settlement and subsequent loss of its market. The higher is the expected settlement, the more likely is a union to be willing to take action to achieve it; on the other hand, if the firm expects a high settlement, one close to the union's initial demand, it may see little to be gained in resisting. The probability of a non-strike action occurring is negatively associated with the reduction in the profit margin brought about by the action.

4.6.3 Modelling Issues

In producing a new model, we recall that mis-information models of strikes propose that strikes are more likely to occur when bargainers do not have full information regarding the firm's future profits. In those models, the profit considered is gross profit or perhaps profit per employee; in this model we assume that profit per unit of output is constant, so that changes in gross profits occur through variations in the firm's sales, and which are determined by real price increases and the elasticity of demand.

This suggests the importance of mis-information regarding the elasticity of demand; if unions under-estimate it, or firms over-estimate it, unions make larger demands while firms are more resistant, so making industrial action more likely. Further, both parties are likely to be uncertain regarding the duration of any industrial action associated with each possible level of settlement, so the probability of an immediate settlement which avoids a strike is negatively associated with this uncertainty. Unions may think that comparatively short strikes are sufficient to cause firms to make acceptable offers; on the other hand, firms may believe that protracted strikes are necessary to cause unions to accept reasonable offers.

Our model assumes that the firm's market is neither expanding nor contracting, and does not include an income elasticity term. We accept the proposition of efficiency wage models that changes in the business cycle are more likely to result in changes in employment levels than in wages, at least in the primary sector of the labour market. The business cycle enters into the model implicitly via the duration of unemployment and wage losses; boom conditions suggest shorter periods of unemployment, and perhaps higher wages in primary labour markets if there is an excess demand for skilled workers. The negative relationship between the duration of unemployment and industrial action, suggests that industrial action is pro-cyclical, but a widening gap between primary sector wages and replacement wages has a countervailing effect. The many empirical models which find strikes to be pro-cyclical, suggest that the unemployment duration effect dominates the replacement wage effect.

In the time-series models in Chapters 2 and 3, the significance of various business cycle indicators is consistent with our model, if we accept that those indicators proxy the duration of unemployment. In Australia, duration of unemployment statistics are available, but we argue in Chapter 5 that they may not capture the likely duration for recently retrenched workers.[33] The measurement of wage losses during unemployment and alternative employment is problematic because of government policy with respect to social security payments[34], and because there is little data on average earnings in secondary labour markets.

In microeconomic cross-sectional models in Chapters 6 and 7, we use indicators of local labour market tightness as proxies for the duration of unemployment. Because social security schedules of benefits are the same for all unemployed workers, and because secondary labour market wages are probably fairly uniform, the loss of earnings during unemployment and alternative employment has the same variation, and therefore significance, as pre-dispute wages. As a result, we cannot easily ascertain whether a statistically significant finding regarding wages, supports this model or others which give a role to pre-strike earnings.

We note earlier that in workplaces where there is not full union membership, it may be difficult for agreements to discriminate against non-unionists. Higher levels of union density at workplaces may be associated with larger acceptable employment losses by unions and, therefore, higher wage demands and less concern for market erosion due to strikes. As a result, we expect a positive relationship between the incidence of industrial action and union density.

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[33]A consistent unemployment duration series for Australia begins in 1978, but we have other series in the model which extend back to 3:1959. We will argue in Chapter 5 that unemployment duration series may be unsuitable for use in strikes equations because of the effects of chronic long term unemployment.

[34]Since the Whitlam government (1972-75), benefits have been set at approximately 25 percent of average weekly earnings.

This relationship is also supported by the proposition that higher levels of density are likely to facilitate the organisation of industrial actions by union officials.

The theoretical model of strikes developed in this chapter, suggests an empirical model of the form

$$Strike_i = \alpha_0 + \alpha_1 d_i + \alpha_2 CES_i + \alpha_3 CFS_i + \sum_{j=1}^{k} \alpha_{k+3} X_{ji} + \epsilon_i \qquad (4.29)$$

where $Strike_i$ is a measure of strikes, d_i the union's demand, CES_i a measure of employee strike costs, CFS_i a measure of strike costs to the firm, X_{ji} an eclectic set of k regressors derived from other economic models, and ϵ_i a random error term. Using the symbols shown in Table 4.1,

$$CES_i = f_E(s_E, D_E, L_D^E, \eta_E, \lambda, U, l_a, l_u, \zeta) \qquad (4.30)$$

and

$$CFS_i = f_F(s_F, D_F, L_D^F, \eta_F, \lambda, \delta) \qquad (4.31)$$

where s is the expected settlement, D the expected strike duration, L_D the expected market erosion directly associated with a strike, η the elasticity of demand, λ labour's share of total cost, U the average duration of unemployment, l_a the wage loss in alternative employment, l_u the wage loss during unemployment, and ζ and δ are union and firm discount rates.

The theoretical model of non-strike industrial action, suggests an empirical model of the form

$$Action_i = \beta_0 + \beta_1 d_i + \beta_2 CEA_i + \beta_3 CFA_i + \sum_{j=1}^{k} \beta_{k+3} X_{ji} + \nu_i \qquad (4.32)$$

where $Action_i$ is a measure of non-strike industrial action, CEA_i a measure of employee costs, CFA_i a measure of costs to the firm, and ν_i a random error term. Again using the symbols shown in Table 4.1,

$$CEA_i = g_E(s_E, T_E, \eta_E, \lambda, U, l_a, l_w, \zeta) \qquad (4.33)$$

and

$$CFA_i = g_F(s_F, T_F, \eta_F, \lambda, \rho, \delta) \qquad (4.34)$$

where T is the expected duration of the non-strike action and ρ the reduction in the profit margin caused by the non-strike action.

In the Chapters 5 and 6 we construct empirical models of strikes, and in Chapter 7, models of non-strike action. As Mumford (1993) and other observers of empirical models have found, there is often a vast gulf between the variables which are specified in theoretical models, and those which are available to include in regression models. We return to this problem in these chapters.

The important theoretical contributions of these models of strikes and non-strike industrial actions are that they assume that increases in union wages lead to lower employment levels at unionised workplaces. Although not part of the model, real wage increases are likely to encourage the substitution of capital for labour, which reinforces the real price effect. The opportunity costs of industrial action depend on the duration of unemployment, wage losses during unemployment and alternative employment, and market erosion due to higher product prices and losses of goodwill caused directly by strikes.

The models are unconventional because they do not assume profit maximisation by the firm, or that unions maximise the expected value of a utility function, contingent on a probability distribution of the firm's acceptance of a union's demand accompanied by a threat of industrial action. Nevertheless, the assumptions of cost-plus pricing by firms and the use of maximin strategies by unions, which are arguably more reasonable, produce intuitively appealing results.

Table 4.1:	List of Variables in the Theoretical Models
d	union demand (proportion increase)
s_E, s_F	union and firm expected wage settlement (proportion increase) following an industrial action, respectively
D_E, D_F	union and firm expected strike duration to achieve settlement s, respectively
T_E, T_F	union and firm expected duration of a non-strike action to achieve settlement s, respectively
L_d^E, L_s^E	union estimated loss of market share due to increases in real prices associated with wage increases d and s, respectively
L_d^F, L_s^F	firm estimated loss of market share due to increase in real prices associated with wage increases d and s, respectively
L_D^E, L_D^F	union and firm estimated loss of market share due to strike of length D, respectively
L	$L = L_d + L_D$ or $L = L_s + L_D$
ζ, δ	union and firm discount rates, respectively
L_0	union's maximum acceptable loss of market share
w_0	initial wage rate (including implicit benefits and costs)
l_a	$l_a = (w_0 - w_a)/w_0$, where w_a is the alternative wage and $w_0 > w_a$
l_u	$l_u = (w_0 - w_u)/w_0$, where w_u is the unemployment benefit and $w_0 > w_u$
η_E, η_F	union and firm estimates of the price elasticity of demand, respectively
λ	share of labour in total costs (proportion)
N	firm's labour force
q	output to labour ratio
π	profit per unit of output
ρ	reduction in profit margin (proportion) during non-strike industrial action
U	duration of unemployment

Table 4.2 Signs of the Impact of Variables on the Probability of a Strike Occurring

	Effect On				
Variable	Union	d	Firm[1]	Firm[2]	Combined[3]
d			+		
s	+		-	-	?
D	-		-	-	-
L_D	-		-	-	-
ζ	-	-		-	-
δ			-	-	-
L_0	+	+		+	+
l_a	-	-		-	-
l_u	-	-		-	-
η	-	-	+	?	?
λ	-	-	+	?	?
U	-	-		-	-

Notes:
1. Taking into account the direct impact of d.
2. Taking into account the factors which determine d.
3. Combining columns 2 and 5. When signs are the same, the impact is clear; when they differ, the impact on strikes is uncertain.

Table 4.3 Signs of the Impact of Variables on the Probability of a Non-Strike Industrial Action Occurring

	Effect On				
Variable	Union	d	Firm[1]	Firm[2]	Combined[3]
d			+		
s	+		-	-	?
T	-		-	-	-
ζ	-	-		-	-
δ			-	-	-
L_0	+	+		+	+
l_a	-	-		-	-
l_u	-	-		-	-
η	-	-	+	?	?
λ	-	-	+	?	?
ρ			-	-	-
U	-	-		-	-

Notes: 1 Taking into account the direct impact of d.

2 Taking into account the factors which determine d .

3 Combining columns 2 and 5. When signs are the same, the impact is clear; when they differ, the impact on non-strike industrial action is uncertain.

5 A New Time-Series Model of Australian Strikes

5.1 Introduction

In this chapter we use the theoretical framework developed in Chapter 4 to construct an empirical model which explains the quarterly variation in working days lost per thousand employees in Australia. We seek to operationalise and test the model shown in Equations 4.29 to 4.31, by choosing a set of suitable proxy variables and estimating a time-series regression equation. This model gives a key role to the opportunity costs of strikes to firms and unions; the latter depends on the degree of labour shedding brought about by wage increases and strikes, replacement wages of retrenched employees and their average duration of unemployment.

We test other hypotheses identified in the economic strikes literature, principally the roles of the business cycle, mis-information and union power. We also examine the impact the government's industrial relations policy, in particular the Prices and Incomes Accord, and whether different federal governments in Australia have been more strike-prone than others.

The opportunity costs of strikes, as we have defined them, cannot be calculated easily from Australian time-series data, and we argue that a macroeconomic capacity utilisation variable offers the best prospect of capturing its determinants. But as Mumford (1993) points out, and is abundantly clear in the empirical literature, the unambiguous assigning of proxies to particular hypotheses is problematic.

An extensive range of diagnostic tests are used in order that valid inferences may be drawn from the estimated model. Further, we examine the stability of the model's parameters over time to determine whether its ability to explain strikes is independent of the specific sample used.

Before proceeding further, we introduce a note of caution. The strikes literature assumes, at least implicitly, that disputes occur over shares of profits and, therefore, that the workplaces in which they occur are private enterprises, or perhaps government business enterprises.[1] There appear to be no theories of strikes in the non-commercial sector, by groups of employees such as public servants, council workers, teachers and nurses, who from time to time are involved in strikes in Australia. In Australian time-series strikes data, we are unable to isolate the non-commercial sector. It is not clear how strongly the aggregation of the commercial and non-commercial sectors affects the testing of strike models which have as their fundamental assumption that disputes occur over profit shares. In the worst case, strikes in non-commercial workplaces manifest as random variation in aggregate models; in the best, traditional relativities in wages and other working conditions between different groups of workers, transmit strike-causing conditions in the commercial sector, to the non-commercial sector. This is not a trivial matter because approximately one third of Australian employment is in the public sector, and a large part of this in non-commercial workplaces.

5.2 The Dependent Variable: Strike Costs

A survey of economic models of strikes indicates that there is a divergence of views concerning what is a useful measure of strikes. We define the cost of strikes to be working delays lost per thousand civilian wage and salary earners.[2]

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[1]Although the objective of profit maximisation which is commonly assumed may be a reasonable assumption for private enterprises, government business enterprises appear to have broader objectives.

[2]The ABS produces a series for the cost of lost wages, but none for the cost of lost production.

Clearly, the working days lost series must be deflated by an appropriate measure of the size of the labour force, so that the dependent variable is not trended as a consequence of growth of the workforce over time.[3]

This measure is used because it best represents the average cost of strikes per employee, and captures both the number of employees involved in strikes and the duration of strikes. In this we follow the approaches of Oxnam (1953), Bentley and Hughes (1970 and 1971), Beggs and Chapman (1987b and c) and Chapman and Gruen (1991).[4]

The relationship between working days lost and the cost of strikes may be less direct than it might appear *prima facie*. Turnbull (1992) describes changes in the nature of work in British and Australian stevedoring, and in particular the reduction in the number of dockers employed, as highly mechanised and individualised work practices replace more labour intensive work gangs. Changes in the once strike-prone Australian stevedoring and mining industries suggest that the relationship between working days lost and the cost of strikes, is not constant over time. On the assumption of rising labour productivity, we expect that the value of lost output in strike-affected workplaces, to rise over time for any given level of working days lost.

Several Australian authors attempt to draw a direct link between working days lost and trade union militancy. Bentley and Hughes (1970), in their business cycle analysis, identify the determinants of strikes as '(a) the frequency of

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[3]Wider measures of the labour force would include groups such as military service personnel and self-employed persons, who are unlikely ever to be involved in strikes.

[4] Oxnam makes the interesting observation that strikes are less costly to the Australian economy than a range of other industrial malaises, which include industrial accidents, slackness on the job, absenteeism, and high labour turnover. [p 87]

strikable issues; (b) the effectiveness of strike protests; and (c) the willingness to strike'. [p 153] They see militancy, or willingness to strike, as one of the factors which influence the incidence of strikes and argue that militancy proxies ought to be included in the set of regressors.

Strike statistics are manifestations of industrial unrest which may arise from pressure from either, or both, sides of the employer-employee relationship. All economic theories of strikes, at least dating back to Hicks (1932), recognise this. In Ashenfelter and Johnson's (1969) model, a hardening of the employer's response to union demands results in a downward shift of the employer's resistance curve which, other things being equal, increases the likelihood of a strike occurring. Clearly, no conclusions can be drawn with respect to changes in the militancy of unions, by observing changes in strike statistics in isolation from information regarding the resistance of employers.

Notwithstanding this, Oxnam (1968) sees a very direct connection between strikes and militancy, in claiming that 'to a considerable extent ... the strike problem in this country consists of nothing more serious than gestures of industrial militancy'. [p 22] Phipps (1977) claims that working days lost is 'worse than useless as a proxy for trade union aggressiveness' [p 308], yet goes on to argue that the number of strikes per ten thousand workers was a 'reasonable surrogate for *successful* union pushfulness' [p 309].[5] This is based on the proposition that, in essence, increases in pushfulness, *ceteris paribus*, increase the number of

[5]Phipps does not discuss the appropriateness of working days lost per employee as a measure of pushfulness.

strikes; the *ceteris paribus* assumption is clearly unreasonable, hence the surrogacy claimed by Phipps is unjustified.

Perry (1978a), in investigating whether Australian strikes data supports the Hines' (1964) hypothesis, argues that working days lost per employee is the broadest measure of union militancy because it captures the number of strikes per employee, the number of workers involved, and the average duration of strikes. This contradicts Hines who suggests that changes in union density captures important aspects of militancy. Perry recognises that strikes are, in part, determined by employers' responses to unions' demands, and to "unsympathetic" Commission determinations[6], but asserts that strikes can still be treated as a proxy for militancy. He claims, in support of this, that his regressions indicate that employers' reaction functions are relatively stable over the sample periods, which span 1947 to 1976.

Perry (1979), in examining strikes in the period 1919 to 1939, makes similar claims to those in his earlier paper, regarding the stability of employers' reaction functions. Using a "shift" variable to capture an autonomous change during the great depression, he concludes that 'the model ... accommodates itself to strike activity as a proxy (for militancy) and in particular includes a role for employer behaviour'. [p 235] Although Perry identifies a relation between inflation and strikes in Australia, his claim that working days lost per employee is a good proxy for trade union militancy is not convincing.

[6]Determinations in which the Commission rejects all or a large part of a union's seriously proposed claims (not ambit claims).

Beggs and Chapman (1987a) who test several theories concerning the factors which cause strikes, argue that the most satisfactory measure of strikes is working days lost per union member because it is 'the broadest measure of trade union militancy'. [p 48] This contradicts, in part, their proposition that some strikes may be *employer-provoked* disputes, designed to run down unwanted inventories.

It is not clear why, Beggs and Chapman place so much apparent importance on the issue of strikes as a measure of militancy; in principle, the cost of strikes is measurable whereas militancy is not.[7] They argue, in essence, that the Accord introduces an era in which the union movement is persuaded to adopt a less militant stance. If this is so, the Accord dummy used in Beggs and Chapman (1987b and c), places militancy, squarely, on the right hand side of their regression equations. In Beggs and Chapman (1987a) there is no Accord dummy, but in their forecasting analysis they attribute differences between the actual and predicted strike activity to the effect of the Accord; again the Accord, and therefore militancy, is offered as a causal factor rather than an outcome.

The issue of militancy aside, Beggs and Chapman (1987a) argue that working days lost per unionist

> increases with the number of strikes *per employee*, the number of workers involved per strike and average strike duration.[8] [p 48]

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[7]The hypothesis that the Accord reduces strike activity is comparatively easy to test; that it reduces militancy, is more elusive.

[8]My italics. The thrust of the preceding text suggests that the authors have used the term "employee" where they surely intended to use "unionist".

This measures the cost of strikes per union member, and is a less precise measure of costs to the economy than working days lost per employee.[9]

The theoretical model in Chapter 4 does not deal with short term strikes, which may be regarded as part of tactical manoeuvring by unions. It is not possible to remove these from the ABS working days lost series, and we make the assertion that factors which cause increases in the incidence of "serious" strikes, have a similar impact on short term strikes.

We take a position commonly suggested by strike theories, that militancy is a causal factor rather than an outcome, and that strikes variables should not be regarded as proxies for militancy.

5.3 The Explanatory Variables

We now consider a range of variables suggested by the literature and by our theoretical strikes model in Chapter 4, which are likely to influence strike activity. A list of definitions and sources of data are shown in Table 5.1.

5.3.1 The Opportunity Cost of Strikes

Our theoretical model proposes that unions are more strike averse when the opportunity cost of strikes are greater; these costs are summarised in Equation 4.30. Union strike costs are positively associated with the union's estimate of the likely settlement (because of its effect on prices), strike duration, market erosion resulting from strikes, the elasticity of demand for the firm's product, labour's share of total costs, the duration of unemployment, replacement wages, and negatively with the union discount rate. On the other hand, higher settlements

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[9]Working days lost per unionist poses an additional problem in that union membership is an annual series which requires interpolation to match it with the quarterly working days lost series.

bring about greater earnings for those employees who are not retrenched following strikes and wage increases, and our model assumes that demands are only made when the union expects the net benefit to be positive.

High strike costs to firms make them more likely to concede to union demands. The model proposes that the firm's strike costs and employer resistance, is positively associated with the size of the settlement, strike duration, the erosion of the firm's market caused by strikes, the elasticity of demand, labour's share of costs, and negatively with the firm's discount rate. The costs of concession are, of course, positively associated with the magnitude of the union's demand.

As a proxy for some of these cost factors, we use the capacity utilisation variable contained in the NIF-10 data base; this is the ratio of real non-farm gross domestic product to potential real non-farm gross domestic product, both at market prices.[10] This attempts to gauge the level of real productive activity in the economy, relative to the level which would fully employ its economic resources.

It is reasonable to suppose that unions expect that the ability of firms to pay higher wages is greater when the economy is operating close to full capacity. Consequently, unions anticipate higher settlements and shorter strikes to secure them, both leading to greater strike propensities of unions. Conversely, if unions' assessments are correct, firms are more likely to concede to demands, so the combined impact on strikes of greater capacity utilisation is uncertain in this respect.

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[10] In NIF-10 Potential Gross Non-farm Domestic Product is calculated by linking peaks of the Gross Non-farm Domestic Product Series using constant growth rates between successive peaks, and extrapolating the last of these rates to determine values beyond the last peak.

It is clear that jobs are easier to find when capacity utilisation is high, so the average duration of unemployment of retrenched workers is smaller, and the costs of strikes to unions are reduced. Although ABS average unemployment duration data are available, consistent series extend back to only 1978, but perhaps more importantly, the data is muddied by the growth of long term unemployment beginning in the mid-1970s.[11] Because the theoretical model focuses on the re-employment prospects of recently retrenched workers, we believe that capacity utilisation is a satisfactory proxy for the duration of unemployment.

The model also proposes that strikes are negatively associated with the difference between union and efficiency wages, and wages paid in secondary labour markets and dole payments. In Australia, social security payments are linked to Average Weekly Earnings, albeit with a lag, and high levels of capacity utilisation suggest that the gap between primary sector wages and social security payments widens in the short term. It is also possible, but not certain, that the gap between primary sector and secondary sector wages increases during high levels of economic activity, when the demand for skilled labour may rise *vis-à-vis* unskilled labour. A widening of these gaps suggests that employees are less willing to strike in boom conditions, which runs counter to the argument associated with the duration of unemployment.

The model hypothesises that estimates of the elasticity of demand in the product market effect the wage demands of unions and the resistance of firms. The growth of markets during the boom may cause both sides to revise their estimates; if unions believe that boom conditions allow firms to pass on real price increases

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[11]See Flatau *et al* (1991).

with little impact on sales, while firms are more conservative, we can expect union demands to be greater, but little relaxation of the firm's resistance. This, too, implies a positive relationship between strikes and capacity utilisation.[12]

At high levels of capacity utilisation, unions and firms may believe that market erosion due to losses of goodwill associated with strikes, is reduced. They may see their firms with buoyant sales, and regard strikes in other firms as having a neutralising effect on the negative impact of strikes at their own workplaces. Strike activity is likely to increase if employers are more conservative than unions in their assessment of reductions in market erosion in the boom.

Efficiency wage models suggest that when capacity utilisation decreases, firms shed labour so that labour's share of total cost declines, assuming that capital costs are fixed. This implies that during boom conditions, labour's share is greater, so moderating wage demands and strike propensities of unions. At the same time, however, larger price increases as a consequence of any given wage increase in greater reductions in sales and profits, so that firms are more resistant. The overall impact of this on strikes is uncertain.

Our model proposes that strikes are negatively associated with union and employer discount rates. It is unclear what factors might cause union discount rates to change over time, nor is it evident that interest rates are satisfactory proxies for employers' discount rates. Although it may be reasonable to use interest rate variables as a proxies for employer discount rates in profit maximising firms in a competitive market system, our model assumes cost-plus pricing in

[12]Alternatively, we could argue that both parties' estimates of the elasticity of demand are unaffected by the boom, but that divergences in estimates in income elasticity bring about a similar outcome.

private enterprises. Even if interest rates are satisfactory proxies in the private sector, we have no basis for believing that they proxy those in the public sector. Casting further doubt on using an interest rate variable, prior to the de-regulation of the financial sector in 1984, interest rates did not fully reflect the rates of time preference of borrowers and lenders.[13] For these reasons, we do not attempt to include discount rates in the empirical model.

It is clear, of course, that capacity utilisation is a business cycle indicator so, at an empirical level, the significance of this variable is consistent with our own model and many business cycle models of strikes. The differences are in the explanations of the observed pro-cyclical behaviour of strikes.

The first empirical analyses demonstrate that strikes are pro-cyclical. Rees (1952) rationalises his observations by claiming that boom conditions offer a strategic advantage to employees; employers' ability to resist union demands are lower due to fears that strikes would result in the losses of shares of rising markets to competitors. In addition, employers observe rising real wages elsewhere in the economy, and consequently rising opportunity costs of alternative labour sources; therefore they have greater difficulty of substituting non-union labour for striking employees.[14] The weakened position of employers makes unions more likely to pursue claims backed by strike action. Theories of bargaining, however, are more equivocal on this point; a weakened position, other

[13]Indeed, during some periods in the 1970s, the real rate of interest was negative.

[14]The corollary to this second proposition is that in weak labour markets, employers can more readily make such substitutions; this appears to be fanciful, at least in the context of the Australian industrial relations system during the sample period used here.

things being equal, suggests that employers would be more likely to concede to union demands, so reducing the incidence of strikes.

Bentley and Hughes (1971) argue that the business cycle produces variation in the number of labour-hours worked, and consequently in the number of strikable issues. They note that this variation is more pronounced in the traditionally strike-prone industries, and the number of strikes varies through the business cycle, given a constant rate of grievances per labour-hour. They concede that certain types of grievances are more likely in different phases of the cycle, but seem unprepared to specify whether the overall rate of grievances per labour-hour is higher or lower in the boom.[15] Oxnam (1975) states that rapid economic expansion increases the need for changes in work practices to facilitate growth of output, so the frictions generated by change increases the number of strikable issues. This is advanced in conjunction with the proposition that unions have more power in boom conditions, so then these issues are more likely to be vigorously pursued.

Ashenfelter and Johnson (1969) argue that the business cycle impacts on the union's concession curve. At high rates of unemployment, when alternative sources of labour are more abundant, strike-free wage demands at the end of a contract are lower, and the likelihood of a strike occurring reduced.

Imperfect and asymmetric information models suggest that during recession, employees may believe that their own employers are unable to provide better working conditions. In these circumstances, demands for improvements in

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[15]They argue that grievances over hiring, overtime, technological change, speed-ups of work, and frustrated wage expectations, increase in the boom; grievances over redundancies and cost cutting rise during recession.

working conditions may be less strongly pursued, so conditions may stagnate or deteriorate. In boom conditions, the propensity to strike increases because employees believe that their employers have a greater capacity to pay, and furthermore, they consider themselves to have shown restraint in pursuing wage increases during the difficult conditions of the preceding recession.

It is clear that there is no compelling single theory which explains the pro-cyclical behaviour of strikes, and that all propositions noted above have, at least, an element of plausibility. All empirical researchers who investigate Australian strikes, identify this phenomenon.

It is asserted that inflation and unemployment rates, at least since the mid-1970s, have been unsatisfactory measures of economic activity due to structural changes occurring in the relationship between inflation, unemployment and real economic activity. With the onset of stagflation, the unemployment series exhibits a large upwards shift which persists beyond the end of our sample; the inflation series experiences a similar shift which remains for all but the last few years of the sample. Both inflation and unemployment do not correlate strongly with capacity utilisation, and there appears to be some evidence of a structural break in its relationship with inflation in 1972.[16]

5.3.2 Union Density

Comparatively little theory has been advanced to explain the relationship between strikes and union density. Theories of strikes assume that a union is

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[16]The Pearson correlation coefficient between capacity utilisation and inflation for the sample is 0.34, and between capacity utilisation and unemployment -0.36. For the period 3:1959 - 4:1972, the correlation coefficient between capacity utilisation and inflation is 0.64, and for the period 1:1973 - 4:1992 is 0.34; the corresponding coefficients between capacity utilisation and the unemployment rate are -0.60 and -0.72.

present, yet few address the question of how variations in union density may affect strike propensities. Our model assumes that the workforce is sufficiently organised to enable union officials to manage a strike, but that any benefits achieved or costs incurred, flow to all employees, irrespective of union membership.

We propose that higher levels of union density at a workplace are likely to be associated with a larger acceptable employment loss to union officials who, therefore, make higher wage demands and pay less heed to the long term consequences of strikes. As a result, we expect to observe a positive relationship between the incidence of strikes and union density. Although our theoretical model is couched in terms of enterprise unions, we argue that the ratio of the actual membership of any union to the potential membership across relevant industry or occupational groups, impacts on the union's willingness to make demands likely to reduce employment levels. Therefore, the model suggests a positive relationship between the propensity of unions to strike and union density, both at the firm and at the macroeconomic level.[17]

This relationship is also supported by the proposition that higher levels of density are likely to facilitate the management of strikes by union officials. It is hypothesised that the ability to organise a strike is an increasing function of union density at any workplace, and that as union density increases at a macroeconomic level, more workplaces are sufficiently organised to strike.

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[17]On the contrary, it may be argued that closed shop workplaces might be strongly opposed to job shedding. It is clear, however, that real wage increases in excess of productivity, are likely to have this result via losses of market share and substitutions of capital for labour, at least in the long run, in all but highly protected workplaces.

Hines (1964) uses changes in union density as a proxy for union militancy in an attempt to show that union activity is an important determinant of inflation in Britain. He argues that union membership drives are indicative of a hardening of unions' bargaining positions. He also proposes that employers are more likely to make concessions when faced with greater union strength, but if this is so, it is not clear whether strike activity increases or decreases as a consequence.

Purdy and Zis (1974), in attempting to refute Hines' hypothesis, deny that a link can be drawn between union density and union power, and argue that the growth of compulsory unionism in Britain renders Hines' proposition invalid. Although they claim that union strength and union density are not *necessarily* positively related to strike activity, it is difficult to imagine the reverse where an increase in density at a particular workplace would cause a deterioration in the union's position.

Booth (1985) and Naylor (1989) analyse the free rider aspects of settlements achieved by unions; Booth notes that

> expectations held by both unions and employers regarding individual workers' responses to a strike call are likely to be a key factor in the bargaining process. [p 772]

At low levels of density, the solidarity required to maintain effective strike action may be difficult to initiate and sustain, but at high levels, a strike is more readily managed by union officials.

At the workplace level, density statistics may not always be useful predictors of the propensity to strike, because some sections of the workforce may be highly unionised and others not; strikes may result from the actions of small, but highly unionised groups, even when the over-all density at the workplace is low. At a macroeconomic level, it is likely that an important factor governing strike propensities is the number of workplaces where at least one occupational group has a high level of union membership. It seems unlikely that macroeconomic changes in union density are the result of *uniform* changes across occupations and industries. It is probable that large parts of observed increases result from membership drives by particular unions[18], or growth of sectors which already have strong union traditions. Similarly, decreases in density may result from workforce reductions in highly unionised sectors, or shifts from the use of full-time to part-time employees.[19]

Some researchers who use a union density variable in empirical models are Hunter (1974), Snyder (1975 and 1977), Perry (1978b), Edwards (1978), Kaufman (1982), Gramm (1986), Mishel (1986), Tracy (1987), and Abowd and Tracy (1989).

Union density is defined to be the ratio of the number of union members to the total number of civilian wage and salary earners. Because union membership is an annual series, we use linear interpolations to obtain a quarterly series, and recognise that actual changes from quarter to quarter are likely to be less regular.

A more serious doubt about the use of a union density variable is whether, in a single equation model attempting to explain strikes, density can be legitimately regarded as exogenous. This turns on the extent to which changes in density are the result of membership drives, and whether some of the factors

[18]This may include agreements between unions and employers to introduce closed shop policies.

[19]Peetz (1990) estimates that since 1982, structural change accounts for at least half of the decline in union density. Borland and Ouliaris (1994) state that their analysis is 'consistent with other recent studies which have attributed the decline to .... the changing composition of employment'. [p 466]

which cause union leaders to embark on membership drives are the same as those which precipitate strikes. We use a Hausman test of endogeneity to investigate this possibility.

5.3.3 Inflation

Our model proposes that inflation plays no explicit part in determining wages and profits in the long run, because it is assumed that some form of wage indexation occurs. This, of course, does not deny that inflation may cause changes to occur in perceptions of costs and benefits of acquiescence and resistance to wage demands. In so far as inflation leads employees to believe that their real wages are declining, or employers that their real costs are increasing, the model suggests that strikes are positively associated with inflation. We note earlier that an inflation regressor is sometimes used as a business cycle proxy, but we argue that, at least during our sample period, that inflation is a weak indicator of economic activity.

It is well-known that in an economy comprised of flexible markets, that perfectly anticipated pure inflation is fully accommodated in money wages, so that real wages are unaffected. Australian labour markets do not generally display this flexibility, at least in the short term, nor is it clear to what extent inflation is anticipated, and to what degree actual inflation departs from a pure inflation. Solow (1975) suggests that increases in inflation distort perceptions of long term changes in real living standards; if this is so, a general belief that living standards are falling may precipitate more strike activity.

Tobin (1972) points out that many employees receive administered money wages which change infrequently. Although the trend in real wages may be an increasing one, between the wage adjustments of any group of employees, inflation causes a gradual erosion of purchasing power to occur. Myopic employees focus on inter-adjustment losses rather than on trends, so higher rates of inflation are likely to promote stronger demands for nominal wage increases, for any given level of long term real earnings growth.

Solow (1975) draws attention to the common failure of governments to index income tax schedules during periods of inflation. If real wages are static or rising, increases in money wages cause greater proportions of income to be paid as tax; this may cause a divergence between the rates of growth of real pre-tax and post-tax earnings. Employees may regard the latter, perhaps wrongly, as an indicator of their own welfare, and are more willing to strike to recoup these perceived losses.

Solow also notes that in periods of relatively high inflation, volatility in the prices of assets often enables large, and lightly taxed, speculative gains to be made by investors, and 'the traditional virtues of simple competence, diligence, and honesty do not pay off'. [p 48] It is reasonable to suppose that in these circumstances, employees whose incomes are derived from wages and salaries, are more aggressive in their pursuit of real wage increases.

Expanding on Solow's view concerning shares of wealth, and Tobin's observation regarding the periodicity of administered wage adjustments, we note that the growth of real average weekly earnings does not imply a *uniform* growth in the real earnings of all labour market groups. Real growth in average earnings, accompanied by high rates of inflation, suggest that traditional relativities between different groups may change, at least in the short term. This is likely to cause those employees whose real wages lag those of other groups, to pursue restoration of relativities, and therefore to be more strike-prone. This argument may be weaker in periods of wage indexation, however there remains the issue of relativities between employees whose wages are determined by awards, and those, for example the self-employed, whose earnings are not.

The foregoing arguments draw no distinction between anticipated and unanticipated inflation. We assert that unanticipated inflation is likely to be crucial in explaining strikes when lengthy employment contracts are entered into, without cost of living adjustments. This is uncommon in Australia, and explicit cost of living adjustments have often been part of national wage decisions and awards. Given that the arbitration system has, by and large, sought at least to maintain real earnings, except during the Accord period, it is unlikely that unanticipated inflation is more than a minor factor in determining strike incidence.

We use the rate of change of the Consumer Price Index to measure the rate of inflation.[20]

5.3.4 Mis-information

In our model, the parties to a dispute may have different views regarding the elasticity of demand in the product market. This affects the employer's estimation of the reduction in profit resulting from a real price increase, and the union's assessment of the likely loss of employment. In Section 5.3.1., we suggest that during boom conditions, the union may estimate it to be less elastic, and the

[20]It is clear that one of the Implicit Price Deflators provides a more general measure of inflation, however the Consumer Price Index is used as the basis for cost of living adjustments and is broadly understood. The Deflator is rarely reported in the media, and it is not widely known to the public.

firm more elastic, so implying a positive relationship between strikes and the business cycle.

The fundamental tenet of the imperfect information school of strike analysis, is that strikes are more likely to occur when employers and unions use different variables to form views regarding future rents available for distribution. Some of the writers who investigate this are Mauro (1982), Cousineau and Lacroix (1986), and Gramm *et al* (1988).

We use a variant of the mis-information variable suggested by Beggs and Chapman (1987a); this is the product of the deviation of overtime and profit[21] from their mean values, when the former is positive and the latter is negative, and zero otherwise.[22] Beggs and Chapman argue that when overtime is high, employees may believe profits to be high, and along with this, the capacity to pay higher real wages; if, in fact, profits are low, the capacity to pay is low, and the employer's resistance stronger. The result of this mis-information regarding the true state of profits, is a greater incidence of strikes. This variable, of course, captures mis-information regarding contemporaneous profits, rather than future profits.

Negative values of Beggs and Chapman's mis-information variable occur when profits are low and overtime is high; this is consistent with employers believing sales and profits to be sensitive to price increases, but high levels of overtime may prompt unions to believe that any labour shedding would be small.

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[21]Profit is defined to be the ratio of gross operating surplus of corporate trading enterprises to the total wage bill of civilian wage and salary earners , both seasonally adjusted.

[22]Beggs and Chapman use deviations from linear trends, however over the longer sample period used here, neither variable is trended.

For this, and the reasons proposed by Beggs and Chapman, we hypothesise a negative relationship between strike activity and this mis-information variable.

5.3.5 Real Wages

Our theoretical model suggests that strike incidence is negatively associated with the gap between primary sector wages, and secondary sector wages and dole payments. It is arguable that increases in real average weekly earnings signal an increase in this gap[23]. Changes in social security payments lag changes in Average Weekly Earnings, and given an excess supply of long term unemployed workers, wage increases in secondary labour markets are likely to be smaller than those in the primary sector. Therefore, we hypothesise a negative relationship between strike activity and recent increases in real Average Weekly Earnings.

Our empirical model is consistent with the relationship between strikes and real wages proposed in other models. Ashenfelter and Johnson (1969) use a wage variable to capture recent changes in real earnings, which influences the union's concession curve via its impact on the strike-free wage demand at the end of a contract. Recent decreases in real wages cause unions to make greater wage demands, and so increase the probability of a strike occurring. Although few contracts with termination dates exist in Australia, this is unlikely to invalidate Ashenfelter and Johnson's conclusion that real wages are important in explaining strikes, although the timing of the presentation of logs of claims in Australia is less regular than in the US.

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[23] In Section 5.2.1 we argue that during the boom, increases in secondary sector wages and dole payments are likely to lag those in the primary sector.

Ashenfelter and Johnson use an Almon lag function of changes in real wages, however we begin with a simple one-period lag of changes in real average weekly earnings. We also test geometric distributed lag functions of changes in real average weekly earnings, because it is arguable the recent history of real wage increases is important, and that this impact decays over time. We prefer to use the simpler variable when it is, at least, equally capable of explaining strikes. The distributed lag function we test is

$$\Delta RAWE(\lambda)_t^* = (1-\lambda)\sum_{i=0}^{\infty}\lambda^i \Delta RAWE_{t-i-1} \qquad (5.1)$$

where $RAWE_t$ is the level of real average weekly earnings and $0 < \lambda < 1$.

Others who use real wage variables are Pencavel (1970), Hunter (1974), Snyder (1975 and 1977), Hibbs (1976), Farber (1978), and Edwards (1978). By contrast, Knight (1972), Shorey (1977), Shalev (1980), and Kaufman (1982), use changes in nominal earnings, together with the inflation rate, treated as a separate variable.

5.3.6 Inventories

Our model proposes that both employers and unions are strike averse if they believe that a strike will erode the firm's goodwill, resulting from customers' inability to obtain regular supplies of the product. This loss impacts on both long run profits and employment levels of unionists, and suggests that strikes are more likely to occur when inventories are high, and the risk of market erosion is smaller.

Beggs and Chapman (1987a) argue that high and unwanted levels may prompt employers to provoke strikes, so that inventories run down to desired levels when employees withdraw their labour. In Chapter 3 we argue that this is not convincing given that Australian strikes are typically of short duration, and the use of this strategy would cause the industrial relations climate to deteriorate for some considerable time afterwards.[24]

The use of an inventories variable is also proposed by Reder and Neumann (1980), who argue that the incidence of strikes varies inversely with the total cost of strikes. High levels of inventories reduce strike costs and enable firms to hold out against union demands and strike action. Hart (1989), who addresses the role of delays in the bargaining process, claims that when inventories are exhausted, or as he terms it, a "crunch" occurs, the flow of sales revenue ceases and the firm's market share is reduced. Firms are anxious to reach agreement quickly when inventories are low, but more likely to resist demands, and risk strikes, when inventories are high.

Like Beggs and Chapman, Reder and Neumann, and Hart, our model proposes a positive relationship between strike activity and inventories. Others who use inventories variables are Shalev (1980), Tracey (1987), and Gramm *et al* (1988).

We use a variable similar to that suggested by Beggs and Chapman (1987a); this is the deviation of the NIF-10 ratio of stocks to sales to its trend. The ratio has a strong negative trend over the period under investigation.

5.3.7 Profit

Our model assumes that real profit margins are constant, and that changes in total profits occur through changes in sales volumes. This implies that changes

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[24]In the 1980s there have been instances of firms requiring employees to take part of their annual leave when faced with rising inventories, and others of requiring employees to work four-day weeks. Although neither of these practices are welcomed by unionists, it is likely that they are accepted as a solutions to short term problems, whereas employer-provoked strikes are not.

in profits are determined by real wage and price increases, and the elasticity of demand. In our empirical model which takes a broader approach, we include a profit variable as an indicator of the firm's capacity to pay, and the union's assessment of the potential for obtaining wage increases.

Ashenfelter and Johnson (1969) argue that the strike-free wage demand at the end of a contract is positively associated with the firm's profits in the preceding period. Whether strikes are positively associated with profits is uncertain, because higher profits make employers more able to concede to wage demands. The absence of fixed term contracts in Australia, appears not to invalidate their underlying argument.

Like Ashenfelter and Johnson, we leave the profit variable unsigned *a priori*. Others who use a profit variable are Pencavel (1970), Knight (1972), Walsh (1975), Phipps (1977), Farber (1978), Davies (1979), Shalev (1980), Mauro (1982), Beggs and Chapman (1987a), Gramm *et al* (1988), and McConnell (1990).

Our profit variable is the ratio of gross operating surplus of corporate trading enterprises to the total wage bill of civilian wage and salary earners, both seasonally adjusted.[25]

5.3.8 Political Regimes and Federal Elections

Several writers investigate whether the orientation of the national government influences the incidence of strikes. Pencavel (1970), Skeels (1971), Shorey (1977), Hazeldine *et al* (1977), Snyder (1977), Edwards (1978), and

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[25]Clearly, this is *not* the ratio of profits to wages in corporate trading enterprises, but we believe the proportion of employees in corporate trading enterprises to be sufficiently stable to allow profits to be defined in this way.

Paldam and Petersen (1982) use dummy variables to differentiate between left-wing and right-wing governments, and Snyder (1975 and 1977), Edwards (1978) and Kaufman (1982) use the percentage of Democrats in the Congress in their US studies.

We test whether different federal governments, or whether the Australian Labor Party is in power, influence strikes. It is not possible to specify signs, *a priori* to different regimes; conservative governments perceived to take a hard line stance against union power may provoke more strikes, but as Paldam and Pedersen (1982) point out, the converse may be true if socialist governments are unable to deliver the improvements in living standards anticipated by unionists who support them in elections.

Following Snyder (1975), we also hypothesise that the occurrence of elections may alter the costs and benefits of strikes to bargainers. The union movement may become less eager to strike prior to an election, so that public antipathy towards strikes does not adversely affect the Labor vote. On the other hand, the imminence of an election may present an opportunity to public sector unions to place greater pressure on the government who is their employer. It is not possible to state which of these effects dominate prior to any particular election. Although it is unlikely that all elections have a significant impact on the incidence of strikes, we test all federal elections during the sample period.

In a federal system, such as Australia, it is possible that state government policies and election run-ups may affect the incidence of strikes. Because, however, this model deals with national aggregate strike statistics, it seems inappropriate, especially given the large number of additional variables required.

For all political regime and election variables, the dummies take the value 1 for full quarters and fractional values for incomplete quarters.[26]

5.3.9 Incomes Policy Variables

In the years following the introduction of the "total wage" which abandoned the concept of a basic wage plus margins for skills, the Australian industrial relations system moved progressively away from arbitration and towards collective bargaining; indeed, Deery and Plowman (1985) note

> Whereas in the five years proceeding the introduction of the total wage, national reviews (basic wage plus margins) contributed eighty five per cent to award wage increases (however) this proportion fell to only twenty eight per cent in 1972-73 and to only nineteen per cent in 1973-74. [p 298]

In April 1975, following two years of a 'wages explosion' in which award wages increased by approximately 30 percent per annum, wage guidelines, in the form of wage indexation, were re-introduced.[27] At that time the government faced an annual inflation rate in excess of seventeen percent, unemployment rising rapidly and already above five percent, and profits falling to approximately eleven percent of GDP.

In essence, Australia had a series of incomes policies from 2:1975 until beyond the end of the sample period, except between 3:1981 and 4:1982 when decentralised wage determination occurred. Watts and Mitchell (1990a), in examining the impact of Australian incomes policies on wage structures, claim that

> there is strong evidence that the wage guidelines, introduced as part of a national incomes policy, have been associated with considerable restraint in aggregate wage outcomes. [p 353]

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[26] For example, for the 1974 election, P_{74t} takes the value 0.13 in 1:1974 and 0.87 in 2:74.

[27] Wage indexation, which links wages to the so-called cost of living, began with the Commission's Harvester judgement of 1907, and continued until 1953.

It is hypothesised that this restraint also manifested itself in reduced levels of strike activity. We adopt the break-down of Watts and Mitchell (1990b) of the period 2:1975 to 2:1981 of wage indexation into four phases: first, 2:1975 to 2:1976 of full quarterly indexation; second, 3:1976 to 2:1978 of partial and plateau quarterly indexation; third, 3:1978 to 3:1979 of full indexation half-yearly; and fourth, 4:1979 to 2:1981 of partial indexation half-yearly. We also examine the impact on strike activity of the wages pause in 1:1983 and 2:1983, in which money wage increases were prohibited.

With the election of the Hawke Labor government in March 1983, a new approach to Australian economic and industrial relations policy began with the Prices and Incomes Accord. The Accord embraced many aspects of economic and social policy and offered an active role to the trade union movement in deliberations regarding macroeconomic policy. It included the notion of a "social wage" in which social welfare benefits were seen as an adjunct to earnings. Importantly, so far as industrial conflict is concerned, it replaced an adversarial approach with a consensual or corporatist one and established a wage bargaining process involving government, employers and unions. Indeed, at the Accord's introduction, it was claimed by the government that an important benefit would be reduced levels of industrial conflict in Australian industry, and in particular lower incidences of strikes.

Beggs and Chapman (1987a) use a model based on data from the period 3:1959 to 1:1983 to forecast the incidence of strikes for the first three years of the Accord. By comparing these forecasts with what actually occurred, they conclude that

> strike activity fell markedly in this time in a way not explainable by macroeconomic conditions. It is not unreasonable to attribute some part of this experience to the Accord. [pp 57-58]

This conclusion regarding the Accord is challenged, for example by Clark (1987), on the grounds that, in the same period, the incidence of strikes declined in other OECD countries. He suggests that the Australian experience is simply part of an international trend and, by implication, would have occurred in the absence of the Accord. Nevertheless, Chapman and Gruen (1991), in reviewing recent empirical studies, note that during the period 1983-87 the Australian experience is "unique"; Australian strikes decrease by approximately 70 percent compared with 40 percent in the rest of the OECD. They conclude that 'it is difficult to believe that the Accord has not gone an important way to achieving its objective of a diminution of industrial disputation'. [p 498] Other Australian researchers, for example Lewis and Spiers (1990), Chapman *et al* (1991), Flatau *et al* (1991) and Kenyon (1992), claim that the Accord produces other benefits including reduced social inequality, moderation of wage inflation (in part due to a union commitment to no extra claims outside the centralised wage fixing institutions[28]), job creation, reductions of insider (union) power, and greater labour market flexibility.

Renegotiation of the Accord between the government and the ACTU occurred six times during 1983-92, and major changes were made to accommodate the devaluation of the Australian dollar in 1985, and the shift to enterprise bargaining in 1987 associated with the 'second-tier' negotiations. The endurance

[28]Wooden (1990) argues that "The key element of the Accord... was the establishment of wage-setting guidelines which specified that no national wage adjustment would be made unless all unions gave an undertaking not to pursue any claims outside the system". [p 54]

and flexibility of the Accord shows that it has been an example of a well-established, dynamic consensual incomes policy of the corporatist kind.

We test the effect of the Accord on strike activity in two ways. First, we investigate whether the introduction of the Accord is associated with structural breaks in the relationships between strike activity and the economic regressors we describe above. Second, we use intercept dummies for the whole Accord period, and for different phases of the Accord to gauge its impact.

5.3.10 Political Strikes

We include five dummy variables to control for major one-off political strikes, which are regarded as occurring for reasons other than those of an *immediate* economic nature. These are (i) the protest over the gaoling of union official Clarrie O'Shea in 2:1969, (ii) the Medibank protest in 3:1976, (iii) the protests over the gaoling of several Western Australian union officials in 2:1979, (iv) the strike in protest at the introduction of the 1991 N.S.W. Industrial Relations Bill in 4:1991, and (v) the state-wide protest in Victoria directed at proposed changes in state industrial relations policy in 4:1992.[29]

5.3.11 Seasonal Variables

We include seasonal dummies for the first, third and fourth quarters which attempt to capture the apparent seasonality of working days lost per employee shown in Figure 5.1.

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[29]The first three of these are also used by Beggs and Chapman (1987a).

5.3.12 A Note of Caution

Economic theories of strikes have their foundations in the microeconomic theory of the firm and labour markets. The testing of these theories, using macroeconomic data, presents some obvious difficulties. Tobin (1972) warns that

> The myth of macroeconomics is that the relations among aggregates are enlarged analogues of relations among corresponding variables for individual households, firms, industries, markets. [p 9]

Unfortunately Australia has little satisfactory microeconomic time-series data which would facilitate the testing of strikes theories. All of the economic variables specified in the model, with the probable exception of inflation, almost certainly vary considerably between regions, industries and firms, and it is highly likely that the use of aggregate statistics masks important effects. For example, if real average weekly earnings are constant, there may be some groups whose real wages are rising, and unlikely to strike on this account, and others whose real wages are falling and more likely to strike; strikes may occur due to real wage effects, although the real wage variable used in the model shows no variation. Clearly, similar arguments apply to capacity utilisation, union density, the Beggs and Chapman mis-information variable, profits and inventories.

5.4 The Model

We adopt the London School of Economics general to specific methodology suggested by Hendry and Richard (1983). It is assumed that the true data generating mechanism of Australian strikes is nested within a general model which we specify as

$$LWDLE_t = \alpha_0 + \sum_{i=1}^{k} \beta_i LWDLE_{t-i} + \sum_{i=0}^{k} [\gamma_i LCAPU_{t-i} + \delta_i \Delta_4 LDENS_{t-i}$$
$$+ \zeta_i \Delta LCPI_{t-i} + \eta_i LOP_{t-i} + \theta_i \Delta LRAWE_{t-i}$$
$$+ \kappa_i LPROF_{t-i} + \lambda_i LINVRES_{t-i}] + \sum_{i=1}^{5} \mu_i P_{it}$$
$$+ \sum_{i=1}^{4} \nu_i G_{it} + \xi PA_t + \sum_{i=1}^{2} \pi_i AC_{it}$$
$$+ \rho_1 S_{1t} + \rho_3 S_{3t} + \rho_4 S_{4t} + \epsilon_t \qquad (5.2)$$

where

$LWDLE_t$ =	logarithm of working days lost per thousand civilian wage and salary earners
$LCAPU_t$ =	logarithm of the ratio of real GDP to potential real GDP
$\Delta_4 LDENS_t$ =	4 quarter change in the logarithm of union density
$\Delta LCPI_t$ =	quarterly change in the logarithm of the CPI
LOP_t =	product of deviation of the logarithms of overtime and profit from their means, when the former is positive and the latter negative, and zero otherwise
$\Delta LRAWE_t$ =	quarterly change in the logarithm of real average weekly earnings
$LPROF_t$ =	logarithm of the ratio of gross operating surplus of corporate trading enterprises to the wage bill of civilian wage and salary earners
$LINVRES_t$ =	deviation of the logarithm of the ratio of inventories to sales from trend

P_{it} = political strike dummy, i = 1, 2, ..5

G_{it} = wage guidelines dummy, i = 1, 2, ..4

PA_t = wage pause dummy

AC_{1t} pre-second tier Accord dummy

AC_{2t} second tier Accord dummy

S_{it} = seasonal dummy, i = 1, 3, 4

ϵ_t = random error term

The hypothesised signs of the coefficients are γ_i, δ_i, ζ_i, λ_i, $\mu_i > 0$, while η_i, θ_i, ν_i, ξ, $\pi_i < 0$, and κ_i, β_i ,ρ_i are unsigned.

5.4.1 The Sample

We estimate the model using quarterly data from 3:1959 to 4:1992. The quarter 3:1959 is a convenient starting point because the NIF-10 data base provides useful economic time-series for several of the variables extending back to this time.

5.5 Procedures Used to Estimate the Model

Our view is that linear models should be used in preference to others, except where there is a clear theoretical justification for an alternative functional form. In preliminary work, however, we find that a linear version of Equation (5.2) produces an estimated model which exhibits heteroskedasticity, and whose residuals are such that the null hypothesis of normality must be rejected.[30] We, therefore, use a logarithmic model which behaves satisfactorily with respect to heteroskedasticity, normality and other diagnostic tests.

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[30]In the *best* specific linear model, the test statistics are, for heteroskedasticity, $CHI\text{-}SQ_1$ = 4.7553[.029] and $F_{1,129}$ = 4.8590[.029], and for normality of residuals, $CHI\text{-}SQ_2$ = 862.7832[.000].

The dummy variables associated with political regimes, elections and industrial policies are numerous, and it is not practical to include all of these in the general model simultaneously. Nor, for the same reason, is it possible to accommodate all likely structural breaks in the relationship between strikes and the economic regressors in the general model. Furthermore, to retain a reasonable number of degrees of freedom, we restrict the number of lags to two in the economic regressors and the lagged dependent variable. The procedure we use is:

(i) estimate the general model specified as Equation (5.2) to determine the lag structure

(ii) investigate and accommodate structural breaks

(iii) determine whether the inclusion of political regime and pre-election dummies improve the performance of the model.

We use Microfit3 software to estimate the model.

5.5.1 Testing for Unit Roots

As a preliminary procedure to testing the model, we test the economic time-series for the presence of unit roots. It is well known, at least since the work of Granger and Newbold (1974), that regressions using time-series data, may be spurious if the data is non-stationary.[31] The testing of time-series data for non-stationarity, or the presence a unit root, became a standard procedure after the symposium in the *Oxford Bulletin of Economics and Statistics* in August 1986, and so is absent from all but the most recent time-series models of strikes.

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[31] Stationarity of a time series X_t requires that $E(X_t)=\mu$ and $Var(X_t)=\sigma^2$.

Although several tests of non-stationarity are proposed, we use the Augmented Dickey-Fuller (ADF) test, which is the most commonly used procedure. A time-series X_t has a unit root at zero frequency if

$$X_t = \alpha X_{t-1} + \epsilon_t \qquad (5.3)$$

where $\alpha = 1$, and with the possible inclusion of drift (constant) and a time trend. The ADF test uses ordinary least squares to estimate the model

$$\Delta X_t = \lambda_0 + \lambda_1 X_{t-1} + \sum_{i=1}^{k} \xi_i \Delta X_{t-i} + \epsilon_t \qquad (5.4)$$

where k is sufficiently large to ensure that ϵ_t is white noise. The null hypothesis of the existence of a unit root can be rejected if the t statistic associated with the coefficient λ_1 is negative, and significantly different from zero. Table 5.2 shows that the unit root hypothesis can be rejected in all of the seasonally adjusted economic regressors, namely $LCAPU_t$, $\Delta_4 LDENS_t$, $\Delta LCPI_t$, $LPROF_t$ and $LINVRES_t$.

The dependent variable, $LWDLE_t$, is not seasonally adjusted, and Figure 5.1 appears to show that it exhibits seasonal variation; we test for a unit root using the method suggested by Charemza and Deadman (1992), in which the ADF equation is expanded to include seasonal dummy variables.[32] Table 5.2 shows that a unit root hypothesis can be rejected for this variable.

5.5.2 From the General Model to the Specific

Table 5.3 shows the estimated coefficients of the general model, together with regression diagnostics. Tests for autocorrelation, functional form, normality, heteroskedasticity and autoregressive conditional heteroskedasticity are

[32]We also test the dependent variable for seasonal unit roots using the method suggested by Hylleberg *et al* (1990). Null hypotheses of half yearly and quarterly unit roots are rejected; using an intercept, seasoanl dummies and a time trend, and eliminating spikes caused by political strikes, for π_2, $t = -4.23$, and for π_3 and π_4, $F_{2,116} = 22.55$.

satisfactory, however we suspect some multicollinearity between particular variables and their lagged counterparts. The t statistics are generally weak for all regressors, except the political strikes dummies and the first quarter seasonal dummy.

We remove the insignificant variables one at a time, deleting at each step the variable with the smallest absolute t statistic. The specific model we obtain is shown in Table 5.4, and all retained regressors are significant on one sided tests at the 0.05 level. The lagged dependent variables and all lagged economic regressors are eliminated, and none of the profit and real wage variables is significant. All diagnostic tests of the model are satisfactory.

5.5.3 Testing for Structural Breaks

The insignificance of the real wage variable and the profit variable leads us to suspect that structural breaks may be present in the model, which mask the importance of these regressors. In testing for breaks we add these variables back into the parsimonious model.

First, we suspect that a structural break occurs at the beginning of the Accord. It is argued earlier, that it introduced a consensual industrial relations framework, which we hypothesise effects the way in which employers and employees responded to changes in the economic environment. We propose that after the break, employees are more likely to accept real wage reductions, partly in response to promises by the government to improve the "social wage", and also to the apparent acceptance by unions of the argument of the government that these reductions would facilitate higher rates of non-inflationary employment growth.

We also hypothesise that the Accord dampens the normal upsurge in strike activity during boom conditions.

Second, we conjecture that the onset of stagflation in the early 1970s also causes a structural break. This period marks the end of around twenty years of comparatively steady growth of real incomes, and unemployment and inflation are, compared with what follows, very low. Although there is no clear point at which stagflation begins, the election of the first Whitlam Labor government in December 1972 appears to be a reasonable choice, especially because the change of government may have contributed to the occurrence of a break.[33] An Accord dummy AC_t is defined to be 1 for the period 3:1983 to 4:1992, and 0 otherwise, and a stagflation dummy SF_t as 1 for the period 1:1973 to 2:1983, and 0 otherwise.

We use the method suggested by Johnson (1984) which requires augmentation of the basic model with intercept dummies, and variables which are the multiplicative interactions of these dummies with the economic regressors. The significance of any the augmenting variables, singly or in groups, is evidence of a structural break. Joint tests of the significance of all augmenting variables are shown in Table 5.5 and support the hypothesis that a break occurs at the onset of stagflation, and at the beginning of the Accord. The table also shows that the coefficients which are affected are those of changes in real wages and capacity utilisation. When the Accord dummy, AC_t, is introduced as part of this procedure,

[33]We also test whether a break may occur a little later at the commencement of the second Whitlam government, however there is more statistical support for the earlier break.

the second tier dummy, AC_{2t}, ceases to be significant and is deleted from the model. The model which accommodates these breaks is shown in Table 5.6.

5.5.4 Variable Addition Tests

Following adjustments to the model to accommodate structural breaks, we use variable addition tests to determine whether any of the dummies representing different industrial relations policies, governments and pre-election periods, singly or in groups, improve the goodness of fit of the model. We find that the coefficient of the 1974 pre-election dummy is significant and positively signed, and that of the second phase of the wages guidelines is significant and negative. The final parsimonious model is shown in Table 5.7.

Because profit is a key element of many theoretical models, we attempt to add $PROF_{t-1}$ to the parsimonious model, although it performs poorly in the general model. Table 5.8 shows that it fails to be significant on a variable addition test. This result is at variance with, for example, Ashenfelter and Johnson (1969), and Phipps (1977); yet others, for instance, Farber (1978) and Gramm *et al* (1988), are unable to demonstrate the significance of similar profit variables. Nor is the contemporaneous profit variable, $PROF_t$, significant; it is not clear what comparison should be made with Beggs and Chapman (1987a), who find that profit is significant in explaining average strike duration, but not in explaining workers involved per unionist.

In time-series modelling, some researchers include a time trend to capture "slowly changing dynamic factors", not usually specified in detail; a few of these are Ashenfelter and Johnson (1969), Snyder (1977), Davies (1979), Kaufman (1982), and Beggs and Chapman (1987a). We add a trend term, $TIME_t$, and an interaction between the trend and the Accord, $AC*TIME_t$, to determine whether there is any empirical basis for using a trend to "explain" strikes. Table 5.8 shows there is no support for the use of a trend or a breaking trend, although a cursory inspection of the strikes series shown in Figure 5.1 may suggest otherwise.

The model is tested to determine whether dummies for different federal governments, or the imminence of federal elections might improve the goodness of fit of the model. We test the single and joint significance of pre-1972 Liberal and Country Party governments, the Whitlam Labor governments, and the Fraser Liberal and Country/National Party governments. We do not test the significance of the Hawke Labor governments because almost all of this period is coincident the Accord which we test separately. The results of these tests are shown in Table 5.9. There is no evidence that different federal governments have any influence on strikes, other than through their approaches to macroeconomic and industrial relations policy.[34]

There is evidence that the 1974 election significantly increased strikes, but none of the other elections appear to have any impact. The results of these variable addition tests are shown in Table 5.10.

We find that only the second phase of the wage guidelines is significant in reducing the incidence of strikes; this is a period of partial and plateau quarterly wage indexation. Single and joint variable addition tests for the other phases, and for the wages pause, are shown in Table 5.11.

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[34]A dummy, W_{1t}, representing the first Whitlam Labor government is significant, but its inclusion renders the pre-1974 election dummy, P_{74t}, insignificant. Although the substitution of W_{1t} for P_{74t} produced a marginally smaller standard error of regression, 0.39289 against 0.39763, problems of functional form emerge when subsets of the sample are used. When the first 125 observations are used, Ramsey's RESET test yields $CHI\text{-}SQ_1$ = 4.5917[.032] and $F_{1,108}$ = 4.1185[.045], and all smaller samples exhibited similar problems, in contrast to the models which used P_{74t}.

The significance of the intercept dummy, AC_t, which is introduced in the testing of structural breaks, suggests that the Accord decreases strikes by the same percentage in all quarters. Because this seems implausible, we test the significance, first, of dummies representing the six versions of the Accord. Second, we re-test the dummies AC_{1t} and AC_{2t}, which mark a change in the character of the Accord with the introduction of the 'second tier' decision, and which are included in the general model. Although Table 5.12 shows that these two approaches produce singly and jointly significant sets of dummies, in both cases, Wald tests of linear restrictions are unable to demonstrate that there is any significant difference in the impacts on strikes of the various stages of the Accord.

5.5.5 Regression Diagnostics

Table 5.7 shows the parsimonious estimated model after allowing for structural breaks, and the introduction of political and industrial policy dummies. It also shows that the model performs satisfactorily in tests of autocorrelation, functional form, normality of the residuals, heteroskedasticity, and autoregressive conditional heteroskedasticity.

Multi-collinearity diagnostic statistics are presented in Tables 5.13, 5.14 and 5.15, and show, respectively, Pearson correlation coefficients, variance inflation factors, and eigen value conditional indices. Because there are no critical values for tests of hypotheses regarding multicollinearity, we rely on rules of thumb; these suggest that the model is not compromised by multi-collinearity.

5.5.6 Stability of Regression Coefficients

We investigate whether the significance of the regressors, and the magnitude of their coefficients is independent of the sample used for estimation.

The existence of dummy variables in the model means that the test for the stability of regression coefficients proposed by Chow (1960), and the test of recursive coefficients advanced by Brown *et al* (1975), are problematic.

As an alternative, we perform recursive regressions beginning with the sample 3:1959 to 2:1975, which is the first half of the full data set. We increase the sample size by two quarters per step, up to 4:1992. The dummy variables and interaction variables are not included when they are everywhere zero in any particular sample. In Table 5.16 we show the output of the model using the sample period of Beggs and Chapman (1987a), namely 3:1959 to 2:1983.

Figures 5.2 to 5.10 show graphs of the coefficients of the economic and industrial relations policy regressors, and their ninety percent confidence intervals; if zero is *not* contained in such a confidence interval, we can conclude, on a one-sided t test, that the associated regressor is significant at the five percent level.

The graphs show that the variables $LCAPU_t$, $\Delta_4 LDENS_t$, $\Delta LCPI_t$, and $LINVRES_t$ are significant for all samples, and the profiles of coefficients are relatively stable. LOP_t is also significant for all samples, however the profile of coefficients takes a step upwards for samples after those ending in 4:1980.[35]

For samples ending 2:1978 to 4:1979, $SF{*}\Delta LRAWE_{t-1}$ is not quite significant at the five percent level , however beyond this, it is significant, and the profile of the coefficients is comparatively stable.

[35]The value of the coefficient changes from approximately -0.08 to -0.06. Of the nine non-zero values of LOP_t, four fall in the period 2:1981 to 1:1982.

5.5.7 Testing for Endogeneity of the Regressors

We argue that strike activity is influenced by inflation. Hines (1964) proposes the contrary, that union militancy, manifesting itself as strikes, is a key factor in explaining British inflation. Borland and Ouliaris (1994) find in Australia, that union density depends, in part, on real wages and changes in unemployment. This suggests that inflation and wages are endogenous, and may invalidate the use of a single equation specification of the model.

We also test, as a precautionary measure, the endogeneity of several other variables. These are: inventories, on the basis that strikes may cause reductions of inventories; union density, because strikes may cause changes in the willingness of employees to belong to unions, or the imminence of strikes may cause union leaders to embark on recruitment drives; and capacity utilisation, which may be reduced by strikes halting production.

Because the wage variable is the real quarterly change, lagged one quarter, the direction of causality can only be from wages to strikes and, therefore, we do not test this regressor.

We use the specification test suggested by Hausman (1978), and use lags of the suspect regressors as instrumental variables.[36] We test the regressors separately, then $\Delta LCPI_t$ and $LINVRES_t$ jointly, then all four jointly. The results of these tests are shown in Table 5.17, and in no test are we able to reject the null hypothesis of exogeneity.

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[36]A sufficient number of lags are used to remove autocorrelation from the regressions.

5.6 Interpretation Of Estimated Coefficients

In this section we interpret the regression coefficients of the parsimonious model based on the full sample period, and shown in Table 5.7. Because the estimated equation is logarithmic, excepting the dummy variables, the coefficients may be interpreted as constant elasticities.[37]

5.6.1 Capacity Utilisation

The elasticity of working days lost per employee with respect to capacity utilisation is complicated by the existence of two capacity utilisation variables in the model, namely $LCAPU_t$ and $AC{*}LCAPU_t$. In the pre-Accord period $AC{*}LCAPU_t$ is zero, so the elasticity is shown by the coefficient of $LCAPU_t$; a one percent increase in capacity utilisation is associated with an increase in working days lost per employee of approximately 13.5 percent. This coefficient is very close to the value of the 13.3 obtained when the sample is restricted to the pre-Accord period, and shown in Table 5.16. This pre-Accord finding is consistent with the prediction of our theoretical model that unions make larger demands, and make strikes more likely, when the period of unemployment of retrenched workers is shorter. This result is also consistent with the conclusions of many other modellers who show that strikes are pro-cyclical; none, to our knowledge, use capacity utilisation as a business cycle proxy.

During the Accord there is an apparent positive, but weaker relationship between working days lost per employee and capacity utilisation.[38] A Wald test of linear restriction is unable to reject the null hypothesis that the coefficients of

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[37] These elasticities are averages, and assume other variables are held constant.

[38] The sum of the coefficients of the capacity utilisation variables is 13.5094 - 10.4228 = 3.0866.

$LCAPU_t$ and $AC{*}LCAPU_t$ sum to zero; this suggests that during the Accord period, the pro-cyclical behaviour of strikes ceased.[39]

5.6.2 Union Density

The coefficient of $\Delta_4 LDENS_t$ is the elasticity of working days lost per employee with respect to the ratio of union density, to union density lagged four quarters.[40] A one percent increase in density is associated with an increase in working days lost per employee of approximately 6.6 percent. This is consistent with our theoretical model which proposes that higher levels of union density at a workplace are likely to be associated with a larger acceptable employment loss to union officials who, therefore, make higher wage demands and pay less heed to the long term costs of strikes. Among Australian time-series models, only Perry (1979) finds a significant role for union density, yet we find strong support for changes in density in explaining strikes.

5.6.3 Inflation

We observe a positive relationship between working days lost per employee and inflation. An inflation rate of one percent per quarter, compared with a zero rate, is associated with an approximate increase of 12.9 percent in working days lost per employee.[41]

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[39] $CHI\text{-}SQ_1 = 1.1542[.283]$.

[40] $\Delta LDENS4_t = \text{Log}(DENS_t) - \text{Log}(DENS_{t-4}) = \text{Log}(DENS_t/DENS_{t-4}) = \text{Log}(1 + u_t)$ where $DENS_t$ is union density and u_t is its annual growth rate.

[41] $\Delta LCPI_t = \text{Log}(CPI_t) - \text{Log}(CPI_{t-1}) = \text{Log}(CPI_t/CPI_{t-1}) = \text{Log}(1 + Inf_t)$ where Inf_t is the quarterly rate of inflation measured by the CPI.

5.6.4 Mis-information

The coefficient of the Beggs and Chapman (1987a) mis-information variable, LOP_t, is negative, implying that working days lost per employee are significantly greater in periods when overtime is above average, and profits are below average. The estimated impact on working days lost per employee, at the median of the nine non-zero values of LOP_t, -6.9645, is an increase of approximately 49.5 percent which lends strong support to the mis-information hypothesis.[42]

5.6.5 Real Wages

The real wage variable is significant, but only during the period beginning with the first Whitlam government, and ending with the commencement of the Accord. In what is a period of considerable real wage volatility, and prior to the hypothesised moderating influence of the Accord, we find support for our theoretical model which suggests that strike incidence is negatively associated with the gap between primary sector wages, and secondary sector wages and dole payments. This result is also consistent with other models which propose a negative relationship between strike frequency and real wages, and first shown empirically by Ashenfelter and Johnson (1969).

The variable, $SF{*}\Delta LRAWE_{t-1}$, when it is not zero, is the logarithm of the ratio of real average weekly earnings to that in the previous quarter, lagged one period; this is equivalent to the logarithm of one plus the quarterly growth rate.[43]

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[42]The impact on $LWDLE_t = \beta_5\, LOP_t = -.057749 \times -6.9645 = .40219$. The multiplicative impact on $WDLE_t = exp(.3929) = 1.49510$.

[43]$\Delta LRAWE_{t-1}$ = Log($RAWE_{t-1}$) - Log($RAWE_{t-2}$) = Log($RAWE_{t-1}/RAWE_{t-2}$) = Log(1 + r_{t-1}) where r_t is the quarterly growth rate.

An increase in the rate of growth of real wages of one percent per quarter, is associated with a reduction in working days lost per employee of approximately 10.4 percent in the following quarter.

We also replace $\Delta LRAWE_{t-1}$ with distributed lag functions of changes in the logarithms of real average weekly earnings, and defined in Equation (5.1). Table 5.18 shows that the coefficients of $SF*\Delta LRAWE_t^*$ are significantly different from zero, in one sided tests, and have the expected sign, for $\lambda < 0.8$. Although the regression standard errors, for $\lambda < 0.4$, are of the order half of one percent smaller than those produced using $\Delta LRAWE_{t-1}$, we judge the difference to be too small to warrant the replacement of the simpler lagged variable.

5.6.6 Inventories

We find that working days lost per employee are positively associated with residuals of inventories from trend. Because the mean value of the residuals is zero, there is no simple interpretation of the coefficient of $LINVRES_t$ as an elasticity. The impact of this variable being at the level of its standard deviation, 0.0484, compared with being at its mean value, is to increase the predicted value of working days lost per employee by approximately 32.6 percent.[44]

5.6.7 Political Strikes

The five political strikes all have significant and large impacts on working days lost. The coefficients of the dummy variables imply that the increases in working days lost per employee are, over and above the effects of other variables, (i) 153.5 percent for the protest over the gaoling of union official Clarrie O'Shea

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[44]The impact on $LWDLE_t = \beta_8 \ \Delta LINVRES_t = 5.8204 \times .048436 = .28192$. The multiplicative impact on $WDLE_t = exp(.28192) = 1.3257$.

in 2:1969, (ii) 366.9 percent for the Medibank protest in 3:1976, (iii) 258.7 percent for the protests over the gaoling of several Western Australian union officials in 2:1979; (iv) 194.3 percent for the strike in protest at the introduction of the 1991 N.S.W. Industrial Relations Bill in 4:1991; and 498.2 percent for the state-wide protest in Victoria directed at proposed changes in state industrial relations legislation in 4:1992.[45]

5.6.8 Political Regimes and Federal Election

None of the federal government dummies is significant at a satisfactory level of significance, and only one of the pre-election dummies, P_{74t} is significant. The estimated impact of the 1974 federal election is an increase in working days lost per employee of 168.8 percent in the quarter leading up to it.

5.6.9 Seasonal Factors

The model confirms that there is a strong seasonal pattern in working days lost, however there is no significant difference between the June and September quarter effects; therefore, the September quarter dummy is deleted from the model. Seasonal factors reduced working days lost per employee by 30.7 percent in the March quarter, and 19.7 percent in the December quarter, both compared with the June and September quarters.[46]

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[45]Kennedy (1981) points out that in semi-logarithmic models, neither the estimated coefficient of a dummy nor its exponential, is a satisfactory estimate of the true impact. We use his estimate of the proportional increase associated with a dummy which is $g^* = \exp(\hat{c} - ½\mathrm{Var}(\hat{c})) - 1$ where $\hat{c}$ is the estimated positive coefficient of the dummy.

[46]It is easy to show that the Kennedy's (1981) estimate g^* for $\hat{c}$ becomes $g^* = \exp(\hat{c} + ½\mathrm{Var}(\hat{c})) - 1$ for $\hat{c} < 0$.

5.6.10 Incomes Policy Variables

Only the second phase of wage guidelines covering the period 3:1976 to 2:1978, when quarterly partial and plateau indexation occurred, is significant; the estimated reduction in working days lost per employee is 30.4 percent. The moderation in wage outcomes which Watts and Mitchell (1990a) describe, appears to coincide with a reduction in strike activity, at least in the second phase.

Because the presence of the Accord affects both the capacity utilisation and real wage variables, the impact of the Accord cannot be determined solely from the coefficient of AC_t. It is arguable, and borne out by the estimated model, that it is implausible that the impact of the Accord is independent of the behaviour of other economic regressors, as is implied by the use of only an intercept dummy. If we assume that no structural break in the model would have occurred at 3:1983 in the absence of the Accord, the Accord dummy coefficient, together with the coefficients and values of $AC{*}LCAPU_t$ and $SF{*}\Delta LRAWE_{t-1}$, permits the calculation of the estimated impact.[47] A useful bench mark is the impact when the economy is at full capacity and the change in real wages in the previous quarter is zero, because then both $AC{*}LCAPU_t$ and $SF{*}\Delta LRAWE_{t-1}$ are zero; then the estimated reduction in working days lost per employee attributable to the Accord is 44.2 percent per quarter.

The negative impact of the Accord is greater at higher levels of capacity utilisation, and greater when real wages are decreasing. At the mean level of

[47] Writing $LWDLE_t = \beta_0 + \Sigma\, \beta_j X_j + \beta_2 LCAPU_t + \beta_3 AC{*}LCAPU_t + \beta_8 SF{*}\Delta LRAWE_{t-1} + \beta_{AC} AC_t + \epsilon_t$ where $\{X_j\}$ is the set other variables used in the model. In the Accord period $SF{*}\Delta LRAWE_t = 0$ and $AC_t = 1$, so by subtraction, and adding Kennedy's (1981) adjustment, we obtain the multiplicative impact on $LWDLE_t$ of the Accord as $\beta_{AC} + \frac{1}{2}\mathrm{Var}(\beta_{AC}) + \beta_2 AC{*}LCAPU_t - \beta_8 \Delta LRAWE_{t-1}$. Note that β_{AC} and β_8 are both negative.

capacity utilisation during the Accord period, 95.8 percent, and the mean quarterly rate of growth of real average weekly earnings, 0.1 percent, the reduction in working days lost attributable to the Accord is 15.2 percent.

This average impact is considerably less than that claimed by others who investigate the impact of the Accord on strikes. Beggs and Chapman (1987a) claim a reduction of approximately 40 percent in working days lost per unionist; Beggs and Chapman (1987b and c), a reduction in working days lost per employee of 62 percent[48]; Chapman and Gruen (1991), a reduction in working days lost per employee of around 70 percent; Morris and Wilson (1994), a reduction in workers involved per unionist of 47 percent prior to the "second tier", and 35 percent afterwards.[49] The large impacts that Beggs and Chapman (1987a, b and c) claim, refer to the first three years of the Accord; we may suspect their large estimates are spurious because of high levels of capacity utilisation and high rates of real wage growth during that period. We find, however, that the mean values of $CAPU_t$ and $\Delta RAWE_t$ are 94.9 percent and 0.1 percent respectively, for the period 3:1983 to 2:1986, and are only slightly different from those of the Accord period used in our model (and noted above). The smaller Accord impact suggested by our model is, therefore, unlikely to be the result of different labour market conditions during the first three years of the Accord *vis-à-vis*, those of the longer period.

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[48]This is an error in both articles. The coefficient of the Accord dummy in their logarithmic model of Beggs and Chapman (1987c) is -0.621 with standard error 0.272 which implies an Accord reduction effect of $\exp(-0.621) - 1 = -0.463$ (approximately 46 percent). Using Kennedy's (1981) correction, the reduction is $\exp(-0.621 + ½ \times 0.272^2) - 1 = -0.442$ (approximately 44 percent).

[49]The estimate of the Accord impact in Morris and Wilson (1995) is the same as that reported in this chapter, except for a small difference due to the use of Kennedy's (1981) formula. See footnote 42.

We note the absence of a union density variable in these other models, except Morris and Wilson (1995). In the pre-Accord period the mean four-quarterly change in union density is -0.000285, in the first three years of the Accord, -0.0048135, and in the Accord period we use, -0.0085885; over our sample period, union density tends to decline at an accelerating rate. These researchers do not attempt to measure the impact of this on strike activity, and it is likely that they attribute some part of the reduction in strikes after 1983 to the Accord, which should be imputed to reductions in union density.[50]

5.7 Comparisons with Other Australian Empirical Models

We compare our model with re-estimated versions of other Australian empirical researchers which we produce in Chapter 3, but we do not attempt to ranks those models. For all re-estimated models, we use data from the period 3:1959 to 4:1992. To make the comparisons fair, we include the same political strike, pre-election, government and industrial relations policy dummies in all models. Further, we allow structural breaks at the onset of stagflation and at the commencement of the Accord. To enable the use of non-nested tests, we modify Beggs and Chapman's Model 28 by replacing the dependent variable working days lost per unionist, with working days lost per employee.[51] All models use a logarithmic functional form.

The results of these tests are shown in Table 5.19. In all comparisons, tests using Akaike's information criterion and Schwarz's Bayesian information

[50]Indeed it is possible, although not tested here, that the so-called "international trend" referred to by Clark (1987), may be the result of similar changes in union density in other OECD countries.

[51]Beggs and Chapman (1987a) use union membership as the denominator of their dependent variable.

criterion, indicate that our model preforms better than the other re-estimated models. J tests, JA tests and encompassing tests, however, are less able to discriminate between the models but, on balance, our model is preferred to all others.[52]

5.8 Concluding Remarks

Our estimated regression equation is broadly consistent with the predictions of our theoretical model although, of course, it is compatible with other theories of strikes. The positive relationship between strikes and capacity utilisation supports the hypothesis of a negative relationship between strikes and the opportunity costs of retrenched employees. A negative relationship between strikes and increases in real average weekly earnings, suggests a negative relationship between strikes and the gap between primary and secondary sector wages and the dole.

Non-nested tests of our estimated model against other Australian empirical models are very encouraging. Although particular tests are sometimes inconclusive in comparing models, it is reasonable to claim that our model out-performs other re-estimated models. The evidence, however, is not sufficiently strong to discredit the other models.

The significance of inflation and Beggs and Chapman's (1987a) mis-information variable gives weight to mis-information theories in explaining Australian strikes. The model also shows that the change in real wages, a variable of critical importance to our model and many models since Ashenfelter and

[52] At the 0.01 level of significance, our model is preferred to all other models on at least one test, and, with one exception, no other model is preferred to ours on any test. Our model fails against Perry's Model 27 on a JA test, but it is preferred in J and encompassing tests.

Johnson (1969), can be usefully introduced into an Australian strikes model provided that structural breaks in the relationship are accommodated.

We confirm an important role for changes in union density in explaining strikes found by Perry (1979). Indeed, it is astonishing that such a seemingly obvious factor in explaining strikes has been so neglected, both in Australia and overseas. The model shows that there is a positive association between strikes and inventories, and this is consistent with our own model, Reder and Neumann's (1980) joint cost hypothesis and Beggs and Chapman's (1987a) employer provocation conjecture.

We find that the Accord appears to have dampened Australian strike activity, yet the order of magnitude of this reduction is somewhat less than that claimed by other researchers. The Accord has had its greatest impact at high levels of capacity utilisation and when real wages are falling, or put another way, the Accord appears to have its greatest effect during conditions which would otherwise heighten strike activity. Conversely, in periods of reduced economic activity and rising real wages, the reductions appear to be largely the result of these particular economic conditions, rather than to the presence of the Accord.

The recursive regressions we produce demonstrate that the regression coefficients are not very sensitive to the specific period used to estimate the model. The regression diagnostics are satisfactory, as they are when subsets of the data are used. In particular, the coefficients of the regressors obtained using the full sample, and shown in Table 5.7, are almost the same as those found when the sample is restricted to the pre-Accord period, and shown in Table 5.16.

The regression model of strikes described in this chapter is generally supportive of the theoretical framework developed in Chapter 4, and is a superior empirical model to all previous Australian time-series models. The challenge which remains is to test our theoretical model with a cross-sectional data set. In using microeconomic data, we are able focus on the competitive environment of the firm and local labour market conditions, neither of which are easily identified in macroeconomic data.

In the next chapter we test our theoretical model, along with other theories of strikes, using data from the Australian Workplace Industrial Relations Survey. We test whether the importance of the opportunity cost of strikes can discerned at the level of the workplace; we suspect that local labour market conditions are more important in determining opportunity costs than macroeconomic variables. We shed light on some factors masked by aggregation by modelling, separately, strikes in privately owned workplaces, government non-commercial establishments and government business enterprises. We compare these models with the two known cross-sectional models of Australian strikes.

Table 5.1: Sources of Data in the Empirical Strikes Model[1]

WDL,	Working Days Lost	3:1959 - 4:1971 Working Days Lost, *Labour Report*, ABS Ref No 6.7. 1:1972 - 4:1992 Working Days Lost, *Industrial Disputes, Australia*, ABS Cat No 6321.0.
E,	Employees	Non-Farm Civilian Wage and Salary Earners (National Accounts Basis) (sa),
CAPU,	Capacity Utilisation	Ratio of Real Gross Domestic Product to Potential Real Gross Domestic Product
U,	Registered Union Members	1959 - 1973 Trade Unions: Number of Members, *Labour Report*, ABS Ref No 6.7. 1974 - 1992 Trade Unions: Number of Members, *Trade Union Statistics, Australia*, ABS Cat No 6323. Annual series interpolated to quarterly.
CPI,	Consumer Price Index	Consumer Price Index All Groups Percentage Change, Weighted Average of Capital Cities (sa).
OT,	Overtime	3:1959 - 2:1966 Department of Employment and Youth Affairs, in *Occasional Paper No 8, Australian Economic Statistics 1949-50 to 1989-90*, RBA. 3:1966 - 4:1992 Labour Market - Overtime per Employee (sa). Department of Employment and Youth Affairs series is annual data and consequently has no seasonal variation. Quarterly values are obtained by interpolation and splicing on to the NIF series.
PROF,	Profit	Composite variable showing profits as a percentage of the total wage bill. Gross Operating Surplus Corporate Trading Enterprises (sa). Non-Farm Civilian Wage and Salary Earners (National Accounts Basis) (sa). Average Earnings of Non-Farm Civilian Wage and Salary Earners (National Accounts Basis) (sa)
RAWE,	Real Average Weekly Earnings	The earnings series is deflated using the Consumer Price Index Average Earnings of Non-Farm Civilian Wage and Salary Earners (National Accounts Basis) (sa).
INV,	Inventories	Ratio of Stocks to Sales (sa).

[1]All series are from *ABS NIF-10s Model Data*, Cat No 1343.0 and are for the period 3:1959 to 4:1992 unless otherwise stated.

Table 5.2:	**Augmented Dickey-Fuller Tests for Unit Roots in the Economic Variables**[1]			
Variable	**ADF Statistic**	**Number of Lags**[2]	**Durbin-Watson**	**LM Test for Autocorrelation $CHI\text{-}SQ_1$**
$LWDLE_t$[3]	-3.82***	1	2.02	2.4708[.116]
$LCAPU_t$	-3.20***	0	2.07	0.2658[.606]
$\Delta_4 LDENS_t$	-4.27***	1	2.10	1.5393[.215]
$\Delta LCPI_t$	-2.21**	2	2.09	4.2402[.039]
$\Delta LCPI_t$	-1.65*	3	1.93	3.3358[.068]
$\Delta LRAWE_t$	-12.28***	0	1.97	4.3769[.036]
$LPROF_t$	-2.44**	0	2.08	0.3373[.561]
$LINVRES_t$	-2.78**	1	2.04	2.1290[.145]

Notes: 1 Critical values of the ADF statistic taken from Charemza and Deadman (1992).

*** significant at the 0.01 level
** significant at the 0.05 level
* significant at the 0.10 level

2 Lags required to achieve white noise characteristics in the residuals.

3 The test of $LWDLE_t$ is augmented by seasonal dummy variables.

Table 5.3: Estimated General Time Series Model of Strikes
Dependent Variable: $LWDLE_t$
Estimation Method: Ordinary Least Squares

Regressor	Coefficient	Std Error	t-Ratio[Prob]
INTERCEPT	6.8859	1.7028	4.0438[.000]
$LWDLE_{t-1}$	-0.0876	0.0956	-0.9164[.362]
$LWDLE_{t-2}$	0.0106	0.0930	0.1144[.909]
$LCAPU_t$	5.1131	4.9884	1.0250[.308]
$LCAPU_{t-1}$	7.4175	5.5360	1.3399[.184]
$LCAPU_{t-2}$	-3.4323	4.7871	-0.7170[.475]
$\Delta_4 LDENS_t$	5.8945	5.8532	1.0070[.317]
$\Delta_4 LDENS_{t-1}$	-1.3865	8.7227	-0.1590[.874]
$\Delta_4 LDENS_{t-2}$	8.0158	6.0530	1.3243[.189]
$\Delta LCPI_t$	13.0883	7.2401	1.8078[.074]
$\Delta LCPI_{t-1}$	-5.3506	7.1456	-0.7488[.456]
$\Delta LCPI_{t-2}$	3.5011	6.8449	0.5115[.610]
LOP_t	-0.0553	0.0336	-1.6432[.104]
LOP_{t-1}	-0.0729	0.0407	-1.7896[.077]
LOP_{t-2}	-0.0019	0.0420	-0.0463[.963]
$\Delta LRAWE_t$	3.4099	4.0348	0.8451[.400]
$\Delta LRAWE_{t-1}$	-0.1824	4.4059	-0.0414[.967]
$\Delta LRAWE_{t-2}$	4.2377	3.7893	1.1183[.266]
$LPROF_t$	0.8760	1.3225	0.6624[.509]
$LPROF_{t-1}$	-0.2761	1.3961	-0.1977[.844]
$LPROF_{t-2}$	0.8754	1.2092	0.7240[.471]
$LINVRES_t$	4.2662	3.0711	1.3892[.168]
$LINVRES_{t-1}$	0.3281	3.9453	0.0832[.934]
$LINVRES_{t-2}$	-0.6198	2.9811	-0.2079[.836]
P_{1t}	0.9852	0.4632	2.1272[.036]
P_{2t}	1.3145	0.4911	2.6764[.009]
P_{3t}	1.0019	0.5229	1.9162[.058]
P_{4t}	1.2711	0.4817	2.6391[.010]
P_{5t}	2.3013	0.5009	4.5947[.000]
G_{1t}	0.5905	0.3262	1.8100[.074]
G_{2t}	0.2313	0.3061	0.7556[.452]
G_{3t}	0.5681	0.3307	1.7179[.089]
G_{4t}	0.4045	0.2671	1.5143[.133]
PA_t	0.7097	0.4142	1.7134[.090]
AC_{1t}	-0.0361	0.1765	-0.2049[.838]
AC_{2t}	-0.2886	0.1582	-1.8238[.071]
S_{1t}	-0.2732	0.1239	-2.2048[.030]
S_{3t}	0.1827	0.1258	1.4529[.150]
S_{4t}	-0.1173	0.1288	-0.9109[.365]

R-Sq	0.7517	$F_{38,92}$	7.3127[.000]
Adj R-Sq	0.6485	SE	0.4298
Resid SS	16.9916	Mean Dep Var	4.3175
SD Dep Var	0.7249	Max Log-likelihood	-52.0987
DW	1.9070		

Diagnostic Tests

Test Statistics		LM Version	F Version	
Serial Cor(1)	$CHI\text{-}SQ_1$	1.0581[.304]	$F_{1,91}$	0.7410[.392]
Serial Cor(4)	$CHI\text{-}SQ_4$	3.6861[.450]	$F_{4,88}$	0.6370[.637]
Funct Form	$CHI\text{-}SQ_1$	0.1433[.705]	$F_{1,91}$	0.0996[.753]
Normality	$CHI\text{-}SQ_2$	1.4903[.475]	Not applicable	
Hetero	$CHI\text{-}SQ_1$	0.7415[.389]	$F_{1,129}$	0.7343[.393]
ARCH(1)	$CHI\text{-}SQ_1$	0.7420[.389]	$F_{1,91}$	0.5183[.473]
ARCH(4)	$CHI\text{-}SQ_4$	0.8807[.927]	$F_{4,88}$	0.1489[.963]

Table 5.4: **Parsimonious Model Before Structural Breaks**
Dependent Variable: $LWDLE_t$
Estimation Method: **Ordinary Least Squares**

Regressor	Coefficient	Std Error	t-Ratio[Prob]
$INTERCEPT$	4.7378	0.1330	35.6236[.000]
$LCAPU_t$	10.5924	1.8443	5.7432[.000]
$\Delta_4 LDENS_t$	7.6193	2.2712	3.3547[.001]
$\Delta LCPI_t$	10.0350	4.2770	2.3462[.021]
LOP_t	-0.0860	0.0236	-3.6433[.000]
$LINVRES_t$	4.5203	1.0575	4.2745[.000]
P_{1t}	1.0513	0.4366	2.4081[.018]
P_{2t}	1.2231	0.4353	2.8100[.006]
P_{3t}	1.1993	0.4362	2.7496[.007]
P_{4t}	1.4477	0.4511	3.2093[.002]
P_{5t}	2.2528	0.4630	4.8656[.000]
S_{1t}	-0.3806	0.0929	-4.0984[.000]
S_{4t}	-0.2778	0.0944	-2.9416[.004]
AC_{2t}	-0.2567	0.1186	-2.1640[.032]

R-Sq	0.6862	$F_{13,120}$	20.1856[.000]
Adj R-Sq	0.6522	S E	0.4294
Res SS	22.1296	Mean Dep Var	4.2982
S D Dep Var	0.7282	Max Log-likelihood	-69.4758
DW	1.8950		

Diagnostic Tests

Test Statistics		LM Version		F Version
Serial Cor(1)	$CHI\text{-}SQ_1$	0.2533[.615]	$F_{1,119}$	0.2254[.636]
Serial Cor(4)	$CHI\text{-}SQ_4$	1.7532[.781]	$F_{4,116}$	0.3845[.819]
Funct Form	$CHI\text{-}SQ_1$	0.0030[.956]	$F_{1,119}$	0.0027[.959]
Normality	$CHI\text{-}SQ_2$	0.2951[.863]	Not applicable	
Hetero	$CHI\text{-}SQ_1$	0.0553[.814]	$F_{1,94}$	0.7294[.395]
ARCH(1)	$CHI\text{-}SQ_1$	0.9386[.333]	$F_{1,119}$	0.8394[.361]
ARCH(4)	$CHI\text{-}SQ_4$	1.4715[.832]	$F_{4,116}$	0.3220[.863]

Table 5.5: Tests for Structural Breaks in the Parsimonious Model

		Break at 1:1973	
Joint Tests			
	Lagrange Multiplier	$CHI\text{-}SQ_9$	= 20.1597[.017]
	Likelihood Ratio	$CHI\text{-}SQ_9$	= 21.8764[.009]
	F	$F_{9,106}$	= 2.1230[.034]
Significant Variable			
	$SF*\Delta LRAWE_{t-1}$	t	= -2.7539[.007]
		Break at 3:1983	
Joint Tests			
	Lagrange Multiplier	$CHI\text{-}SQ_8$	= 23.2149[.003]
	Likelihood Ratio	$CHI\text{-}SQ_8$	= 25.5324[.001]
	F	$F_{8,107}$	= 2.8542[.006]
Significant Variable			
	$AC*LCAPU_t$	t	= -2.2866[.024]
		Breaks at 1:1973 and 3:1983	
Joint Tests			
	Lagrange Multiplier	$CHI\text{-}SQ_{17}$	= 31.4904[.017]
	Likelihood Ratio	$CHI\text{-}SQ_{17}$	= 35.9811[.005]
	F	$F_{17,98}$	= 1.8064[.038]
Significant Variable			
	$SF*\Delta LRAWE_{t-1}$	t	= -2.0474[.043]
	$AC*LCAPU_t$	t	= -1.6964[.093]

Table 5.6:	Parsimonious Model After Structural Breaks	
	Dependent Variable:	$LWDLE_t$
	Estimation Method:	Ordinary Least Squares

Regressor	Coefficient	Std Error	t-Ratio[Prob]
INTERCEPT	4.8307	0.1354	35.6813[.000]
$LCAPU_t$	13.4527	2.1060	6.3878[.000]
$AC*LCAPU_t$	-10.5380	3.4491	-3.0552[.003]
$\Delta_4 LDENS_t$	7.3424	2.1978	3.3407[.001]
$\Delta LCPI_t$	12.5416	4.3522	2.8817[.005]
LOP_t	-0.0763	0.0229	-3.3362[.001]
$SF*\Delta LRAWE_{t-1}$	-7.7500	3.6380	-2.1303[.035]
$LINVRES_t$	5.0017	1.0367	4.8248[.000]
P_{1t}	1.0214	0.4182	2.4423[.016]
P_{2t}	1.2618	0.4196	3.0072[.003]
P_{3t}	1.3608	0.4264	3.1911[.002]
P_{4t}	1.1447	0.4329	2.6442[.009]
P_{5t}	1.8595	0.4525	4.1094[.000]
S_{1t}	-0.3805	-0.0892	4.2650[.000]
S_{4t}	-0.2463	0.0908	-2.7139[.008]
AC_t	-0.6315	0.1685	-3.7480[.000]

R-Sq	0.7171	$F_{15,118}$	19.9374[.000]
Adj R-Sq	0.6811	S E	0.41121
Res SS	19.9529	Mean Dep Var	4.2982
S D Dep Var	0.7282	Max Log-likelihood	-62.5387
DW	2.0326		

Diagnostic Tests

Test Statistics	LM Version		*F* Version	
Serial Cor(1)	CHI-SQ$_1$	0.1115[.738]	$F_{1,117}$	0.0974[.756]
Serial Cor(4)	CHI-SQ$_4$	1.8473[.764]	$F_{4,114}$	0.3984[.809]
Funct Form	CHI-SQ$_1$	0.1459[.703]	$F_{1,117}$	0.1275[.722]
Normality	CHI-SQ$_2$	0.0445[.978]	Not applicable	
Hetero	CHI-SQ$_1$	0.5661[.452]	$F_{1,132}$	0.5601[.456]
ARCH(1)	CHI-SQ$_1$	1.4085[.235]	$F_{1,117}$	1.2429[.267]
ARCH(4)	CHI-SQ$_4$	3.5577[.469]	$F_{4,114}$	0.7773[.542]

Table 5.7:	Final Parsimonious Model		
	Dependent Variable:	$LWDLE_t$	
	Estimation Method:	Ordinary Least Squares	
Regressor	**Coefficient**	**Std Error**	**t-Ratio[Prob]**
INTERCEPT	4.8405	0.1314	36.8297[.000]
$LCAPU_t$	13.5094	2.0422	6.6151[.000]
$AC*LCAPU_t$	-10.4228	3.3356	-3.1248[.002]
$\Delta_4 LDENS_t$	6.6047	2.1598	3.0581[.003]
$\Delta LCPI_t$	12.8696	4.3698	2.9451[.004]
LOP_t	-0.0577	0.0228	-2.5245[.013]
$SF*\Delta LRAWE_{t-1}$	-9.8164	3.5772	-2.7442[.007]
$LINVRES_t$	5.8204	1.0370	5.6126[.000]
P_{1t}	1.0120	0.4044	2.5024[.014]
P_{2t}	1.6349	0.4334	3.7718[.000]
P_{3t}	1.3628	0.4134	3.2961[.001]
P_{4t}	1.1671	0.4187	2.7871[.006]
P_{5t}	1.8845	0.4376	4.3062[.000]
P_{7at}	1.1067	0.4855	2.2794[.024]
S_{1t}	-0.3698	0.0863	-4.2832[.000]
S_{4t}	-0.2234	0.0884	-2.5266[.013]
G_{2t}	-0.3768	0.1706	-2.2093[.029]
AC_t	-0.6348	0.1635	-3.8815[.000]

R-Sq	0.7399	$F_{17,116}$	19.4141[.000]
Adj R-Sq	0.7018	S E	0.3976
Res SS	18.3404	Mean Dep Var	4.2982
S D Dep Var	0.7282	Max Log-likelihood	-56.8925
DW	2.2355		

Diagnostic Tests

Test Statistics		LM Version		F Version
Serial Cor(1)	$CHI\text{-}SQ_1$	2.6266[.105]	$F_{1,115}$	2.2992[.132]
Serial Cor(4)	$CHI\text{-}SQ_4$	4.5019[.342]	$F_{4,113}$	0.9734[.425]
Funct Form	$CHI\text{-}SQ_1$	0.3866[.534]	$F_{1,115}$	0.3327[.565]
Normality	$CHI\text{-}SQ_2$	0.1135[.945]	Not applicable	
Hetero	$CHI\text{-}SQ_1$	2.2320[.135]	$F_{1,132}$	2.2359[.137]
ARCH(1)	$CHI\text{-}SQ_1$	0.1426[.706]	$F_{1,115}$	0.1225[.727]
ARCH(4)	$CHI\text{-}SQ_4$	1.4747[.831]	$F_{4,112}$	0.3116[.870]

Table 5.8: Variable Addition Tests of Profit, Trend and September Quarter Dummy[1]

Regressor		Test Statistics		
LPROF$_t$	Profit	Lagrange Multiplier	$CHI\text{-}SQ_1$	= 1.1456[.284]
		Likelihood Ratio	$CHI\text{-}SQ_1$	= 1.1505[.283]
		F	$F_{1,115}$	= 0.9916[.321]
LPROF$_{t-1}$	Lagged Profit	Lagrange Multiplier	$CHI\text{-}SQ_1$	= 0.8945E-5[.998]
		Likelihood Ratio	$CHI\text{-}SQ_1$	= 0.8945E-5[.998]
		F	$F_{1,114}$	= 0.7667E-5[.998]
S_3	September Quarter Dummy	Lagrange Multiplier	$CHI\text{-}SQ_1$	= 0.9220[.337]
		Likelihood Ratio	$CHI\text{-}SQ_1$	= 0.9252[.336]
		F	$F_{1,115}$	= 0.7968[.374]
TIME$_t$	Time Trend	Lagrange Multiplier	$CHI\text{-}SQ_1$	= 0.8298[.362]
		Likelihood Ratio	$CHI\text{-}SQ_1$	= 0.8324[.362]
		F	$F_{1,115}$	= 0.7166[.399]
*AC*TIME*$_t$	Trend Accord Interaction	Lagrange Multiplier	$CHI\text{-}SQ_1$	= 1.2783[.258]
		Likelihood Ratio	$CHI\text{-}SQ_1$	= 1.2844[.257]
		F	$F_{1,115}$	= 1.1076[.295]

Note: 1 Using the parsimonious made shown in Table 5.7.

Table 5.9: Variable Addition Test of Pre-Hawke Federal Government Dummies[1]

Regressor	Period	Coefficient	t-Ratio[Prob]
	Pre-Whitlam Liberal and Country Party Governments		
M_{1t}	22:11:1958 - 8:12:1961	-0.2393	-1.6407[.104]
M_{1t}	9:12:1961 - 29:11:1963	0.0324	0.1791[.858]
H_{2t}	30:11:1963 - 25:11:1966	0.0342	0.2475[.805]
H_{2t}	26:11:1966 - 24:10:1969	-0.1159	-0.7843[.434]
MC_t	25:10:1969 - 1:12:1972	0.0587	0.3828[.703]
	Joint Variable Addition Tests		
	Lagrange Multiplier	$CHI\text{-}SQ_5$ =	6.9091[.227]
	Likelihood Ratio	$CHI\text{-}SQ_5$ =	7.0936[.214]
	F	$F_{5,111}$ =	1.2069[.311]
	Whitlam Labor Governments		
W_{1t}	2:12:1972 - 17:05:1974	0.4989	2.2331[.027]
W_{2t}	18:05:1974 - 12:12:1975	0.2204	0.2955[.768]
	Joint Variable Addition Tests		
	Lagrange Multiplier	$CHI\text{-}SQ_2$ =	6.7830[.034]
	Likelihood Ratio	$CHI\text{-}SQ_2$ =	6.9607[.031]
	F	$F_{2,114}$ =	3.0392[.052]
	Fraser Liberal and National Party Governments		
F_{1t}	13:12:1975 - 9:10:1977	-0.0019	-0.0086[.993]
F_{2t}	10:10:1977 - 17:10:1980	0.0541	0.3680[.714]
F_{3t}	18:10:1980 - 4:03:1983	-0.1595	-0.8545[.395]
	Joint Variable Addition Tests		
	Lagrange Multiplier	$CHI\text{-}SQ_3$ =	0.88660[.829]
	Likelihood Ratio	$CHI\text{-}SQ_3$ =	0.88955[.828]
	F	$F_{3,113}$ =	0.25088[.861]

Note 1 Government dummies are added one at a time to the parsimonious model shown in Table 5.7, then groups are added to perform the joint tests.

Table 5.10: Variable Addition Test of Federal Election Dummies (excluding P_{74t})[1]

Regressor	Date	Coefficient		t-Ratio[Prob]
P_{61t}	9:12:1961	0.7310		1.3390[.183]
P_{63t}	30:11:1963	0.4888		0.8781[.382]
P_{66t}	26:11:1966	0.5372		0.8945[.373]
P_{69t}	25:10:1969	-0.3072		-0.5703[.570]
P_{72t}	2:12:1972	-0.1692		-0.3028[.763]
P_{75t}	13:12:1975	0.1388		0.2635[.793]
P_{77t}	10:10:1977	0.7061		1.4209[.158]
P_{80t}	18:10:1980	0.1164		0.2296[.819]
P_{83t}	5:03:1983	-0.0257		-0.0453[.964]
P_{84t}	1:12:1984	0.7276		1.3143[.191]
P_{87t}	11:07:1987	-0.1950		-0.4237[.673]
P_{90t}	24:03:1990	-0.6097		-1.3363[.184]
Joint Variable Addition Tests				
	Lagrange Multiplier	$CHI\text{-}SQ_{12}$ =	1.9011[.454]	
	Likelihood Ratio	$CHI\text{-}SQ_{12}$ =	12.4631[.409]	
	F	$F_{12,104}$ =	0.8447[.605]	

Note: 1 Pre-election dummies are added one at a time to the parsimonious model shown in Table 5.7, then all are added to perform the joint tests. P_{74t} is already in the the parsimonious model.

Table 5.11:	Variable Addition Tests of Wage Guidelines and Wages Pause Dummies[1]			
Regressor	**Period**	**Coefficient**		***t*-Ratio[Prob]**
		Wage Guidelines		
G_{1t}	2:1975 - 2:1974	0.2267		1.1243[.263]
G_{3t}	3:1978 - 3:1979	0.0361		0.1607[.873]
G_{4t}	4:1979 - 2:1981	-0.0207		-0.1130[.910]
	Joint Variable Addition Tests			
	Lagrange Multiplier	CHI-SQ_3 =	1.5694[.666]	
	Likelihood Ratio	CHI-SQ_3 =	1.5786[.664]	
	F	$F_{3,113}$ =	0.4464[.720]	
		Wages Pause		
PA_t	1:1983 - 2:1983	0.2525		0.7835[.435]

Note: 1 Wage guidelines dummies are added one at a time to the parsimonious model shown in Table 5.7, then all are added to perform the joint tests. G_{2t} is already in the the parsimonious model.

Table 5.12: Tests of Accord Dummy Variables[1]

Regressor	Period	Coefficient		t-Ratio[Prob]
		Accords Marks 1 to 6		
A_{1t}	3:1983 - 3:1985	-0.5896		-1.8232[.071]
A_{2t}	4:1985 - 1:1987	-0.7770		-2.4929[.014]
A_{3t}	2:1987 - 3:1988	-0.3754		-1.5815[.117]
A_{4t}	4:1988 - 2:1989	-0.7658		-3.0289[.003]
A_{5t}	3:1989 - 1:1990	-0.7731		-3.4822[.001]
A_{6t}	2:1990 - 4:1992	-0.7246		-1.5964[.113]
	Joint Variable Addition Tests			
	Lagrange Multiplier	CHI-SQ_6 =	20.1862[.003]	
	Likelihood Ratio	CHI-SQ_6 =	21.8790[.001]	
	F	$F_{6,111}$ =	3.2812[.005]	
	Linear Restriction: $A_{1t} = A_{2t} = A_{3t} = A_{4t} = A_{5t} = A_{6t}$			
	Wald Test	CHI-SQ_5 =	4.6648[.458]	
		Accord Pre and Post Second Tier Decision		
AC_{1t}	3:1983 - 1:1987	-0.6460		-3.0919[.002]
AC_{2t}	2:1987 - 4:1992	-0.6328		-3.8172[.000]
	Joint Variable Addition Tests			
	Lagrange Multiplier	CHI-SQ_2	= 15.4109[.000]	
	Likelihood Ratio	CHI-SQ_2	= 16.3715[.000]	
	F Test	$F_{2,115}$	= 7.4723[.001]	
	Linear Restriction: $AC_{1t} = AC_{2t}$			
	Wald Test	CHI-SQ_1	= 0.0076[.931]	

Note: 1 Accord dummies are added one at a time to the parsimonious model shown in Table 5.7, then all are added to perform the joint tests.

Table 5.13:	**Multi-collinearity Diagnostics - Pearson Correlation Coefficients of Economic Regressors**					
Regressor	$LCAPU_t$	$AC{*}LCAPU_t$	$\Delta_4 LDENS_t$	$\Delta LCPI_t$	LOP_t	$SF{*}\Delta LRAWE_{t-1}$
$LCAPU_t$	1.0000					
$AC{*}LCAPU_t$	0.3579	1.0000				
$\Delta_4 LDENS_t$	0.0832	0.3403	1.0000			
$\Delta LCPI_t$	0.3444	0.1787	0.4002	1.0000		
LOP_t	-0.1186	-0.1377	-0.0694	-0.2763	1.0000	
$SF{*}\Delta LRAWE_{t-1}$	0.1500	0.1746	0.1266	0.3299	-0.0697	1.0000
$LINVRES_t$	-0.1508	0.3853	0.4484	0.3981	-0.1843	0.1166

Table 5.14:	**Multi-collinearity Diagnostics - Variance Inflation Factors[1]**		
Regressor	**Variance Inflation**	**Regressor**	**Variance Inflation**
$LCAPU_t$	2.0080	P_{3t}	1.0732
$AC{*}LCAPU_t$	5.3731	P_{4t}	1.1009
$\Delta_4 LDENS_t$	1.5559	P_{5t}	1.2023
$\Delta LCPI_t$	2.1985	P_{7at}	1.1374
LOP_t	1.2252	S_{1t}	1.1732
$SF{*}\Delta LRAWE_{t-1}$	1.2739	S_{4t}	1.2550
$LINVRES_t$	2.1201	G_{2t}	1.3844
P_{1t}	1.0267	AC_t	4.6043
P_{2t}	1.1794		

Note: 1 No critical values exist for the variance inflation factor (VIF). Studenmund (1992) suggests a useful rule of thumb, which is to suspect severe multi-collinearity if VIF exceeds 10, where the number of regressors is large.

Table 5.15:	**Multi-collinearity Diagnostics - Eigen Values[1]**				
Number	**Eigen Value**	**Condition Index**	**Number**	**Eigen Value**	**Condition Index**
1	4.1900	1.0000	10	0.7432	2.3744
2	2.3792	1.3271	11	0.6940	2.4572
3	1.3517	1.7606	12	0.6712	2.4985
4	1.2699	1.8165	13	0.5480	2.7655
5	1.1066	1.9459	14	0.4427	3.0765
6	1.0535	1.9943	15	0.3298	3.5641
7	1.0080	2.0388	16	0.2725	3.9214
8	0.9916	2.0556	17	0.0864	6.9630
9	0.8238	2.2552	18	0.0381	10.4864

Note: 1 No critical values exist for conditional indices associated with the eigen values. Belsley *et al* (1980) suggest that conditional indices of 30 or more, are symptomatic of severe multi-collinearity.

Table 5.16: **Restricted Parsimonious Model**
Dependent Variable: $LWDLE_t$
Estimation Method: **Ordinary Least Squares**
Sample: **3:1959 to 2:1983**

Regressor	Coefficient	Std Error	t-Ratio[Prob]
INTERCEPT	4.7984	0.1319	36.3711[.000]
$LCAPU_t$	13.2766	1.9801	6.7049[.000]
$\Delta_4 LDENS_t$	6.3031	2.5292	2.4921[.015]
$\Delta LCPI_t$	14.5516	4.6075	3.1582[.002]
LOP_t	-0.0548	0.0221	-2.4815[.015]
$SF^*\Delta LRAWE_{t-1}$	-10.7412	3.7656	-2.8524[.005]
$LINVRES_t$	5.6881	1.0586	5.3734[.000]
P_{1t}	1.0323	0.3861	2.6737[.009]
P_{2t}	1.6637	0.4146	4.0123[.000]
P_{3t}	1.3831	0.3955	3.4969[.001]
P_{74t}	1.0949	0.4649	2.3549[.021]
S_{1t}	-0.2778	0.0972	-2.8570[.005]
S_{4t}	-0.2685	0.0980	-2.7406[.008]
G_{2t}	-0.3945	0.1658	-2.3797[.020]

R-Sq	0.7584	$F_{13,82}$	19.7947[.000]
Adj R-Sq	0.7200	S E	0.37874
Res SS	11.762	Mean Dep Var	4.4573
S D Dep Var	0.7158	Max Log-likelihood	-35.4439
DW	2.2338		

Diagnostic Tests

Test Statistics		LM Version		F Version
Serial Cor(1)	CHI-SQ$_1$	2.1710[.141]	$F_{1,81}$	1.8741[.175]
Serial Cor(4)	CHI-SQ$_4$	5.8928[.207]	$F_{4,78}$	1.2753[.287]
Funct Form	CHI-SQ$_1$	2.1186[.146]	$F_{1,81}$	1.8279[.180]
Normality	CHI-SQ$_2$	1.7516[.417]	Not applicable	
Hetero	CHI-SQ$_1$	0.7392[.390]	$F_{1,94}$	0.7295[.395]
ARCH(1)	CHI-SQ$_1$	0.4548[.500]	$F_{1,81}$	0.3856[.536]
ARCH(4)	CHI-SQ$_4$	1.9954[.737]	$F_{4,78}$	0.4139[.798]

Table 5.17: Testing the Parsimonious Model for Exogeneity of Regressors Using Hausman's Specification Test

Regressors	Test Statistics		
$LCAPU_t$	Lagrange Multiplier	$CHI\text{-}SQ_1$ =	1.2855[.257]
	Likelihood Ratio	$CHI\text{-}SQ_1$ =	1.2917[.256]
	F	$F_{1,114}$ =	1.1126[.294]
$\Delta L_{f}DENS_t$	Lagrange Multiplier	$CHI\text{-}SQ_1$ =	0.1942[.659]
	Likelihood Ratio	$CHI\text{-}SQ_1$ =	0.1943[.659]
	F	$F_{1,113}$ =	0.1665[.684]
$\Delta LCPI_t$	Lagrange Multiplier	$CHI\text{-}SQ_1$ =	0.5757[.448]
	Likelihood Ratio	$CHI\text{-}SQ_1$ =	0.5770[.447]
	F	$F_{1,111}$ =	0.4937[.484]
$LINVRES_t$	Lagrange Multiplier	$CHI\text{-}SQ_1$ =	0.6910[.406]
	Likelihood Ratio	$CHI\text{-}SQ_1$ =	0.6928[.405]
	F	$F_{1,113}$ =	0.5946[.442]
$\Delta L_{f}DENS_t$, $\Delta LCPI_t$	Lagrange Multiplier	$CHI\text{-}SQ_2$ =	0.6932[.707]
	Likelihood Ratio	$CHI\text{-}SQ_2$ =	0.6951[.706]
	F	$F_{2,110}$ =	0.2949[.745]
$\Delta L_{f}DENS_t$, $\Delta LCPI_t$, $LCAPU_t$, $LINVRES_t$	Lagrange Multiplier	$CHI\text{-}SQ_4$ =	2.9628[.564]
	Likelihood Ratio	$CHI\text{-}SQ_4$ =	2.9971[.558]
	F	$F_{4,108}$ =	0.6297[.642]

Table 5.18: Lagged Changes in Real Average Weekly Earnings and Distributed Lag Functions[1]

Regressor	Coefficient	*t*-Ratio[Prob]	Regression S E
$SF^*\Delta LRAWE_{t-1}$	-9.8164	-2.7442[.007]	0.39763
$SF^*\Delta LRAWE(\lambda)^*_t$, , $\lambda=0.1$	-12.7634	-3.0029[.003]	0.39525
$SF^*\Delta LRAWE(\lambda)^*_t$, , $\lambda=0.2$	-14.1264	-2.9826[.003]	0.39545
$SF^*\Delta LRAWE(\lambda)^*_t$, , $\lambda=0.3$	-15.5101	-2.9204[.004]	0.39603
$SF^*\Delta LRAWE(\lambda)^*_t$, , $\lambda=0.4$	-16.7624	-2.7803[.006]	0.39731
$SF^*\Delta LRAWE(\lambda)^*_t$, , $\lambda=0.5$	-17.8481	-2.5699[.011]	0.39912
$SF^*\Delta LRAWE(\lambda)^*_t$, , $\lambda=0.6$	-18.3351	-2.2500[.026]	0.40166
$SF^*\Delta LRAWE(\lambda)^*_t$, , $\lambda=0.7$	-17.1251	-1.7559[.082]	0.40498
$SF^*\Delta LRAWE(\lambda)^*_t$, , $\lambda=0.8$	-11.8334	-0.9932[.323]	0.40860
$SF^*\Delta LRAWE(\lambda)^*_t$, , $\lambda=0.9$	2.6102	0.1727[.863]	0.41028

Note: 1 Geometric distributed lag variables, $SF^*\Delta LRAWE\lambda^*_t$, replace the lagged real wage variable, $SF^*\Delta LRAWE_{t-1}$, in the parsimonious model shown in Table 7.5. The structural break observed in $\Delta LRAWE_{t-1}$, also occurs in the distributed lag variables.

Table 5.19: Non-Nested Tests of the Model Against Other Australian Empirical Models

Test Statistic		M_1 against M_2			M_2 against M_1
		Bentley and Hughes Model 25			
J-Test		2.0506[.040]			10.9599[.000]
JA-Test		1.9688[.049]			3.4714[.001]
Encompassing	$F_{3,113}$	2.4324[.069]		$F_{10,113}$	12.1034[.000]
Akaike's Information Criterion of M_1 versus M_2			= 37.5885		favours M_1
Schwarz's Bayesian Information Criterion of M_1 versus M_2			= 27.4461		favours M_1
		Phipps Model 26			
J-Test		3.2155[.001]			6.1131[.000]
JA-Test		3.0792[.002]			3.8523[.000]
Encompassing	$F_{4,112}$	2.6455[.037]		$F_{7,112}$	5.4052[.000]
Akaike's Information Criterion of M_1 versus M_2			= 10.4513		favours M_1
Schwarz's Bayesian Information Criterion of M_1 versus M_2			= 6.1046		favours M_1
		Perry Model 27			
J-Test		2.2660[.023]			8.6166[.000]
JA-Test		2.0917[.036]			0.5016[.616]
Encompassing	$F_{3,112}$	1.7035[.170]		$F_{8,112}$	9.2007[.000]
Akaike's Information Criterion of M_1 versus M_2			= 25.6235		favours M_1
Schwarz's Bayesian Information Criterion of M_1 versus M_2			= 18.3976		favours M_1
		Beggs and Chapman Model 28			
J-Test		3.6615[.000]			5.2032[.000]
JA-Test		3.5296[.000]			3.2538[.001]
Encompassing	$F_{6,110}$	2.1853[.050]		$F_{5,110}$	5.6628[.000]
Akaike's Information Criterion of M_1 versus M_2			= 8.8009		favours M_1
Schwarz's Bayesian Information Criterion of M_1 versus M_2			= 10.2498		favours M_1
		Beggs and Chapman Model 29			
J-Test		2.8354[.005]			6.6232[.000]
JA-Test		2.7358[.006]			3.8271[.000]
Encompassing	$F_{4,112}$	2.0112[.098]		$F_{8,112}$	5.4218[.000]
Akaike's Information Criterion of M_1 versus M_2			= 13.2842		favours M_1
Schwarz's Bayesian Information Criterion of M_1 versus M_2			= 7.4885		favours M_1

Notes:

1. M_1 is the parsimonious model shown in Table 5.7

2. M_2 are the parsimonious re-estimated models of other Australian researchers shown in Tables 3.2 to 3.9.

3. All re-estimated models use the dependent variable $LWDLE_t$, irrespective of the original specification.

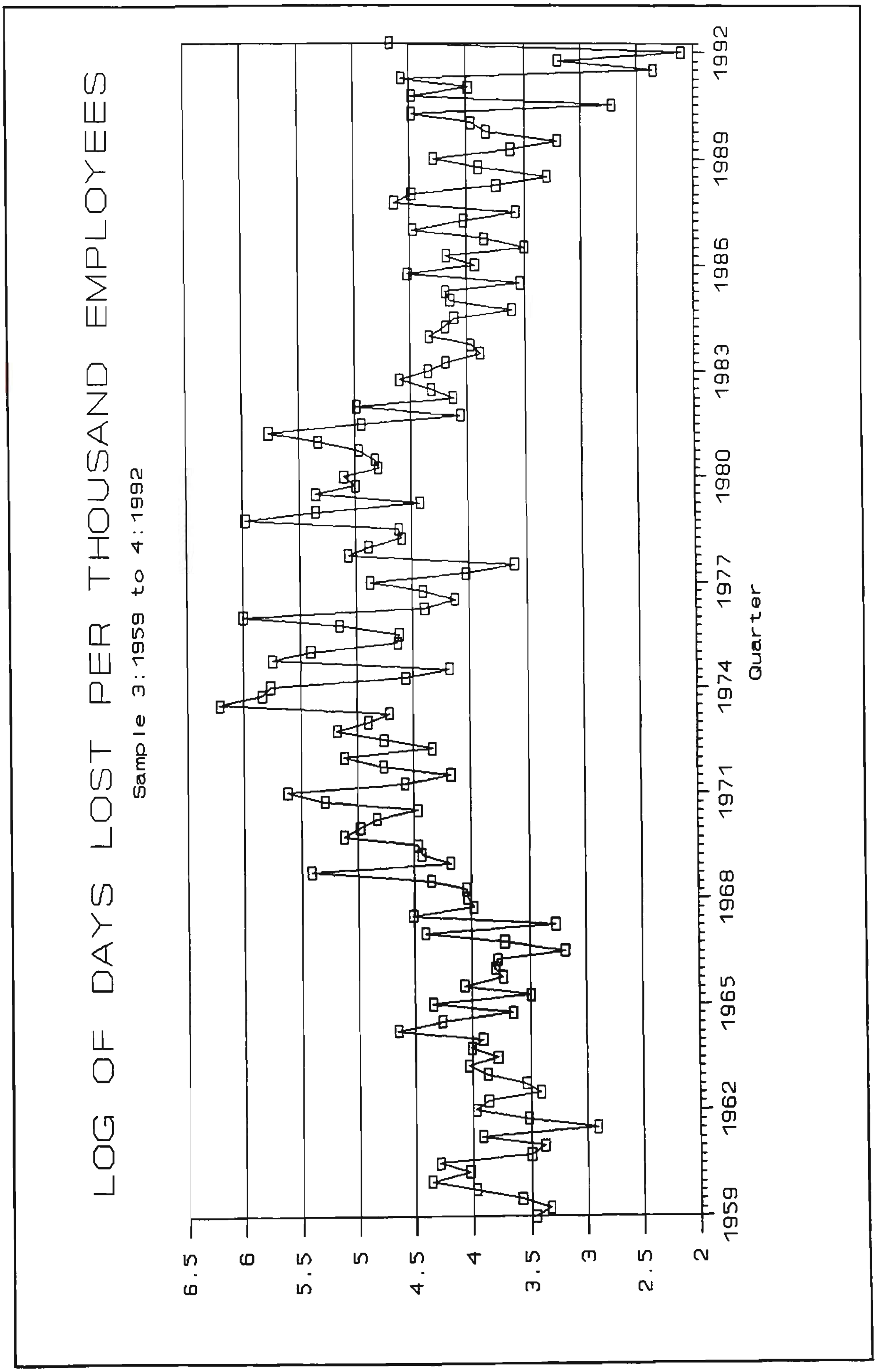

Figure 1: Logarithm of Working Days Lost per Thousand Employees

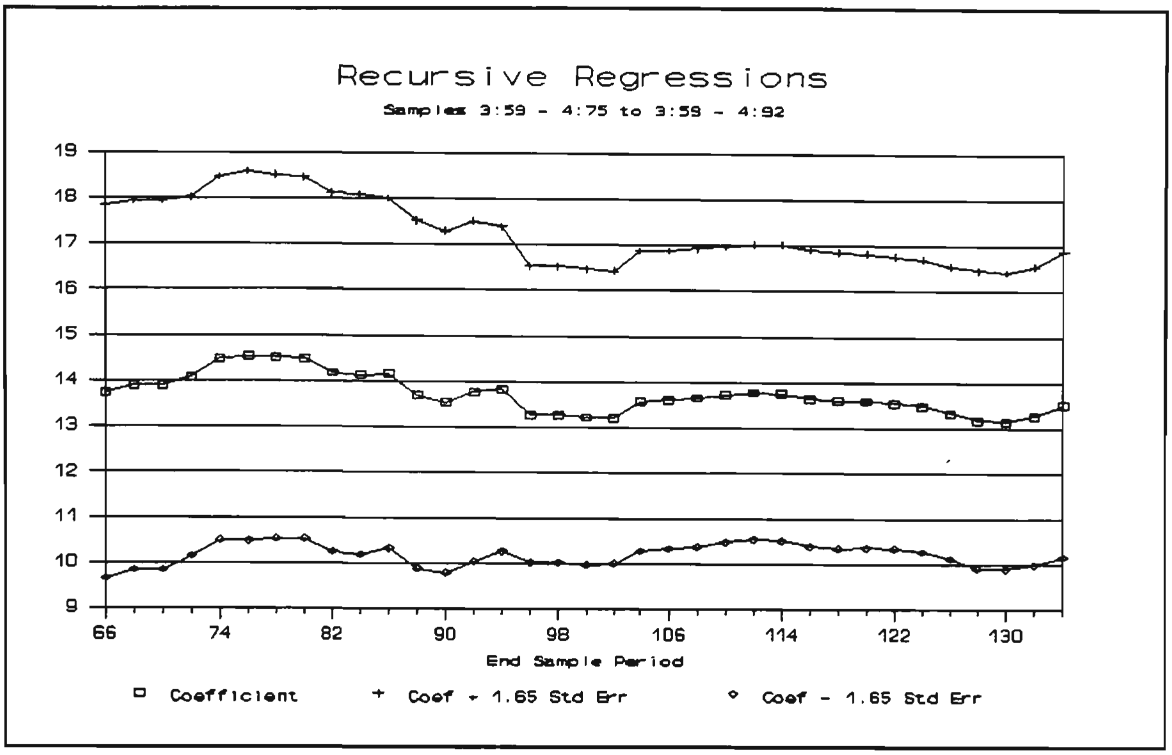

Figure 2: Recursive Regressions Coefficients of $LCAPU_t$

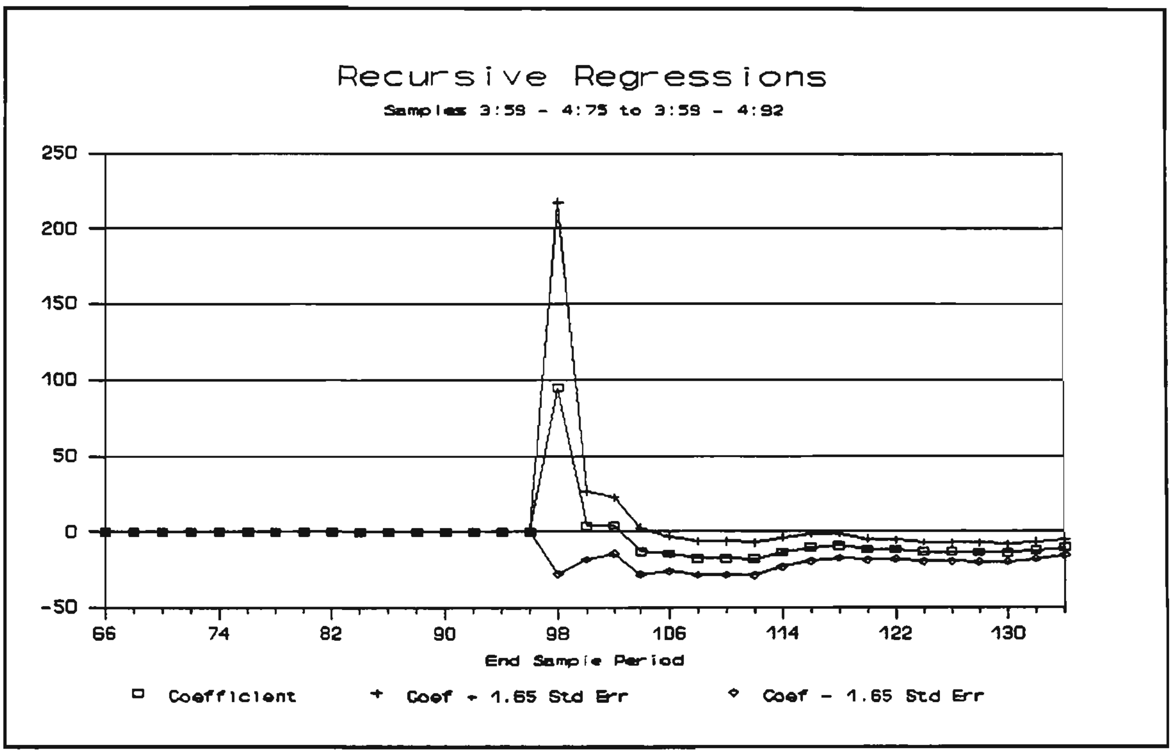

Figure 3: Recursive Regressions Coefficients of $AC*LCAPU_t$

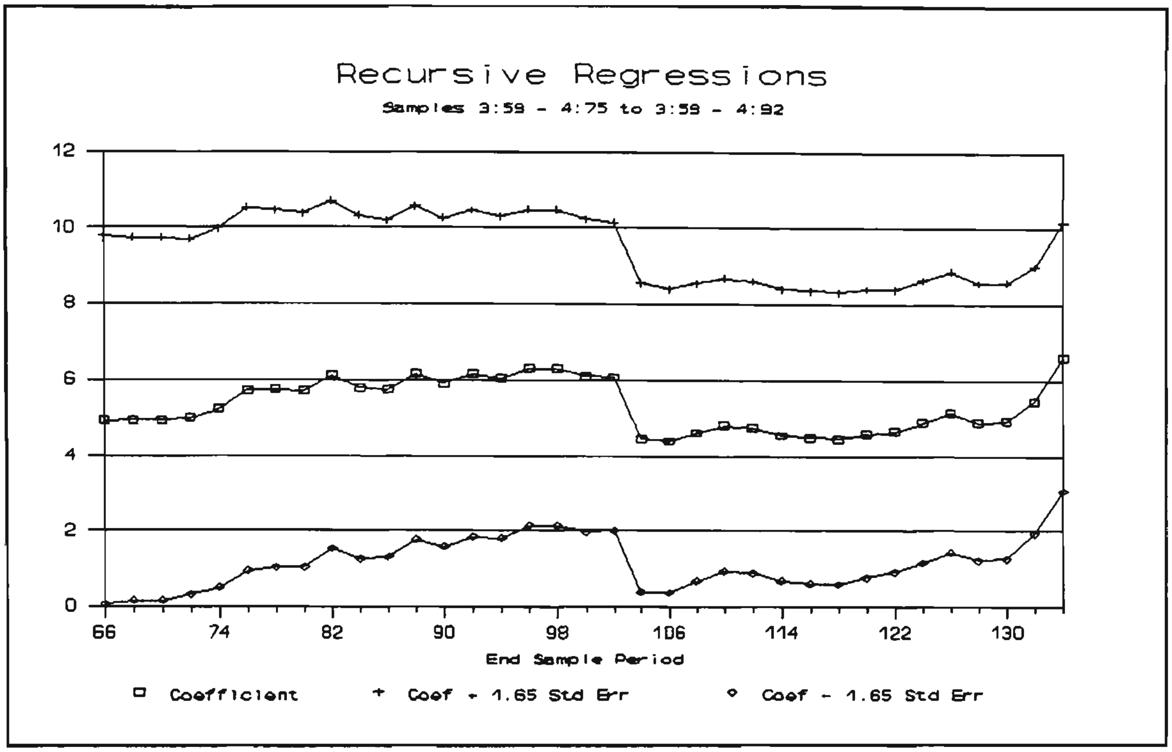

Figure 4: Recursive Regressions Coefficients of $\Delta LDENS_t$

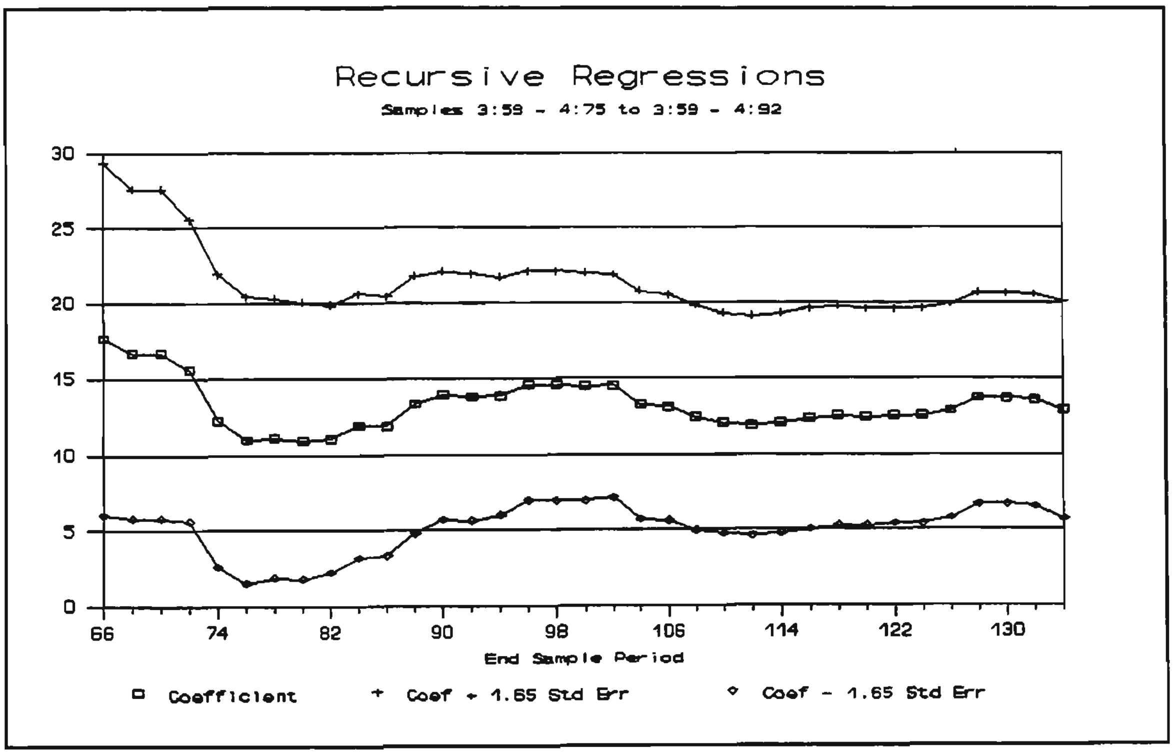

Figure 5: Recursive Regressions Coefficients of $\Delta LCPI_t$

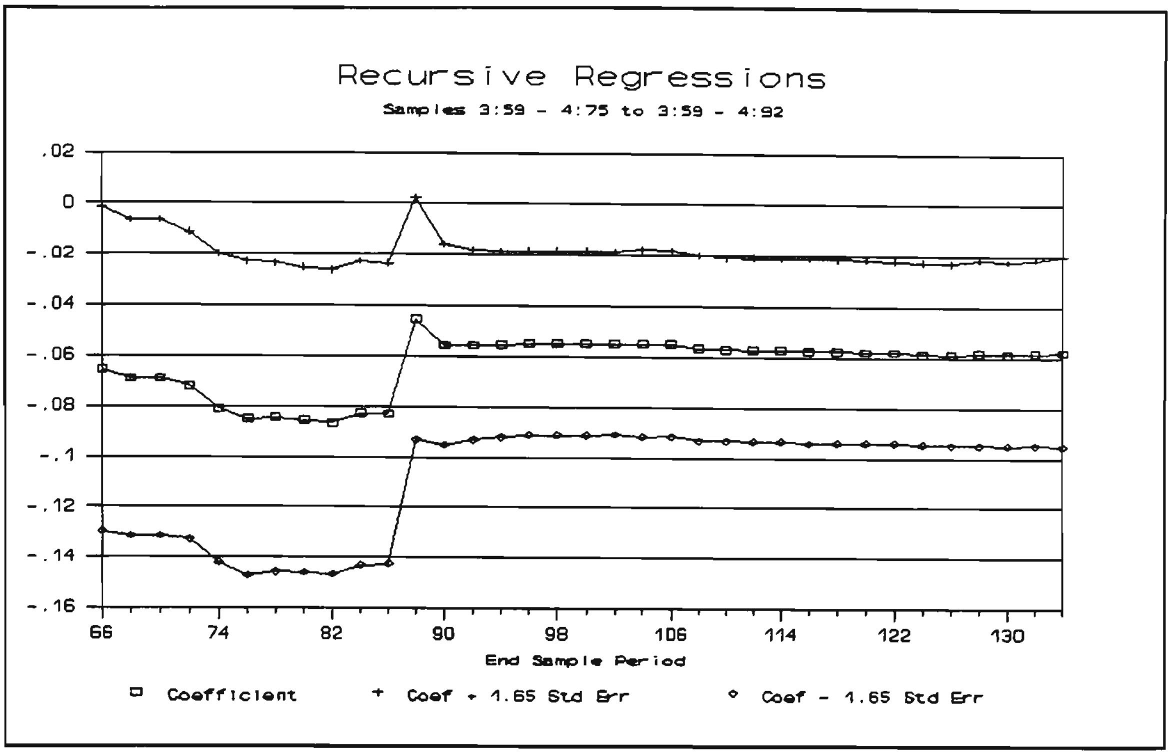

Figure 6: Recursive Regressions Coefficients of LOP_t

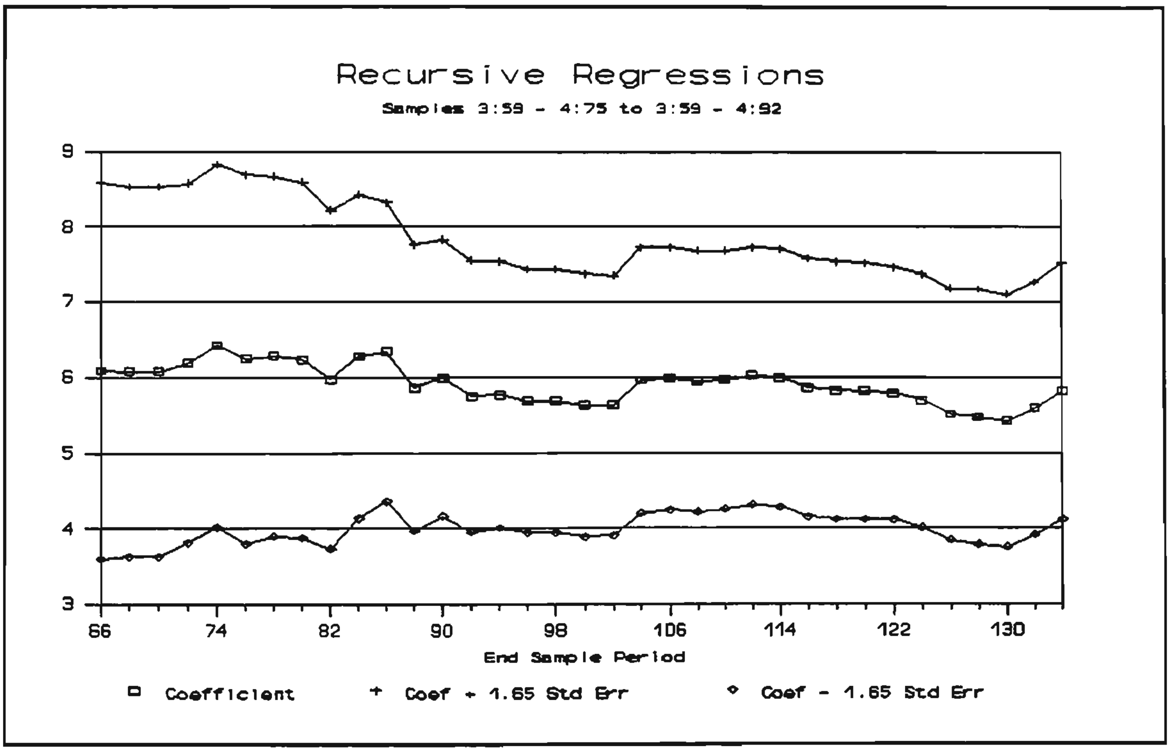

Figure 7: Recursive Regressions Coefficients of $LINVRES_t$

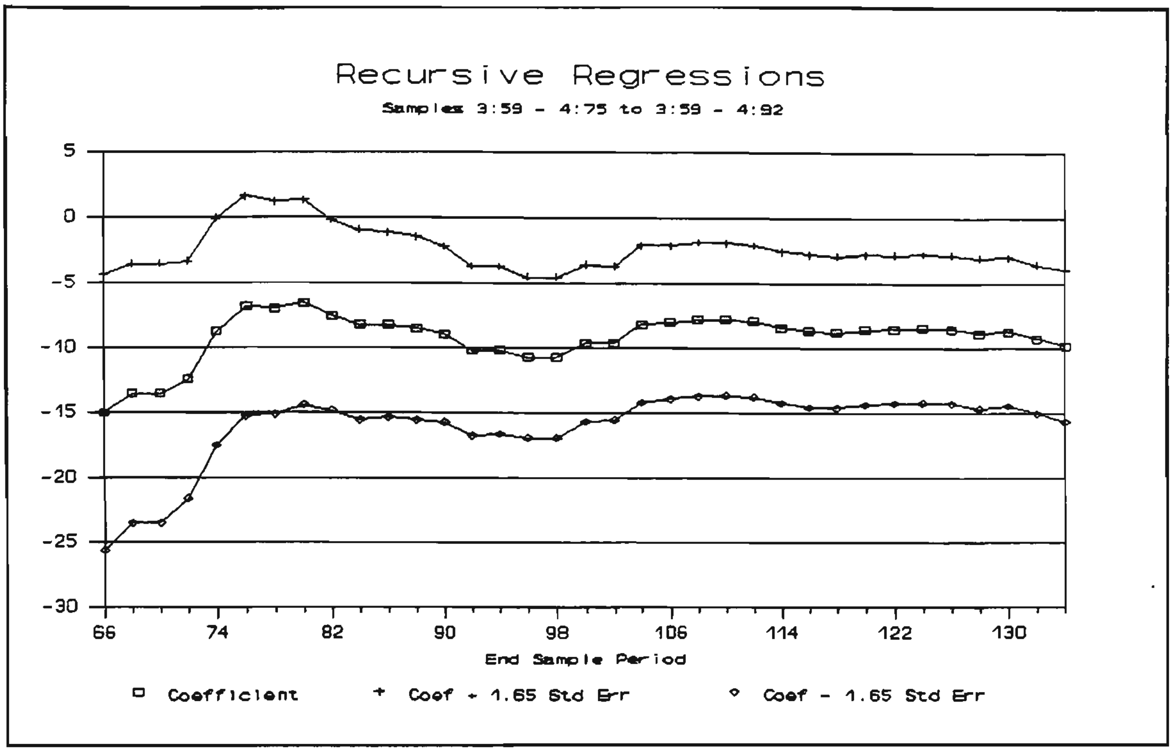

Figure 8: Recursive Regressions Coefficients of $SF^{*}\Delta LRAWE_{t-1}$

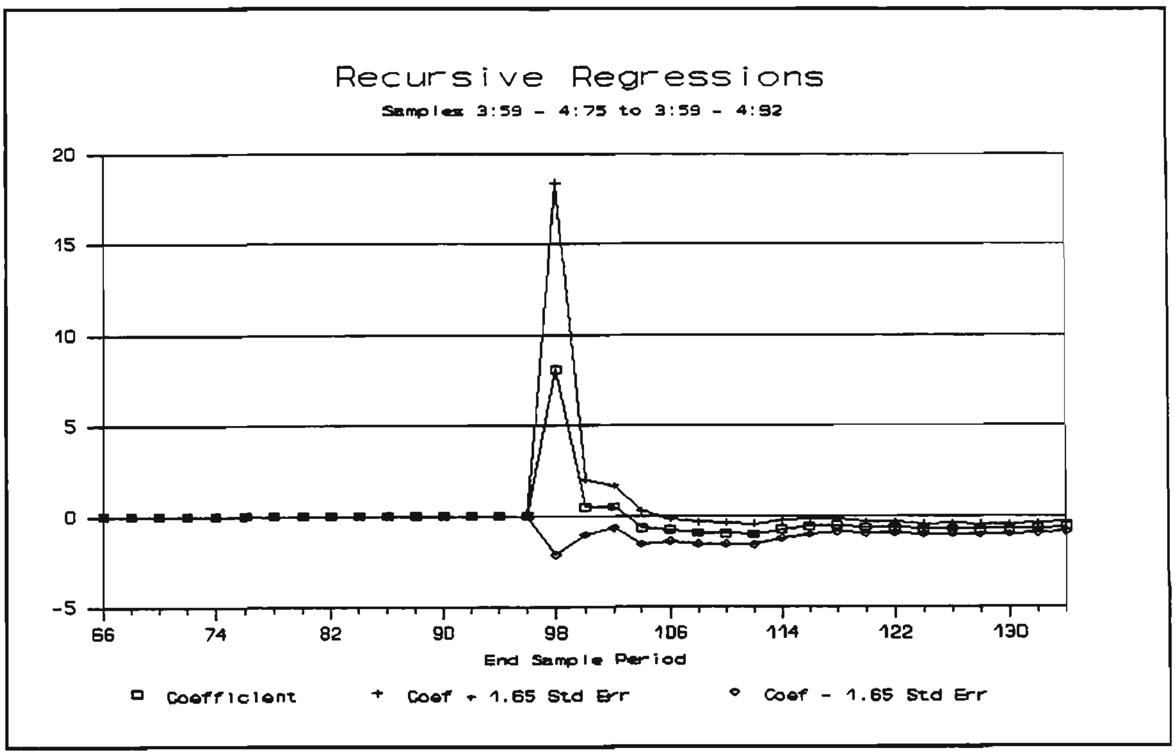

Figure 9: Recursive Regressions Coefficients of AC_t

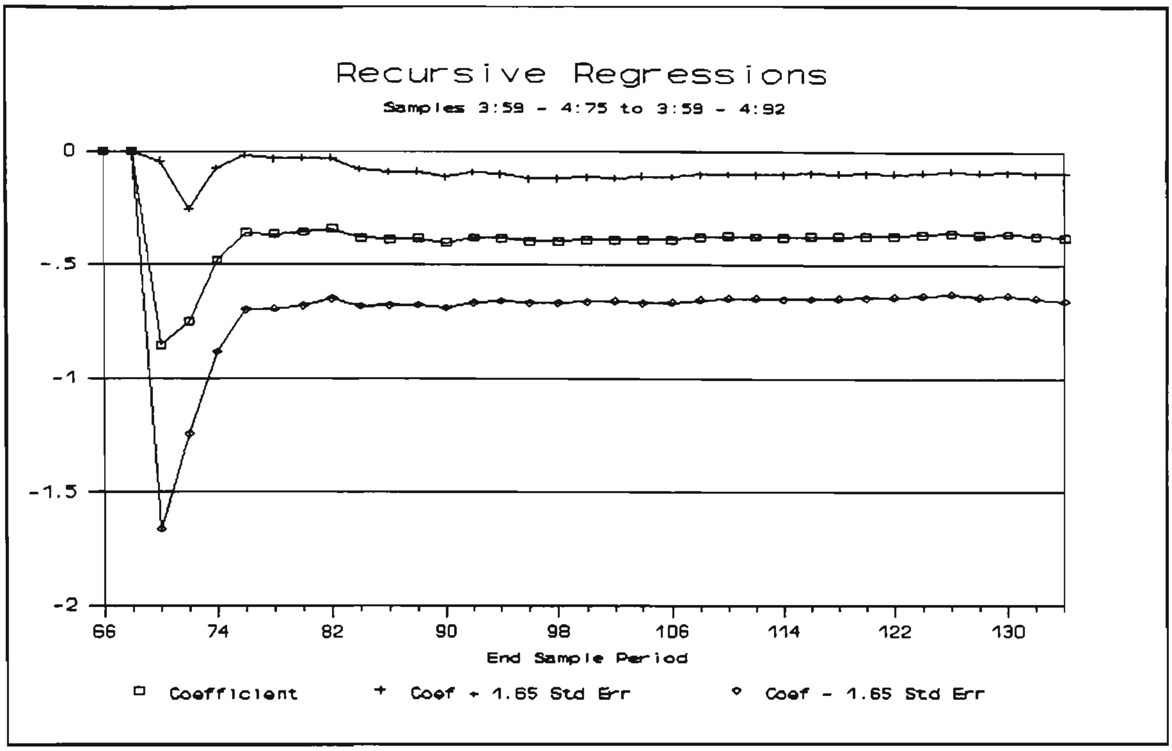

Figure 10: Recursive Regressions Coefficients of G_{2t}

6 A Cross-Sectional Model of Australian Strikes

6.1 Introduction

In Chapter 4 we develop a model which proposes that the opportunity cost of strikes to the union is an important determinant of strike activity. These costs occur when real wage increases and strikes, lead to the shedding of labour in unionised workplaces; this causes the typical retrenched worker to undergo a period of unemployment, followed by re-employment where replacement wages are less than the prior wage. Opportunity costs of strikes to the firm are associated with permanent losses of market shares caused by strikes, when customers switch to other suppliers, and when buyers avoid entering into long term contracts with strike-prone firms.

These costs, of course, are weighed against the benefits of a strike. For the union, these are the future higher earnings of employees who remain employed; for the firm, a strike lowers the final settlement and so makes future labour costs less than those which would otherwise occur. (We remind the reader that the model excludes ambit claims and short strikes which are preliminary tactical manoeuvres, and assumes that a union demand is one over which it is prepared to strike; further, it assumes that productivity gains will be passed on to employees, and that informal wage indexation is the norm.)

The theoretical model suggests an empirical model, introduced in Section 4.6.3, of the form

$$Strike_i = \alpha_0 + \alpha_1 d_i + \alpha_2 CES_i + \alpha_3 CFS_i + \sum_{j=1}^{k} \alpha_{k+3} X_{ji} + \epsilon_i \qquad (4.29)$$

where $Strike_i$ is a measure of strikes, d_i the union's demand, CES_i a measure of employee strike costs, CFS_i a measure of strike costs to the firm, and ϵ_i a random error term. X_{ji} is an eclectic set of k regressors which are proxies for variables suggested by imperfect and asymmetric information models, and joint costs models of strikes.

In the previous chapter, we test the model using macroeconomic time-series data. Measured against other Australian models, our empirical model performs well, but we point out that it may not fully come to grips with local labour market conditions and the competitive position of the firm, both of which are prominent aspects of our theoretical model. The use of microeconomic cross-sectional data provides an opportunity to investigate these matters at the level of the workplace.

Very importantly, the use of microeconomic data allows us to develop separate empirical models for different types of ownership status. Economic models, including our own, are based on the implicit assumption that firms are private enterprises, and almost all assume profit maximising behaviour. In modern Western economies, many workplaces are not privately owned and, almost certainly, are not profit maximisers. Government business enterprises (GBEs) may seek normal profits, but are often required by governments to provide services which are inherently unprofitable, and government non-commercial establishments (GNCEs) have objectives associated with providing government-specified levels of service. Our theoretical model assumes that the firm uses cost-plus pricing and, therefore, loosely describes private enterprises and GBEs.

In this chapter, we make use of the Australian Workplace Industrial Relations Survey (AWIRS). AWIRS was conducted in 1989-90 by the Commonwealth Department of Industrial Relations, to inquire into industrial relations policies and practices; in particular, it covers formal industrial relations structures, interactions between employers, unions, union members and employees, and the outcomes of these interactions. On these matters, it provides an extensive body of information concerning a sample of 2,004 workplaces with twenty or more employees, in all industries.[1] It also gives some useful information regarding local labour tightness and competitive conditions. AWIRS has given rise to a wide range of publications, however little use has been made of it to investigate the determinants of strikes.[2]

AWIRS records whether at least one strike occurs in the survey year, but does not reveal the number of strikes and their duration. The absence of a time dimension means that we are unable to investigate the impact on strikes of changes in macroeconomic and institutional variables. Clearly this is a handicap, because although we draw inferences regarding factors which are associated with strikes in the survey year, we must tread cautiously in suggesting that these variables are also significant at other times. Notwithstanding these limitations, AWIRS provides an opportunity to analyse some of the factors which cause workplaces to experience strikes, and in particular, to investigate whether the data supports our theoretical model.

6.2 Previous Australian Cross-Sectional Strike Models

With a few exceptions, empirical analyses of Australian strikes have been limited to macroeconomic time-series models. We begin by reviewing what are the only published Australian cross-sectional models of strikes; these are Drago and

[1]AWIRS also has a sample of 349 workplaces with less than twenty employees, however the set of questions is smaller and, as a result, it is difficult to merge the two samples.

[2]Callus *et al* (1991) provides an overview of AWIRS. A useful summary of publications which use AWIRS is contained in Olsen *et al* (1995).

Wooden (1990) and Dawkins *et al* (1992).

6.2.1 Model 31: Drago and Wooden

Drago and Wooden (1990) construct models of strikes which use data from a private survey conducted in 1988, of member firms of the Business Council of Australia. The dependent variables are the logarithms of the number of stoppages, $STOPS_i$, and the number of days of closure due to stoppages, $CLOS_i$. They argue that the models are inherently non-linear since

> closing a workplace for one day during a year is likely to be more serious for employees than, say, choosing to close a workplace for a tenth day after shutting it down for nine days previously. Furthermore, the cost to the firm in terms of losing reputation as a reliable supplier is likely to be significantly higher for a first strike action than for subsequent actions.[3] [p 34]

The set of regressors used to explain a strike variable, S_i, is, they claim, "eclectic", and is of the general form

$$S_i = \alpha + \Sigma\beta_j ECON_{ji} + \Sigma\gamma_k WPLACE_{ki} + \Sigma\delta_l UNION_{li} + \Sigma\zeta_m COOP_{mi} + \Sigma\eta_n AWARD_{ni} + \Sigma\theta_r WFORCE_{ri} + \Sigma\kappa_s CONTROL_{si} + \epsilon_i \tag{6.1}$$

The set of economic variables, $ECON_{ji}$, is different from those commonly used in strikes models, and it may be argued, are highly subjective. The labour market variable, LM_i, is management's perception of the ease of hiring additional labour; the profit variable, $PROFIT_i$, management's perception of their own firm's profitability, *vis-à-vis* those of other firms in the same industry; and the technological change variable, $TECHCH_i$, is the frequency of technological change

[3]The second strand of this argument does not take into account the possibility that the reputation might have already been lost in strikes prior to the commencement of the survey year.

in the industry.[4]

A set of non-economic variables, $WPLACE_{ki}$, measures employer and workplace attributes, $UNION_{li}$ describes union characteristics, $COOP_{mi}$ measures the extent of union-management cooperation, $AWARD_{ni}$ indicates types of awards at the workplace, $WFORCE_{ri}$ describes workforce profiles, $CONTROL_{si}$ is a set of industry and state dummies, and ϵ_i is a random error term .

Drago and Wooden choose not to report parsimonious versions of their models, so we do not reproduce their results here.[5] Stoppages are positively, and significantly, associated with the degree of monopolisation, workforce size, the proportion of employees paid piece rates, the proportion of blue collar workers, the square of the absenteeism rate, the number of trade unions present, the extent of union influence at the workplace, the presence of combined union committees, the presence of joint union-management committees, and the coverage of the workplace by both federal and state awards. Strikes are negatively, and significantly, associated with the percentage of hours worked as overtime, the presence of profit-sharing schemes for non-managerial employees, the absence of a union at the workplace, and the square of the extent of union-management co-operation.[6]

Closures are positively, and significantly, associated with the proportion of blue collar workers, the absenteeism rate, the presence of combined union

[4]To save space, we define names for the categories of variables used by Drago and Wooden.

[5]The stoppages model contains 43 regressors, of which 23 are significant, and the closures model includes 38 regressors, of which 14 are significant, both at the ten percent level on two sided tests.

[6]Quadratic terms in profit, monopolisation and size, are also significant, and assisted in obtaining a better functional form.

committees, and the presence of joint union-management committees. They are negatively, and significantly, associated with size, the presence of profit-sharing schemes for non-managerial employees, the ratio of supervisory employees to non-supervisory employees, the absence of a union at the workplace, the extent of union-management co-operation, and the proportion of employees covered by company awards.

It is difficult to draw any strong conclusions from these models regarding orthodox theories of strikes. The economic variables, with the exception of profit in the stoppages model, perform poorly. This, however, does not necessarily imply a contradiction of the results of other empirical studies which find profit and tightness of labour markets to be significant; the different definitions of these variables may account for this.[7] Irrespective of these definitional problems, these models do not enable us to draw conclusions regarding how strikes are influenced by changes in profits and local labour market conditions over time.

The positive association between strikes and the presence of joint union-management committees, appears to be a contradiction of mis-information hypotheses, since it is reasonable to assume that one function of these committees is the facilitation of communication.[8] On the other hand, in the closures model, strikes are negatively associated with the degree of union-management co-operation.

The models reveal several state and industry differences. Queensland,

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[7]The subjective assessments of *employers* may be of greater relevance than more objective measures, particularly if they diverge from those of employees.

[8]We return to this matter later.

South Australia, and the combined Western Australia and Northern Territory, have significantly fewer stoppages; South Australia, and the combined Western Australia and Northern Territory, have significantly fewer days of closure.[9] Construction, and the category "other industries", experience significantly more stoppages and more days of closure.[10]

6.2.2 Model 32: Dawkins, Wooden and Bushe-Jones

Dawkins *et al* (1992) use AIWRS to determine the extent of use of grievance procedures in Australian workplaces, and the impact of their presence on strikes.

AWIRS records whether any strike occurs at each workplace in the survey year, so the strike variable is a binary dummy. In several ways, this is a major shortcoming of the data; we are unable to distinguish between workplaces which may have a single, but rare, strike in the survey period, from others with records of chronic strike activity. We can not identify which strikes are of short duration, and which are protracted, nor can we ascertain the primary cause of any particular strike.

Dawkins *et al* regard strikes as an outcome of bargaining between unions and employers, and take 'an eclectic and slightly *ad hoc* approach to the modelling of strike causation'. [p 20] In essence, they see the incidence of strikes as dependent on the characteristics of the bargainers, the types of issues in dispute, and the history of bargaining at workplaces.

[9]New South Wales is the reference state.

[10]The reference industry is finance, and the "other industries" category is mining, manufacturing, trade and transport.

A probit model is constructed with regressors which, in many respects, are similar to those of Drago and Wooden (1990). The model takes the general form

$$\begin{aligned} PROBIT(STRIKE_i) = {} & \alpha + \Sigma\beta_j WPLACE_{ji} + \Sigma\gamma_k FMAN_{ki} \\ & + \Sigma\delta_l UNION_{li} + \Sigma\zeta_m WFORCE_{mi} \\ & + \Sigma\eta_n IRENV_{ni} + \Sigma\theta_r BARG_{ri} + \Sigma\kappa_s ECON_{si} \\ & + \Sigma\lambda_u TECH_{ui} + \Sigma\varsigma_v EXTENV_{vi} \\ & + \Sigma\tau_w INDUST_{wi} + \epsilon_i \qquad (6.2) \end{aligned}$$

where $STRIKE_i$ is 1 if a strike occurs at the i^{th} workplace during the survey year, and 0 otherwise.[11] The sets of regressors used are workplace characteristics, $WPLACE_{ji}$, firm and management characteristics, $FMAN_{ki}$, union characteristics, $UNION_{li}$, workforce characteristics, $WFORCE_{mi}$, the internal industrial relations environment, $IRENV_{ni}$, types of bargaining issues, $BARG_{ri}$, the firm's economic environment, $ECON_{si}$, the technological environment, $TECH_{ui}$, and the external industrial relations environment, $EXTENV_{vi}$. A set of industry dummies, $INDUST_{wi}$, are used as controls.

AWIRS may be superior to Drago and Wooden's private survey, because it approximates random selection more closely. Dawkins *et al* do not report parsimonious versions of their estimated models, so we do not reproduce their results here.[12] The probability of a workplace experiencing at least one strike in the survey year is significantly, and positively, associated with workplace and enterprise size, whether the firm is a private enterprise, union density, the number

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[11]Again we define variable category names to simplify the list of 50 regressors used by Dawkins *et al.*

[12]Each model contains 48 reported regressors. At the five percent level on one sided tests, model 1, with a "grievance procedures present" variable, has 16 significant regressors; model 2, with a "use of grievance procedures" variable, has 18 significant regressors; and model 3, with a "grievances procedures present and used all the time" variable, has 19 significant regressors. The coefficients of the industry dummies are not reported.

of unions present, whether employees are likely to make use of a union delegate to voice matters of concern, the percentage of employees working overtime, the presence of organisational change in the previous two years[13], whether the workplace is affected by industrial disputes at other workplaces, and the presence and frequency of use of grievance procedures. The probability of a strike is negatively, and significantly, associated with the percentage of part-time workers, whether employee-management co-operation is "very good", the number of fringe benefits provided to the majority of employees, and whether grievance procedures are "present and used all the time".

Clearly, the findings regarding the role of grievance procedures are equivocal. The positive signs of the coefficients of the presence of grievance procedures dummy, and the frequency of their use variable, suggest that grievance procedures predispose workplaces to be strike-prone, however Dawkins *et al* also find that

> the probability of a strike taking place (within a twelve month period) in a workplace where grievance procedures exist and are followed in all cases being almost 13 percentage points lower than at workplaces where such procedures do not exist or are not strictly observed, all other things being equal (when calculated at the mean of the dependent variable). [p 41]

6.3 Some Modelling Issues

We note earlier that almost all economic models of strikes appear to make, at least, the tacit assumption that strikes occur in privately owned profit maximising firms. This is surprising because large proportions of the labour force in Western economies are employed in the public sector, and much of this in

[13]This is defined as a major restructuring of work, new ownership of the enterprise, a shift to greater commercial orientation, or reorganisation of management structure.

GNCEs. It is clear that in GNCEs, the sharing of profits is not a bargaining issue, yet it is apparent that the public sector, at least in Australia, is no less strike-prone than the private sector.[14]

In Section 5.1 we argue that, in time-series models, the link between public sector and private sector strikes is the long-standing set of wage relativities commonly found between occupations and industries. A successful wage demand by unions in the private sector may bring about similar demands in the public sector, which may cause strikes to occur. In other words, changes in expectations regarding future profits in the private sector, affects wage demands and strikes in GNCEs. Consequently, an inability to isolate GNCEs in Australian macroeconomic strikes models, may not be of great moment. In cross-sectional microeconomic models, there is no simple means of capturing GNCE employees' views regarding wages in the private sector. Differences in the aims of workplaces, and in the scope for bargaining, suggest that separate models should be developed for private sector workplaces, GNCEs and GBEs.[15]

6.4 Tests of Hypotheses

We use probit models and AWIRS data to construct eclectic models of strikes. Prominence is give to factors in our theoretical model, in addition to variables suggested by other economic models. We also include dummies for changes at the workplace which may bring about industrial conflict, and are not

[14]AWIRS shows that 14.2 percent of privately owned workplaces experienced at least one strike, compared with 28.6 percent in GNCEs and 10.7 percent in GBEs. These percentages are not the same as those in our estimated models, because some cases are lost due to missing values.

[15]If we were to merge all sectors in an empirical model, the "missing value" of profit in GNCEs, would cause the estimated model to degenerate into a commercial sector model. Further, identification of ownership status using dummy variables, makes the unsatisfactory assumption that the coefficients of all other regressors are independent of this factor.

closely associated with disputes concerning wages.

6.4.1 Hypotheses Suggested by the New Model

We test several hypotheses derived from the theoretical model presented in Chapter 4. We expect lower wage demands, and unions to be more strike averse, where the elasticity of demand in the product market is greater; in this circumstance, higher wages lead to greater redundancies. Elastic demand also suggests that firms are more resistant, so the *a priori* relationship between strikes and elasticity is uncertain. Similarly, when labour costs are a large proportion of total costs, price increases following wage increases are larger, leading to the moderation of wage demands, but causing firms to be more resistant.

If the workplace already pays high efficiency or union wages, the loss of earnings of retrenched employees following further wage increases, is greater; therefore we hypothesise a negative relationship between strikes and relative wages at the workplace. Because buoyant local labour market conditions suggest shorter periods of unemployment for retrenched employees, we propose a positive relationship between strikes and indicators of local labour market tightness. Like all strike models, our model hypothesises a negative relationship between strikes and discount rates.

6.4.2 Mis-information Hypotheses

In the 1980s, many economic models of strikes emerged which see the information available to bargainers playing a central role; they propose that, with perfect information available to both parties, strikes would be rare. In itself, this is not new, and is noted by Hicks (1932); what is new is an examination of the nature of the mis-information problems which lead to strikes.

In Chapter 2 we describe the imperfect information models of Mauro (1982), Cousineau and Lacroix (1986), Gramm (1986) and Gramm *et al* (1988). Their central idea is that in wage bargaining, firms and unions haggle over shares of expected future profits, and they base their expectations on different sets of indicative variables; the greater the divergence of expectations, the more likely it is that a strike will occur.

We also outline the asymmetric information models of Hayes (1984), Tracy (1987), Booth and Cressy (1987) and Hart (1989). The essence of these models is that firms know their own profits with certainty, but unions posses only a subjective probability distribution of profits; the latter is initially based on the union's inferences from generally known economic conditions. A strike is used by the union to extract from the firm more information regarding its true profits.[16] In our empirical model, we attempt to identify regressors which capture mis-information problems at the workplace.

6.4.3 Joint Cost Hypotheses

Reder and Neumann (1980) produce a joint cost minimisation model which we outline in Chapter 2. They propose that strikes impose costs on both firms and employees, and that bargaining pairs develop protocols which minimise the expected total cost of negotiation. Gunderson *et al* (1986) find empirical support for this hypothesis, and claim that strikes are less likely when the joint costs of strikes are high relative to those of alternative mechanisms such as the use of joint committees, continuous bargaining, voluntary arbitration, and grievance

[16]More correctly, information is required regarding future profits. Current or past profits are relevant only if bargainers believe that they are leading indicators of future profits.

procedures.

6.5 An Empirical Model of Strikes in Australian Private Enterprises

Because many theoretical models assume that strikes result from failures of bargainers to agree on the distribution of expected future profits or rents, we begin by producing a model restricted to privately owned workplaces. We presume that strikes are always the results of failures of employers and unions to reach agreement and, therefore, limit the model to workplaces which have a union presence.[17] Our own model and theoretical models in the economic literature, regard union demands as wage demands, or demands of a wage-like character; although this is our main approach, AWIRS allows us to investigate other possible causes of strikes.

We select a set of regressors from AWIRS as proxies for factors which we believe are likely to influence strike activity. In many instances, the proxies are less than totally convincing, and in some cases their significance may appear to support competing hypotheses. Because of this, we are unable to specify signs of all coefficients *a priori*, with certainty. Although we advance justifications for our choice of regressors, other researchers may argue that different proxies are superior. A review of the literature, however, indicates that there is no consensus on the selection of proxies, and this matter is explored by Mumford (1993).

In selecting a set of proxies, we make the set of regressors as small as practical. We reject the approach of using a large range of regressors in what sometimes appears to be a hope that a few will turn out to be significant. We

[17]Although it is possible that employees in a non-unionised workplace might be drawn into a strike originating outside the workplace, AWIRS reveals no evidence of this occurring during the survey period. In the sample of 2,004 workplaces, 298 have no union presence, and none of these experience a strike.

believe, too, that regressors which are not significant at reasonable levels, should be eliminated from the model.

We specify a general model as

$$\begin{aligned} PROBIT(STRIKE_i) = {} & \alpha + \Sigma\beta_k DEMAND_{ki} + \Sigma\gamma_l CES_{li} \\ & + \Sigma\delta_m CFS_{mi} + \Sigma\zeta_n INFORM_{ni} + \Sigma\eta_r RENT_{ri} \\ & + \Sigma\theta_s UNION_{si} + \Sigma\kappa EMPASS_i + \Sigma\varsigma_u ISSUE_{ui} \\ & + \Sigma\tau_v CONTROL_{vi} + \epsilon_i \qquad (6.3) \end{aligned}$$

where $STRIKE_i$ is 1 if a strike occurs at the ith workplace, and 0 otherwise. The sets of regressors are union demand variables, $DEMAND_{li}$, opportunity strike costs to employees, CES_{mi} , opportunity cost of strike costs to firms, CFS_{ni}, information, $INFORM_{ni}$, economic rents, $RENT_{ri}$, union power, $UNION_{si}$, membership of an employers' association, $EMPASS_i$, strikable issues, $ISSUE_{ui}$, and control variables, $CONTROL_{vi}$. A full list of the variables used in the model, together with the numbers of the AWIRS questions from which they are derived, is shown in Table 6.1.[18]

6.5.1 The Dependent Variable

The dependent variable is the binary dummy *STRIKE*, which records whether or not a strike occurs during the survey year. Of the privately owned workplaces which have a union presence, 19.6 percent experience at least one strike.

6.5.2 Union Demand Variables

In Chapter 4 we propose that size of the union's demand is positively associated with the maximum acceptable employment loss, and negatively with

[18]Many of the variables we use are crude intercept dummies, however we are constrained in our choice of proxies by the information contained in AWIRS.

wage losses during unemployment and later re-employment, the elasticity of demand, labour's share of total cost, the average duration of unemployment and the union discount rate. The probability of a strike occurring is positively associated with the magnitude of the union's demand.

High levels of union density, *DENSITY*, suggest that unions may be prepared to accept greater reductions in membership and, therefore, make higher demands; this implies a positive association between density and strike activity.

Prior wages, and wage losses, are difficult to model using AWIRS data; because we cannot ascertain when, during the survey period, a strike occurred, and what the wage level of the striking employees was prior to the strike, if indeed a strike occurred. As wage loss proxies, we use the ratio of the over-award component of wages to the award of the largest group at the workplace receiving overawards, *OAWARD*, and dummies to show whether management considers its wages to be high, *RWAGEHI*, or to be low, *RWAGELO*, both relative to those in similar workplaces in the same industry. If overtime earnings are the norm, wage losses are greater, so we include an overtime dummy, *OT*, which indicates whether the workplace uses overtime. Because all retrenched workers face the same schedule of social security benefits, and because we assume that there is comparatively little variation in secondary labour market wages, these variables proxy the wage losses of retrenched workers.

The elasticity of demand depends on whether there are good substitutes for the firm's product. As elasticity proxies, we use a dummy which indicates whether the workplace faces strong competition, *STRCOMP*, and another to indicate whether it is exposed to foreign competition, *EXPOSED*.[19] If the firm is operating at capacity, real price increases may be possible without substantial losses of market shares; we define the dummy *CAPAC* to indicate whether the workplace is operating at or near full capacity. To capture the impact of wage increases on price increases, we use *LABCOST*, the ratio of labour costs to the workplace's total costs.

The average duration of unemployment depends on local labour market tightness. As proxies, we use whether employers find difficulty in recruiting non-managerial employees, *TIGHTLAB*, and whether the workplace has unfilled non-managerial vacancies, *VACANCY*. Although neither of these proxies give a direct indication of secondary labour market conditions, the first of these suggest that retrenched workers may find speedy re-employment in the primary sector, and the second, that retrenchments are less likely. Growth of the workplace also suggests that retrenchments are less likely, so unions are more likely to make larger demands; we include the variable *GROWTH*, which is the increase in employment at the workplace over the preceding year.

As discount rate proxies, we use the proportion of females amongst full-time permanent employees, *FEMALE*[20], and the percentage of skilled employees,

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[19]In preliminary work, we investigate whether a dummy for limited competition (derived from gb5), and dummies for the firm having many and few competitors (derived from gb4), are useful proxies for profits. There are, however, strong correlations between each of these and *STRCOMP* and, therefore, we use only the latter.

[20]*FEMALE* is defined as the proportion of females amongst full-time permanent employees, rather than of all employees. We use *NONCORE* to proxy employee rents, and this variable includes casual and part-time female employees. *NONCORE* may also be a discount rate proxy, along with *FEMALE*, and we expect a negative relationship between strikes and *NONCORE*, irrespective of whether it is a discount rate or rent proxy.

SKILLED.[21] Traditionally, many women appear not to regard any particular job as a life-time career, so they may have higher discount rates than men. Skilled employees may be relatively more entrenched in internal labour market structures and less likely to change jobs frequently; therefore, they may take a longer term view of their terms and conditions of employment, compared with unskilled employees. It is also possible that the taking of a long term view, applies to the negotiating process itself; people who regard their employment at a workplace as permanent, may be prepared to negotiate for relatively longer periods, so reducing the probability of strikes occurring. On balance, however, we expect strikes to be negatively associated with discount rate proxies.

6.5.3 Opportunity Strike Costs to Employees

The opportunity cost of strikes to employees are positively associated with wage losses during unemployment and later employment, the elasticity of demand, labour's share of total cost, the average duration of unemployment, the duration of the strike, market erosion caused by the strike, and the union discount rate. The probability of a strike occurring is negatively associated with this cost.

All but two of these variables also determine the union's demand, and we use the same proxies. The expected duration of a strike may depend on prior wages and local labour market tightness; if wages are low compared with those in similar workplaces, and if the workplace has difficulty in filling vacancies, unions may expect employers to concede more quickly. It is likely that if the workplace has a strong monopoly position, strikes have less impact on long term sales, so the

[21] We define "skilled" broadly as all employees other than the category "labourers/unskilled workers" in AWIRS.

elasticity variables also serve as proxies for market erosion caused by strikes.

6.5.4 Opportunity Strike Costs to the Firm

The opportunity costs of strikes to the firm are positively associated with the elasticity of demand, labour's share of total cost, the duration of the strike, market erosion caused by the strike, and the firm's discount rate. All but the last of these variables are also determinants of the opportunity cost of strikes to employees. The probability of a strike occurring is negatively associated with this cost.

If the firm is a profit maximiser, it is reasonable to assume that the firm's discount rate is the interest rate. Although it is true that the rates of interest on the borrowings of workplaces have different risk premiums[22], we argue that, since the workplace's discount rate measures the opportunity cost of future profits *vis-à-vis* current profits, a risk-free long term rate is the proper rate.[23] Because this is likely to be the same for all workplaces at any given time, we do not include an employer discount rate variable in this model.

Our wage loss variables are indistinguishable from prior wage proxies used in other models. Ashenfelter and Johnson (1969), for example, argue that there is a negative relationship between prior wages and the probability of a strike occurring, and this is verified in their empirical model. Not all empirical researchers use wage variables, and some who do produce results which are at

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[22]Highly indebted workplaces may respond differently from others when faced with demands from employees; AWIRS, however, does not provide any information regarding debt. It is possible that the mis-information variable *SIZE* (in Section 6.5.4), and the employer rents variables *HIPROF* and *LOSS* (in Section 6.5.5) act as proxies for risk premiums.

[23]In Chapter 5, we argue that for much of our sample the financial sector was regulated, and that interest rates did not reflect rates of time preference. At the time of AWIRS, the financial sector had been deregulated for approximately five years.

variance with strike theories. Booth and Cressy (1987) find a significant positive relationship which casts some doubt on their *a priori* expectation, but they pay little attention to explaining this anomaly and remark that the coefficient is "small". Drago and Wooden (1990) find positive but insignificant positive relationships, and Dawkins *et al* (1992) find negative but insignificant relationships.[24] Positive associations may indicate that high wages are the result of past and present militancy of unions, and that the wage variable acts as a militancy proxy.

6.5.4 Mis-information Variables

We propose that if the firm has a profit sharing scheme, unions are better informed regarding the firm's true profitability; we use the dummy *PSHARE* to indicate the presence of such a scheme, and we expect its coefficient to be negative. If the firm makes provision for non-managerial employees to acquire equity in the company, employees have better access to information concerning profits; accordingly, we use the dummy *SHARES* to signify the presence of this arrangement. It is not entirely clear, however, that the presence of employee shares should have a negative impact on strikes; if access to shares is denied to some groups, this may lead to the dissatisfaction, and militancy, of groups not permitted to own shares.[25] Where participation is denied to some employees, we are unable to identify them, and to determine the extent to which share holders are

[24]Dawkins *et al* (1992) also use a count of fringe benefits to capture non-wage compensation, which they find to have a significant and negative relation with strikes. This assumes that all benefits have equal weight, and we reject the use of this variable.

[25]Of the 2004 workplaces in the sample, 277 make provision for non-managerial employees to acquire shares. In only 53.7 percent of workplaces are all employees eligible to own shares, and in 72.9 percent, shares are held by no more than half the employees.

involved in strike activity.

If the workforce is fragmented by shift work, information flows may be less efficient, and the probability of a strike occurring increased. It is possible, too, that shift work may itself be a strikable issue, and both arguments suggest a positive relationship between shift work and strikes.[26] On the other hand, the presence of shift work, which we designate with the dummy *SHIFT*, may make strikes more difficult to organise, and so the relationship with strikes is uncertain.

If a workplace is part of a larger enterprise and controlled from outside, employees may be less well informed regarding profits; therefore, we expect that the outside control dummy, *CONTROL*, is positively associated with strikes.

It has been proposed by many researchers, for example, Booth and Cressy (1987) and Drago and Wooden (1990), that employees have less access to information in large workplaces, and so we expect a positive relationship between the number of employees at a workplace, *SIZE*, and strikes.[27] It may be argued that enterprise size is a better indicator of mis-information problems; we believe, however, that the effect of the difference between workplace and enterprise size, is captured by the *CONTROL* variable.[28]

Mis-information theories suggest that the presence of any formal arrangements at workplaces which may improve communication between

[26]AWIRS provides broad categories for the normal hours of operation of workplaces, and we define workplaces as having shift work if this is in the range 51 to 84 hours, or greater.

[27]Booth and Cressy find that workplace size is significant in explaining strikes, but enterprise size is not.

[28]Although the Pearson correlation coefficients between workplace and enterprise size is low, enterprise size (ga11) is recorded as a seven-level ordinal variable, with varying intervals, the highest of which is open-ended.

management and employees, should, *ceteris paribus*, reduce the likelihood of strike activity. Reder and Neumann (1980) argue that bargainers develop protocols which minimise the costs of industrial negotiation, and which reduce the likelihood of strikes occurring.

We propose that the presence of an industrial relations or employee relations manager, *IRMAN*, regular meetings between senior management or line management with employees, *MEETINGS*, and joint consultative committees, *JUMCOM*, are likely to reduce the likelihood of strikes. On the other hand, their presence may be a response to an underlying industrial malaise at the workplace, so these variables may proxy union militancy or unspecified strikable issues; as a consequence, their presence may be associated with a greater likelihood of strikes.[29] This makes the relationship between these variables and strikes less certain, *a priori*.

Imperfect information models propose that employees use general economic indicators to form expectations about the profits of their workplaces; if these variables suggest that profits are high, when they are not, strikes are more likely to occur. Employees may associate overtime and growth with high profitability, and this suggests a positive relationship between strikes and these variables. Earlier we argue that growth makes redundancies less likely, so that union demands are larger and strikes more common, but the presence of overtime makes unions more strike averse. The conjecture derived from our model regarding growth is reinforced by mis-information hypotheses, but that concerning overtime

[29]Drago and Wooden (1990) find a significant and positive relationship between the presence of joint committees and strikes.

is weakened.

6.5.5 Economic Rents Variables

It is a fundamental proposition of labour economics that where firms and employees have no economic rents, employees are price takers, and attempts by unions to raise wage levels cause firms to use less labour and, in the most extreme case, the failure of the firm. Our theoretical model proposes that real mark-ups are constant, and that profits vary through time with changes in sales volumes. In a cross-sectional model, we argue that the elasticity proxies *STRCOMP* and *EXPOSED*, also proxy monopoly rents. Because expectations regarding future rents may depend on recent profits, we also include a dummy to indicate rates of return on capital in excess of ten percent in the previous financial year, *HIPROF*, and a loss dummy, *LOSS*.

Ashenfelter and Johnson (1969) point out that larger profits are likely to make unions more eager to pursue wage increases but, because they enlarge the capacity of firms to concede to wage demands, the relationship between profits and strikes is uncertain. On the other hand, if the firm's profits are large, it may have large financial reserves which allow it to sustain lengthy strikes, in its attempt to cause the union to moderate its demand.

Employee rents associated with workplace-specific skills may also be a bargaining issue, and positively associated with strikes. If employees tend to stay for long periods at a workplace, they are likely to have more workplace-specific skills, and for this we use the percentage of employees who have been more than five years at their present workplace, *TENURE*, as a proxy. We also use the percentage of non-core workers, *NONCORE*, since high rates are likely to be associated with low levels of workplace-specific skills, and therefore, with fewer strikes.[30]

6.5.6 Union Power Variables

The model examines the determinants of strikes in workplaces in which there is a union presence. Models which use union power variables, or union militancy proxies, hypothesise a positive relation between union density and strikes. We already use a density variable as a proxy for the union's maximum acceptable employment loss amongst the factors which determine the unions demand.

It is also argued that the greater the number of unions at a workplace, the greater the probability of a strike occurring, partly because more groups of employees are represented, and partly because of the possibility of inter-union rivalries and conflicts which may result in strikes. We, therefore, include the number of unions, *UNIONS*, as a regressor.

In an attempt to measure the strength of unionisation, for any given level of density or number of unions present, we propose that a high ratio of union delegates to workforce size, *UDEL*, and the presence of regular joint meetings between unions at a workplace, *COMBINE*, are both associated with a stronger union bargaining position, and a greater likelihood of strikes. We suggest in Chapter 5, when dealing with time-series macroeconomic models, that the overall level of density may not be particularly important, whereas high levels of density

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[30]AWIRS indicates whether a formal job training scheme had been implemented at the workplace during the last five years, however we are unable to determine the extent to which this is applied to all employees, or the quantum of the improvement in workplace specific skills which may have resulted. Nor does it identify those workplaces which may have had more longstanding training schemes.

at particular workplaces, or amongst specific occupational groups, may be a key factor in explaining strikes. Accordingly, we test a dummy which indicates whether the dominant union at a workplace has full membership of all eligible employees, *DOMUNION*, and we hypothesise that there is a positive relationship between this and the probability of a strike occurring. *DENSITY* and *DOMUNION* are strongly correlated, so we estimate separate versions of the model and do not use these regressors simultaneously.[31]

It is possible, of course, that faced with a more powerfully backed union demand, an employer may concede more readily and so avoid a strike; therefore, the positive relationship between union power and strikes, commonly advanced in the literature, is not absolutely certain. Estimated models which include in their data non-unionised workplaces, exaggerate the importance of union power variables; AWIRS shows that if no union is present, a strike does not occur.

A union's power may be strengthened when the ratio of labour costs to the workplace's total costs, *LABCOST*, is high, and the prospect of managerial staff maintaining output during a strike is small. This variable is also one of the factors which determines the union's demand and the opportunity cost of strikes in our theoretical model, because it is the link between wage increases and price increases.

6.5.7 Employer Power Variable

Factors which render the union more powerful, cause the employer to be relatively weaker. We suggest that an additional factor is the firm's membership of

[31]Restricting the sample to privately owned enterprises which have a union presence, the Pearson correlation coefficient between *DENSITY* and *DOMUNION* is 0.75.

an employers' association, denoted by the dummy *EMPASS*. Membership may strengthen an employer's resistance to a union's demand, and so a strike is more likely.

6.5.8 Strikable Issues Variables

We introduce a set of dummies which describe special situations which may lead to strikes, but differ from those directly identifiable with bargaining over wages and wage-like issues. AWIRS does not permit us to discover whether any particular strike was primarily in pursuit of a wage increase.[32]

We suggest that major changes in products or services, denoted by *OUTPUTCH*, changes in work practices, *WORKCH*, changes towards more commercially oriented operations, *COMMCH*, changes in management structures, *MANAGCH*, and technical change, *TECHCH*, are likely to be industrial issues; as a consequence, they affect the likelihood of strikes occurring. It is not immediately clear whether these changes are associated with a deterioration of working conditions, and it is possible that some changes may reduce the likelihood of strikes. The signs of the coefficients of these variables cannot be determined, *a priori*, because AWIRS merely records whether change occurs, but gives little information regarding its character or magnitude.

The presence of performance based pay for some groups of non-managerial employees (not including profit sharing), *PBR*, may create tensions between employers and employees, and increase the probability of strikes. Both Booth and Cressy (1987) and Drago and Wooden (1990) identify positive and significant

[32]AWIRS does provide some information regarding the issues in dispute in the last strike during the survey year, however the strikes question simply asks whether there had been any strike. We are unable to discover how many strikes occurred at particular workplaces, and associate strikes with causes.

associations between strikes and payment by results. On the other hand, if employees are reasonably satisfied with such a scheme, it may bring about a reduced likelihood of strikes.

High absenteeism rates at workplaces suggest that working conditions are poor and demands for improvements greater; this suggests that strikes are positively associated with absenteeism. Salamon (1987) suggests, however, that absenteeism may be a substitute for industrial action, so the expected relationship is uncertain. We use a dummy, *ABRATE*, which indicates whether employers regard absenteeism as a problem.[33]

Finally, we include a dummy to signify whether the workplace has formal disputes procedures in place, *DISPROC*, because it may be argued that they make it less likely that potential strikable issues will result in strikes. Drago and Wooden (1990) and Dawkins *et al* (1992), however, find positive relationships and between strikes and disputes procedures; this suggests that their presence indicates that disputes are commonplace, and that the industrial relations climate is poor.[34] It is also possible that they provide a forum for disputation, and so encourage strikes.

6.5.9 Control Variables

AWIRS permits the researcher to use industry dummies to control for differences in strike propensities which may be the result of differences in working conditions, traditions, an so on, between industries. Although use of industry dummies is common, we reject their use in this model; we believe that they tend

[33]AWIRS provides an absenteeism rate (n30), however it refers only to one specific week, and we regard whether management perceives absenteeism to be a problem, as a better indicator of the general incidence of absenteeism.

[34]They identify a negative impact only when disputes procedures are present and "used all the time".

to show which industries are more strike prone, and not reveal the factors which lead to different strike rates. Indeed, their use may obscure the importance of variables suggested by theories of strikes.

The presence of a company or enterprise award, signified by the dummy *COAWARD*, may be associated with more workplace bargaining and, therefore, a greater likelihood of strikes. Further, at workplaces where there are both federal and state awards, denoted by the dummy *FEDSTAT*, there is a greater potential for industrial conflict. If one award system is seen by employees to be relatively more generous, employees covered by the other are more likely to press for improvements in their own terms and conditions, and make strikes more likely.[35] On the other hand, company awards may be better able to deal with local problems, and the presence of federal and state awards may mean that flow-ons occur with little disputation.

We hypothesise that if a workplace has a high cost structure compared with similar workplaces, and which we indicate with the dummy *HICOST*, employers may be more reluctant to concede given the already high costs. Any wage demand is more likely to be resisted by a high cost workplace, and a strike made more likely. We also use a low relative cost dummy, *LOCOST*.

6.6 The Estimation Procedure

We follow the most common approach amongst cross-sectional modellers, and specify a probit model; we use LIMDEP software for its estimation.[36] We

[35]We do not include federal or state award dummies because both have fairly high correlations with *FEDSTAT*; in our sample, the Pearson correlation between a federal award dummy and *FEDSTAT* is 0.6419, and between a state award dummy and *FEDSTAT* is 0.4576.

[36]As a peripheral exercise, we test linear probability and logit models, and find the results to be broadly similar to those we report here.

adopt a general to specific methodology suggested by Hendry and Richard's (1983) approach which we use in Chapter 5; we eliminate those regressors suggested by strikes theories to be important, but which fail to be significant at reasonable decision levels.[37] There is, of course, no lagged structure to investigate. We first estimate the model using all regressors described in Section 6.5, then delete the regressor with the smallest absolute *t* value; we then re-estimate, and continue the procedure until all remaining variables have coefficients which are significantly different from zero on two sided tests at the twenty percent level.[38]

There is a side benefit to searching for a parsimonious model; since many of the regressors used in the general model have missing values, the number of valid observations increases as insignificant variables are deleted.

6.7 The Estimated Private Sector Model

We begin with a potential sample of 960 workplaces which have a union presence; missing values reduce the effective sample size to 564 cases. Table 6.2 shows summary statistics of the regressors.

In Table 6.3 we report two versions of the general model, the first using union density, and the second using the dominant union dummy; we then show both forms of the parsimonious model in Table 6.4. (We do not report the marginal probabilities evaluated at the means of the regressors as is sometimes

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[37]This is in contrast with Drago and Wooden (1990) and Dawkins *et al* (1992) who, in their reported models, retain regressors with absolute *t* values smaller than 0.50.

[38]This, of course, corresponds to a ten percent decision level on a one sided test, and which is arguably a "reasonable" level. Since some of the coefficients can be signed *a priori*, but others cannot or are doubtful, we use the two sided test at the twenty percent level of significance in all cases. The procedure parallels the backward elimination procedure in OLS, except that we do not test whether previously excluded variables should be re-introduced at each step. We re-test all excluded variables at the end of the procedure.

seen in probit models; we assert that, since dummy variables never take on their mean values, such an exercise is meaningless.) A comparison of these tables indicates that several regressors which are significant in the general models, fail to meet that criterion when other variables are deleted, and additional valid cases used[39]; some regressors which are not significant in the general model, become so after other poorly performing variables are culled.[40]

There is a positive relationship between overaward wages and strikes.[41] This appears to contradict our theoretical model which proposes that strikes are negatively associated with wage losses during unemployment and re-employment. It also at variance with many other models which hypothesise a negative association between prior wages and strikes. We suspect that the overaward variable is a post-strike value, if indeed a strike occurs[42], and so this does not necessarily contradict theoretical models. A possible explanation is that overaward rates have been in place for some time, and that unions at these workplaces have a history of militancy which brings this about. In other words, *OAWARD* may be a proxy for long-standing union militancy.

In both models there is a positive relationship between strikes and vacancies, and suggests that unions behave more aggressively when labour markets are tight. This is consistent with our theoretical model, because tight labour

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[39]These are, in both models, *CAPAC*, in the union density model, *EMPASS*, and in the dominant union model, *COMBINE*, *TECHCH* and *ABRATE*.

[40]These are, in both models, *SHARES*, *VACANCY* and *LOCOST*, and in the dominant union model, *PSHARE*, *NONCORE*, *COMMCH* and *MANAGCH*.

[41]Since we are describing parsimonious models, all relationships are significant.

[42]The first over-award question in AWIRS (ec11) refers to *any* payments made in the survey year; others strongly suggest that the respondent should state the current situation, which implies a post-strike wage if a strike occurs during the survey period (unless a strike is in progress).

markets suggest that retrenched employees find re-employment quickly, and the retrenchment costs to employees associated with wage increases and strikes, are smaller.

Strikes are negatively associated with the proportion of females employees, and is consistent with our proposition that women have higher discount rates than men. Although, we propose that the proportion of skilled employees proxies employee discount rates, this variable has a negative coefficient in both models. We suggest that, in the absence of terminating contracts, skilled employees do have relatively lower discount rates, but this manifests itself in a greater willingness to pursue lengthy negotiations before striking. A different explanation is that skilled employees have better prospects of alternative employment, and seek other jobs as a means of raising their own wages instead of striking; this may induce employers to raise wages to retain employees or to attract new ones.

The positive association between strikes and the presence of strong competition, is consistent with our conjecture that employers estimates of the elasticity of demand may be greater than those of unions. If this is so, the employer's estimated strike cost is relatively higher than that of the union, leading the union to make large demands and the employer to be more resistant. The positive association is also consistent with smaller monopoly rents which make employers more resistant to union demands.

There is qualified support for mis-information theories of strikes. In both versions of the model, strikes are positively associated with outside control and workplace size, and negatively associated with regular meetings between management and employees. In both, the presence of employee shares increases the probability of strikes, so whatever contribution shares make to information available to employees, its impact may be outweighed by tensions between groups having different access to shares. In the dominant union model, the presence of profit sharing schemes reduces the likelihood of strikes.

In the union density model, the presence of an industrial or employee relations manager is positively associated with strikes. Whatever effect this presence has on improving communication between management and employees, it suggests that the industrial relations climate is relatively poor and, therefore, strikes are more likely to occur.

In the union density model, both union density and delegate representation, are positively associated with strikes; in the dominant union model, there is a positive relationship between strikes and the dominant group being fully unionised, the presence of combined union committees, and delegate representation.

The number of unions is not significant in either model, so there is no evidence that either inter-union rivalries, or coverage of a larger number of groups, contribute to strikes. Both Drago and Wooden (1990) and Dawkins *et al* (1992) find significant and positive relationships between strikes and the number of unions present, but we suspect that both models are compromised by the simultaneous inclusion of a union presence dummy, because the "no union presence" response is recorded in two variables.[43]

There is a positive relationship between membership of an employers' association and strikes in the union density model, but not in the dominant union

[43]We cannot identify which cases are excluded in Dawkins *et al* (1992) due to missing values, so we do not check the Pearson correlation between these variables in their sample. When we restrict the sample to privately owned workplaces, the coefficient is 0.4879.

model. Therefore, there is some support for the proposition that membership fosters greater resistance by employers, and makes strikes more likely.

The positive relationship between the presence of strong competition and strikes in both models, suggests that when the firm's profits are normal and union demands smaller, employer resistance is much greater, so making strikes more likely. There is a negative relationship between the percentage of non-core employees and strikes, so we claim, tentatively, to show that disputes over shares of employee rents.

We propose several factors which may be regarded as potential causes of strikes, but some are associated with reduced strike activity; change in the workplace may improve working conditions, or may be accompanied by compensating benefits. In both models there is a negative relationship between strikes and major changes in products or services.[44] In the dominant union model, there are negative relationships between strikes and changes towards more commercial orientation[45], and major technical changes; there is a positive relationship between strikes and changes in management structures.

Whether employers regarded absenteeism as a problem, which we use to proxy working conditions, is positively associated with strikes in the dominant union model. There is no evidence that absenteeism is a substitute for strikes.

We hypothesise that the higher the cost structure of a workplace, the more strongly an employer resists demands, and the greater the probability of a strike

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[44]The AWIRS question (ge1a) suggests a change in the character of the workplace's output, rather than in the level of output.

[45]We suspect that this variable is not relevant in privately owned workplaces, however 15.4 percent of these workplaces make a positive response to this question (ge1d).

occurring. The high cost dummy performs poorly in both models, but the coefficients have expected positive signs; the low cost dummy is significant and has expected negative coefficients in both. None of the models give any indication that coverage of employees at a workplace by both state and federal awards, or by company awards, has any significant impact on strikes.

6.8 Strikes in GNCEs

We note at the beginning of this chapter that economic models of strikes make the assumption that they are an outcome of bargaining over profit shares; by implication, the enterprise is commercial. In this section we explore whether hypotheses proposed in the literature and suggested by our theoretical model, are valid for Australian GNCEs. In AWIRS, all GNCEs have a union presence, and 31.9 percent record at least one strike during the survey year.[46]

There may be some interesting differences in strike propensities between federal, state and local government workplaces, stemming from differences in government industrial relations policies. AWIRS, however, does not reveal the level of government of GNCEs or GBEs, nor the states in which they are located.[47]

We use the same sets of union demand, opportunity cost of strikes, union power, employee power, strikable issues, and control variables used in the private sector model, with several exceptions. GNCEs have no profits over which to bargain and in many cases market competition is meaningless, so we delete the

[46]This is approximately sixty percent higher than in privately owned workplaces with a union presence.

[47]This denies us the opportunity to investigate whether strike propensities are influenced by whether the employer is a left-wing or right-wing State government.

profit and competition variables. We propose that the rents of employees associated with workplace-specific skills are similar to those in privately owned workplaces, so we retain the tenure and non-core variables.

The counterpart of revenue in this model is the government's budget allocation for the establishment, and that of profit is slackness in the government's overall budgetary position. A strike which attempts to secure higher wages or other benefits, can be successful if the government is prepared to operate with a larger budget deficit and increased borrowings, higher taxes, smaller outlays in other parts of the budget, or some combination of these. Another possibility is that wage increases are contingent on productivity improvements, brought about by technological change or changes in work practices. Yet another is that the range and levels of service may be reduced, and job shedding occurs so that the workplace continues to operate at the same total cost; this is suggested by our theoretical model, except that job shedding does not stem from price induced reductions in demand.

The data does not enable us to use governments' budget deficits to model the capacity of employers to meet wage demands. We are forced to assume that employees in all GNCEs, face the same resistance from their employers.

Mis-information theories suggest that strikes are more likely to occur when employees in privately owned workplaces wrongly assess profits; in GNCEs there may be mis-information regarding the government's true budgetary position. Because there are no profits, we delete the profit sharing and employee shares variables. We retain the shift work, outside control and size variables, because all suggest relative remoteness and more uncertainty amongst employees regarding the ability of employers to surrender to wage demands. We also retain the presence of an industrial relations manager, regular meetings between managers and employees, and joint consultative committee variables, because they may provide better information to employees of the prospects of securing improvements in working conditions. The overtime and growth variables are kept, because high levels of overtime and employment growth both suggest that the output of the workplace is in strong demand, and that the employer may be prepared to make a larger budget allocation to maintain its supply.

6.8.1 The Estimated GNCE Model

We begin with a potential sample of 497 GNCEs which have a union presence; missing values reduce the effective sample size to 369 cases.

In Table 6.5 we report two versions of the general model, the first using union density, and the second using the dominant union variable; we show both parsimonious models in Table 6.6. A comparison of these tables indicates that several regressors which are not significant in the union density general model, become so after other poorly performing variables are deleted[48]; one which is significant, fails to meet the significance criterion when other variables are deleted and additional valid cases drawn into the parsimonious models.[49]

Table 6.6 shows that in the dominant union model, there is a positive relationship between strikes and the presence of relatively low wages; none of the other wage variables is significant in either model. This provides some limited support for the proposition of our theoretical model that strikes are more likely

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[48]These are *TENURE*, *EMPASS*, *OUTPUTCH* and *PBR*.

[49]This is *LOCOST*.

when the wage losses of retrenched employees are small. It is also consistent with the role of pre-existing wages proposed by Ashenfelter and Johnson (1969) and others.

Overtime and employment growth are positively associated with strikes. Although the former suggests greater losses of earnings, both results suggests that employee opportunity costs of strikes are smaller because the prospects of retrenchments occurring are reduced. The positive association between union density and strikes, is consistent with the proposition that union demands are larger when the maximum acceptable employment loss is greater.

Our theoretical model proposes that when labour costs form a large part of total costs, unions make smaller demands and firms are more resistant, because wage increases have a larger impact on sales and employment levels. In GNCEs, where there are no sales, this result suggests that increases in wages place greater pressure on budgets, and make employers more likely to resist demands.

Strikes are negatively associated with the employee discount rate proxy, the proportion of skilled employees; we conclude that skilled employees are more likely to bargain for longer periods before striking. On the other hand, strikes are positively associated with the proportion of females, and is opposite to what we find in the private sector, and what we expect *a priori*. We speculate that in GNCEs, full-time permanent female employees are likely to view their positions within internal labour market structures, with attendant benefits, as long term. This, of course, only implies that males and females have the same discount rates, and if so, this variable ought not be significant. If, however, females regard themselves as having been poorly treated in the past, *vis-à-vis* males, workplaces with relatively large numbers of females may be more aggressive in pursuing improved working conditions and, therefore, are more strike-prone.

In both models, there is a positive relationship between strikes and the presence of an industrial relations manager, and a negative relationship with the presence of shift work and overtime. In the union density model, there is a positive relationship between strikes and size. This gives some support to mis-information hypotheses, however the signs of the coefficients of other mis-information variables are opposite to those expected *a priori*. Shift work may act as a union power proxy because it makes the management of strikes by unions more difficult, so weakening unions' bargaining positions. The presence of an industrial relations manager is positively associated with strikes, and so appears to proxy underlying industrial problems.

The positive association between strikes and tenure, and the negative association with the non-core variable, supports the role of employee rents in explaining strikes. We propose that high levels of workplace-specific skills are associated with large proportions of employees being employed for more than five years, and with low proportions of non-core employees; larger rents expand the scope for bargaining and make strikes more likely.

Several proxies of union power are significant in explaining strikes; these are union density, delegate representation, full coverage in the dominant union, and labour costs as a proportion of total costs. Combined union committees, and the number of unions, are not significant in explaining strikes.

There is a negative relationship between membership of an employers' association and strikes. A possible explanation of this seemingly perverse result is that if the private sector is a pace-setter, membership may give GNCE sector employers a better understanding of what is accepted in the private sector; as a result, employers may be more willing to concede when confronted with demands for parity.

In both models, there are positive relationships between strikes and changes in work practices, and with the presence of disputes procedures. The latter suggests that disputes procedures are symptomatic of underlying industrial problems, and they outweigh the ability of these procedures to resolve conflict without a strike occurring; alternatively, they may encourage conflict. In the union density model, there is a positive association between strikes and major changes in products or services and work practices. These changes suggest a deterioration in working conditions, which are not adequately compensated in the views of employees. In the union density model, there is a negative relationship between strikes and payment by results; although these schemes are comparatively rare in GNCEs, we conclude that employees tend to regard them as producing satisfactory wage outcomes.

In the dominant union model, there is some evidence that strikes are negatively associated with the presence of "company" awards, and whether the workplace has relatively high costs. The insignificance of vacancies and tight labour market conditions, suggest that GNCE internal labour markets are more isolated from external labour market conditions than private sector workplaces.

6.9 Strikes in GBEs

In modelling strikes in GBEs, we test the same set of regressors used in the model of privately owned workplaces. In those enterprises which return a profit, ownership status may not have any bearing on the likelihood of strikes; strikes remains as a possible outcome in the bargaining over shares of profit. GBEs which do not normally earn sufficient revenue to cover costs, and are subsidised from public funds, are akin to GNCEs. On the other hand, GBEs usually face competition, irrespective of their profitability, and have this in common with private sector workplaces. When firms face strong competition, the elasticity of demand for their product is greater, and our theoretical model suggests that if this is so, employees make lower demands and are less likely to strike; at the same time, it makes employers more resistant.

Although AWIRS provides information concerning rates of return on capital, the question refers only to the previous year, so we cannot ascertain which GBEs *normally* operate at a loss. In the sample, all GBEs have a union presence, and 17.3 percent record at least one strike during the survey year; this is slightly less than that in private sector workplaces with a union presence.

6.9.1 The Estimated GBE Model

We begin with a potential sample of 221 workplaces, and missing values reduce the effective sample size to 143 cases.

In Table 6.7 we report two versions of the general model, the first using union density, and the second using the dominant union variable. We then show a parsimonious model in Table 6.8. It is clear in Table 6.7 that density and the dominant union variable perform poorly, and are eliminated early in the general to specific procedure. A comparison of these tables indicates that several regressors which are not significant in the general models, become so after other poorly performing variables are deleted[50]; others which are significant initially, fail when other variables are deleted and additional valid cases drawn in to the model.[51]

None of the wage variables, excepting overtime, is significant in explaining strikes. The negative association between strikes and overtime suggests that overtime is a wage loss proxy and is consistent with our theoretical model; it fails as a mis-information proxy. Strikes are positively associated with tight labour market conditions and employment growth, and both suggest smaller risks of retrenchments occurring following strikes and wage increases.

There is a negative relationship between strikes and the employee discount rate proxy, the proportion of females; this is congruous with the proposition that women in GBEs have higher discount rates than males. This negative association is the same as that observed in the private sector, but is in contrast with the positive relationship in GNCEs. This suggests that females in the private sector and in GBEs, are less likely than their counterparts in GNCEs, to regard their present employment as permanent.

Amongst the mis-information proxies, size is positively associated with strikes. Strikes are negatively associated with outside control of the workplace; while this control variable fails as a mis-information proxy, it is possible that workplaces which are controlled from outside are less militant in GBEs, because they are more remote from centres of industrial conflict.

There is a positive relationship between strikes and tenure, so we find some

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[50]These are *TENURE* (in the density model), *OUTPUTCH* and *TECHCH*.

[51]These are *LOCOST*, *SKILLED* and *COAWARD*.

support for the proposition that higher levels of workplace-specific skills are associated with strikes. The negative relationship between strikes and non-core employees, contrasts with the positive relationship in the GNCEs, and clearly it fails as an employee rent proxy. It is possible that the working conditions of non-core employees are inferior to those of other employees, and this may be a strikable issue in GBEs. There is a positive association between strikes and high profits, whereas, in the private sector models, this variable is not significant.[52]

Union density, whether the dominant union has full membership, and the number of unions, are not significant in explaining strikes. This, of course, does not deny the importance of union power, since all workplaces in the sample have a union presence. There is no support for our proposition that high levels of union density make unions more willing to accept employment losses, and leading them to make larger demands. Strikes are positively associated with the presence of combined union committees, and suggests that these committees facilitate the management of strikes.

There are positive associations between strikes and major changes in outputs or services, and the presence of disputes procedures, and negative relationships with changes towards more commercially oriented operations, and major technical change.

6.10 Conclusions

Table 6.9 shows all variables used in the models of privately owned workplaces, GNCEs and GBEs; it shows the signs of the coefficients of these

[52]*HIPROF* is derived from answers to question gc4 in the General Management Questionnaire, and so is reasonably reliable; further, since the workplace is publicly owned, profitability is likely to be known by employees. It is also possible that some respondents have recorded the rate of return of the enterprise, rather than the workplace.

variables in the parsimonious models, and the signs expected *a priori*. Here we do not differentiate between the union density and dominant union models.

Our theoretical model proposes that strikes are negatively associated with the likely duration of unemployment, and subsequent losses of earnings after retrenchment. Employment growth, vacancies and tight labour markets suggest that real wage increases and strikes are less likely to cause large numbers of redundancies. The estimated models are consistent with this hypothesis.

In GBEs, there is support for the relationship we propose between strikes and wage losses, proxied by *RWAGELO*, following retrenchments brought about by union demands and strikes, and the widely hypothesised negative relationship between strikes and prior wages. The positive relationship between strikes and *OAWARD*, in the private sector, leads us to suspect that the over-award variable proxies past and present union militancy, rather than wage losses or the wage rate prior to the commencement of any bargaining.

In GNCE and GBE models, there is a positive association between strikes and employment growth, and a negative association with overtime; this is consistent with unions making larger demands when the risks of retrenchments are smaller, and with overtime being a wage loss proxy.

The private sector and the GBE models are consistent with the hypothesis that female employees have higher discount rates, and are therefore less likely to strike. The opposite is found in GNCEs, and we speculate that this is a consequence of women having longer term employment expectations in this sector and, compared with males, have been poorly treated in the past.

Our model suggests that union demands are more circumspect and strikes less likely when the elasticity of product demand is greater, but employers are more resistant. Further, if employers over-estimate elasticity, and unions under-estimate it, strikes are more likely. The positive association between strikes and the presence of strong competition in the private sector, is consistent with employers believing demand to be more elastic, and more resistant to demands, than unions who may think that demands can be passed on to customers with little loss of employment.

We hypothesise that skilled employees have relatively lower discount rates, and are more likely to strike because future gains have a higher present value. The reverse occurs in the private sector and GNCEs, and there is no association in GBEs. This suggests that, in the absence of terminating contracts, lower discount rates amongst skilled employees, manifest as a greater willingness to continue bargaining, given that failure to reach agreement with employers is not likely to lead to shut-downs or lock-outs. Alternatively, it is consistent with skilled employees already having relatively good working conditions, or finding other jobs to improve their conditions instead of striking.

In all models there is a positive relationship between strikes and workplace size, and this lends some support to mis-information hypotheses. The negative association between strikes and workplace meetings in privately owned workplaces also supports mis-information hypotheses, but if meetings can be regarded as part of a negotiations protocol, it is also consistent with the joint cost hypothesis of Reder and Neumann (1980).

In the private sector models, there is further support for mis-information theories in the significance of profit sharing schemes, outside control, and regular workplace meetings. The unexpected signs associated with employee shares, and the presence of industrial relations managers, suggest that the former is a potential source of conflict, and the latter a response or encouragement to underlying industrial relations problems.

We argue at the outset of this chapter that the presence of a union at a workplace is a pre-condition for the occurrence of a strike, and that the use of a union presence dummy is inappropriate. In all models there are positive relationships between strikes and proxies of union power; which of these are significant depends on ownership status.

There is conflicting evidence regarding the effect of membership of an employee association on strikes; in the private sector, the relationship is positive, and is consistent with the proposition that membership proxies employer resistance. The reverse, however, is true in GNCEs.

The potential strikable issues which involve change at the workplace, presents a mixed set of outcomes. This is not unexpected when there is little information about whether change involves improvements in working conditions. Technical change, and changes to more commercial orientation, are associated with less strike activity in the private sector and GBEs. In GNCEs, the positive association between strikes and changes in products or services, and work practices, suggests that employees in GNCEs are more resistant to change; no change is negatively associated with strikes, unlike the other sectors.

In the GNCEs and GBEs, the positive association between strikes and presence of disputes procedures, suggests that these workplaces are characterised by on-going industrial relations problems, and perhaps that they encourage disputation, but in privately owned workplaces there is no association.

Our theoretical model hints that if redundancies are already "in the wind", fewer unions are likely to make demands which may be precipitous; such a situation may be the introduction of new technology. The negative association between strikes and technical change in the private sector and GBEs supports this proposition.

Earlier in this chapter we reminded the reader that our theoretical model excludes short tactical strikes, but these cannot be eliminated from the data set. Our empirical results are broadly consistent with the theoretical model which suggests that the probability of strikes occurring depends on competition in the product market, local labour market conditions, labour's share of total costs and union density. The predictive success of these models shown in Tables 6.3 to 6.8, seems extraordinarily good; unfortunately, however, the success rate in predicting "no strike" is very high, compared with the rate in predicting "strike".[53]

In the next chapter, we use the theoretical framework developed in Chapter 4, to construct empirical models of non-strike industrial actions in privately owned workplaces, GNCEs and GBEs. In contrast with the many empirical models of strikes found in the labour economics literature, there seem to be no empirical models of any non-strike industrial action; this is despite common knowledge that non-strike action is often used by unions. Our empirical models will attempt to make some progress towards redressing this imbalance.

Many of the variables in the theoretical strikes model also appear in the

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[53]This is typical of probit models when in the data, the "yes" response is much more common than the "no" response, or *vice versa*.

non-strike actions model, and we use the same proxies. The main difference between the strikes and the non-strike actions models, is that, in the later, industrial action does not cause permanent market erosion and, during industrial action, profit margins are reduced but not eliminated.

Table 6.1: Variables Used in Cross-Sectional Strikes Models and AWIRS Question Numbers[1]

STRIKE =	1 if a strike occurred, 0 otherwise (en1a)
Union Demand and Opportunity Cost Variables	
OAWARD =	overaward component as a percentage of award wage (n9)
RWAGEHI =	1 if higher relative earnings, 0 otherwise (ec20)
RWAGELO =	1 if lower relative earnings, 0 otherwise (ec20)
OT =	1 if some overtime present, 0 otherwise (ed7)
EXPOSED =	1 if exposed to world market, 0 otherwise (gb3)
STRCOMP =	1 if strong competition, 0 otherwise (gb5)
LABCOST =	labour cost as a percentage of total costs (gc1)
DENSITY =	union density (n40)
FEMALE =	females as a percentage of full-time permanent employees (ftpf ftpt)
SKILLED =	skilled employees as a percentage of all employees (labo totocc)
CAPAC =	1 if workplace at or near full capacity, 0 otherwise (gc2)
TIGHTLAB =	1 if tight market for non-managerial employees, 0 otherwise (ej2b-ej2h)
VACANCY =	1 if non-managerial vacancies present, 0 otherwise (ej1b-ej1h)
GROWTH =	rate of employment growth (n11)
Information Variables	
PSHARE =	1 if profit sharing present, 0 otherwise (ec5)
SHARES =	1 if employee shares present, 0 otherwise (ec7)
SHIFT =	1 if shift work present, 0 otherwise (ed2)
CONTROL =	1 if workplace controlled from elsewhere, 0 otherwise (g11)
SIZE =	number of employees (ga1)
IRMAN =	1 if industrial relations manager present, 0 otherwise (gd1a,b)
MEETINGS =	1 if regular employer-employee meetings present, 0 otherwise (eh1b,d)
JUMCOM =	1 if joint consultative committee present, 0 otherwise (eh1f)
Economic Rent Variables	
LOSS =	1 if workplace making a loss, 0 otherwise (gc4)
HIPROF =	1 if workplace making a high profit, 0 otherwise (gc4)
TENURE =	percentage of employees worked for at least 5 years (ed1d)
NONCORE =	percentage of non-core employees (n12)
Union Power Variables	
UNIONS =	number of unions at workplace (ek1)
UDEL =	union delegates per employee (ek16 ga1)
COMBINE =	1 if combined union committee present, 0 otherwise (ek24)
DOMUNION =	1 if dominant union 100 percent unionised, 0 otherwise (n24)
Employer Power Variable	
EMPASS =	1 if workplace a member of an employers' association, 0 otherwise (n7)
Strikable Issues Variables	
OUTPUTCH =	1 if change in product or service, 0 otherwise (ge1a)
WORKCH =	1 if change in work practices, 0 otherwise (ge1b)
COMMCH =	1 if change to a more commercial operation, 0 otherwise (ge1d)
MANAGCH =	1 if change in management structure, 0 otherwise (ge1e)
TECHCH =	1 if major technical change, 0 otherwise (ge1g)
PBR =	1 if payment by results present, 0 otherwise (ec3)
ABRATE =	1 if absenteeism a problem, 0 otherwise (gd7g)
DISPROC =	1 if disputes procedures present, 0 otherwise (em5)
Control Variables	
COAWARD =	1 if company awards present, 0 otherwise (eb7f)
FEDSTAT =	1 if federal and state awards present, 0 otherwise (eb7b)
HICOST =	1 if high cost workplace, 0 otherwise (gc7)
LOCOST =	1 if low cost workplace, 0 otherwise (gc7)

Note: 1 Some of these variables are proxies for more than one hypothesis.

Table 6.2: Summary Statistics in General Models

	Private		GNCE		GBE		
	Mean	SD	Mean	SD	Mean	SD	Type
Dependent Variable							
STRIKE	0.1636	0.3702	0.2857	0.4519	0.1097	0.3136	binary
Union Demand and Opportunity Cost Variables							
OAWARD	10.8700	12.9800	1.2281	4.1254	2.2553	6.4612	percent
RWAGEHI	0.4269	0.4951	0.1491	0.3770	0.2373	0.4269	binary
RWAGELO	0.0857	0.2801	0.2787	0.4490	0.2624	0.4414	binary
OT	0.9255	0.2628	0.5888	0.4972	0.8875	0.3170	binary
EXPOSED	0.3486	0.4708			0.0833	0.2773	binary
STRCOMP	0.8208	0.3839			0.4313	0.4970	binary
LABCOST	0.3674	0.2009	0.6749	0.2319	0.5480	0.2200	ordinal
DENSITY	0.6066	0.2796	0.7190	0.2085	0.8447	0.1777	ratio
FEMALE	0.2867	0.2470	0.4747	0.2683	0.2910	0.2341	ratio
SKILLED	0.7720	0.2512	0.8396	0.1712	0.8605	0.2240	ratio
CAPAC	0.8219	0.3829	0.9436	0.2309	0.9763	0.1527	binary
TIGHTLAB	0.6698	0.4707	0.4651	0.4994	0.3878	0.4889	binary
VACANCY	0.9483	0.2217	0.8951	03068	0.9583	0.2006	binary
GROWTH	0.0630	0.4847	0.2047	1.9283	0.0915	1.7104	percent
Information Variables							
PSHARE	0.0790	0.2699			0.1623	0.3700	binary
SHARES	0.2134	0.4101					binary
SHIFT	0.4629	0.4991	0.2901	0.4544	0.2993	0.4595	binary
CONTROL	0.5973	0.4909	0.7756	0.4177	0.8557	0.3525	binary
SIZE	122.10	398.39	130.71	293.60	136.53	303.17	integer
IRMAN	0.0717	0.2583	0.0866	0.2818	0.1254	0.3323	binary
MEETINGS	0.7648	0.4245	0.9352	0.2646	0.8658	0.3421	binary
JUMCOM	0.0877	0.2832	0.3173	0.4660	0.1737	0.3802	binary
Economic Rent Variables							
LOSS	0.0947	0.2931			0.0344	0.1829	binary
HIPROF	0.3746	0.4845			0.1721	0.3787	binary
TENURE	0.3623	0.2634	0.3960	0.2543	0.4245	0.2928	ordinal
NONCORE	19.726	24.443	13.658	17.474	8.2263	14.169	percent
Union Power Variables							
UNIONS	2.1858	1.5633	3.0937	1.8976	3.1856	2.4290	integer
UDEL	0.0165	0.0210	0.0289	0.0259	0.0386	0.0332	ratio
COMBINE	0.0577	0.2333	0.0593	0.2365	0.0920	0.2901	binary
DOMUNION	0.4877	0.5003	0.3191	0.4667	0.5683	0.4970	binary
Employer Power Variable							
EMPASS	0.8930	0.3094	0.2644	0.4416	0.3671	0.4837	binary
Strikable Issues Variables							
OUTPUTCH	0.1823	0.3874	0.1662	0.3728	0.2064	0.4061	binary
WORKCH	0.2805	0.4497	0.4751	0.5000	0.4533	0.4995	binary
COMMCH	0.1539	0.3612	0.1775	0.3826	0.5068	0.5017	binary
MANAGCH	0.3528	0.4783	0.5061	0.5006	0.5144	0.5015	binary
TECHCH	0.3499	0.4774	0.3289	0.4705	0.4195	0.4952	binary
PBR	0.1558	0.2697	0.0115	0.0567	0.1191	0.3069	binary
ABRATE	0.0693	0.2541	0.0591	0.2361	0.0584	0.2353	binary
DISPROC	0.4767	0.4999	0.6959	0.4606	0.6878	0.4650	binary
Control Variables							
COAWARD	0.0650	0.2468	0.0462	0.2103	0.1161	0.3215	binary
FEDSTAT	0.3752	0.4846	0.1213	0.3270	0.1346	0.3424	binary
HICOST	0.3016	0.4591	0.1664	0.3730	0.1992	0.4008	binary
LOCOST	0.2037	0.4031	0.2308	0.4219	0.2245	0.4187	binary

Table 6.3 **General Probit Models in Privately Owned Workplaces with a Union Presence**
Maximum Likelihood Estimates

Regressor	Model 1 Coef	Model 1 *t* Ratio[Prob]	Model 2 Coef	Model 2 *t* Ratio[Prob]
Constant	-7.5980	-0.15[.8780]	-5.3873	-0.11[.9139]
Union Demand and Opportunity Cost Variables				
OAWARD	0.0161	2.59[.0097]	0.0159	2.50[.0124]
RWAGEHI	-0.1116	-0.59[.5539]	-0.1038	-0.55[.5850]
RWAGELO	-0.3168	-0.95[.3403]	-0.1898	-0.57[.5669]
OT	3.8638	0.08[.9255]	3.8069	0.08[.9391]
EXPOSED	-0.0920	-0.50[.6197]	-0.1398	-0.74[.4572]
STRCOMP	0.8010	2.84[.0046]	0.8230	2.86[.0042]
LABCOST	-0.3964	-0.84[.4003]	-0.2587	-0.55[.5839]
DENSITY	1.5826	3.86[.0001]		
FEMALE	-0.9616	-2.05[.0404]	-0.7888	-1.64[.1015]
SKILLED	-0.7267	-1.93[.0531]	-0.6847	-1.81[.0706]
CAPAC	0.3037	1.34[.1791]	0.3166	1.40[.1629]
TIGHTLAB	0.0859	0.41[.6789]	0.0805	0.38[.7029]
VACANCY	0.6722	1.27[.2027]	0.6180	1.22[.2234]
GROWTH	0.1513	1.09[.2770]	0.1129	0.81[.4203]
Information Variables				
PSHARE	-0.1010	-0.31[.7590]	-0.2610	-0.76[.4503]
SHARES	0.1811	0.89[.3740]	0.1498	0.73[.4643]
SHIFT	0.0008	0.00[.9966]	0.1003	0.54[.5885]
CONTROL	0.3011	1.47[.1416]	0.3708	1.80[.0724]
SIZE	0.0008	1.28[.2010]	0.0010	1.62[.1063]
IRMAN	0.5039	1.55[.1223]	0.4885	1.49[.1364]
MEETINGS	-0.3889	-1.93[.0533]	-0.4059	-1.99[.0466]
JUMCOM	-0.0056	-0.02[.9850]	0.0103	0.04[.9722]
Economic Rent Variables				
LOSS	-0.1818	-0.55[.5824]	-0.2338	-0.69[.4881]
HIPROF	-0.0973	-0.55[.5853]	-0.1136	-0.63[.5277]
TENURE	0.3193	0.88[.3804]	0.3626	0.99[.3246]
NONCORE	-0.0065	-1.43[.1539]	-0.0052	-1.15[.2504]
Union Power Variables				
UNIONS	-0.0077	-0.12[.9019]	-0.0416	-0.65[.5189]
UDEL	9.3771	2.52[.0119]	10.3410	2.76[.0058]
COMBINE	0.4112	1.27[.2041]	0.4483	1.37[.1696]
DOMUNION			0.87706	4.54[.0000]
Employer Power Variable				
EMPASS	0.8414	1.62[.1058]	0.8122	1.61[.1076]
Strikable Issues Variables				
OUTPUTCH	-0.5782	-2.27[.0232]	-0.5606	-2.18[.0290]
WORKCH	0.0899	0.44[.6628]	0.0526	0.25[.8019]
COMMCH	-0.0970	-0.40[.6882]	-0.1747	-0.72[.4744]
MANAGCH	0.0904	0.50[.6206]	0.1332	0.72[.4692]
TECHCH	-0.3081	-1.69[.0914]	-0.3115	-1.70[.0900]
PBR	-0.0122	-0.04[.9692]	-0.0737	-0.24[.8142]
ABRATE	0.4724	1.61[.1073]	0.5053	1.69[.0912]
DISPROC	0.0407	0.21[.8308]	0.0379	0.20[.8440]
Control Variables				
COAWARD	0.0281	0.09[.9278]	0.0390	0.12[.9033]
FEDSTAT	-0.1679	-0.97[.3305]	-0.1896	-1.09[.2744]
HICOST	0.0831	0.42[.6750]	0.0927	0.46[.6455]
LOCOST	-0.1782	-0.79[.4305]	-0.1435	-0.63[.5278]

		Model 1	Model 2
Log-Likelihood		-161.0430	-158.4617
Restricted Log-likelihood		-282.2336	-284.2332
Chi-sq_{42}[Prob]		242.4[.0000]	251.5[.0000]
Cases		525	525
Cragg-Uhler R^2		0.0985	0.1024
McFadden R^2		0.4294	0.4425
Prediction Rate (%)	Total	83.7	83.8
	Strike	45.8	50.0
	No Strike	93.9	92.9

Table 6.4 **Parsimonious Probit Models in Privately Owned Workplaces with a Union Presence**
Maximum Likelihood Estimates

Regressor	Model 1 Coef	Model 1 *t* Ratio[Prob]	Model 2 Coef	Model 2 *t* Ratio[Prob]
Constant	-3.1442	-5.25[.0000]	-2.4850	-4.71[.0000]
Union Demand and Opportunity Cost Variables				
OAWARD	0.0163	3.19[.0015]	0.0161	3.03[.0025]
STRCOMP	0.3948	1.94[.0521]	0.4767	2.30[.0215]
DENSITY	1.6740	4.98[.0000]		
FEMALE	-0.7298	-2.39[.0171]	-0.4375	-1.38[.1677]
SKILLED	-0.6513	-2.30[.0213]	-0.7006	-2.40[.0166]
VACANCY	0.6855	2.02[.0435]	0.6243	1.87[.0617]
Information Variables				
PSHARE	-0.4466	-1.46[.1446]		
SHARES	0.2404	1.53[.1257]	0.2212	1.34[.1796]
CONTROL	0.3959	2.44[.0149]	0.3955	2.39[.0168]
SIZE	0.0011	2.63[.0085]	0.0012	2.80[.0052]
IRMAN	0.3572	1.36[.1752]		
MEETINGS	-0.3595	-2.28[.0334]	-0.3804	-2.39[.0168]
Economic Rent Variable				
NONCORE	-0.0114	-3.30[.0010]	-0.0092	-2.71[.0067]
Union Power Variables				
UDEL	6.8911	2.54[.0110]	7.7929	2.85[.0044]
COMBINE	0.4493	1.64[.1007]		
DOMUNION			0.8298	5.25[.0000]
Employer Power Variable				
EMPASS	0.5063	1.45[.1475]		
Strikable Issues Variables				
OUTPUTCH	-0.4103	-2.09[.0364]	-0.4364	-2.06[.0398]
COMMCH	-0.2856	-1.36[.1731]		
MANAGCH	0.2053	1.41[.1583]		
TECCH	-0.2077	-1.37[.1707]		
ABRATE	0.3726	1.40[.1618]		
Control Variable				
LOCOST	-0.3716	-2.06[.0393]	-0.2826	-1.55[.1210]

		Model 1	Model 2
Log-Likelihood		-220.1529	-212.3184
Restricted Log-Likelihood		-359.4440	-361.7612
Chi Sq[Prob]		287.6[.0000]	298.9[.0000]
Degrees of Freedom		16	20
Cases		677	697
Cragg-Uhler R^2		0.0826	0.0898
McFadden R^2		0.3875	0.4131
Prediction Rate (%)	Total	81.5	83.8
	Strike	33.1	43.6
	No Strike	94.4	94.0

Table 6.5 **General Probit Models in Government Non-Commercial Establishments with a Union Presence**
Maximum Likelihood Estimates

Regressor	Model 1 Coef	Model 1 *t* Ratio[Prob]	Model 2 Coef	Model 2 *t* Ratio[Prob]
Constant	-3.6083	-3.16[.0016]	-1.4919	-1.67[.0957]
Union Demand and Opportunity Cost Variables				
OAWARD	-0.0112	-0.30[.7614]	-0.0162	-0.42[.6723]
RWAGEHI	0.0087	0.03[.9751]	-0.0587	-0.21[.8272]
RWAGELO	0.2278	1.08[.2825]	0.2542	1.28[.1996]
OT	-0.6112	-2.60[.0094]	-0.5335	-2.36[.0183]
LABCOST	0.8679	2.07[.0381]	0.6314	1.62[.1064]
DENSITY	1.4456	2.77[.0056]		
FEMALE	1.3232	2.99[.0028]	1.2896	3.10[.0019]
SKILLED	-1.3591	-2.17[.0296]	-1.3899	-2.39[.0167]
CAPAC	0.2086	0.54[.5861]	-0.2557	0.44[.9380]
TIGHTLAB	0.0014	0.01[.9948]	-0.0231	-0.12[.9058]
VACANCY	0.3777	1.20[.2308]	0.1867	0.62[.5355]
GROWTH	0.1133	1.68[.0919]	0.1066	1.58[.1139]
Information Variables				
SHIFT	-0.5027	-1.95[.0512]	-0.3475	-1.45[.1474]
CONTROL	0.2198	0.75[.4509]	-0.1964	-0.78[.4374]
SIZE	0.0012	2.95[.0031]	0.00013	0.90[.3673]
IRMAN	0.7025	2.04[.0413]	0.7451	2.34[.0194]
MEETINGS	0.3007	0.67[.4999]	0.3741	0.90[.3704]
JUMCOM	0.0490	0.24[.8071]	0.0198	0.10[.9171]
Economic Rent Variables				
TENURE	0.2114	0.58[.5639]	0.2124	0.62[.5378]
NONCORE	-0.0137	-1.68[.0925]	-0.0200	-2.68[.0073]
Union Power Variables				
UNIONS	-0.0445	-0.80[.4211]	0.0316	0.67[.5026]
UDEL	12.9390	3.67[.0002]	10.1220	3.08[.0021]
COMBINE	-0.0313	-0.08[.9355]	-0.0552	-0.16[.8750]
DOMUNION			0.2896	1.54[.1235]
Employer Power Variable				
EMPASS	-0.3038	-1.03[.3034]	-0.4122	0.13[.2581]
Strikable Issues Variables				
OUTPUTCH	0.1692	0.72[.4709]	0.0782	0.35[.7282]
WORKCH	0.4197	2.20[.0278]	0.4164	2.27[.0234]
COMMCH	-0.0015	-0.01[.9955]	0.0519	0.22[.8242]
MANAGCH	-0.1031	-0.52[.6016]	-0.0259	-0.14[.8908]
TECHCH	0.1415	0.71[.4790]	0.1963	1.04[.2993]
PBR	-1.9289	-1.24[.2150]	-1.1746	-0.80[.4231]
ABRATE	0.2761	0.69[.4912]	-0.0024	-0.01[.9951]
DISPROC	0.8807	3.70[.0002]	0.8581	3.80[.0001]
Control Variables				
COAWARD	-0.8836	-1.50[.1336]	-0.8744	-1.57[.1156]
FEDSTAT	-0.2891	-0.94[.3472]	-0.1619	-0.57[.5682]
HICOST	-0.3141	-1.21[.2257]	-0.4402	-1.74[.0812]
LOCOST	0.2953	1.30[.1940]	0.2096	0.99[.3203]

		Model 1	Model 2
Log-Likelihood		-150.7357	-167.4362
Restricted Log-likelihood		-230.0959	-239.8452
Chi-sq_{36}[Prob]		158.7[.0000]	144.8[.0000]
Cases		374	374
Cragg-Uhler R^2		0.0767	0.0647
McFadden R^2		0.2580	0.3019
Prediction Rate (%)	Total	76.7	75.9
	Strike	46.5	40.0
	No Strike	90.2	92.3

Table 6.6 **Parsimonious Probit Models in Government Non-Commercial Establishments with a Union Presence Maximum Likelihood Estimates**

Regressor	Model 1 Coef	Model 1 *t* Ratio[Prob]	Model 2 Coef	Model 2 *t* Ratio[Prob]
Constant	-2.5586	-3.26[.0011]	-1.2107	-1.99[.0461]
Union Demand and Opportunity Cost Variables				
RWAGELO	0.2776	1.57[.1170]		
OT	-0.3830	-1.89[.0592]	-0.3858	-1.91[.0565]
LABCOST	0.9503	2.60[.0092]	0.6038	1.72[.0860]
DENSITY	0.9708	2.10[.0356]		
FEMALE	1.4198	3.80[.0001]	1.4217	4.04[.0000]
SKILLED	-1.0605	-1.89[.0582]	-1.3559	-2.49[.0129]
GROWTH	0.1034	1.81[.0701]	0.0887	1.29[.1961]
Information Variables				
SHIFT	-0.6105	-2.70[.0068]	-0.3894	-1.80[.0718]
SIZE	0.00078	2.61[.0089]		
IRMAN	0.4738	1.62[.1047]	0.7905	2.82[.0048]
Economic Rent Variable				
TENURE	0.4280	1.32[.1864]		
NONCORE	-0.0087	-1.29[.1968]	-0.0180	-2.81[.0049]
Union Power Variables				
DENSITY	0.9708	2.10[.0356]		
UDEL	11.1530	3.52[.0004]	9.6833	3.20[.0014]
DOMUNION			0.2732	1.57[.1170]
Employer Power Variable				
EMPASS	-0.6050	-2.48[.0133]	-0.4526	-1.98[.0475]
Strikable Issues Variables				
OUTPUTCH	0.2715	1.36[.1738]		
WORKCH	0.2438	1.50[.1328]	0.4202	2.59[.0097]
PBR	-1.9812	-1.46[.1437]		
DISPROC	0.7626	3.75[.0002]	0.8529	4.29[.0000]
Control Variables				
COAWARD	-0.8903	-1.67[.0948]		
HICOST	-0.4158	-1.90[.0578]		

		Model 1	Model 2
Log-Likelihood		-168.5343	-177.5122
Restricted Log-Likelihood		-240.6727	-245.4826
Chi Sq[Prob]		144.276[.0000]	135.9409[.0000]
Degrees of Freedom		17	16
Cases		392	397
Cragg-Uhler R^2		0.0641	0.0582
McFadden R^2		0.2997	0.2769
Prediction Rate (%)	Total	74.4	73.5
	Strike	40.3	32.8
	No Strike	89.3	91.9

Table 6.7 **General Probit Models of Strikes in Government Business Entreprises with a Union Presence**
Maximum Likelihood Estimates

Regressor	Model 1 Coef	Model 1 t Ratio[Prob]	Model 2 Coef	Model 2 t Ratio[Prob]
Constant	-3.8271	-0.07[.9459]	-1.6730	-0.03[.9762]
Union Demand and Opportunity Cost Variables				
OAWARD	-0.0840	-1.28[.1988]	-0.0772	-1.18[.2381]
RWAGEHI	1.2844	1.13[.2591]	1.5183	1.28[.2003]
RWAGELO	0.7240	0.76[.4448]	0.7606	0.81[.4205]
OT	-6.0261	-3.26[.0011]	-6.1361	-3.38[.0007]
EXPOSED	0.2801	0.19[.8472]	0.6858	0.46[.6486]
STRCOMP	0.2787	0.24[.8088]	-0.1208	-0.10[.9204]
LABCOST	-0.3226	-0.13[.8957]	-0.0563	-0.02[.9823]
DENSITY	0.5751	0.16[.8740]		
FEMALE	-13.526	-2.21[.0271]	-15.123	-2.49[.0126]
SKILLED	4.7950	1.83[.0669]	4.7031	1.89[.0591]
CAPAC	-3.2791	-1.82[.0693]	-3.3390	-1.86[.0623]
TIGHTLAB	0.8422	0.93[.3539]	0.7231	0.79[.4274]
VACANCY	5.7721	0.10[.9182]	4.7885	0.09[.9318]
GROWTH	4.6864	1.71[.0870]	4.6267	1.64[.1013]
Information Variables				
PSHARE	-2.0663	-0.24[.8131]	-0.2208	-0.03[.9763]
SHIFT	1.1203	1.09[.2745]	1.2076	1.17[.2421]
CONTROL	-1.5893	-1.03[.3038]	-1.9527	-1.16[.2444]
SIZE	0.0023	1.32[.1879]	0.0024	1.40[.1600]
IRMAN	1.1264	0.96[.3373]	1.0393	0.89[.3726]
MEETINGS	0.2913	0.25[.7996]	0.2282	0.20[.8393]
JUMCOM	-0.5244	-0.43[.6688]	-0.1112	-0.10[.9207]
Economic Rent Variables				
LOSS	-2.1354	-0.96[.3345]	-2.3511	-1.09[.2746]
HIPROF	2.2316	1.37[.1704]	2.0408	1.29[.1970]
TENURE	2.5098	1.23[.2177]	2.9251	1.54[.1243]
NONCORE	0.0972	2.21[.0274]	0.1014	2.22[.0263]
Union Power Variables				
UNIONS	-0.3430	-1.36[.1726]	-0.3673	-1.42[.1548]
UDEL	-17.080	-1.12[.2632]	-16.921	-1.17[.2401]
COMBINE	3.5539	2.14[.0319]	3.6221	2.15[.0314]
DOMUNION			-0.5516	-0.57[.5702]
Employer Power Variable				
EMPASS	-0.0708	-0.07[.9431]	-0.1349	-0.13[.8954]
Strikable Issues Variables				
OUTPUTCH	1.3454	1.03[.3017]	1.5608	1.21[.2273]
WORKCH	-1.3156	-1.23[.2202]	-1.5403	-1.48[.1385]
COMMCH	-2.2535	-2.12[.0336]	-2.4182	-2.27[.0234]
MANAGCH	0.9823	0.85[.3932]	0.8338	0.71[.4801]
TECHCH	-0.7277	-0.76[.4441]	-0.6329	-0.65[.5136]
PBR	6.3720	0.73[.4646]	4.8963	0.64[.5239]
ABRATE	-0.3670	-0.21[.8322]	-0.3162	-0.19[.8471]
DISPROC	2.6624	1.84[.0652]	3.0525	2.06[.0395]
Control Variables				
COAWARD	-2.8176	-1.53[.1260]	-2.7806	-1.62[.1042]
FEDSTAT	0.6254	0.51[.6087]	0.4391	0.42[.6743]
HICOST	1.3757	1.01[.3108]	1.2752	1.03[.3021]
LOCOST	-0.0388	-0.03[.9726]	-0.0555	-0.05[.9596]

	Model 1	Model 2
Log-Likelihood	-15.2148	-15.0640
Restricted Log-likelihood	-66.8119	-66.8119
Chi-sq_{41}[Prob]	103.19[.0000]	103.50[.0000]
Cases	145	145
Cragg-Uhler R^2	0.3455	0.3479
McFadden R^2	0.7723	0.7745
Prediction Rate (%) Total	89.5	89.5
Strike	52.0	52.0
No Strike	97.5	97.5

Table 6.8 **Parsimonious Probit Model of Strikes in Government Business Enterprises with a Union Presence**
Maximum Likelihood Estimates

Regressor	Coef	*t* Ratio[Prob]
Constant	1.0092	0.68[.4953]
Union Demand and Opportunity Cost Variables		
OT	-4.1540	-4.52[.0000]
FEMALE	-5.7394	-2.85[.0043]
TIGHTLAB	0.7590	1.64[.1007]
GROWTH	2.4794	1.78[.0755]
Information Variables		
CONTROL	-1.1563	-1.67[.0941]
SIZE	0.0012	1.62[.1053]
Economic Rent Variable		
HIPROF	1.7436	2.67[.0075]
TENURE	2.5931	2.34[.0194]
NONCORE	0.0411	2.32[.0202]
Union Power Variables		
COMBINE	0.8192	1.47[.1406]
Strikable Issues Variables		
OUTPUTCH	1.7236	2.74[.0062]
COMMCH	-1.4562	-2.59[.0095]
TECHCH	-0.8527	-1.71[.0873]
Control Variable		
DISPROC	1.3876	2.03[.0419]

Log-Likelihood		-23.6662
Restricted Log-Likelihood		-69.0238
Chi Sq_{14}[Prob]		90.71[.0000]
Cases		158
Cragg-Uhler R^2		0.2477
McFadden R^2		0.6571
Prediction Rate (%)	Total	86.9
	Strike	44.0
	No Strike	94.8

Table 6.9 **Signs of Variable Coefficients in Parsimonious Models and *a priori* Signs**

	a priori	Private	GNCE	GBE
Union Demand and Opportunity Cost Variables				
OAWARD	-	+		
RWAGEHI	-			
RWAGELO	+		+	
OT	-		-	-
EXPOSED	?			
STRCOMP	?	+		
LABCOST	?		+	+
DENSITY	+	+	+	
FEMALE	-	-	+	
SKILLED	-	-	-	
CAPAC	+			
TIGHTLAB	+			+
VACANCY	+	+		
GROWTH	+		+	+
Information Variables				
PSHARE	-	-		
SHARES	?	+		
SHIFT	?		-	
CONTROL	+	+		-
SIZE	+	+	+	+
IRMAN	?	+	+	
MEETINGS	?	-		
JUMCOM	?			
Economic Rent Variables				
LOSS	-			
HIPROF	?			+
TENURE	+		+	+
NONCORE	-	-	-	+
Union Power Variables				
UNIONS	+			
UDEL	+	+	+	
COMBINE	+	+		+
DOMUNION	+	+	+	
Employer Power Variable				
EMPASS	+	+	-	
Strikable Issues Variables				
OUTPUTCH	+	-	+	+
WORKCH	+		+	
COMMCH	+	-		-
MANAGCH	+	+		
TECHCH	+	-		-
PBR	+		-	+
ABRATE	+	+		
DISPROC	+		+	+
Control Variables				
COAWARD	+		-	
FEDSTAT	+			
HICOST	+		-	
LOCOST	-	-		

7 Models of Australian Non-Strike Industrial Action

7.1 Introduction

The labour economics literature contains an extensive range of models of strikes, but there is scant reference to common forms of non-strike industrial action. These actions, which include stop work meetings, overtime and other bans, go slow tactics, and work to rules campaigns, are used frequently in Australia; there is, however, a paucity of statistical data concerning their prevalence. There appear to be no theoretical or empirical economic models which seek to explain the frequency of non-strike industrial action, or why particular forms of action are chosen by unions. We believe this neglect of non-strike industrial action is a serious omission from the labour economics literature.

It is arguable that strikes are more important than other industrial actions, because they impose greater costs on the economy; strikes halt production and often bring about further costs in other workplaces. Non-strike actions may be less costly to workplaces, because they tend to reduce output or raise costs, rather than halt production. Australian strikes, however, are typically of short duration, so it is possible that prolonged non-strike action causes greater costs than strikes of, say, a few days duration.

In this chapter we use AWIRS data to produce empirical models of all non-strike industrial action in Australian unionised workplaces, and models of particular kinds of non-strike action. We use the theoretical framework for non-strike action developed in Chapter 4, and other variables suggested by alternative economic models of strikes. Finally, we draw some comparisons between our empirical strikes and non-strike action models.

7.2 Non-Strike Industrial Action in the Literature

Salamon (1987) describes non-strike action in Britain, and proposes that the term "industrial action" should be broadly defined to encompass actions not normally undertaken by unions, and may occur in non-union workplaces. These actions include high absenteeism and labour turnover rates; they are not used in support of any particular demand, but are often an uncoordinated response to poor working conditions. Salamon claims that there is conflicting evidence regarding whether unorganised action and union-organised action are substitutes or complements.

Organised non-strike action may be a preliminary tactic of muscle-flexing, after which a strike may follow, should employers fail to make concessions. Non-strike actions have the apparent advantage to employees of exerting considerable pressure on employers, at comparatively low cost to themselves. Salamon points out that, compared with strikes, these actions are less likely to be taken by employers as breaches of contract, and that the use of disciplinary action may strengthen employees' resolve. Nevertheless, Salamon states that 'it is easier for the union to ensure that there is collective solidarity .... in a strike than in other forms of industrial action'. [p 330] Although he claims that more than half of British industrial action is of the non-strike kind, Salamon concludes that it is not easy to judge whether non-strike actions are substitutes for strikes, or complementary to strikes.

Blanchflower and Cubbin (1986), who we discuss in Section 2.4.5, develop probit models, using British WIRS80 data, to analyse the determinants of any industrial action at a workplace.[1] They do not model individual forms of non-strike action, and their "actions" model seems peripheral to models of shorter and longer strikes. In their discussion of the regressions, they claim that 'strikes capable of swift resolution are likely to have arisen for rather different reasons than longer strikes'. [p 34] Nevertheless, they propose the same set of regressors in all estimating probit equations, which implies an hypothesis that short and long strikes, and the group of all industrial actions, all stem from the same factors. Blanchflower and Cubbin pay little attention to non-strike action in either their theory of strikes, or in the discussion of their empirical results.

7.3 Non-Strike Industrial Action in Australia

The Australian Workplace Industrial Relations Survey (AWIRS) provides some recent evidence of the prevalence non-strike action in workplaces with twenty or more employees, in Australia. It records whether workplaces experienced different forms of industrial action in the survey year (1989-90); it does not record the number of times each action is used, its duration, nor whether any non-strike action precedes a strike.

The relative costs of strike and non-strike actions cannot be determined from AWIRS; it does, however, record that, of the workplaces experiencing industrial action, 49.4 percent indicated that strikes had "the most impact", 25.3 percent named overtime and other bans, and 17.0 percent nominated stop work meetings.[2] Although the information in AWIRS is imprecise, it shows that in

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[1]They define any action to mean strikes, overtime bans, workings to rule, blacking of work, go-slows and work/sit ins, but exclude lock-outs. [p 31]

[2]See AWIRS question en5. It should be noted that en5 suggests that 440 workplaces had some industrial action, but question en1h which is "no industrial action in last year" indicates that 741 workplaces did have industrial action. This discrepancy cannot be explained by "do not know"

Australia there are several forms of industrial actions in fairly common use by unions to place leverage on employers; consequently, it is reasonable to conclude that ABS strikes statistics understate the true incidence and costs of industrial disputation in Australia. We are unable to ascertain whether conditions which increase the incidence of strikes, also lead to increases in non-strike action. Nor are we able to determine whether during some periods, strikes are more commonly used than other forms of action. This uncertainty suggests that strikes statistics may not give a true indication of the costs of industrial action, much less industrial militancy.

Table 7.1 shows the incidence of unionised workplaces reporting industrial action in AWIRS, broken down by particular types of action and workplace status. A cursory inspection shows that government workplaces are almost twice as likely to report some form of industrial action, than are privately owned workplaces; the frequencies are, for privately owned workplaces, 26.2 percent, for government non-commercial establishments (GNCEs), 49.4 percent, and for government business enterprises (GBEs), 45.9 percent.

The main focus of this chapter is on producing an empirical model of all non-strike industrial action. Because our theoretical model strongly suggests non-strike action which is potentially protracted, we exclude stop work meetings from our analysis. Table 7.1 shows that non-strike action occurred in 16.9 percent of privately owned workplace, in 27.2 percent of GNCEs and in 33.5 percent of GBEs.

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responses since there are just five of these in en5 and none in en1h; this is not sufficient, however, to warrant a different broad conclusion regarding perceptions of strike costs *vis-a-vis* the costs of non-strike actions.

It is tempting to suggest that these difference in the reporting of non-strike action, are a consequence of greater rigidity in internal labour market structures in the public sector, and which may make non-strike action relatively more effective than strikes. The statistics shown in Table 7.1, however, may be misleading. AWIRS does not reveal the numbers of actions of each type, but simply records whether *any* action occurred.[3] Further, employees in GNCEs and GBEs may be no more militant than those in privately owned workplaces, but may confront relatively more industrial problems which give rise to industrial action.

7.4 Modelling Issues

In Chapter 4 we produce a theoretical model which proposes that the opportunity cost of industrial action to employees, is an important determinant of whether the union makes a demand on the firm, accompanied by a threat of industrial action. It is this opportunity cost which explains how a union chooses between threatening to use a strike or a non-strike industrial action.

The model of non-strike industrial action, suggests an empirical model of the form

$$Action_i = \beta_0 + \beta_1 d_i + \beta_2 CEA_i + \beta_3 CFA_i + \sum_{j=1}^{k} \beta_{k+3} X_{ji} + v_i \qquad (4.32)$$

where $Action_i$ is a measure of non-strike industrial action, d_i the union's demand, CEA_i a measure of employee costs of industrial action, CFA_i a measure of costs of industrial action to the firm, X_{ji} a set of regressors suggested by alternative economic models (of strikes), and v_i a random error term. The costs are

$$CEA_i = g_E(s_E, T_E, \eta_E, \lambda, U, l_a, l_w, \zeta) \qquad (4.33)$$

[3] We cannot conclude, for example, that because 2.2 percent of privately owned workplaces report *at least one* work to rules campaign, compared to 10.1 percent of GBEs, that the latter have relatively greater frequencies of work to rules campaigns, or longer campaigns.

and

$$CFA_i = g_F(s_F, T_F, \eta_F, \lambda, \rho, \delta) \qquad (4.34)$$

where s is the expected settlement, T the expected duration of the non-strike action, η the elasticity of demand, λ labour's share of total cost, U the average duration of unemployment, l_a the wage loss in alternative employment, l_u the wage loss during unemployment, ζ and δ are union and firm discount rates, and ρ the reduction in the firm's profit margin during the non-strike action. A list of all variables is shown in Table 4.1.

The union makes a smaller wage demand on the firm when the elasticity of demand in the product market is greater, and when labour's share of total costs is greater, because large wage increases lead to greater reductions in sales and, consequently, redundancies. The demand is constrained by the maximum employment loss acceptable to the union leadership, and may be greater when membership is large. Higher prior wages, and the prospect of longer periods of unemployment, cause greater wage losses to retrenched workers; this leads the union to make a smaller demand so the likelihood of resistance by the firm, and a non-strike action occurring, is reduced.

When demand is elastic, and labour costs are a large proportion of total costs, the firm is more resistant, because wage increases have a greater impact on sales and profits. Large discount rates lead to a smaller likelihood of industrial action occurring, because the union attaches less weight to the future earnings of members, and the firm to future cost savings which are brought about by resistance.

These arguments, of course, apply equally to the models of strike and non-strike action. The differences in the non-strike model are threefold: first, profit margins are reduced during non-strike action, but production and sales continue; second, there are no losses of earnings during non-strike action (except perhaps overtime earnings); third, there is no loss of goodwill due to the erosion of the firm's market directly attributable to strikes.

The strikes model proposes that the union is less likely to threaten a strike, and the firm more likely to acquiesce to a demand to avoid a strike, when the risk of market erosion is greater. Although competition in the product market makes the union more reticent in making demands, and the firm more resistant because of the impact of price increases, it seems likely that competition in the product market increases the risk of erosion, and increases the opportunity cost of strikes to both parties. When the costs of market erosion are greater, the union is more likely to threaten non-strike action, and the firm is more likely to resist, so increasing the likelihood of non-strike action occurring.

Larger prior earnings mean that employees endure greater wage losses during strikes, and we remind the reader that the model excludes short tactical strikes where wage losses may be trivial. Assuming that the firm does not stand down employees for failing to carry out duties as directed, the use of a non-strike action does not result in the total loss of earnings for its duration. Although the loss of earnings during strikes makes non-strike action more attractive to unions, *ceteris paribus*, the model suggests that high wage workplaces are likely to be more strike averse than others, and their unions more likely to use non-strike action.

Setting aside the opportunity cost of strikes to the union, a strike is a more powerful industrial weapon than non-strike action. Assuming the firm cannot supply customers from inventories, or that managerial staff are unable to maintain output, strikes halt production and reduce profits to zero.[4] The model suggests that non-strike action is more likely to be threatened when it causes larger reductions in the firm's profit margin per unit of output.

We specify a general model as

$$\begin{aligned} PROBIT(ACTION_{ji}) = {} & \alpha + \Sigma\beta_k DEMAND_{ki} + \Sigma\gamma_l CEA_{li} \\ & + \Sigma\delta_m CFA_{mi} + \Sigma\zeta_n INFORM_{ni} + \Sigma\eta_r RENT_{ri} \\ & + \Sigma\theta_s UNION_{si} + \Sigma\kappa EMPASS_i + \Sigma\varsigma_v ISSUE_{ui} \\ & + \Sigma\tau_u CONTROL_{vi} + \epsilon_i \qquad (7.3) \end{aligned}$$

where $ACTION_{ji}$ is 1 if the j[th] type of non-strike industrial action occurs at the i[th] workplace, and 0 otherwise. The sets of regressors are union demand variables, $DEMAND_{ki}$, opportunity costs of industrial action to employees, CEA_{li}, opportunity costs of industrial action to the firm, CFA_{mi}, information, $INFORM_{ni}$, economic rents, $RENT_{ri}$, union power, $UNION_{si}$, membership of an employers' association, $EMPASS_i$, industrial issues, $ISSUE_{ui}$, and control variables, $CONTROL_{vi}$. These are the same regressors used in the strikes models in Chapter 6, and a full list is shown in Table 6.1; summary statistics are shown in Table 6.2.

We are unable to identify proxies in AWIRS which are unambiguously associated with variables in the theoretical non-strike action model. A proxy for the union's ability to reduce profit margins during a non-strike action is elusive. The competition variables which suggest that strikes cause erosion of markets, are

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[4]Here the model may understate the likely position of the firm during a strike. Production and sales cease, but fixed costs continue.

also proxies for the elasticity of demand, which appears in both the strikes and non-strike actions models.[5]

There seems little purpose in reiterating the justifications of our choice of proxies in Chapter 6. These are set out in Sections 6.5.2 to 6.5.9; reference to market erosion caused by strikes remains relevant, because erosion makes non-strike action more likely and strikes less likely. We assert that other economic theories of strikes could, with minor modifications, describe non-strike action, so our eclectic approach of Chapter 6 is used here.

Further to other theories of strikes, Salamon (1987) suggests that non-strike actions are more difficult to sustain than short strikes, so we expect relatively more non-strike action in workplaces where union density and delegate representation are greater, and where combined union committees are present. These regressors are significant in explaining strikes, but Salamon's proposition leads us to expect them to be even more important in non-strike action models.

Like strikes, we assume that non-strike industrial action result from the failure of bargainers to agree on the distribution of expected future economic rents. Consequently, we produce separate models of non-strike industrial action in privately owned workplaces, in GNCEs where competition and profits are absent, and in GBEs where the objectives are usually wider than the pursuit of profits.

7.5 Empirical Models of Australian Non-Strike Action

We again adopt the general to specific methodology used in Chapter 6, and suggested by Hendry and Richard's (1983) approach to time-series modelling. We

[5]This appears to be an approach similar to that of Blanchflower and Cubbin (1986) who use the same regressors to model strikes and all industrial actions. The difference is that they include strikes in their all industrial actions variable, whereas we differentiate between strikes and non-strike actions, and exclude stop work meetings.

eliminate those regressors suggested by theory to be important, but fail to be significant at reasonable decision levels. We first estimate the model using all regressors described in Equation 7.3, and outlined in Section 6.5. We delete the regressor with the smallest absolute t value; then we re-estimate the model, and continue the procedure until all remaining variables have coefficients which are significantly different from zero on two sided tests at the twenty percent level.

We begin with probit models of any non-strike industrial action at workplaces with a union presence, and then produce separate models for the use of overtime bans, go slow tactics, work to rules campaigns, and other bans. In Chapter 6 we argue that workplaces in which unions are absent, should be excluded from the sample, because strikes are never observed in non-union workplaces. We extend this to models of non-strike action and note that no form of industrial action is observed in any of the non-union workplaces in AWIRS.

7.5.1 Models of Any Non-Strike Industrial Action

The parsimonious versions of these models are shown in Table 7.2. Our theoretical model proposes that greater wage losses following retrenchment lead unions to make smaller demands, and make non-strike industrial action less likely to occur. The positive coefficient of the low wage variable in the GNCE model is consistent with this, however wage loss variables are not significant in the other models.

Our theory indicates that elastic demand in the product market causes unions to make smaller demands, but firms to be more resistant, leading to uncertainty regarding the expected signs of the coefficients of the competition variables. The negative coefficient of the domestic competition variable in the

GBE model, suggests the importance of elasticity in explaining non-strike action. The insignificance of the domestic and external competition variables in the other models is inconclusive; it is possible that strong competition causes unions to make smaller demands, but this is "cancelled" by the greater resistance of firms.

Non-strike action is positively associated with union density in all models. This is consistent with the proposition that unions make larger demands, and are prepared to make greater sacrifices of membership, when membership is high. It is also consistent with the more conventional view that density is a proxy for union power, which leads to unions taking more industrial action.

In privately owned workplaces, the likelihood of non-strike action is negatively associated with the proportion of females, but in GNCEs the relationship is positive. The former relationship is consistent with women having higher discount rates than men, and the latter with women being eager to redress poorer working conditions of the past.

Positive associations between non-strike actions and tight labour market conditions in the private sector and GBEs, are consistent with our theory that union demands are greater when retrenched workers are more likely to find speedy re-employment. The positive association with employment growth in the private sector, suggests that demands are greater when the risks of retrenchments are smaller. In contradiction, however, non-strike action is negatively associated with vacancies in GNCEs, and suggests that GNCE internal labour market structures are relatively more isolated from external conditions.

The coefficients of all mis-information variables, excepting profit sharing and outside control in privately owned workplaces, fail to have the signs expected *a priori*.[6] In GBEs, non-strike action is positively associated with the presence of shift work, and suggests that shift work is an industrial issue. Non-strike action is positively associated with the presence of an industrial relations manager and regular meetings between management and employees, and suggests that these variables are proxies for on-going industrial disharmony. A positive relationship between non-strike action and the presence of a joint union-management committee in GNCEs, suggests that this variable, too, proxies disharmony, or perhaps that these committees are forums for disputation and encourage the use of non-strike action.

In privately owned workplaces, non-strike action is negatively associated with losses, and positively associated with the employee rents proxy, the proportion of employees with at least five years of tenure. Although this result in the private sector is consistent with disputes occurring over shares of economic rents, in GNCEs the evidence is more equivocal. In GNCEs, non-strike action is negatively associated with tenure, contrary to expectation, but negatively associated with the proportion of non-core employees as expected; the former suggests larger employee rents, but the latter suggests smaller employee rents.

In all models, union power proxies are positively associate with the use of non-strike action. There is, however, one exception; in GBEs, the ratio of union delegates to employees is negatively associated with non-strike action and hints that, at least in these workplaces, that greater delegate representation makes strikes easier to organise, and that strikes are the preferred industrial weapons of unions.

[6] This assumes that these variables are correctly assigned as mis-information proxies. The strikes models in Chapter 6 suggest that several of these may proxy on-going industrial problems, so in Table 7.7 we leave these variables unsigned *a priori*.

In GBEs, non-strike action is positively associated with membership of an employers' association, but in GNCEs the relationship is negative. The former suggests that membership leads to greater employer resistance; the latter, as we propose in Chapter 6 in the model of strikes, suggests that membership provides information to employers about standards in the private sector.

The models give little indication that change in the workplaces lead to non-strike industrial action. Although we leave the reader to examine Table 7.2 for details, we note that non-strike action is negatively associated with technical change in privately owned workplaces and GBEs. Our theoretical model suggests that union demands are likely to be more restrained when the risk of retrenchments are greater; in Chapter 6 we speculate that technical change may lead to redundancies, or at least make them more likely to occur, when firms substitute capital for labour. In these circumstances, we may expect unions to make smaller demands, so reducing the occurrence of non-strike industrial action.

In privately owned workplaces and GNCEs, non-strike action is positively associated with the presence of disputes procedures. As we find in the empirical strikes models, disputes procedures appear to proxy on-going industrial conflict; their presence does not render workplaces less prone to non-strike action. It is also possible that the presence of disputes procedures encourage disputation.

In GNCEs and GBEs, non-strike action is positively associated with the presence of a "company" award, and in GNCEs it is positively associated with the presence of both Federal and State awards.

7.5.2 Models of Any Overtime Ban

Like the models which follow, the models of the use of overtime bans are more problematic than those of all non-strike industrial action, because of their greater imbalance between "action" and "no action" responses in the dependent variable. In AWIRS, overtime bans occur in 8.3 percent of privately owned workplaces with a union presence, in 12.3 percent of GNCEs, and in 17.4 percent of GBEs. The overtime bans models are shown in Table 7.3.

Although we categorise the presence of overtime as an employee wage loss proxy, this variable is not significant in any of the overtime ban models; overtime bans are just as likely to occur in workplaces which do not report the use of overtime. This strange outcome appears to be the result of the overtime question in AWIRS referring only to *recent* overtime.[7]

The wage loss variables are not significant in the models for privately owned workplaces and GNCEs; in GBEs, the significance of the low wages dummy is consistent with our theoretical model, but the significance of the high wage dummy is contradictory and, as we conjecture in Chapter 6, this variable may proxy union militancy.

In GNCEs, overtime bans are negatively associated with labour costs as a proportion of total costs and suggests that, when the employer is unable to secure an extra budget allocation to meet union demands, the prospect of retrenchments cause unions to make smaller demands. In privately owned workplaces and GBEs, overtime bans are positively associated with tight labour market conditions, and

[7]The overtime question in AWIRS, ed7, refers to overtime in the month prior to the survey; the overtime bans question refers to the survey year.

this is consistent with our theoretical model. The positive association with union density in privately owned workplaces is congruous with unions making larger demands, and being more prepared to lose membership.

Several of the variables which we propose as mis-information proxies, again have signs which are opposite to those expected *a priori*, and may signal industrial disharmony. The exceptions are that overtime bans are positively associated with outside control in GNCEs, and with shift work in GBEs; the latter is also consistent with shift work being an industrial issue.

Union power variables are positively associated with the use of overtime bans, except that union delegate representation has a counter-intuitive negative coefficient in the GBE model. The significance of the presence of a combined union committee suggests that overtime bans may be difficult to enforce in multi-union workplaces, without formal collaboration between unions.

The industrial issue variables are not strongly represented in these models, however overtime bans are positively associated with changes in work practices in government workplaces, and with changes in management structures in privately owned workplaces.

7.5.3 Models of Any Go Slow Tactic

In AWIRS, the use of go slow tactics occurs in 2.6 percent of privately owned workplaces with a union presence, in 1.9 percent of GNCEs and in 2.7 percent of GBEs. The go slow models are shown in Table 7.3.

In these models we find only limited support for our theoretical model. In privately owned workplaces and GNCEs, the use of go slow tactics is positively associated with labour's share of total costs; in GNCEs, it is negatively associated with employment growth. None of the wage loss or unemployment duration proxies is significant. Nevertheless, in the private sector model, the use of go slow tactics is positively associated with union density, and is consistent with larger union demands and greater willingness to accept membership reductions.

Mis-information explanations of the use of go slow tactics are not confounded by counter-intuitive coefficient signs, but few of these variables are significant. In privately owned workplaces, go slow tactics are positively associated with outside control, in GNCEs, with workplace size, and in GBEs, with the presence of shift work, although the last of these could be an industrial issue variable.

In privately owned workplaces and GNCEs, the use of go slow tactics is positively associated with union power proxies. There is no association in GBEs, but we remind the reader that all GBEs are unionised and that union density in them is relatively high.

None of the industrial issue variables is negatively associated with the use of go slow tactics. In GNCEs, these tactics are positively associated with changes in management structures, and in GBEs, with changes in the product or services.

7.5.4 Model of Any Work to Rules Campaign

In AWIRS, the use of work to rules campaigns occurs in 3.1 percent of privately owned workplaces with a union presence, in 15.7 percent of GNCEs and in 10.1 percent of GBEs. The work to rules models are shown in Table 7.5.

In GNCEs, these campaigns are more likely in low wage workplaces, and this is consistent with our model which proposes that larger union demands are made when wage losses following retrenchments are smaller. In GBEs, they are negatively associated with labour's share of total costs, and suggests that unions make smaller demands when consequential price increases are larger, and labour shedding is greater. In privately owned workplaces and GBEs, the use of work to rules campaigns is positively associated with union density, which is again consistent with our theoretical model.

The significance of outside control in the GNCE and GBE models, lends some support to mis-information hypotheses. In the private sector, the positive association between the use of work to rules campaigns and tenure, and the negative associations with the proportion of non-core employees and the workplace making a loss, support the proposition that these actions occur in disputes over shares of economic rents.

Union power proxies are positively associated with the use of work to rules campaigns in all models. In GNCEs, these campaigns are positively associated with changes in work practices, but negatively with changes towards greater commercial orientation. In GBEs, they are negatively associated with technical change, once more suggesting that union demands are smaller when redundancies are more likely.

7.5.5 Model of Any Ban other than an Overtime Ban

In AWIRS, the use of industrial bans, other than of overtime, occurs in 2.6 percent of privately owned workplaces with a union presence, in 9.3 percent of GNCEs and in 9.2 percent of GBEs. The models are shown in Table 7.6.

The wage loss variables are not significant in the models of privately owned workplaces and GBEs; in GNCEs, the significance of the low wages dummy is consistent with our theoretical model, but the significance of the high wage dummy is contradictory as we find in the overtime ban model for GBEs.

Labour's share of total cost is significant in all models; in the private sector, the association is negative, but in the public sector it is positive. We recall that our theoretical model proposes that when labour costs are large, unions make smaller demands, but firms are more resistant so that we are unable to specify the sign of the coefficient of this variable *a priori*.

In the GBE model, the use of other bans is positively associated with tight labour markets, suggesting shorter periods of unemployment and, therefore, larger union demands. In the private sector, the positive association with employment growth, and in GNCEs, with vacancies, suggest that unions make larger demands when the risk of redundancies is smaller; in GBEs, however, the association with employment growth is negative, and contradicts our theoretical model.

All mis-information proxies which are significant, fail to have coefficient signs which accord with those expected *a priori*. In GNCEs, the role of employee rents is perplexing; the use of other bans is negatively associated with the proportion of employees who have been at the workplace for more than five years, and negatively associated with the proportion of non-core employees. Union power proxies are positively associated with the use of other bans in the private sector and GNCEs, but not in GBEs.

7.5.6 An Overview of the Non-Strike Models

The empirical models described in the preceding sections, broadly speaking, are consistent with our theoretical model of non-strike industrial action. We are, however, unable to claim that the models lend unambiguous support to our theory. For example, the presence of competitive markets may proxy smaller monopoly rents rather than the elasticity of demand; the tight labour market dummy may simply be a business cycle counterpart in a cross-sectional setting, rather than a proxy for the average duration of unemployment of retrenched employees; and union density may be yet another union power proxy, and may have little connection with employment losses which unions regard as acceptable. In this respect, our models fare no worse than many of the empirical strikes models which we outline in Chapters 2 and 3.

The goodness of fit statistics are not encouraging in any of the models. This, of course, is common in probit and logit models of binary choice and, in these non-strike action models, probably reflects a myriad of idiosyncratic factors which are inherently outside the ambit of workplace surveys. The over-all predictive success of these models seems very good, and is, in the majority of models, in excess of 80.0 percent, and in none is smaller than 64.0 percent. A closer examination shows that the success rate in predicting "no action" is extraordinarily high, but no model is able to produce a success rate of 50.0 percent in predicting "action", and some rates are less than 10.0 percent.[8] We believe that this imbalance in predictive success rates is a consequence of "action" occurring much less frequently than "no action" in the data, and is typical of binary choice models where severe asymmetry occurs in the dependent variable.

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[8]Predictive success records how often the actual occurrence of an "action" is predicted by the model. Most of our models do better when we record how often a predicted "action" turns out to be correct.

7.6 Strikes Versus Non-Strike Action

We claim that our empirical strikes and non-strike actions models are both broadly consistent with the predictions of our theoretical models. In Table 7.7 we compare the signs of the coefficients of significant variables in the strikes and non-strike actions models. An inspection shows that many variables which are significant in explaining strikes, are also significant in explaining the use of non-strike action, and have the same sign. More common, however, is a variable being significant in a strikes model, but not in the corresponding non-strike action model, and *vice versa*.

We summarise the concurrence of signs of the coefficients in the strikes and the non-strike action models as follows:

	Private	GNCE	GBE
RWAGELO		positive	
DENSITY	positive	positive	
FEMALE	negative	positive	
TIGHTLAB			positive
PSHARE	negative		
CONTROL	positive		
UDEL	positive	positive	
COMBINE	positive		positive
OUTPUTCH			positive
WORKCH		positive	
MANAGCH	positive		
TECHCH	negative		negative
DISPROC		positive	

The significance of the low wage variable, union density, the proportion of females (in privately owned workplaces) and tight labour markets, are consistent with both theoretical models. The threat of redundancies suggested by technical change, reduces both types of industrial action in privately owned workplaces and

GBEs, and accords with our theoretical models. The significance of the presence of profit sharing and outside control, supports our conjecture that mis-information explanations of strikes can be extended to non-strike industrial action, at least in privately owned workplaces. The union power proxies, union delegate representation and the presence of a combined union committee, are also significant in explaining both kinds of action.

We note earlier that we are unable to identify proxies which are unambiguously associated only with the theoretical non-strike actions model. In the empirical models, several variables stand out as being associated with strikes, but not with non-strike action. These are labour's share of total cost, the use of overtime and the proportion of employees with at least five years tenure, in GNCEs and GBEs, and workplace size in all models. In GNCEs and GBEs, the presence of both Federal and State awards is positively associated with non-strike action, but not with strikes. None of these variables is obviously associated with strikes, but not with non-strike action in our theoretical models. In other empirical models of strikes, workplace size is often treated as a mis-information proxy and it is commonly found that there is a positive association between strikes and size; we confirm this relationship for strikes, but not for non-strike action.[9]

There are few differences in signs of coefficients between the strike and non-strike actions models. Vacancies and changes in output or services make GNCEs more strike prone but less prone to non-strike action; in GNCEs, strikes are negatively associated with the presence of "company" awards, but non-strike

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[9]A reasonable expectation is that the solidarity of employees in refusing to carry out duties as directed, is more easily achieved when there are many employees involved in the industrial action. The non-strike action models, however, refute this.

actions are positively associated; in GBEs, payment by results is positively associated with strikes, but negatively with non-strike action. We do not propose rationalisations of all differences between the strikes and non-strike actions models because, with the exception of size, they are not consistent across all types of workplaces.

7.10 Conclusion

A reasonable assessment of the empirical models described in this chapter is that they are disappointing in not showing clearly which factors lead unions to choose to use non-strike action rather than strikes, and why particular forms of non-strike action are chosen. The models are more successful in identifying variables associated with non-strike action, but many of these are also associated with the use of strike action. In all models, much of the variation remains unexplained.

We remark earlier that AWIRS does not provide an ideal set of variables with which to analyse the causes of industrial action, however to reject the use of AWIRS would set aside the only microeconomic data available in Australia, apart from private surveys. Although we have misgivings about the data, the lack of clear distinctions between the models suggests that the choices of actions by unions are, to a large extent, idiosyncratic. The choice may be conditioned by longstanding traditions in workplaces, industries and unions; it may be dependent on subjective judgements of union leaders regarding which tactics are likely to be more effective, and not closely associated with economic or organisational variables.

The question of the choice between strike action and non-strike action aside, the estimated models are consistent with our theory which describes the factors determining union demands, and whether a non-strike action is likely to occur. Although we do not find uniform consistency with the theoretical model across privately owned workplaces, GNCEs and GBEs, we find little which contradicts it. The exception is that in GNCEs, the proportion of females is positively associated with the use of non-strike action, and suggests that this variable is wrongly assigned as a discount rate variable.

The positive association of non-strike action with union density in all models is consistent with the conjecture derived from our theoretical model, that unions make larger demands, and are more likely to risk the retrenchment of union members, when density is high. Positive associations with labour market tightness in privately owned workplaces and GBEs, are consistent with unions making larger demands when local labour market conditions are tight, and the period of unemployment of retrenched workers is likely to be shorter. In GNCEs, lower wages are associated with non-strike action, and suggests that smaller wage losses following retrenchment cause unions to make larger demands on employers.

In conclusion, we note that our theoretical model excludes industrial action which is intended by the union to be short term, and simply a tactical manoeuvre. Further, since it assumes implicit cost of living adjustments occur, and that productivity improvements are shared with employees, any union demands in excess of these norms lead to reduced sales and retrenchments. Clearly, we are unable to identify in AWIRS non-strike actions which are associated with excess demands, and although we cannot say that our empirical models "support" the theoretical model, they are, nevertheless, broadly consistent with it.

Table 7.1: **AWIRS Estimated Incidence of Reports of Any Industrial Action in Workplaces with a Union Presence and by Organisation Status[1]**

	Percent			
Action	**Private**	**GNCE**	**GBE**	**Total**
Strike	14.2	28.6	10.7	18.0
Stop Work Meeting	21.5	35.2	38.3	27.8
Overtime Ban	8.3	12.3	17.4	10.7
Go Slow	2.6	1.9	4.9	2.7
Work to Rules	3.1	15.7	10.1	7.6
Other Bans	2.6	9.3	9.2	5.5
Any Non-Strike Action[2]	16.9	27.2	33.5	22.1
Any Action	26.2	49.4	45.9	35.7
Estimated Sample[3]	960	497	221	1678

Notes:

1 Workplaces with twenty or more employees and excluding the g7 category "other commercial".

2 Excluding stop work meetings and picketing.

3 Using workplace weights.

Table 7.2: Parsimonious Probit Models of Any Non-Strike Industrial Action in Unionised Workplaces[1] Maximum Likelihood Estimates

	Private		GNCE		GBE	
Regressor	**Coef**	***t* Prob]**	**Coef**	***t* [Prob]**	**Coef**	***t* [Prob]**
INTERCEPT	-3.5540	-7.94[.0000]	-2.0011	-3.46[.0006]	-3.5955	-4.26[.0000]
Union Demand and Opportunity Cost Variables						
RWAGELO			0.3250	1.80[.0722]		
STRCOMP					-0.8111	-2.38[.0173]
DENSITY	1.4411	3.73[.0002]	0.7981	1.76[.0790]	1.6046	2.11[.0351]
FEMALE	-0.6182	-1.51[.1318]	0.9132	2.68[.0074]		
TIGHTLAB	0.3486	1.79[.0742]			0.7491	2.63[.0086]
VACANCY			-0.7186	-3.09[.0020]		
GROWTH	0.5190	2.55[.0108]				
Information Variables						
PSHARE	-1.0119	-1.90[.0574]				
SHIFT					0.6686	2.29[.0221]
CONTROL	0.2605	1.40[.1629]				
IRMAN					0.8267	2.24[.0251]
MEETINGS					0.7963	1.88[.0601]
JUMCOM			0.4104	2.46[.0139]		
Economic Rent Variables						
LOSS	-0.5307	-1.52[.1290]				
TENURE	1.3093	3.72[.0002]	-0.9002	-2.86[.0043]		
NONCORE			-0.0150	-2.34[.0191]		
Union Power Variables						
UNIONS			0.1729	3.73[.0002]	0.1199	2.06[.0392]
UDEL	7.4190	2.05[.0407]	7.1799	2.42[.0156]	-12.3150	-2.53[.0116]
COMBINE	0.7276	2.76[.0058]	0.4889	1.47[.1424]	0.6477	1.58[.1139]
Employer Power Variable						
EMPASS			-0.9102	-3.49[.0005]	0.4567	1.46[.1436]
Industrial Issues Variables						
OUTPUTCH			-0.3943	-1.89[.0591]	1.2819	3.52[.0004]
WORKCH			0.5602	3.48[.0005]		
MANAGCH	0.2800	1.65[.0984]				
TECHCH	-0.3411	-1.87[.0618]			-0.6685	-2.24[.0253]
PBR					-1.1604	-1.82[.0693]
DISPROC	0.6938	3.70[.0002]	0.5386	2.76[.0058]		
Control Variables						
COAWARD			0.7105	1.69[.0917]	0.6543	1.33[.1819]
FEDSTAT			0.5664	2.17[.0299]		
HICOST					0.4528	1.43[.1514]
LOCOST			-0.3165	-1.55[.1204]		
Log-Likelihood	-147.1733		-174.5301		-64.7186	
Restricted Log-likelihood	-295.4735		-240.1019		-118.9807	
Chi-sq[Prob]	296.6[.0000]		131.1[.0000]		109.0[.0000]	
DF	13		16		15	
Cases	621		395		188	
Cragg-Uhler R^2	0.1215		0.0574		0.1362	
McFadden R^2	0.5019		0.2731		0.4560	
Prediction Rate (%)						
Total	84.7		79.0		76.6	
Action	37.5		47.8		54.1	
No Action	96.0		91.5		87.4	

Note: 1 Excluding stop work meetings.

Table 7.3: Parsimonious Probit Models of the Use of Any Overtime Ban in Unionised Workplaces Maximum Likelihood Estimates

	Private		GNCE		GBE	
Regressor	**Coef**	***t* Prob]**	**Coef**	***t* [Prob]**	**Coef**	***t* [Prob]**
INTERCEPT	-4.1390	-8.45[.0000]	-1.1737	-1.85[.0649]	-3.0655	-4.31[.0000]
Union Demand and Opportunity Cost Variables						
RWAGEHI					0.8895	2.08[.0370]
RWAGELO					1.2785	3.27[.0011]
LABCOST			-0.6981	-1.80[.0712]		
DENSITY	1.5800	3.57[.0003]				
FEMALE	-1.9271	-3.70[.0002]	0.7558	2.09[.0366]	-1.9061	-2.22[.0263]
SKILLED			-1.1524	-2.02[.0430]		
TIGHTLAB	0.6228	2.92[.0035]			0.8173	2.63[.0086]
GROWTH					-2.1105	-1.92[.0552]
Information Variables						
SHIFT	-0.4116	-2.31[.0211]			0.8841	2.71[.0067]
CONTROL			0.4639	1.64[.1006]		
IRMAN			0.5572	2.01[.0440]	1.0760	2.58[.0099]
MEETINGS					0.7258	1.34[.1793]
JUMCOM			0.7629	3.90[.0000]		
Economic Rent Variables						
TENURE	1.2212	3.42[.0006]				
Union Power Variables						
UNIONS	0.1414	3.09[.0020]				
UDEL	4.7960	1.38[.1666]			-11.9770	-1.98[.0478]
COMBINE	0.3386	1.30[.1936]	1.0280	3.21[.0013]	0.7686	1.93[.0530]
Employer Power Variable						
EMPASS			-0.5921	-2.19[.0712]	0.5189	1.56[.1182]
Industrial Issues Variables						
WORKCH			0.5722	3.10[.0019]	0.5703	1.78[.0749]
MANAGCH	0.4974	2.89[.0038]				
DISPROC	0.9256	4.35[.0000]				
Control Variables						
COAWARD			0.7105	1.69[.0917]		
Log-Likelihood	-141.1891		-125.8797		-47.8100	
Restricted Log-likelihood	-325.2553		-176.2547		-102.0090	
Chi-sq[Prob]	368.1[.0000]		100.7[.0000]		108.4[.0000]	
DF	10		10		12	
Cases	743		422		186	
Cragg-Uhler R^2	0.1445		0.0643		0.1605	
McFadden R^2	0.5659		0.2858		0.5313	
Prediction Rate (%)						
Total	86.7		64.6		80.6	
Action	38.1		17.7		47.7	
No Action	95.2		98.3		90.8	

Table 7.4: **Parsimonious Probit Models of the Use of Any Go Slow Tactics in Unionised Workplaces Maximum Likelihood Estimates**

	Private		GNCE		GBE	
Regressor	**Coef**	***t* Prob]**	**Coef**	***t* [Prob]**	**Coef**	***t* [Prob]**
INTERCEPT	-3.6429	-6.12[.0000]	-5.1024	-3.74[.0002]	-1.6685	-2.13[.0331]
Union Demand and Opportunity Cost Variables						
LABCOST	0.9723	1.70[.0882]	1.5287	1.37[.1701]		
DENSITY	0.9038	1.57[.0029]				
FEMALE	-1.4970	-2.36[.0182]				
SKILLED					-1.8930	-2.36[.0184]
GROWTH			-3.1519	-1.78[.0743]		
Information Variables						
SHIFT					0.8409	1.68[.0931]
CONTROL	0.5607	1.75[.0795]				
SIZE			0.0006	2.31[.0207]		
Economic Rent Variables						
TENURE			1.7094	1.87[.0612]		
NONCORE			-0.0632	-1.77[.0760]		
Union Power Variables						
UNIONS	0.0867	1.50[.1337]				
UDEL	7.5716	1.87[.0610]				
COMBINE			0.8629	1.89[.0590]		
Industrial Issues Variables						
OUTPUTCH					1.1281	2.18[.0291]
MANAGCH			1.4158	1.89[.0585]		
Control Variables						
HICOST	0.4960	2.12[.0338]			1.1579	2.37[.0177]
Log-Likelihood	-68.3624		-23.5195		-19.6441	
Restricted Log-likelihood	-121.8934		-57.7718		-36.6383	
Chi-sq[Prob]	107.4[.0000]		68.5[.0000]		34.0[.0000]	
DF	7		7		4	
Cases	728		413		198	
Cragg-Uhler R^2	0.1197		0.2197		0.1709	
McFadden R^2	0.4392		0.59.29		0.4640	
Prediction Rate (%)						
Total	96.2		96.2		93.9	
Action	0.0		7.7		0.0	
No Action	100.0		99.3		98.4	

Table 7.5: **Parsimonious Probit Models of the Use of Any Work to Rules Campaign in Unionised Workplaces**
Maximum Likelihood Estimates

	Private		GNCE		GBE	
Regressor	**Coef**	***t* Prob]**	**Coef**	***t* [Prob]**	**Coef**	***t* [Prob]**
INTERCEPT	-3.7981	-7.30[.0000]	-0.4336	-0.60[.5495]	-3.9477	-3.68[.0002]
Union Demand and Opportunity Cost Variables						
RWAGELO			0.5965	2.90[.0038]		
STRCOMP					-0.8021	-2.48[.0132]
DENSITY	1.1316	2.08[.0377]			1.4828	1.72[.0859]
FEMALE			0.7965	2.04[.0412]		
SKILLED			-1.0147	-1.58[.1137]		
TIGHTLAB			0.4398	2.16[.0310]	0.5036	1.77[.0769]
VACANCY			-1.3821	-5.39[.0000]		
GROWTH			0.1588	2.06[.0396]		
Information Variables						
SHIFT	-0.3143	-1.38[.1668]				
CONTROL			0.6404	2.00[.0450]	1.3389	1.84[.0654]
JUMCOM			0.5032	2.71[.0063]		
Economic Rent Variables						
TENURE	0.7784	1.70[.0890]				
NONCORE	-0.0062	-1.33[.1818]	-0.0428	-4.83[.0000]		
LOSS	-1.1242	-1.29[.1963]				
Union Power Variables						
UNIONS	0.1041	1.91[.0558]	0.1015	2.26[.0236]	0.1012	2.12[.0338]
UDEL	7.4031	1.88[.0605]				
Employer Power Variable						
EMPASS			-0.6091	-1.91[.0566]		
Industrial Issues Variables						
WORKCH			0.5537	3.01[.0026]		
COMMCH			-0.6493	-2.26[.0039]		
TECHCH					-0.5497	-1.88[.0601]
DISPROC	0.5196	1.98[.0478]				
Control Variables						
FEDSTAT			0.4308	1.49[.1372]		
HICOST	0.2587	1.67[.0949]	0.6038	2.69[.0070]		
LOCOST			-0.4552	-1.96[.0503]		
Log-Likelihood	-77.6011		-140.0757		-53.0296	
Restricted Log-likelihood	-127.9327		-162.6592		-73.6168	
Chi-sq[Prob]	100.7[.0000]		45.2[.0000]		85.0[.0000]	
DF	9		15		6	
Cases	602		417		201	
Cragg-Uhler R^2	0.1032		0.0290		0.0748	
McFadden R^2	0.3934		0.1388		0.2797	
Prediction Rate (%)						
Total	94.6		84.7		86.9	
Action	6.1		30.9		12.5	
No Action	99.3		93.1		97.1	

Table 7.6: Parsimonious Probit Models of the Use of Any Other Ban in Unionised Workplaces Maximum Likelihood Estimates[1]

	Private		GNCE		GBE	
Regressor	Coef	t Prob]	Coef	t [Prob]	Coef	t [Prob]
INTERCEPT	-1.0565	-1.40[.1605]	-5.8650	-4.58[.0000]	-1.4790	-2.16[.0312]
Union Demand and Opportunity Cost Variables						
RWAGEHI			*0.6055*	*1.78[.0757]*		
RWAGELO			0.3961	1.42[.1556]		
STRCOMP					-0.5490	-1.50[.1343]
LABCOST	-1.5152	-2.07[.0381]	1.1425	2.11[.0352]	0.9871	1.30[.1943]
DENSITY	1.6006	2.03[.0276]				
FEMALE	-1.4886	-1.96[.0506]				
SKILLED	-1.3345	-2.60[.0093]			-1.1356	-1.99[.0471]
TIGHTLAB					0.6444	1.87[.0593]
VACANCY			1.3642	2.63[.0085]		
GROWTH	0.2800	2.17[.0297]			-2.1806	-2.07[.0382]
Information Variables						
SHIFT			-0.5256	1.86[.0630]		
IRMAN			0.9210	2.81[.0050]		
JUMCOM			0.5032	2.71[.0063]	0.7565	2.25[.0243]
Economic Rent Variables						
TENURE			-1.2261	-2.69[.0073]		
NONCORE			-0.0474	-3.12[.0018]		
LOSS						
Union Power Variables						
UNIONS	0.0789	1.32[.1866]	0.1931	3.89[.0001]		
UDEL			14.3810	3.41[.0006]		
COMBINE	0.6060	1.78[.0752]				
Industrial Issues Variables						
OUTPUTCH			-0.4438	-1.32[.1868]		
TECHCH	-0.7879	-2.51[.0122]				
PBR	-0.6676	-1.42[.1571]	-31.6420	-1.51[.1320]		
DISPROC			2.2935	2.24[.0254]		
Control Variables						
COAWARD			-1.4963	-2.04[.0410]		
Log-Likelihood	-60.6570		-78.4065		-39.9374	
Restricted Log-likelihood	-150.6944		-162.9128		-80.4783	
Chi-sq[Prob]	180.1[.0000]		169.0[.0000]		81.1[.0000]	
DF	10		14		6	
Cases	753		432		195	
Cragg-Uhler R^2	0.1805		0.1421		0.1567	
McFadden R^2	0.5975		0.5187		0.50.4	
Prediction Rate (%)						
Total	94.8		89.4		84.6	
Action	7.7		35.2		7.1	
No Action	99.6		97.1		98.8	

Note: 1 Bans other than overtime bans.

Table 7.7 Signs of Coefficients in the Models of Strikes and Non-Strike Action, and *a priori* Signs

Regressor	*a priori*	Private Strike	Private Non-Strike	GNCE Strike	GNCE Non-Strike	GBE Strike	GBE Non-Strike
Union Demand and Opportunity Cost Variables							
OAWARD	-	+					
RWAGEHI	-						
RWAGELO	+			+	+		
OT	-			-		-	
EXPOSED	?						
STRCOMP	?	+					-
LABCOST	?			+		+	
DENSITY	+	+	+	+	+		+
FEMALE	-	-	-	+	+		
SKILLED	-	-		-			
CAPAC	+						
TIGHTLAB	+		+			+	+
VACANCY	+	+		+	-		
GROWTH	+		+			+	
Information Variables							
PSHARE	-	-	-				
SHARES	?	+					
SHIFT	?			-			+
CONTROL	+	+	+			-	
SIZE	+	+		+		+	
IRMAN	?	+		+			+
MEETINGS	?	-					+
JUMCOM	?				+		
Economic Rent Variables							
LOSS	-		-				
HIPROF	?					+	
TENURE	+		+	+	-	+	
NONCORE	-	-		-	-	+	
Union Power Variables							
UNIONS	+				+		+
UDEL	+	+	+	+	+		-
COMBINE	+	+	+		+	+	+
Employer Power Variable							
EMPASS	+	+		-	-		+
Industrial Issues Variables							
OUTPUTCH	+	-		+	-	+	+
WORKCH	+			+	+		
COMMCH	+	-				-	
MANAGCH	+	+	+				
TECHCH	+	-	-			-	-
PBR	+			-		+	-
ABRATE	+	+					
DISPROC	+		+	+	+	+	
Control Variables							
COAWARD	+			-	+		+
FEDSTAT	+				+		+
HICOST	+			-			
LOCOST	-	-			-		

8 Conclusion

We began this thesis with a review of the international strikes literature, principally from the US and Britain. Prior to the work of Ashenfelter and Johnson (1969), researchers offered theories which attempted to explain the apparent pro-cyclical behaviour of strikes series; many explanations were intuitively appealing and reflected a great depth of understanding of industrial relations, but they were not testable theories.

Ashenfelter and Johnson contributed a new methodology to the analysis of strikes, at least in the labour economics literature, and this has continued to the present day. They produced a theoretical model of strikes, steeped in the neoclassical theory of the firm and the behaviour of the consumer, in which wage bargaining occurred between profit maximising firms and utility maximising unions. From the model, the conditions which increased the probability of negotiations failing and a strike occurring, were derived. Ashenfelter and Johnson then specified proxies for variables in their model, and used economic data and regression analysis to perform empirical tests.

Although some researchers have criticised the specification of Ashenfelter and Johnson's theoretical model, their modelling approach has become the norm. Empirical analysts who do not propose new theories, or modifications to the theories of others, begin with a discussion of theories of strikes, then set out to test these theories using regression models. This is made clear by the survey of the Australian time-series analyses undertaken in Chapter 3.

Prior to presenting a new theoretical model, in Chapter 3 we reviewed the empirical models of Australian strikes of Bentley and Hughes (1970), Phipps

(1977), Perry (1978a), Beggs and Chapman (1987a) and Beggs and Chapman (1987b), and re-estimated those models using data from 3:1959 to 4:1992. We introduced non-economic control variables and accommodated structural breaks and found, broadly speaking, that the performance of the models did not deteriorate when a longer data set was used, and in most instances, the hypotheses of the authors were still supported. In all instances, we were able to modify the models sufficiently, without destroying their original character, to satisfy modern diagnostic tests.

We noted earlier that Mumford (1993) pointed out that although theories of strikes differ quite considerably, there is a commonality amongst the proxies used in regression equations; in short, the significance of a particular proxy is often claimed to support competing theoretical models. Mumford was also unable to rank several important models using data from the New South Wales coal industry, and although this may be peculiar to the data used, few empirical tests of this kind have been made.

In Chapter 4 we offered a new model of strikes and perhaps a first model of non-strike industrial action. In some respects, neither model is radically different from that of Ashenfelter and Johnson, and owes much to Hieser (1970) and Johnston (1972). We make, however, several important contributions to theory which may be summarised as follows.

First, in strikes theories we see no empirical evidence to validate the assumption that firms maximise profits in deciding whether to resist the demands of unions. We assume that when firms perform their cost-benefit calculations, they behave as cost-plus pricers so that any wage increase is passed on to product prices. Firms may, of course, reduce profit margins when price increases lead to reduced sales, but we propose that this is not relevant to wage negotiations. Like the profit maximisers, we have no evidence, other than fragmentary anecdotal confirmation, to support our assumption. We maintain that our assumption is more reasonable, but we show that a profit maximising assumption would make little difference to the character of the model.

Second, assuming that a union knows the probability distribution of the firm's rejection of a demand and a strike occurring, it is inconceivable that the union bases its decisions on expected value calculations. Such calculations are only rational when "games" are played often; clearly, wage demands are made infrequently. We assume that unions use maximin strategies which mean that they choose those actions which maximise their utility in the worst case outcome; since making no demand accompanied by a strike threat is an option, demands of this sort are only made if the union believes that its present level of utility cannot be reduced as a result.

Third, models of strikes commonly specify the loss of earnings during a strike as a cost to employees which, of course, it is. Marshall (1920) proposed that unions can only achieve higher real wages for its member if it accepts lower levels of employment, and this has become a tenet of labour economics. Few strike analysts make more than passing reference to this matter, and those who make explicit reference to labour shedding, treat the retrenched employee as one who remains permanently unemployed, and has no replacement wage. Our model draws the link between real union wage increases in excess of productivity, price increases, sales reductions and retrenchments. Further, we use an opportunity cost of demands and strikes concept, which depends on the amount of labour shedding, wage losses during unemployment, wage losses on subsequent re-employment and the average duration of unemployment.

Fourth, a few writers have referred to strikes causing a loss of goodwill when customers turn to strike-free firms. We make this an important part of the model, and argue that this factor may be a cost to both sides of the bargaining process. Market erosion caused directly by strikes leads to smaller profits because of reduced sales, and to smaller employment levels; this lowers the firm's resistance to wage demands but, for the union, makes strike threats more dangerous than threats of non-strike industrial action.

Fifth, there is a great tendency in conventional models to ascribe costs and benefits unambiguously to the strike and the post-strike period; firms consider losses of profit during a strike and changes in labour cost following a strike, and unions weigh up wage losses during a strike with wage increases afterwards. Even in very protracted disputes, losses during a strike are likely to be small compared to losses to both parties brought about by higher prices in the product market and by market erosion caused by strikes.

Sixth, we produce a coherent theory of non-strike industrial action. We argue that the union's demand is independent of the type of action threatened, but the union chooses whether to threaten strike or non-strike action depending on its assessment of the likely market erosion which would result from a strike. Whether a firm concedes to a demand accompanied by a threat of non-strike action, depends on the union's ability to decrease profit margins through that action.

Finally on the matter of the theoretical model, we exclude from the model all industrial action intended by the union to be short term and of a tactical nature, and those which arise from disputes between unions. We assume that cost of living adjustments occur and that real productivity increases are shared with employees, and that industrial disputes do not occur over these issues. Like all theoreticians, we seek to reveal common principles and do not dwell on the idiosyncratic.

In Chapter 5 we produced a macroeconomic time-series model of Australian strikes, derived from the theoretical framework of Chapter 4 and include variables suggested by other economic theories of strikes and other non-economic control variables. We claim that the estimated regression equation is consistent with the predictions of our theoretical model although others, no doubt, would claim that it supports different theories. The equation was subject to, and performed well on, a more extensive battery of diagnostic tests than seen hitherto in Australian strike models. Recursive regressions showed that the regression coefficients and their significance levels are remarkably stable. In non-nested tests, our model was preferred to the re-estimated versions of all earlier Australian empirical models introduced in Chapter 3.

The model throws a dampener on the claims of those who maintain that the Prices and Incomes Accord had a profound effect on strike activity in Australia, and that it reduced strike activity by between forty and sixty percent. This model suggests that, on average, the Accord reduced working days lost per employee by approximately fifteen percent, and that much of the decline in strike activity in the 1980s was due to reductions in union density.

In Chapter 6 we test our theoretical model at the microeconomic level, using Australian Workplace Industrial Relations Survey data. This allow greater focus on the competitive environment of the firm and on local labour market conditions. Further, it allows us to produce separate models for privately owned workplaces, government non-commercial establishments and government business enterprises where the objectives of the workplaces are different.

Our models exclude workplaces without a union presence because, at a theoretical level a union presence is presumed, and at an empirical level industrial action is not observed in non-union workplaces in AWIRS. We argued that empirical models which group together union and non-union firms are mis-specified.

Although AWIRS data is less than ideal for use in strikes models, we find broad support for the predictions of our theoretical model that competition in the product market, the risk of retrenchment and the duration of unemployment are important in explaining strike activity. The evidence concerning wage loss variables is more equivocal; high wages imply large losses during a strike and large losses afterwards to those who are retrenched, yet in privately owned workplaces we see a positive association between the occurrence of strikes and wages. In the public sector models, however, the hypothesised negative relationship is observed.

The models also give some qualified support to mis-information theories of strikes, but some of the proxies which suggest the existence of better information, yield perverse results. The presence of disputes procedures, industrial relations managers and joint union-management committees are either not significant, or are positively associated with strikes; whether these variables simply signal the presence of unresolved longstanding industrial problems, or whether they encourage disputation, remains an unanswered question.

In Chapter 7 we use the approach of the previous chapter to model non-strike action and, separately, the use of overtime bans, go slow tactics, work to rules campaigns and other bans. The non-strike action models perform better than the models of specific actions, but all mirror the strikes equations in being broadly consistent with our theoretical model.

In AWIRS we were unable to find any variable which is unambiguously associated with either market erosion caused by strikes, or the union's ability to reduce profit margins during non-strike industrial action. No variables are positively associated with strikes and negatively associated with non-strike actions, or *vice versa*, across all sectors. Therefore, our empirical models fail to confirm these aspects of our theoretical model. On the other hand, many of the variables in the theoretical strikes model, are also contained in the non-strike actions model, and our empirical models tend to confirm that the factors which predispose a workplace to strikes, are also associated with non-strike action.

It is typical for writers at the conclusion of a piece of research to suggest the need for yet more research. At a macroeconomic level, this seems unwarranted except for one matter; although international comparisons are notoriously difficult, our model hints that the so-called downward international trend in strike activity during the 1980s, is the result of general reductions in union density.

At the microeconomic level, however, our models reveal that in privately owned workplaces, the use of industrial action, after controlling for other factors, is negatively associated with the proportion of female employees, whereas in government non-commercial establishments the relationship is positive. This difference calls for further investigation.

Great improvements in Australian microeconomic models of industrial disputation are achievable in principle, but are contingent on the production of quality panel data containing reasonably detailed information on industrial action and the economic circumstances of the firm. Given the reduction in strikes in recent years, this may not be a high priority of the government. However, with the ending of the Accord and the change of Federal government in 1996, there may be an increase in industrial disputation in Australia, which may once again focus attention on the macroeconomic costs of strikes.

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